

TARLETON STATE UNIVERSITY
RESPIRATORY PROTECTION PROGRAM

Office of Risk Management and Safety
August 2009

1. GENERAL

It is necessary to protect persons who may be exposed to harmful mists, smoke, vapors, etc. or to an oxygen deficient atmosphere. Whenever possible, engineering controls should be utilized to provide this protection. While these engineering controls are being installed or when engineering controls are not possible, respiratory protection needs to be provided and used.

2. PURPOSE

Any person required to wear a respirator on the job needs instruction and training prior to using the equipment. In part, the training should include the nature, extent, and effects of the respiratory hazards to which a person may be exposed as well as signs and symptoms of exposure. Before a person is required to wear a respirator on the job, a determination should be made that he/she is physically fit and able to wear a respirator. In some cases it may be necessary for a physician to make this determination. The respiratory protective program should be evaluated annually to determine its effectiveness.

3. SCOPE

Applicable departments are expected to establish a Respiratory Protection Program to ensure employee protection on the job. This program establishes standard operating procedures for respiratory equipment selection, fit-testing and use.

4. RESPONSIBILITIES

- a. The Office of Risk Management & Safety will:
 - i. assist in determining if respiratory protection is needed.
 - ii. assist in the selection of appropriate respiratory protection.
 - iii. assist with fit testing and respirator training as appropriate.
 - iv. monitor program compliance.
- b. The department/supervisor will:
 - i. determine if respiratory protection is needed.
 - ii. identify employees requiring respiratory protection.
 - iii. provide medical evaluations as appropriate.
 - iv. provide proper respirators and employee fit testing and maintain fit test records.
 - v. provide respirator training and maintain training records.
- c. The employee will:
 - i. use the respirator in accordance with guidelines described in this Respiratory Protection Program.
 - ii. inform his/her supervisor if a respirator is damaged or lost.
 - iii. report to his/her supervisor any illness or change in physical condition that may interfere with the safe use of a respirator.

5. DEFINITIONS

- a. **ANSI** - American National Standards Institute
- b. **Assigned protection factor (APF)** - the workplace level of respiratory protection that a respirator is expected to provide to employees.
- c. **Canister** or **cartridge** - part of the respirator which removes specific contaminants from the air passed through it.
- d. **Facepiece** - the part of a respirator which covers the user's face. A full facepiece covers the eyes, nose, and mouth; a half facepiece covers the nose and mouth.
- e. **Fit test** - means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.
- f. **High efficiency particulate air (HEPA) filter** - a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter.
- g. **Hood** - a respiratory covering that completely covers the head and neck and may also cover portions of the shoulders and torso.
- h. **Immediately dangerous to life or health (IDLH)** - an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.
- i. **Maximum use concentration (MUC)** - the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator.
- j. **Oxygen deficient atmosphere** - an atmosphere with an oxygen content below 19.5% by volume.
- k. **Permissible Exposure Limit (PEL)** - the legal concentration of a contaminant (as dictated by OSHA) that cannot be exceeded.
- l. **Respirator** - a device which protects a person from breathing airborne contaminants.
- m. **Self-contained breathing apparatus (SCBA)** - an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.
- n. **User seal check** - an action conducted by the respirator user to determine if the respirator is properly seated to the face.

6. RESPIRATOR SELECTION

Respiratory protection is only as good as the respirator in use. Therefore, it is very important to select the right respirator for the right job. The selection of a respirator will be made in accordance with the most current ANSI Z88.2 standard. Only respirators which are approved by NIOSH/MSHA or U.S. Department of Interior, Bureau of Mines should be used.

a. Selection Considerations

The selection of a respirator is dependent on many factors.

- i. The characteristics of the hazardous operation:
 1. work area characteristics
 2. materials used
 3. worker activities
- ii. The nature of the respiratory hazard:
 1. type of hazard: a contaminant or an oxygen deficient atmosphere
 2. physical and chemical properties of the contaminant
 3. physiological effects on the body
 4. actual concentration of the contaminant (as determined by sampling or actual knowledge of the concentration) established Permissible Exposure Limits (PELs) or Threshold Limit Values (TLVs)
 5. Immediately Dangerous to Life and Health (IDLH) concentration
 6. warning properties of the contaminant
- iii. The location of the hazardous area in relation to the nearest area having respirable air; this needs to be considered when planning for:
 1. emergency escape
 2. entry of workers
 3. rescue operations
- iv. The period of time for which respiratory protection must be provided:
 1. routine use
 2. emergency use
- v. The activities of workers in the hazardous area:
 1. light, medium, or heavy work rate
 2. intermittent or continuous work
- vi. The physical characteristics, functional capabilities, and limitations of the various respirators: (certain conditions require a specific respirator)
 1. an oxygen deficient atmosphere requires use of a respirator which provides an independent, respirable atmosphere, a Self Contained Breathing Apparatus (SCBA) or airline; for breathing purposes, air must contain at least 19.5% oxygen; less than 19.5% oxygen is considered to be oxygen deficient.
 2. an IDLH atmosphere requires use of a SCBA or an airline respirator with continuous flow and escape provisions.
- vii. Respirator protection factor (See Table 1):

1. a measure of the degree of protection which is provided by a respirator
2. based on the concentration of the contaminant outside the mask divided by the concentration found inside the mask
3. helps determine maximum concentration of the contaminant in which a particular respirator can be used takes into account the capabilities and limitations of the type of respirator

For example: the protection factor for a half-face piece air purifying respirator is 50; with proper cartridges, etc., this type of respirator is suitable in an atmosphere that contains a contaminant at a concentration that is 50 times higher than the TLV or PEL

b. Respirator Descriptions

There are many types of respirators. Respirators can be classified according to whether they use an air source or the ambient air; whether they operate under a negative or positive pressure; and the configuration of the mask. See Figure 1 for respirator illustrations.

i. Supply Air Respirators

Self contained breathing apparatus (SCBA)

1. use supply air from a cylinder carried by the user Airline
2. use supply air from a source which is located away from the user
3. require a compressor or cylinder(s) and an airline hose a Must be used in an oxygen deficient atmosphere.

ii. Air Purifying Respirators:

1. use ambient air; cannot be used in an oxygen deficient atmosphere.
2. purify the ambient air by use of a chemical cartridge or canister, or a particulate filter.
3. powered air-purifying respirators (PAPRs) operate in a positive-pressure continuous-flow mode utilizing filtered ambient air

iii. Disposable or single use respirators:

1. cloth or paper construction
2. primarily used as a particulate filter for nuisance dusts

iv. Air Flow

Positive pressure respirators maintain positive pressure in the face piece during both inhalation and exhalation. Negative pressure respirators draw air into the face piece by the negative pressure created by inhalation (these are demand type respirators).

