Respiratory Protection Program

General

It is necessary to protect persons who may be exposed to harmful mists, smoke, vapors, aerosols, pathogens, 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 feasible, respiratory protection should be provided and used.

This document is the written standard operating procedures used by Environmental Health and Safety (EHS) in the operation of a respiratory protection program. This standard operating procedure includes all the information and guidance necessary for the proper selection, use, and care of a respirator. The respiratory protection program shall be evaluated regularly to determine its effectiveness.

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INTRODUCTION

Purpose

Any person required to wear a respirator on the job should be instructed and trained 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 most cases, it is necessary for a physician to make this determination, thus all respirator users should be enrolled in a University occupational health program managed by EHS or the Office of Biosafety (Biosafety).

Respirators should be fit tested prior to use and annually thereafter to ensure adequate fit and effective protection of the user. Quantitative fit testing is required, except when EHS determines that qualitative fit testing is acceptable.

Scope

EHS is expected to establish a Respiratory Protection Program to ensure employee protection on

the job. The following standard operating procedures should be used in accomplishing this requirement.

Revisions
Revisions to the Respiratory Protection Program shall be made by the staff Industrial Hygienist or other qualified individual designated by the EHS Director.

Responsibilities
EHS will
- assist in determining if respiratory protection is needed
- determine appropriate respiratory protection
- provide medical evaluations as appropriate
- perform fit testing and respirator training as appropriate
- monitor program compliance

Biosafety will
- assist in determining if respiratory protection is needed for biological users
- determine appropriate respiratory protection for biological users
- provide medical evaluations as appropriate
- perform fit testing and respirator training as appropriate

The department/supervisor will
- identify employees who may require respiratory protection
- assure workers receive proper respirators and employee fit testing
- assure workers receive respirator training

The employee will
- use the respirator in accordance with guidelines described in this Respiratory Protection Program
- inform his/her supervisor if a respirator is damaged or lost
- report to his/her supervisor any illness or change in physical condition that may interfere with the safe use of a respirator

RESPIRATOR DESCRIPTION

Respirators can be classified according to whether they use an air source or ambient air, whether they operate under negative or positive pressure, and the configuration of the mask. See Figure 1 for respirator illustrations.

Air Purifying Respirators
- purify the ambient air by use of a chemical cartridge, canister, or a particulate filter
- powered air-purifying respirators (PAPRs) operate in a positive-pressure continuous- flow mode utilizing filtered ambient air
- disposable/single use respirators or elastomeric facepieces with reusable cartridges, canisters, or filters

Atmosphere Supplying Respirators

- Self contained breathing apparatus (SCBA)
- Airline/supplied air

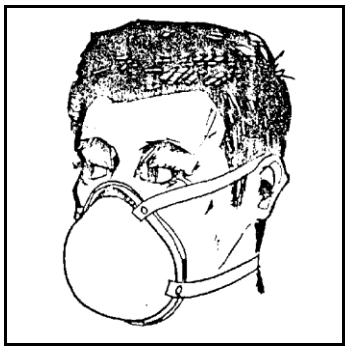
NOTE: Atmosphere supplying respirators must be used in an oxygen deficient atmosphere

Air Flow

- Positive pressure respirators maintain positive pressure in the facepiece during both inhalation and exhalation
  - pressure-demand respirators maintain the mask's positive pressure except during high breathing rates
  - continuous-flow respirators send a continuous flow of air into the mask at all times
- Negative pressure respirators draw air into the facepiece by the negative pressure created by inhalation (these are demand type respirators)

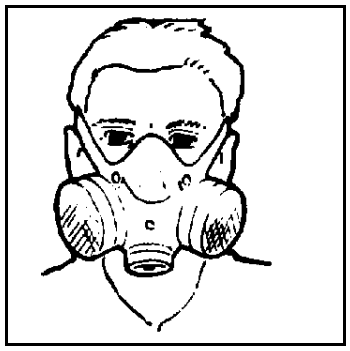
Mask Configuration

- Full facepiece masks cover the face from the hairline to below the chin; this type of mask does provide eye protection.
- Half masks cover the face from above the nose to below the chin; this type of mask does not provide eye protection.
- Quarter masks cover the face from above the nose to above the chin; this type of mask does not provide eye protection.

