RESPIRATOR TRAINING HANDBOOK – HALF/FULL FACE

GENERAL INFORMATION

A **respirator** is a device that protects an individual from the inhalation of harmful airborne substances and/or an oxygen-deficient atmosphere. Respirators filter air in the work area or supply clean air from outside the work area. Respirators are designed as an enclosure that covers the nose, and mouth or the entire face or head.

CODES AND STANDARDS

CSA Z94.4-93 *Selection Care and Use of Respirators* promotes the correct use of respiratory protection but does not specify performance criteria. The CSA regulation defaults to the NIOSH requirements.

NIOSH Standard 42 CFR 84 (1995) for Non-Powered Particulate Filtering Respirators:

As of July 1998, all non-powered particulate filtering respirators used in Canada must comply with one of the nine classes of NIOSH approved respirators. There are three basic series of filters: **N**, **R,** and **P** and each series comes in three filtration efficiencies: 95%, 99% and 99.7% at 0.3 microns where particle capture process are least efficient. The series are defined as follows:

N Series: Non-oil for dust, mist or fumes that are not oil.

R Series: Oil-resistant. These can be used for up to eight hours in an atmosphere containing a particulate oil or oil based substances.

P Series: Oil-proof. This can be used indefinitely in an atmosphere containing particulate oil, subject to considerations of hygiene, damage and breathing resistance.

NIOSH Respirator Standard 30 CFR 11 (1972)

The NIOSH respirator standard applies to respirators worn to protect against gases (i.e. ammonia) and vapours (i.e evaporated fuel or solvents)

For more information about NIOSH standards see www.cdc.gov/niosh

RESPONSIBILITIES UNDER THE MCMASTER RESPIRATORY PROTECTION PROGRAM

Role of Supervisors (Administrative and Academic)

The responsible supervisor shall:

- consider the feasibility of implementing engineering controls before implementing procedures that require the use of respirators;
- contact Environmental & Occupational Health Support Services (EOHSS) before implementing respiratory protection procedures which call for the use of a respirator;
- register with EOHSS the names of all persons that may be required to use respirators and arrange for respirator fit testing to be conducted;
- develop a Standard Operating Procedure (SOP) for all work involving the use of respirators and have all SOP's approved by EOHSS;
- contact the Respirator Protection Program Administrator in all situations where a persons fitness or ability requires a medical opinion before wearing a respirator;
- ensure that all persons required to wear SCBA undergo pre-use and annual cardio respiratory performance evaluations;
- ensure that all persons required to use respirator protection receive initial and ongoing training as prescribed in Section 6 of the Respiratory Protection Program and as required by the conditions outlined in the SOP approved by EOHSS;
- ensure that all persons required to use respiratory protection, use and maintain the respirator in the prescribed manner;
- evaluate the effectiveness of the respiratory protection program on an ongoing basis and conduct annual audit of the program in consultation with the JHSC.

Role of Authorized Person;

People authorized by their supervisor to wear respiratory protection equipment shall;

- work in compliance with the procedures outlined in the Respiratory Protection Program and the SOPs related to the work being conducted.;
- use, clean and store their respiratory equipment in the prescribed manner
- participate in safety training, respirator fit testing, medical assessments and medical surveillance as required by the program;
- notify their supervisor immediately if and when respiratory equipment needs servicing or replacement;
- provide input on the effectiveness of the respiratory protection program and participate in annual assessments of the program by the JHSC.

Training

Training for persons who are required to wear respirators, shall be provided prior to such use and reviewed on an annual basis. Training shall include but not be limited to the following:

♦ Responsibilities ; ♦ Regulatory requirements; ♦ Codes and Standards; ♦ Workplace Hazards; ♦ Engineering controls; ♦ Selecting a respirator for specific hazards;	♦ Limits on the type and size and capabilities of respirators; ♦ How to inspect, put on and remove a respirator; ♦ How to inspect, maintain and store a respirator; ♦ How to conduct positive and negative seal checks

AIRBORNE (RESPIRATORY) HAZARDS

The proper selection and use of a respirator depends on determining the concentration of the hazard or hazards present in the workplace or the presence of an oxygen deficient atmosphere. A hazard analysis must be completed involving the principal investigator or supervisor, the appropriate safety office and the individual working in close contact with the hazard.