1. pressure-demand respirators maintain the mask's positive pressure except during high breathing rates.
2. continuous-flow respirators send a continuous flow of air into the mask at all times.

TABLE 1
RESPIRATOR PROTECTION FACTORS

Protection factors help determine the maximum concentration of the contaminant in which a particular respirator can be used.

RESPIRATOR TYPE	PROTECTION FACTOR
<u>Air Purifying Particulate Removing</u>	
Single-Use, Dust	5
Quarter-Mask, Dust	5
Half-Mask, Dust	10
Half- or Quarter-Mask, Fume	10
Half- or Quarter-Mask, High-Efficiency	10
Half- Face piece, High-Efficiency	50
Powered, High-Efficiency, All Enclosures	1,000
<u>Gas and Vapor Removing</u>	
Half-Mask	10
Full Face piece	50
<u>Atmosphere Supplying Airline</u>	
Demand, Half-Mask	10
Demand, Full Face piece	50
Pressure-Demand, Half-Mask	1,000
Pressure-Demand, Full Face piece	2,000
Continuous Flow, Half-Mask	1,000
Continuous Flow, Full Face piece	2,000
Continuous Flow, Hood, Helmet, or Suit	2,000
<u>Self Contained Breathing Apparatus</u>	
Open-Circuit, Demand, Full Face piece	50
Open-Circuit, Pressure-Demand Full Face piece	10,000
Closed-Circuit, Oxygen Tank-Type, Full Face piece	50

MASKS

Full facepiece mask covers the face from the hairline to below the chin; this type of mask does provide eye protection.

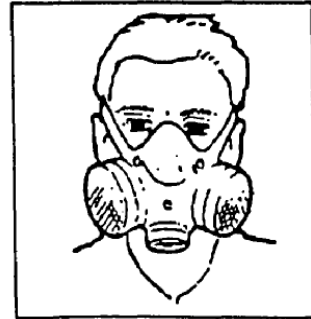
Half mask covers the face from above the nose to below the chin; this type of mask does not provide eye protection.

Quarter mask covers the face from above the nose to above the chin; this type of mask does not provide eye protection.



Disposable Filter

Air Purifying



Half Mask.

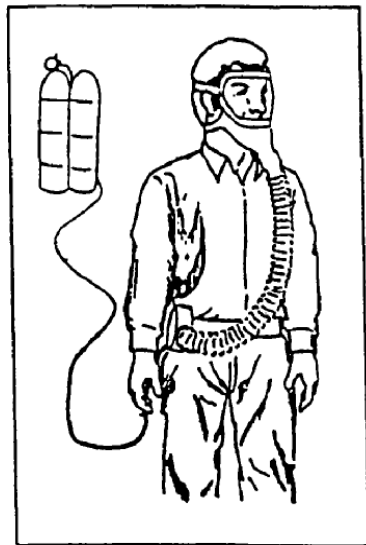


Fullface Mask

Air Purifying

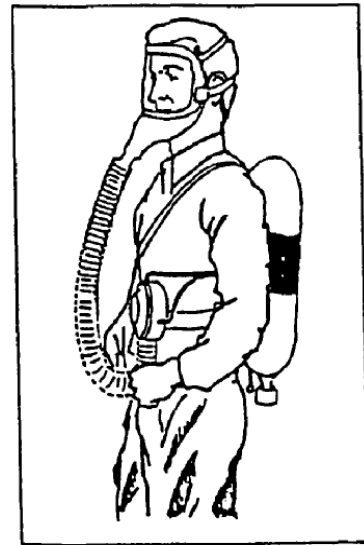


Gas Mask (Canister)



Airline

Supplied
Air



SCBA

Figure 1. Respirator Illustrations

- c. Different protection for different hazards
 - i. Filter respirators
 - 1. provide protection against particulate matter such as dust, fumes, mists, smoke, microorganisms, and asbestos.
 - 2. do not provide protection against chemical vapors or gases, or oxygen deficiency.
 - ii. Chemical cartridge/canister respirators
 - 1. provide protection against certain gases and vapors up to a particular concentration.
 - 2. do not provide protection against oxygen deficiency or particulate matter.
 - iii. Air supply respirators
 - 1. dependent on the type, can provide protection against particulates, chemical vapors and gases, as well as oxygen deficiency.

d. Selection Guidelines

To aid in the selection of an appropriate respirator, refer to figure 2 - Respirator Selection Flow Chart and consider the following:

- iv. If the contaminant is of a biological nature, e.g., a spill of viable bacteria, a High Efficiency Particulate Air (HEPA) filter respirator must be used.
- v. Identity and concentration of the contaminant should be known in order to select a respirator.
- vi. If the identity and concentration of the contaminant is not known, then an air supply respirator must be used.
- vii. When the identity and concentration is known, a respirator must be selected with a protection factor that is high enough to ensure that the user will not be exposed to a chemical level in excess of the PEL or TLV.
- viii. If an oxygen deficient atmosphere is known or suspected to be present, an air supply respirator must be used.
- ix. If an IDLH condition exists, an air supply respirator must be used.

Respirators are available in different sizes; the correct size for the wearer will be determined by a fit test (See Fit Testing Section).

If it is possible that an airline could be damaged or degraded by chemicals, then a SCBA should be used instead of an airline respirator.