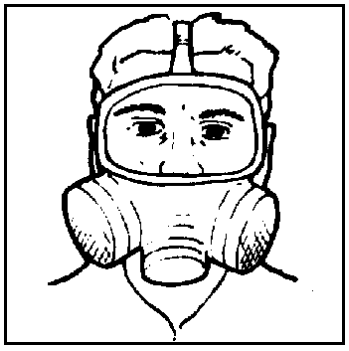


Disposable Filter

Air Purifying



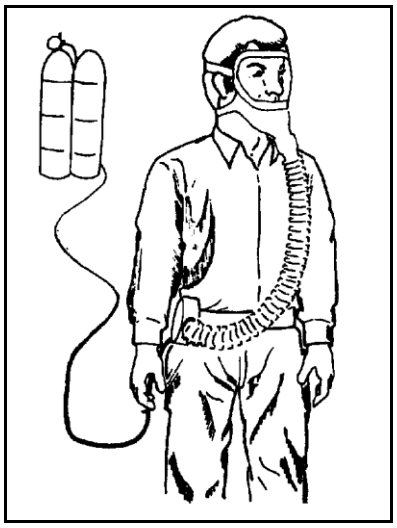
Half-face



Full-face

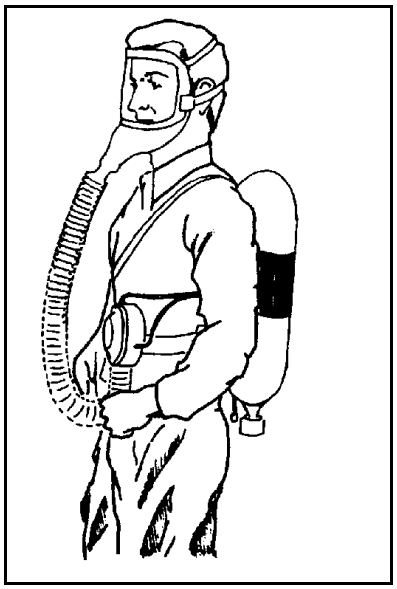
Air Purifying

Gas Mask (Canister)



Airline

Supplied Air



SCBA

Figure 1. Respirator Illustrations

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.

Limitations of Air Purifying Respirators

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

- Cannot be used in atmospheres containing less than 19.5% oxygen
- Cannot be used in IDLH atmospheres (except escape gas masks)
- Cannot be used when the identity of the contaminant is not known
- Cannot be used when contaminant concentrations are unknown or when established maximum levels have been exceeded
- Proper cartridge must be selected for the contaminant
- Relative humidity might reduce the effectiveness of the sorbent
- 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
- Cartridges/canisters are specific to the brand of respirator (e.g. 3M cartridges must be used with a 3M mask)

Classes of Air Purifying Respirators

Disposable dust respirators

- made of cloth or paper

- NIOSH/MSHA approved dust respirators provide protection against nuisance
- dusts (i.e. a TLV of 10 mg/cubic meter or greater)
- difficult to fit test and to obtain a good facepiece-to-face seal

Quarter mask respirator
- used with cartridges or particulate filters
- not suitable for protection against dusts with TLVs less than 0.05 mg/cubic meter

Half mask respirator
- uses one or two cartridges
- approved for vapors, dusts, fumes, mists, gases, and combinations thereof

Full-face mask respirator
- provides more protection than half mask respirators (e.g. eye protection and a higher protection factor)
- approved for same contaminants as half mask respirators, but at higher concentrations

Powered-air respirators
- have no breathing resistance
- can be used with half masks, full-face masks, hoods, and helmets

Mouthpiece respirators
- approved for escape only
- mouthpiece held by teeth; clamp used to close nostrils
- only used when hazard is identified and respirator is approved for that hazard

Air Purifying Element Considerations

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

Canisters
- remove vapors and gases from the air
- have a large sorbent volume and provide protection against higher concentrations
- a component of gas masks

Cartridges
- contain less sorbent than a canister
- can protect against single or multiple contaminants
- lifetime is short

Cartridge selection
- cartridges are color-coded to indicate the contaminants which they protect against (See Table 2)
- the cartridge selected must be made by the same manufacturer and be compatible with the respirator in use
- chemical and HEPA filter cartridges can be combined to provide protection against particulates and gases and vapors

- some cartridges can be combined to provide protection against more than one chemical
- 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

Cartridge/Canister must be replaced if any of the following conditions occur:

- cartridge/canister develops an uncomfortably high temperature (due to chemical absorption reaction)
- wearer detects an odor or taste, or feels eye or throat irritation
- shelf-life date is expired
- the end-of-service-life indicator changes color (if applicable)
- cartridge/canister becomes wet or is grossly contaminated
- physical damage is noticed

Filters (HEPA Cartridges, Dust Pads, or Disposable Dust Respirators) must be replaced if any of the following conditions occur:

- breathing becomes difficult
- filter or dust respirator becomes physically damaged (tears, holes, etc.)
- filter or dust respirator is visibly dirty
- filter or dust respirator becomes wet
- the inside of the dust respirator becomes contaminated
- disposable dust respirators should be disposed of after use

All cartridges, filters, and canisters must be disposed of as. In addition:

- air purifying respirators should be fit tested (See Respirator Fit Test section)
- air purifying respirators should be cleaned, inspected, and stored properly (See Care of Respirator Equipment section)

TABLE 2
Air Purifying Cartridge/Canister Color Codes

CONTAMINANT(S)	ASSIGNED COLORS AND/OR COMPONENTS
Acid gases	White
Ammonia gas	Green
Acid gases and ammonia gas	Green with 1/2 inch white stripe completely around the canister near the bottom
Acid gases and organic vapors	Yellow
Acid gases, organic vapors, and ammonia gases	Brown
Carbon monoxide	Blue
Chlorine gas	White with 1/2 inch yellow stripe completely around the canister near the bottom
Hydrocyanic acid gas	White with 1/2 inch green stripe completely around the canister near the bottom
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 inch blue stripe completely around the canister near the bottom
Organic vapors	Black

Particulates	Purple/Magenta (HEPA)
Particulates (dusts, fumes, mists, fogs, or smoke) in combination with any of the above gases or vapors	Canister color for contaminant with 1/2 inch gray stripe completely around the canister near the top.
Pesticides	Organic vapor canister plus filter
Radioactive materials, excepting tritium and noble gases	Purple/Magenta

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

ATMOSPHERE SUPPLYING RESPIRATORS

Atmosphere supplying 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).

Self-Contained Breathing Apparatus (SCBA)

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

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

- Open circuit
  - most common type used
  - 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
  - if using compressed oxygen, it **CANNOT** be used in a device designed for compressed air
  - air is exhaled, not recycled
  - amount of air is limited: generally allows for 30 or 60 minutes of air; 5 minute units are available for escape purposes
  - air must meet at least Grade D specifications
  - consists of: cylinder, high-pressure hose, alarm, regulator, breathing hose and facepiece, backpack and harness
  - 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
  - function in one of two modes of operation: demand and pressure demand

- 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
- 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

Airline Devices

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:

- Demand
  - air only enters the facepiece when wearer inhales
  - a negative pressure is present in the facepiece during inhalation
- Pressure demand
  - air flows continuously into facepiece
  - a positive pressure is maintained in the facepiece
  - provides more protection than the demand type device
- Continuous flow
  - uses an airflow control valve or orifice instead of a regulator
  - air flows continuously into facepiece
  - a positive pressure is maintained in the facepiece

Hose Masks

Hose masks allow air to the wearer via a large diameter hose, but do not use compressed air.

- not widely used
- hose extends to a non-contaminated air space
- user either breathes with the aid of a blower or breathes against the resistance to airflow in the hose
- depending on manufacturer, a hose mask with a blower may have hose length up to 300 feet and may have a facepiece, helmet, or hood
- depending on manufacturer, a hose mask without a blower may have hose length up to 75 feet and must have a tight fitting facepiece
- with or without a blower, hose masks cannot be used in atmospheres immediately dangerous to life and health

Limitations of Air Supplying Respirators

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

- SCBA
  - these respirators are bulky and heavy and may not be suitable for strenuous work or for working in constricted spaces
  - the use time is limited by the amount of air contained in the cylinder (normally 30 or 60

minutes)
    - 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
    - heat stress and worker fatigue need to be considered

- Airline device
    - the air supply line restricts the wearer's mobility
    - 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)
    - 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
    - if using a compressor, it must be located in a safe, non-contaminated environment; it must have alarms to indicate compressor failure and overheating; it must have an alarm that indicates the presence of carbon monoxide.
    - if using 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
    - airline couplings must be incompatible with outlets for other gas systems

- Hose masks
    - cannot be used in atmospheres immediately dangerous to life and health
    - air supply hose limits mobility
    - hose mask without a blower is limited to a 75 foot hose and wearer must inhale against resistance to airflow which can cause worker fatigue
    - source of contaminant free breathing air must be nearby

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

RESPIRATOR SELECTION

The selection of a respirator will be made according to the guidance of ANSI Z88.2 -1980. Only respirators which are approved by NIOSH should be used.