Airborne hazards generally fall into **seven** basic categories:

- **Dusts** – particles that are formed or generated from solid organic or inorganic materials that have had their size reduced through some mechanical process such as crushing, grinding, abrading or blasting.
- **Fumes** – particles formed when a volatilized solid, such as a metal, condenses in cool air. The physical change is often accompanied by a chemical reaction, such as oxidation.
- **Mists** – mists are formed when a finely divided liquid is suspended in the air. The suspended liquid droplets can be generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing.
- **Gases** – gases are formless fluids that occupy a space or enclosure and can be changed to a liquid or solid state through the combined effect of increased pressure and decreased temperature.
- **Vapors** – vapors are the gaseous form of substances that are normally in a solid or liquid state at room temperature and pressure. Vapors are formed by evaporation from a liquid or solid, and can be found where parts cleaning and solvents are used.
- **Smoke** – smoke consists of carbon or soot particles resulting from incomplete combustion of carbonaceous materials. Smoke generally contains droplets as well as dry particles.
- **Oxygen deficiency** – an oxygen deficient atmosphere has oxygen content below 19.5% by volume. This may occur in confined spaces such as storage tanks, process vessels, towers, drums, tank cars, sewers, septic tanks, underground utility tunnels, manholes and pits.

RESPIRATOR SELECTION

Respirators can only provide adequate protection if:

- respirators are properly selected for the task
- respirators are fitted to the wearer
- respirators are consistently put on and worn properly.

Respirators must be properly maintained in order to continue to provide the protection required for the work situation.

The respirator selected must:

- Be adequate to effectively reduce the exposure of the user to the hazard they are working with.
- Reduce exposure under all conditions, including emergency situations.

Selecting the proper respirator involves choosing a device that fully protects the worker from the respiratory hazard they may be exposed to and permits the worker to perform their job with the least amount of physical burden.

When selecting a respirator you need to consider:

- the nature and extent of the hazard
- other requirements, (personal protection, etc.) encountered when working with the hazard
- the working conditions (temperature, humidity, etc.) under which work is completed.
- the characteristics and limitations of the respirator.

Important factors when selecting a respirator include:

♦ **Nature of the hazard and the physical and chemical properties of the airborne contaminant**

The nature and form of the hazard (gas, dust, organic vapour, fumes, mist, oxygen deficiency or any combination) needs to be taken into consideration. Physical and chemical properties impact the selection of the type of respirator and the cartridges, canisters or filters used.

♦ **Concentration of the contaminants**

Sampling and analysis of workplace air will determine to what degree exposure is occurring and to what degree protection is required. The results provide a point of comparison with the occupational exposure level to determine how much a concentration must be lowered by the respirator to reduce worker exposure to a safe level.

♦ **Permissible or occupational exposure limits**

Selected respirators must be capable of protecting against overexposure by reducing and maintaining exposure to or below the relevant exposure limit. Supervisors should refer to the ACGIH recommended Threshold Limit Values (TLVs) and the NIOSH Recommended Exposure Limits (RELs)

♦ **Nature of the work operation or process**

Tasks and movements associated with the work being completed need to be considered so that the respirator does not limit movement. Particularly if supplied-air respirators are used requiring an individual to stay linked to the source of the air being supplied.

- **Time period the respirator is worn**

  The length of time a worker will be wearing a respirator needs to be taken into consideration. Chemical breakthrough times need to be kept in mind. Workers wearing respirators for longer periods of time require a respirator that imposes the minimum possible physical burden.