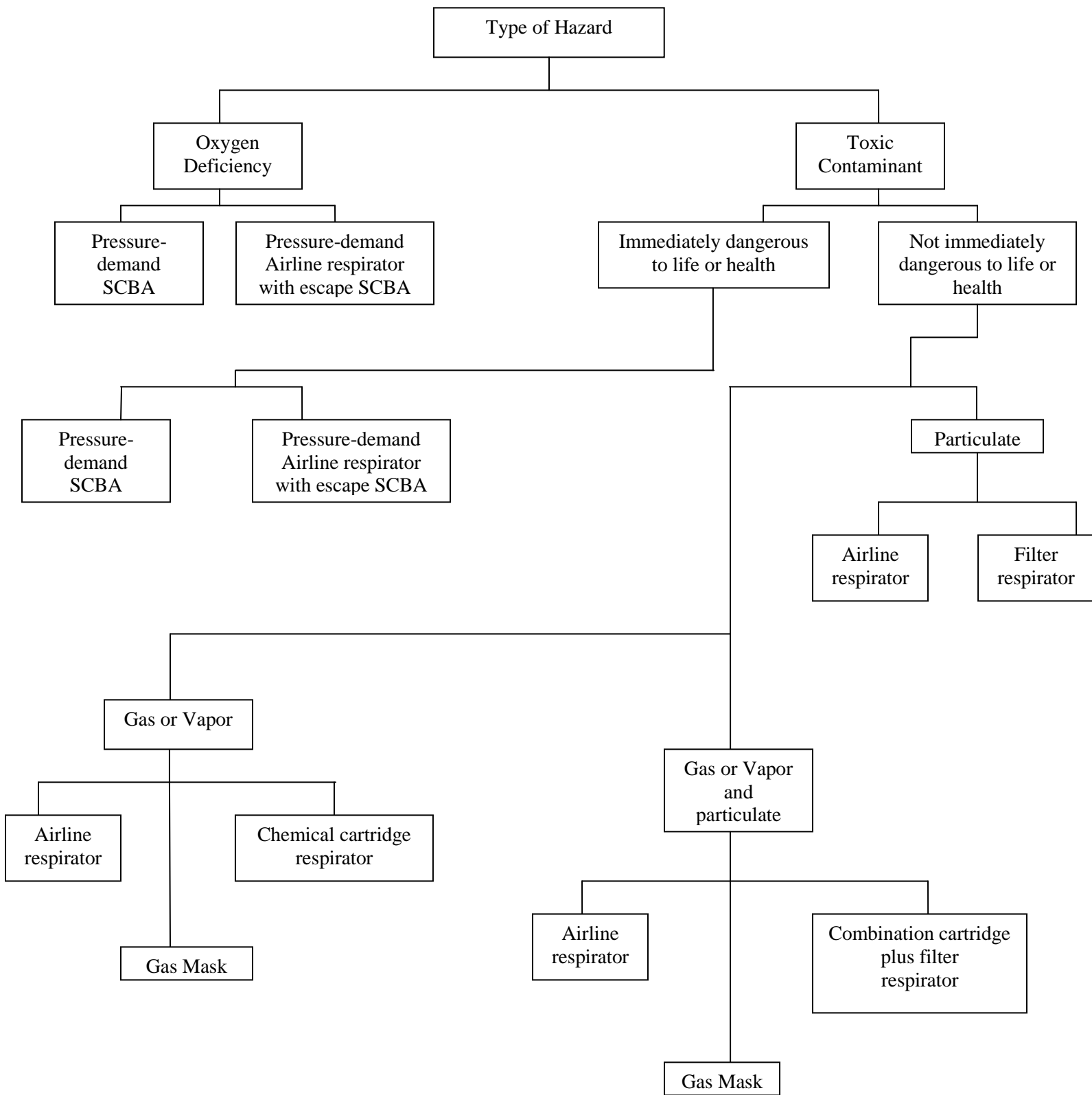


Figure 2. Respirator Selection Flow Chart

7. INSPECTION

Prior to use and after use, the respirator should be inspected to ensure that it is in good operating condition. Inspect at least monthly a respirator that is stored for emergency or rescue use. A respirator inspection should be tailored to the type of respirator, as follows:

- a. Disposable Respirators
 1. Integrity of the filter - check for holes or tears
 2. Elastic strips - check for loss of elasticity, tears, etc.
 3. Metal nose clip - check for breakage

- b. Air Purifying Respirators
 - i. Rubber face piece, check for:
 1. excessive dirt
 2. cracks, tears, or holes
 3. distortion from improper storage
 4. cracked, scratched or loose fitting lens
 5. broken or missing mounting clips
 6. worn threads in filter holder
 7. missing or worn gaskets in filter holder
 - ii. Headstrips, check for:
 1. breaks
 2. loss of elasticity
 3. broken or malfunctioning buckles or attachments
 - iii. Inhalation and Exhalation Valve, check for:
 1. detergent residue, dust particles, dirt
 2. cracks, tears, or distortion
 3. missing or defective valve cover
 - iv. Chemical canisters and/or particulate filters, check for:
 1. proper filter or canister for the hazard
 2. approval designation
 3. worn threads on filter housing
 4. cracks or dents in the filter housing
 5. deterioration of harness (gas mask canister)
 6. service life indicator, expiration date (if applicable)
 - v. Corrugated breathing tube (gas masks), check for:
 1. cracks
 2. missing or loose hose clamps
 3. broken or missing connectors

- c. Atmosphere Supplying Respirators
 - i. Check facepiece, headstrips, valves, and breathing tube as described for air purifying respirators
 - ii. Hood, helmet, blouse, or full suit (if applicable), check for:
 1. rips and torn seams
 2. headgear suspension

- 3. cracks or breaks in faceshield
- iii. Air supply system, check for:
 - 1. low volume of air cylinders
 - 2. incorrect gas in cylinders
 - 3. breaks or kinks in air supply hoses and end fitting attachments
 - 4. loose connections
 - 5. improper setting of regulators and valves (consult manufacturer recommendations)
 - 6. incorrect operation of air purifying elements and carbon monoxide or high
 - 7. temperature alarms (for air compressors)
- iv. Self contained breathing apparatus (SCBA), check for:
 - air or oxygen cylinders that may not be fully charged according to manufacturer's instructions

8. CLEANING AND DISINFECTING

Proper maintenance of respirator equipment is essential to ensure its effectiveness. Whenever possible, each individual should be assigned a respirator for his/her exclusive use. Proper cleaning of a respirator reduces the potential for contamination and dermatitis. Proper cleaning guidelines include:

- a. Frequently clean and disinfect personal respirators
- b. Thoroughly clean and disinfect shared respirators between users
- c. Clean and disinfect emergency use respirators after each use
- d. Ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

Procedure for Cleaning Respirator

- i. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.
- ii. Wash components in warm water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- iii. Rinse components thoroughly in clean, warm, preferably running water. Drain.
- iv. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:
 - 1. Hypochlorite solution (chlorine) made by adding approximately one milliliter of laundry bleach to one liter of warm water; or,
 - 2. Aqueous solution of iodine made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of warm water; or,

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
- v. Rinse components thoroughly in clean, warm preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause premature deterioration of rubber or corrosion of metal parts if not completely removed.
- vi. Components should be hand-dried with a clean lint-free cloth or air-dried.
- vii. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
- viii. Test the respirator to ensure that all components work properly.