General Considerations

The selection of a respirator shall be based on the following:

- characteristics of the hazardous operation
  - work area characteristics
  - materials used
  - worker activities
- nature of the respiratory hazard
  - type of hazard: a contaminant or an oxygen deficient atmosphere
  - physical and chemical properties of the contaminant
  - physiological effects on the body
  - 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), or other published guidelines
  - Immediately Dangerous to Life and Health (IDLH) concentration
  - warning properties of the contaminant
- location of the hazardous area in relation to the nearest area having respirable air; this needs to be considered when planning for:
  - emergency escape
  - entry of workers
  - rescue operations
- period of time for which respiratory protection must be provided
  - routine use
  - emergency use
- activities of workers in the hazardous area
  - light, medium, or heavy work rate
  - intermittent or continuous work
- physical characteristics, functional capabilities, and limitations of the various respirators (certain conditions require a specific respirator)
- respirator protection factor (Table 1)

Respirator Protection

Different respirators provide protection against different hazards:

- Filter respirators
  - provide protection against particulate matter such as dust, fumes, mists, smoke,
  - microorganisms, and asbestos
  - do not provide protection against chemical vapors or gases, or oxygen deficiency
- Chemical cartridge/canister respirators
  - provide protection against certain gases and vapors up to a particular

concentration
  - do not provide protection against oxygen deficiency or particulate matter
- Air supply respirators
  - dependent on the type, can provide protection against particulates, chemical
  - vapors and gases, as well as oxygen deficiency

Respirator Selection Guidelines

To aid in the selection of an appropriate respirator, consider the following:

- 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
- Identity and concentration of the contaminant should be known in order to select respirator
- If the identity and concentration of the contaminant is not known, then an atmosphere supplying respirator must be used
- 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
- If an oxygen deficient atmosphere is known or suspected to be present, an air supply respirator must be used
- 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 Respirator Fit Test 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

Respirator Class and Type	NIOSH Assigned Protection Factor
Air Purifying	
Filtering Facepiece	10
Half-Mask	10
Full-Facepiece	50
Powered Air Purifying	
Half-Mask	50
Full-Facepiece	50
Loose Fitting Facepiece	25
Hood or Helmet	25
Supplied Air	
Half-Mask-Demand	10
Half-Mask-Continuous	50
Half-Mask-Pressure Demand	1000
Full-Facepiece Demand	50
Full-Facepiece Continuous Flow	50

Full-Facepiece Pressure Demand	2000
Loose Fitting Facepiece	25
Hood or Helmet	25
Self-Contained Breathing Apparatus (SCBA)	
Demand	50
Pressure Demand	10,000

Table 1. Assigned Protection Factors (NIOSH)

RESPIRATOR FIT TEST

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 important that every respirator be fit tested before it is used. Fit testing can be accomplished by one of two methods: quantitative or qualitative. Both methods are described below. Quantitative fit testing is required, except when EHS determines that qualitative fit testing is acceptable. Records must be kept for every fit test performed.

Fit testing should be performed prior to initial use and annually thereafter, when a different respirator is used, or if there are changes to the user's face shape that may affect the respirator fit.

Quantitative Fit Test

This method of fit testing is very accurate and determines the actual fit factor of a respirator by comparing concentrations of particles inside the respirator to the ambient air. The following is a review of the PORTACOUNT™ fit test procedure.

- The user dons a respirator equipped with a sampling port/probe and HEPA filters.
- The user wears the respirator while performing the following exercises for a pre-determined amount of time: normal breathing, deep breathing, head side to side, head up and down, talking, grimace, normal breathing.
- The PORTACOUNT™ records the number of particles in the ambient air and within the respirator during each exercise and uses the results from each exercise to calculate the overall fit factor.
- Each respirator has an assigned fit factor pass level (e.g. 100 for half-face, 500 for full-face). The user's overall fit factor must achieve that number to pass the test.