- **Work activities (physical or psychological stress)**

  Heavy work that is physically draining affect a worker's capability of wearing certain types of respirators. Temperature and humidity also affect the physical/psychological stress level associated with wearing a respirator. Filters and cartridges can also be affected.

- **Fit Testing**

  Some workers may be unable to achieve an adequate fit with certain respirator models or types of respirators. As an employer, McMaster provides a number of respirator models and sizes from which workers can choose a respirator that fits correctly.

- **Physical Characteristics, functional capabilities and limitations of the respirator**

  When selecting a respirator, steps need to be taken to ensure that the respirator does not impair the worker's vision, hearing, communication, and movement necessary to safely perform their job.

ASSIGNED PROTECTION FACTOR

In selecting a respirator the assigned protection factor, (AFP), must be greater than the expected air contaminant concentration divided by the exposure limit. The following table illustrates values of assigned protection factors for various types of respirators.

Example: If the expected air concentration of the contaminant is 60 ppm and exposure limit is 2 ppm a respirator with an AFP > 30 must be used.

Respirator Type		AFP
Air Purifying	Half face piece Full face piece	10 100
Power Air Purifying	Full face piece Hood or Helmet	1000 1000
Air Line	Full face piece (pressure)	1,000
SCBA	Full face piece (pressure)	1,000

A NIOSH (National Institute for Occupational Safety and Health) certified respirator must be selected after taking the above criteria into consideration. If NIOSH does not specifically certify a respirator for use against the contaminant being encountered McMaster University will select a NIOSH-certified respirator that has no limitation prohibiting its use for the particular contaminant. The selected respirator must be appropriate for the contaminant's physical form and chemical properties and suitable for the conditions under which it will be used. *(RMM#311)*

CLEANING A RESPIRATOR

When cleaning any type of respirator, follow the manufacturer's recommendations.

General cleaning procedures include the following steps:

- Remove all component parts. This includes filters, cartridges and canisters. Disassemble face pieces, valve assemblies or hoses as required.
- Wash components in 50°C/121°F water with a mild detergent.
- If the detergent used does not contain a sanitizing agent, it is recommended that the respirator be immersed for two minutes in one of the following:

  Hypochlorite solution (50 ppm chloride) or 1ml of bleach per litre of water.
  Aqueous iodine solution (50 ppm iodine) or 0.8 tinture of iodine per litre of water.

- Rinse components thoroughly in clean, warm, running water. Drain.
  Thoroughly rinsing the components is a necessity. Detergents that dry on face pieces can cause dermatitis or may cause the deterioration or the rubber or corrosion of any metal parts.
- Components of the respirator should be hand dried with a clean, lint free cloth or air dried.
- Reassemble the respirator, visually inspecting each piece. Replace filters, cartridges and canisters as required.
- Test the respirator to ensure that all components are working properly.

Do not use any solvents, alcohols or products that contain lanolin when cleaning a respirator.

INSPECTION

All respirators need to be inspected before and after each use.

Emergency use respirators should be inspected after each use and at least monthly.

An inspection includes:

- Checking respirator function.
- Confirming the tightness of connections.
- Checking the condition of various component parts including the face piece, head straps, valves, connecting tube, cartridges, canisters or filters. For SCBA this would include checking the regulator and warning devices.
- Replace all cracked or warped parts with original parts. Repairs to respirators should done by trained individuals.
- Maintain records of dates and findings for personal and emergency use respirators

Defective respirators should be immediately taken out of service and supervisors should be notified.

STORAGE

Respirators must be stored properly to protect against damage or contamination. Respirators should be stored away from dust, sunlight, extreme temperatures, excessive moisture, vermin and damaging chemicals. It must be stored in a manner that prevents deformation.

RMSG Offices recommend storing respirators flat in a ziploc bag, clearly labeled with an individual's name.

Each time an individual dons a particulate (dust mask) or elastromeric (half or full face respirator) he or she must do their own fit check to determine that the respirator is working properly. The steps below outline positive and negative pressure fit checks for various respirators.