9. STORAGE

Respirators need to be stored properly to prolong their life and to maintain their effectiveness.

- a. Do not store around dust, sunlight, heat, extreme cold, excessive moisture, and chemicals.
- b. Do not store respirators unprotected in lockers or tool boxes.
- c. Store respirators with the facepiece and exhalation valve resting in a normal position.
- d. Routinely used respirators may be placed in plastic bags.
- e. Store emergency use respirators in an accessible, clearly marked compartment.

10. PROPER USE OF EQUIPMENT

It is essential that a person who is required to wear a respirator be informed and made aware of conditions and factors which might interfere with a respirator's performance. Listed below are some Do's and Don'ts regarding respirator use:

- a. DO
 - i. Make sure you have the correct respirator for the job.
 - ii. Have an additional person present in dangerous atmospheres.
 - iii. Determine a means of communication between respirator wearers prior to using the respirators in the field (hand signals are acceptable).
 - iv. Use a respirator which has been approved by NIOSH/MSHA or U.S. Department of Interior, Bureau of Mines.
 - v. Check a respirator each time before use.
 - vi. Shave (if applicable) before wearing a respirator.
 - vii. Be aware that some contaminants may enter or damage the body by means other than the respiratory tract (protective clothing may be required).
 - viii. Return to fresh air if: the canisters or cartridges need replacing; you feel nauseous, dizzy, or ill; or if you experience difficulty breathing.
 - ix. Wear eye protection if the contaminant concentration causes eye irritation (a full facepiece respirator may be used).

- x. Be aware that some environmental conditions can compromise a respirator's performance, i.e. high temperatures can cause a person to sweat, breaking the face to facepiece seal; freezing temperatures can ice clog an exhalation valve and regulator; at high breathing rates, positive pressure may not be maintained in positive pressure SCBAs.
- xi. Be alert to signs and symptoms of heat stress.

b. DO NOT

- i. Remove a respirator in a contaminated atmosphere.
- ii. Use a respirator without the proper training.
- iii. Talk unnecessarily or chew gum while wearing a respirator.
- iv. Overexert yourself.
- v. Wear contact lenses while using a respirator.
- vi. Mistakenly use a filter respirator for protection against gases or vapors.
- vii. Allow hair or temple bars from glasses to pass between the face and facepieces of the respirator.

11. AIR PURIFYING RESPIRATORS

Air purifying respirators remove specific contaminants from the air by passing the air through a filter, cartridge, or canister. Air purifying respirators are limited in the protection they provide, so it is necessary to understand their limitations, how to select the correct type, and how to use them.

a. Limitations of Air Purifying Respirators

The following limitations must be considered when using an air purifying respirator:

- i. Cannot be used in atmospheres containing less than 19.5% oxygen.
- ii. Cannot be used in IDLH atmospheres (except escape gas masks).
- iii. Cannot be used when the identity of the contaminant is not known.
- iv. Cannot be used when contaminant concentrations are unknown or when established maximum levels have been exceeded.
- v. Proper cartridge must be selected for the contaminant.
- vi. Relative humidity might reduce the effectiveness of the sorbent.
- vii. Cartridges/canisters should only be used for chemicals having adequate warning properties (odor, taste, or irritant effects are detectable below the TLV or PEL) or the cartridge/canister has an approved end-of-service-life indicator.
- viii. Cartridges/canisters are specific to the brand of respirator (e.g. 3M cartridges must be used with a 3M mask).

b. Classes of Air Purifying Respirators

- i. Disposable dust respirators
 1. made of cloth or paper
 2. NIOSH/MSHA approved dust respirators provide protection against nuisance dusts (i.e. a TLV of 10 mg/cubic meter or greater)

- 3. difficult to fit test and to obtain a good facepiece-to-face seal
 - ii. Mouthpiece respirators
 - 1. approved for escape only
 - 2. mouthpiece held by teeth; clamp used to close nostrils
 - 3. only used when hazard is identified and respirator is approved for that hazard
 - iii. Quarter mask respirator
 - 1. used with cartridges or particulate filters
 - 2. not suitable for protection against dusts with TLVs less than 0.05 mg/cubic meter
 - iv. Half mask respirator
 - 1. uses one or two cartridges
 - 2. approved for vapors, dusts, fumes, mists, gases, and combinations thereof
 - v. Full-face mask respirator
 - 1. provides more protection than half mask respirators (e.g. eye protection and a higher protection factor)
 - 2. approved for same contaminants as half mask respirators, but at higher concentrations
 - vi. Powered respirators
 - 1. have no breathing resistance
 - 2. can be used with half masks, full-face masks, and helmets
- c. Air Purifying Element Considerations

Air purifying elements must be properly selected, stored, maintained, and replaced in order to provide adequate protection to the user.

 - i. Canisters
 - 1. remove vapors and gases from the air
 - 2. have a large sorbent volume and provide protection against higher concentrations of vapors and gases
 - 3. a component of gas masks
 - ii. Cartridges
 - 1. contain less sorbent than a canister
 - 2. lifetime is short
 - iii. Cartridge selection
 - 1. cartridges are color-coded to indicate the contaminants which they protect against (See Table 2)
 - 2. the cartridge selected must be made by the same manufacturer and be compatible with the respirator in use.
 - 3. chemical and HEPA filter cartridges can be combined to provide protection against particulates and gases and vapors.
 - 4. some cartridges can be combined to provide protection against more than one chemical.
 - 5. if a worker is exposed to two or more chemicals and a combination cartridge is not available, then a supply air respirator should be used.