Qualitative Fit Test

This method of fit testing uses 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 isoamyl acetate and a HEPA cartridge must be used for the irritant smoke test)
- The test involves having the test subject don a respirator; exposing user to the test substance; requiring user to perform a task such as reciting the alphabet, moving head from side to side, etc.; determining whether user can detect the test substance
- 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
- If the test substance is not detected, then a satisfactory fit is assumed to be achieved
- When using isoamyl acetate, the following limitations apply:
  - the odor threshold varies among individuals
  - olfactory fatigue may prevent a person from detecting the odor
  - there is no involuntary reaction to the isoamyl acetate like there is to the irritant smoke, so you must rely on the test subject to respond honestly
- Disposable dust masks cannot be fit tested

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

- Reasons for the need for respiratory protection
- Nature, extent and effects of respiratory hazards to which the person may be exposed
- Selection of appropriate respirator for the hazard
- Explanation of the operation, capabilities, and limitations of the selected respirator
- Instructions in inspecting, donning, fit testing and wearing the respirator
- Directions for maintenance and storage of the respirator
- Hands-on training to allow actual handling of the respirator

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:

- Negative pressure test
  - may be impossible to perform on many disposable respirators
  - seal the inlet opening(s) of the respirator
  - inhale gently and hold your breath for 10 seconds
  - 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
- Positive pressure test
  - may be impossible to perform on many disposable respirators
  - cover the exhalation valve of the respirator
  - exhale gently
  - 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

PROPER USE OF RESPIRATORS

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.

Do:

- Make sure you have the correct respirator for the job
- Have an additional person present if in dangerous atmospheres
- Determine a means of communication between respirator wearers prior to using the

respirators in the field (hand signals are acceptable)
- Use a respirator which has been approved by NIOSH
- Check a respirator each time before use
- Shave and put dentures in (if applicable) before wearing a respirator
- Be aware that some contaminants may enter or damage the body by means other than the respiratory tract (protective clothing may be required)
- Return to fresh air if: the canisters or cartridges need replacing; you feel nauseous, dizzy, or ill; or if you experience difficulty breathing
- Wear eye protection if the contaminant concentration causes eye irritation (a full facepiece respirator may be used)
- 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
- Be alert to signs and symptoms of heat stress
- Ensure your respirator is fit tested annually

Do not:
- Remove a respirator in a contaminated atmosphere
- Use a respirator without the proper training
- Talk unnecessarily or chew gum while wearing a respirator
- Overexert yourself
- Wear contact lenses while using a respirator
- Mistakenly use a filter respirator for protection against gases or vapors
- Allow hair or temple bars from glasses to pass between the face and facepiece of the respirator

Respirator Use in Dangerous Atmospheres
Only full-face pressure demand SCBA 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:
- 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
- Communications must be maintained between the individuals present; the communications can include visual, voice, or signal line
- 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
- When a SCBA is used in an atmosphere immediately dangerous to life and health, standby personnel must be present with rescue equipment
- 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
- For respirator use in confined spaces, contact EHS.

Donning an SCBA
There are different methods to don an SCBA. The wearer needs to find a method that feels

comfortable. The following describes one method (per the Fire Protection Training Division, Texas Engineering Extension Service) which can be used to don an SCBA:

- Remove SCBA from the case, locate cylinder gauge, and check the air pressure
- Position the SCBA with the cylinder down, harness toward the wearer, and cylinder control valve pointing toward the body (the SCBA can be placed on the ground or preferably on a table)
- Grasp shoulder strap on which the regulator is mounted with the right hand
- Pick up SCBA, place left arm through the strap supported by the right hand, placing strap on left shoulder
- Remove right hand from the left shoulder strap, place right arm into the remaining strap
- Grasp both shoulder straps near the shoulders and complete positioning of the SCBA, lock snaps, and adjust the straps
- The following method can be used to don the face mask:
    - position the adjustable straps (fully extended) to the outside of the mask
    - place hands between the straps and the mask, with the straps laying on the back of the hands
    - place mask on the face, inserting chin first, working the mask up on the face
    - raise hands away from the mask, continue movement around the sides of the face until the straps are in place
    - 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
    - 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

CARE OF RESPIRATORY EQUIPMENT

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.