Positive Pressure Fit Check
Elastomeric Respirators
(half and full mask)

Place the palm of your hand over the exhalation valve cover and exhale gently.

If the facepiece bulges slightly and no air leaks are detected between your face and the facepiece, a proper fit has been obtained.

If air leakage is detected, reposition the respirator on your face and/or readjust the tension of the elastic straps to eliminate leakage.

Repeat all of the above steps.

Never enter a contaminated area if you cannot fit check your respirator.

Negative Pressure Fit Check
Elastomeric Respirators
(half and full mask)

Place the palm of your hand over the open area of the cartridges.

Inhale gently.

If the face piece collapses slightly, a proper fit has been obtained.

If air leakage is detected, reposition the respirator on your face and/or readjust the tension of the elastic straps.

Repeat all of the above steps.

Never enter a contaminated area if you cannot fit check your respirator.

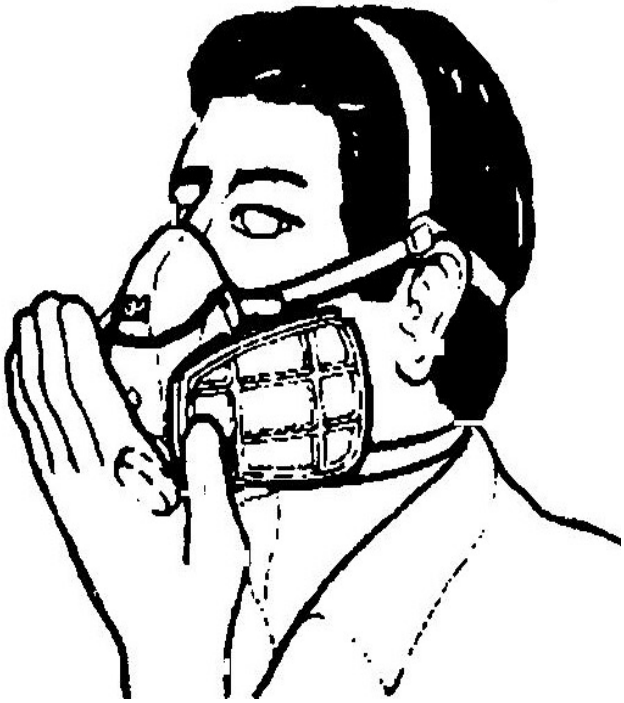

Image taken from 3M training manual

Image taken from 3M training manual

Donning and Doffing a Half Mask Respirator

Image taken from 3M training manual

Place the respirator over your chin, mouth and nose. Pull the head harness over the top of your head. Take the bottom straps in both hands and place them behind your neck. Hook the straps together.

Pull the ends of the straps to adjust the tightness. Be careful not to over tighten.

Perform a positive and / or negative pressure fit check each time the respirator is donned.

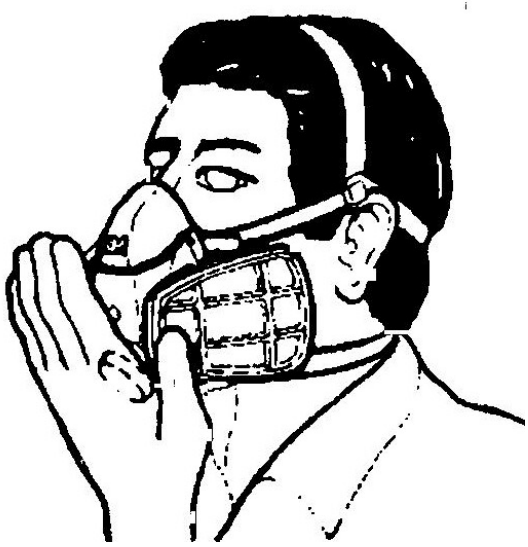

Image taken from 3M training manual

Positive Pressure Fit Check
See manual for details

Image taken from 3M training manual

Negative Pressure Fit Check
See manual for details