- d. Cartridge/Canister must be replaced if any of the following conditions occur:
 - i. cartridge/canister develops an uncomfortably high temperature (due to chemical absorption reaction)
 - ii. wearer detects an odor or taste, or feels eye or throat irritation
 - iii. shelf-life date is expired
 - iv. the end-of-service-life indicator changes color (if applicable)
 - v. cartridge/canister becomes wet or is grossly contaminated
 - vi. physical damage is noticed
 - vii. in addition, it is recommended to replace the cartridge/canister at the end of each day, especially if the respirator is not stored properly (clean and bagged to prevent exposure to humidity and chemical vapors).

- e. Filters (HEPA Cartridges, Dust Pads, or Disposable Dust Respirators) must be replaced if any of the following conditions occur:
 - i. breathing becomes difficult
 - ii. filter or dust respirator becomes physically damaged (tears, holes, etc.)
 - iii. filter or dust respirator is visibly dirty
 - iv. filter or dust respirator becomes wet
 - v. the inside of the dust respirator becomes contaminated
 - vi. in addition, disposable dust respirators should be disposed of after use

Air purifying respirators should be fit tested (See Fit Test Section).

Air purifying respirators should be cleaned, inspected, and stored properly (See Proper Care of Respirator Equipment Section).

TABLE 2
AIR PURIFYING CARTRIDGE COLOR CODES

<u>CONTAMINANT PROTECTED AGAINST</u>	<u>COLOR ASSIGNMENT</u>
Acid gases	White
Hydrocyanic acid gas	White with 1/2-inch green stripe completely around the cartridge near the bottom.
Chlorine gas completely	White with 1/2-inch yellow stripe around the cartridge near the bottom.
Organic vapors	Black
Ammonia gas	Green
Acid gases & Ammonia gas	Green with 1/2-inch white stripe completely around the cartridge near the bottom.
Carbon monoxide	Blue
Acid gases & organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 inch blue strip completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive materials, excepting tritium and noble gases	Purple (Magenta)
Pesticides	Organic vapor canister plus a filter
Particulates (dust, fumes, mist, fogs, or smoke) in combination with any of the above gases or vapors	Canister color for contaminant, as designated above, with 1/2 inch gray stripe completely around the canister near the top.

NOTE: Orange should be used as a complete body, or stripe color to represent gases not included in this table.

12. AIR SUPPLY RESPIRATORS

Air supply respirators require a separate source for breathing air, this source could be a cylinder which is carried by the user (self contained breathing apparatus), a compressor or cylinders which provide air to the user from a distant location via an airline (airline device), or breathing air from a distant location which is directed to the user via a hose (hose mask).

a. Self Contained Breathing Apparatus (SCBA)

There are two basic designs of self contained breathing apparatus (SCBA):

i. Closed circuit

1. a.k.a. “rebreather”
2. mixes oxygen with exhaled breath which has had the carbon dioxide removed by a scrubber
3. have a longer service time than open circuit SCBA (1-4 hr use)
4. during inhalation, a negative pressure is present in the facepiece
5. generally not acceptable for use in atmospheres immediately dangerous to life and health
6. not commonly used.

ii. Open circuit

1. most common type used
2. requires a supply of compressed breathing gas (almost always air, but can be oxygen) which is in a cylinder carried on the user’s back
3. if using compressed oxygen, it CANNOT be used in a device designed for compressed air
4. air is exhaled, not recycled
5. amount of air is limited: generally allows for 30 or 60 minutes of air; 5 minute units are available for escape purposes
6. air must meet at least Grade D specifications
7. consists of: cylinder, high-pressure hose, alarm, regulator, breathing hose, facepiece, backpack and harness
8. principle of operation: air from a cylinder passes through a regulator where pressure is reduced, then through the breathing tube and into the facepiece where it is inhaled by the user
9. function in one of two modes of operation: demand and pressure demand
10. demand: air flows into facepiece only when user inhales; during inhalation there is a negative pressure inside the facepiece which could allow contaminants inside if a leak would develop; should not be used in atmospheres immediately dangerous to life and health
11. pressure demand: maintains a positive pressure in the facepiece at all times; if a leak would develop in the facepiece, contaminants would not enter and harm the user; should be used in atmospheres immediately dangerous to life and health.

b. Airline Device

Airline devices deliver air to the wearer via a high pressure airline hose up to 300 feet in length. The air source can be a compressor or compressed air cylinders, thereby allowing longer use time than SCBAs. These devices can be equipped with a half or full-face mask, helmet, hood, or a complete suit. Airline devices cannot be used in atmospheres immediately dangerous to life and health because of the dependence on the air source and airline, which may become impaired.

There are three types of airline devices:

i. Demand

1. air only enters the facepiece when wearer inhales
2. a negative pressure is present in the facepiece during inhalation

ii. Pressure demand

1. air flows continuously into facepiece
2. a positive pressure is maintained in the facepiece
3. provides more protection than the demand type device

iii. Continuous flow

1. uses an airflow control valve or orifice instead of a regulator
2. air flows continuously into facepiece
3. a positive pressure is maintained in the facepiece

c. Hose Mask

- i. Hose masks allow air to the wearer via a large diameter hose, but do not use compressed air.
- ii. Hose masks are not widely used.
- iii. The hose extends to a non-contaminated air space.
- iv. The user either breathes with the aid of a blower or breathes against the resistance to airflow in the hose.
- v. Depending on the manufacturer, a hose mask with a blower may have a hose length up to 300 feet and may have a facepiece, helmet, or hood.
- vi. Depending on the manufacturer, a hose mask without a blower may have a hose length up to 75 feet and must have a tight fitting facepiece.
- vii. With or without a blower, hose masks cannot be used in atmospheres immediately dangerous to life and health.