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:

Disposable Respirators

- Integrity of the filter - check for holes or tears
- Elastic straps - check for loss of elasticity, tears, etc.
- Metal nose clip - check for breakage

Air Purifying Respirators

Rubber facepiece, check for:

- excessive dirt
- cracks, tears, or holes
- distortion from improper storage
- cracked, scratched or loose fitting lens

- broken or missing mounting clips
- worn threads in filter holder
- missing or worn gaskets in filter holder

Headstraps, check for:

- breaks
- loss of elasticity
- broken or malfunctioning buckles or attachments

Inhalation and exhalation valve, check for:

- detergent residue, dust particles, dirt
- cracks, tears, or distortion
- missing or defective valve cover

Chemical canisters and/or particulate filters, check for:

- proper filter or canister for the hazard
- approval designation
- worn threads on filter housing
- cracks or dents in filter housing
- deterioration of harness (gas mask canister)
- service life indicator, expiration date (if applicable)

Corrugated breathing tube (gas masks), check for:

- cracks
- missing or loose hose clamps
- broken or missing connectors

Atmosphere Supplying Respirators

Check facepiece, headstraps, valves, and breathing tube as described for air purifying respirators.

Hood, helmet, blouse, or full suit (if applicable), check for:

- rips and torn seams
- headgear suspension
- cracks or breaks in faceshield

Air supply system, check for:

- low volume of air cylinders
- incorrect gas in cylinders
- breaks or kinks in air supply hoses and end fitting attachments
- loose connections
- improper setting of regulators and valves (consult manufacturer recommendations)
- incorrect operation of air purifying elements and carbon monoxide or high temperature alarms (for air compressors)

Self-contained breathing apparatus (SCBA), check for:

- air or oxygen cylinders that may not be fully charged according to manufacturer's instructions
- loose connections
- improper setting of regulators and valves (consult manufacturer recommendations)

Note: Defects and deficiencies must be corrected by trained personnel before the respirator is used. Replacement or repairs should be done only by experienced people with the parts designed for the

respirator.

Cleaning and Disinfecting

Proper cleaning of a respirator reduces the potential for contamination and dermatitis.

- Frequently clean and disinfect personal respirators
- Thoroughly clean and disinfect shared respirators between users
- Clean and disinfect emergency use respirators after each use
- Recommended cleaning-disinfecting-deodorizing solution: quaternary ammonium
- Other acceptable cleansing agents include soap and water and alcohol towelettes

Storage

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

- Protect respirators from dust, sunlight, heat, extreme cold, excessive moisture, and chemicals
- Store respirators with the facepiece and exhalation valve resting in a normal position
- Routinely used respirators may be placed in plastic bags
- Store emergency use respirators in an accessible, clearly marked compartment

GLOSSARY

ANSI - American National Standards Institute

Breathing tube - A tube which allows air to flow to the facepiece.

Cartridge - A component of a respirator which removes contaminants from the air.

Contaminant - Any gas, vapor, particulate, etc. present in the air which might harm a person.

Exhalation valve - A device in a respirator which allows exhaled air to leave and prevents outside air from entering.

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.

Filter - A fibrous media that removes liquid or solid particles from the air.

Gas Mask - An air purifying respirator which uses a large volume canister to remove gases and vapors from the air.

HEPA filter - High Efficiency Particulate Air filter used to remove asbestos fibers and other particulates from the air.

IDLH - Immediately Dangerous to Life and Health; respiratory exposure that may cause death, irreversible adverse health effects, or acute eye exposure that would prevent escape.

Inhalation Valve - A device in a respirator which allows respirable air to enter and prevents exhaled air from leaving.

MSHA - Mine Safety and Health Administration

NIOSH - National Institute for Occupational Safety and Health

PEL - Permissible Exposure Limit; the legal concentration of a contaminant (as dictated by OSHA) that cannot be exceeded.

Protection Factor - The ratio of the contaminant concentration outside a respirator to the contaminant concentration inside the respirator.

Respirable - Air which is fit for breathing.

Respirator - A device which protects a person from breathing airborne contaminants.

SCBA - Self Contained Breathing Apparatus

Service Life - The amount of usable time left for a cartridge or canister.

Sorbent - The material found in a cartridge or canister which removes gases or vapors from the air.

TLV - Threshold Limit Value; a recommended exposure limit issued by the American Conference of Governmental Industrial Hygienists; this limit represents a condition which is believed that nearly all workers may be repeatedly exposed to without adverse health effects.

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