d. Limits of Air Supplying Respirators

The following limitations must be considered when using an air supply respirator:

i. SCBA

1. these respirators are bulky and heavy and may not be suitable for strenuous work or for working in constricted spaces
2. the use time is limited by the amount of air contained in the cylinder (normally 30 or 60 minutes)
3. the air in the cylinder must be at least Grade D as determined by the compressed Gas Association Commodity Specification for Air, G-7.1
4. heat stress and worker fatigue need to be considered

- ii. Airline device
 - 1. the air supply line restricts the wearer's mobility
 - 2. protection may be lost due to: cutting, kinking, or crushing of the air supply line; air compressor failure; the depletion of the air in the cylinder(s)
 - 3. only an airline device with an additional self contained air supply (which can be used for escape) is allowed for atmospheres that are immediately dangerous to life and health
 - 4. if using a compressor: it must be located in a safe, non-contaminated environment; it must be equipped with in-line air purifying sorbent beds and filters; it must have alarms to indicate compressor failure and overheating; it must have an alarm that indicates the presence of carbon monoxide or the air must be tested for carbon monoxide
 - 5. if using a cylinder(s): it must be tested and maintained as prescribed by the Department of Transportation (49 CFR 178); it must be marked in accordance with ANSI Z48.1-1954 or other applicable standard
 - 6. air line couplings must be incompatible with outlets for other gas systems
- iii. Hose mask
 - 1. cannot be used in atmospheres immediately dangerous to life and health
 - 2. the air supply hose limits mobility
 - 3. the hose mask without a blower is limited to a 75 foot hose and the wearer must
 - 4. inhale against resistance to airflow which can cause worker fatigue
 - 5. source of contaminant free breathing air must be nearby

e. Donning a SCBA

There are different methods to don a SCBA. The wearer needs to find a method that feels comfortable. The following describes one method (from the Fire Protection Training Division, Texas Engineering Extension Service) which can be used to don a SCBA:

- i. Remove SCBA from the case, open cylinder valve and check the air pressure.
- ii. Position the SCBA with the cylinder down, arms toward the wearer, and cylinder control valve pointing toward the body (the SCBA can be placed on the ground or preferably on a table).
- iii. Grasp shoulder strap on which the regulator is mounted with the right hand.
- iv. Pick up SCBA, place left arm through the strap supported by the right hand, placing strap on left shoulder.
- v. Remove right hand from the left shoulder strap, place right arm into the remaining strap.

- vi. Grasp both shoulder straps near the shoulders and complete positioning of the SCBA, lock snaps, and adjust the straps.
- f. The following method can be used to don the face mask:
- i. position the adjustable straps (fully extended) to the outside of the mask
 - ii. place hands between the straps and the mask, with the straps laying on the back of the hands
 - iii. place mask on the face, inserting chin first, working the mask up on the face
 - iv. raise hands away from the mask, continue movement around the sides of the face until the straps are in place
 - v. adjust straps until the mask fits tightly on the face (this is done by pulling the straps straight back toward the ears), the bottom straps should be adjusted first
 - vi. test the mask by holding the end of the air tube against the palm of the hand, inhale, if a leak is noted, readjust the straps

To schedule SCBA donning practice for your department, contact the Office of Risk Management and Safety.

g. Care and Use of a SCBA

In addition to the general requirements found in the Proper Use of Respirator Equipment and Proper Care of Respirator Equipment sections, there are specific requirements and considerations which must be followed by all SCBA wearers. Because SCBAs are complex and require a thorough understanding of their use and care, a Standard Operating Procedure should be written specifically for a particular manufacturer's SCBA before it is used. An example of a Standard Operating Procedure for a Mine Safety Appliance (MSA) SCBA is included in the Appendix.

- i. OSHA requires that SCBA used for emergency use be inspected once a month and records must be maintained of the inspection.
- ii. NIOSH recommends all stores SCBA be inspected weekly.
- iii. After each use air or oxygen cylinders should be fully charged according to the manufacturer's instructions.
- iv. Determine at least monthly that the regulator and warning devices on the SCBA function properly.
- v. Follow the "Use and Care" instructions for the SCBA which are usually mounted inside the carrying case lid.
- vi. Frequently monitor the pressure gauge on the SCBA which indicates the volume of air remaining in the cylinder.
- vii. Warning devices will signal an alarm when 20-25% of service time remains.

13. RESPIRATOR USE IN DANGEROUS ATMOSPHERES

Only full-face pressure demand respirators are acceptable for use when toxic or oxygen deficient atmospheres may be present or if the identity of the contaminant is unknown. Personnel who may encounter dangerous atmospheres in normal operations or emergencies must be familiar with the following procedures:

- a. One additional person must be present in areas where, if a respirator fails, the respirator wearer could be overcome by a toxic or oxygen deficient atmosphere.
- b. Communications must be maintained between the individuals present; the communications can include visual, voice, or signal line.
- c. An additional person equipped with rescue equipment including a SCBA must be in a nearby safe area where he can assist the others in case of an emergency.
- d. When a SCBA is used in an atmosphere immediately dangerous to life and health, standby personnel must be present with rescue equipment.
- e. Any respirator wearers in an atmosphere immediately dangerous to life and health must be equipped with safety harnesses and safety lines so they can be removed if they are overcome.

Refer to the TSU Confined Spaces Program or contact the Office of Risk Management & Safety for more information.

Field Test Measures

A respirator must be tested for proper fit every time it is worn. The wearer may easily check the fit using negative and positive tests, described as follows:

- i. Negative pressure test
 1. may be impossible to perform on disposable respirators
 2. seal the inlet opening(s) of the respirator
 3. inhale gently and hold your breath for 10 seconds
 4. if the facepiece collapses slightly and no leak is detected, then it can be reasonably assumed that the respirator is properly donned and is the correct size.
- ii. Positive pressure test
 1. may be impossible to perform on disposable respirators
 2. cover the exhalation valve of the respirator
 3. exhale gently
 4. if a slight positive pressure builds up inside the facepiece with no outward leakage of air, then it can be reasonably assumed that the respirator is properly donned and is the correct size.

14. FIT TESTING

There is not one style or size of respirator available which will properly fit every person who needs to wear one. This is why it is so important that every respirator be fit tested before it is used. The OSHA Standard, 29 CFR 1910.134 states that respirators shall be fitted properly and shall be tested for their facepiece-to-face-seal. Fit testing can be accomplished by one of two methods: quantitative or qualitative. Both methods are described below.

- a. Quantitative Fit Test
This method of fit testing is very accurate, but costly. Exposes the respirator wearer to a test atmosphere, e.g. an aerosol, vapor, or gas. An instrument is used to measure the test atmosphere as well as the air inside the respirator. A quantitative fit factor is calculated which indicates how well the respirator fits the wearer. This test is expensive and requires highly trained personnel to administer.
- b. Qualitative Fit Test
This method of fit testing is inexpensive, fast, and easily performed. It is the most commonly used method. The test atmosphere is an easily detected substance such as isoamyl acetate (banana oil) and/or an irritant smoke. The respirator used for the test must provide protection against the test substance (e.g. an organic vapor chemical cartridge must be used for the isoamyl acetate and a HEPA cartridge must be used for the irritant smoke test). Please note:
 - i. Disposable dust masks cannot be fit tested.
 - ii. Refer to the Respirator Training and Fit Test Form(Figure 3).
 - iii. Test will be performed annually or when a different respirator is used.
 - iv. Records must be kept for every fit test performed.

The qualitative fit test involves having the test subject don a respirator, exposing the employee to the test substance, requiring him to perform some task (such as reciting the alphabet), moving head from side to side and determining whether the test subject can detect the test substance:

1. If the test substance is detected, then the respirator does not fit well and the test is repeated after some adjustments have been made to the respirator, or a new respirator may be tested.
2. If the test substance is not detected, then a satisfactory fit is assumed to be achieved.

15. TRAINING

Any person assigned a task requiring respiratory protection must receive adequate training regarding the safe and proper use of the respirator. This training should include the following:

- a. Reasons for the need for respiratory protection
- b. Nature, extent and effects of respiratory hazards to which the person may be exposed
- c. Selection of appropriate respirator for the hazard
- d. Explanation of the operation, capabilities, and limitations of the selected respirator
- e. Instructions in inspecting, donning, fit testing and wearing the respirator
- f. Directions for maintenance and storage of the respirator
- g. Hands-on training to allow actual handling of the respirator
- h. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.

- i. Choose respirators certified for use to protect against the contaminant of concern. A label or statement of certification should appear on the respirator or respirator packaging.
- j. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against.
- k. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

If you have any questions, contact the Office of Risk Management and Safety for more information.

RESPIRATOR TRAINING COMPLETION FORM

COMPANY Tarleton State University LOCATION Stephenville

FIT TEST CONDUCTED BY: _____
(please print) (Signature)

Name: _____ Signature: _____	SCBA Size: S M L Brand: Model:	SCBA Size: S M L Brand: Model:	Cartridge Full-face Size: S M L Brand:	OTHER Size: S M L Brand:
1. I understand why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect to the respirator.				
2. I understand what the limitations and capabilities of the respirator are.				
3. I understand how to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions.				
4. I understand how to inspect, put on and remove, use, and check the seals of the respirator.				
5. I understand what the procedures are for maintenance and storage of the respirator.				
6. I wore this respirator equipment in a test atmosphere generated by smoke or other means.				
7. I know how to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.				

Figure 3. Respirator Training and Fit Test Form

16. MEDICAL EVALUATION

TSU will provide a medical evaluation to determine the employee's ability to use a respirator, before the employee is fit tested or required to use the respirator in the workplace. Administration of the medical questionnaire and examination shall be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee.

- a. Initial medical examination procedures
 - i. TSU has designated Stephenville Medical and Surgical Clinic as the PLHCP.
 - ii. Stephenville Medical and Surgical Clinic will use the OSHA Respirator Medical Evaluation Questionnaire and Physician Approval Form (refer to Appendix A).
- b. Follow-up medical examinations
 - i. The employer shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of the OSHA Respirator Medical Evaluation Questionnaire or whose initial medical examination demonstrates the need for a follow-up medical examination.
 - ii. The follow-up medical examination shall include any medical tests, consultations, or diagnostic procedures that the PLHCP deems necessary to make a final determination.
- c. Additional medical examinations

At a minimum, the employer shall provide additional medical evaluations if:

 - i. employee reports medical signs or symptoms that are related to ability to use a respirator;
 - ii. A PLHCP, supervisor, or the respirator program administrator informs the employer that an employee needs to be reevaluated;
 - iii. Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
 - iv. A change occurs in workplace conditions that may result in a substantial increase in the physiological burden placed on an employee.

TSU will discontinue the employee's medical evaluations when the employee is no longer required to use a respirator.

REFERENCES

Refer to the most recent version of the Occupational Safety and Health Standards, 29 CFR 1910.134, "Respiratory Protection".

Fire Protection Training Division, Texas Engineering Extension Service, Texas A&M University System. Breathing Apparatus.

Occupational and Environmental Safety Training division, Texas Engineering Extension Service, Texas A&M University System. Personal Protection and Safety for Hazardous Waste Workers, 1990.

Texas A&M University, Environmental Health and Safety, Respiratory Protection Program, September 1998.

APPENDIX A
OSHA Respirator Medical Evaluation
Questionnaire
and
Physician Approval Form

OSHA Respirator Medical Evaluation Questionnaire (Appendix C to Sec. 1910.134)

Can you read (circle one): Yes/No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date: _____

2. Your name: _____

3. Your age (to nearest year): _____

4. Sex (circle one): Male/Female

5. Your height: _____ ft. _____ in.

6. Your weight: _____ lbs.

7. Your job title: _____

8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____

9. The best time to phone you at this number: _____

10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No

11. Check the type of respirator you will use (you can check more than one category):

a. _____ N, R, or P disposable respirator (filter-mask, non-cartridge type only).

b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

12. Have you worn a respirator (circle one): Yes/No

If "yes," what type(s): _____

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you **currently** smoke tobacco, or have you smoked tobacco in the last month: Yes/No

2. Have you **ever had** any of the following conditions?

Seizures (fits): Yes/No

Diabetes (sugar disease): Yes/No

Allergic reactions that interfere with your breathing: Yes/No

Claustrophobia (fear of closed-in places): Yes/No

Trouble smelling odors: Yes/No

3. Have you **ever had** any of the following pulmonary or lung problems?

Asbestosis: Yes/No

Asthma: Yes/No

Chronic bronchitis: Yes/No

Emphysema: Yes/No

Pneumonia: Yes/No

Tuberculosis: Yes/No

ilicosis: Yes/No

Pneumothorax (collapsed lung): Yes/No

Lung cancer: Yes/No

Broken ribs: Yes/No

Any chest injuries or surgeries: Yes/No

Any other lung problem that you've been told about: Yes/No

4. Do you **currently** have any of the following symptoms of pulmonary or lung illness?

Shortness of breath: Yes/No

Shortness of breath when walking fast on level ground or walking up a slight hill or incline:

Yes/No

Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No

Have to stop for breath when walking at your own pace on level ground: Yes/No

Shortness of breath when washing or dressing yourself: Yes/No

Shortness of breath that interferes with your job: Yes/No

Coughing that produces phlegm (thick sputum): Yes/No

Coughing that wakes you early in the morning: Yes/No

Coughing that occurs mostly when you are lying down: Yes/No

Coughing up blood in the last month: Yes/No

Wheezing: Yes/No

Wheezing that interferes with your job: Yes/No

Chest pain when you breathe deeply: Yes/No

Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you **ever had** any of the following cardiovascular or heart problems?

Heart attack: Yes/No

Stroke: Yes/No

Angina: Yes/No

Heart failure: Yes/No

Swelling in your legs or feet (not caused by walking): Yes/No

Heart arrhythmia (heart beating irregularly): Yes/No

High blood pressure: Yes/No

Any other heart problem that you've been told about: Yes/No

6. Have you **ever had** any of the following cardiovascular or heart symptoms?

Frequent pain or tightness in your chest: Yes/No

Pain or tightness in your chest during physical activity: Yes/No

Pain or tightness in your chest that interferes with your job: Yes/No

In the past two years, have you noticed your heart skipping or missing a beat: Yes/No

Heartburn or indigestion that is not related to eating: Yes/No

Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you **currently** take medication for any of the following problems?

Breathing or lung problems: Yes/No

Heart trouble: Yes/No

Blood pressure: Yes/No

Seizures (fits): Yes/No

8. If you've used a respirator, have you **ever had** any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)

Eye irritation: Yes/No

Skin allergies or rashes: Yes/No

Anxiety: Yes/No

General weakness or fatigue: Yes/No

Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you **ever lost** vision in either eye (temporarily or permanently): Yes/No

11. Do you **currently** have any of the following vision problems?

Wear contact lenses: Yes/No

Wear glasses: Yes/No

Color blind: Yes/No

Any other eye or vision problem: Yes/No

12. Have you **ever had** an injury to your ears, including a broken ear drum: Yes/No

13. Do you **currently** have any of the following hearing problems?

Difficulty hearing: Yes/No

Wear a hearing aid: Yes/No

Any other hearing or ear problem: Yes/No

14. Have you **ever had** a back injury: Yes/No

15. Do you **currently** have any of the following musculoskeletal problems?

Weakness in any of your arms, hands, legs, or feet: Yes/No

Back pain: Yes/No

Difficulty fully moving your arms and legs: Yes/No

Pain or stiffness when you lean forward or backward at the waist: Yes/No

Difficulty fully moving your head up or down: Yes/No

Difficulty fully moving your head side to side: Yes/No

Difficulty bending at your knees: Yes/No

Difficulty squatting to the ground: Yes/No

Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No

Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

If "yes," name the chemicals if you know them: _____

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:

Asbestos: Yes/No

Silica (e.g., in sandblasting): Yes/No

Tungsten/cobalt (e.g., grinding or welding this material): Yes/No

Beryllium: Yes/No

Aluminum: Yes/No

Coal (for example, mining): Yes/No

Iron: Yes/No

Tin: Yes/No

Dusty environments: Yes/No

Any other hazardous exposures: Yes/No

If "yes," describe these exposures: _____

4. List any second jobs or side businesses you have: _____

5. List your previous occupations: _____

6. List your current and previous hobbies: _____

7. Have you been in the military services? Yes/No

If "yes," were you exposed to biological or chemical agents (either in training or combat):
Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

If "yes," name the medications if you know them: _____

10. Will you be using any of the following items with your respirator(s)?

HEPA Filters: Yes/No

Canisters (for example, gas masks): Yes/No

Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?:

Escape only (no rescue): Yes/No

Emergency rescue only: Yes/No

Less than 5 hours *per week*: Yes/No

Less than 2 hours *per day*: Yes/No

2 to 4 hours per day: Yes/No

Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:

Light (less than 200 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: _____ hrs. _____ mins.

Examples of a light work effort are *sitting* while writing, typing, drafting, or performing light assembly work; or *standing* while operating a drill press (1-3 lbs.) or controlling machines.

Moderate (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: _____ hrs. _____ mins.

Examples of moderate work effort are *sitting* while nailing or filing; *driving* a truck or bus in urban traffic; *standing* while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; *walking* on a level surface about 2 mph or down a 5-degree grade about 3 mph; or *pushing* a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

Heavy (above 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: _____ hrs. _____ mins.

Examples of heavy work are *lifting* a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; *shoveling*; *standing* while bricklaying or chipping castings; *walking* up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

If "yes," describe this protective clothing and/or equipment:_____

14. Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/No

15. Will you be working under humid conditions: Yes/No

16. Describe the work you'll be doing while you're using your respirator(s):

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

Name of the first toxic substance:_____

Estimated maximum exposure level per shift:_____

Duration of exposure per shift:_____

Name of the second toxic substance:_____

Estimated maximum exposure level per shift:_____

Duration of exposure per shift:_____

Name of the third toxic substance:_____

Estimated maximum exposure level per shift:_____

Duration of exposure per shift:_____

The name of any other toxic substances that you'll be exposed to while using your respirator:

19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):

Physician Approval Form

Date: _____

Tarleton State University
Box T-0750
Stephenville, Texas 76402

To Whom It May Concern:

I have performed a standard medical physical for «Name». It is my medical opinion that this individual shall be able to wear a respirator:

_____ Without Any Limitations

_____ With Limited Restrictions: Note Below

_____ Not Authorized For Use

Sincerely,