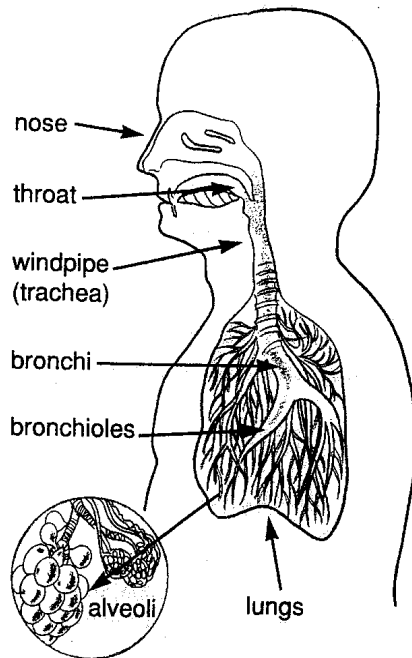


RESPIRATORY HAZARDS

Your Respiratory System

You need oxygen to live. It is your respiratory system's job to provide oxygen to your body, through the blood system, from the air you breathe. It is important for you to know how your respiratory system works so you can understand how airborne contaminants can harm you.



Your body gets oxygen from the air you breathe. When you breathe, air is pulled in through your nose and mouth. It travels down the **throat**, through the **trachea**. The trachea then branches into two airways, called the **bronchi**, that lead into the lungs. The bronchi divide into many smaller airways called **bronchioles**.

Millions of tiny air sacs called **alveoli** are at the end of the bronchioles. Each lung has between 300 and 400 million alveoli. The alveoli have thin membranes that separate them from the blood stream. It's here that the alveoli pass the oxygen from the air you inhale into the blood stream and collect the carbon dioxide from the blood so it can be exhaled.

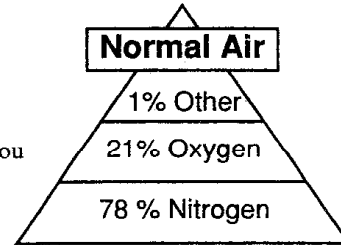
The exchange of oxygen for carbon dioxide is immediate. This means that when you breathe in oxygen, your respiratory system instantly gets rid of the carbon dioxide. This is very important to remember because it means that when you breathe in contaminated air, it enters your respiratory system and is passed into your blood stream immediately, too.

Respiratory Hazards

There are three types of respiratory hazards: oxygen deficient atmospheres, gases and vapors, and particulate contaminants. Also, some atmospheres may contain more than one hazard. For example, an environment could be oxygen deficient and also contain a particulate contaminant.

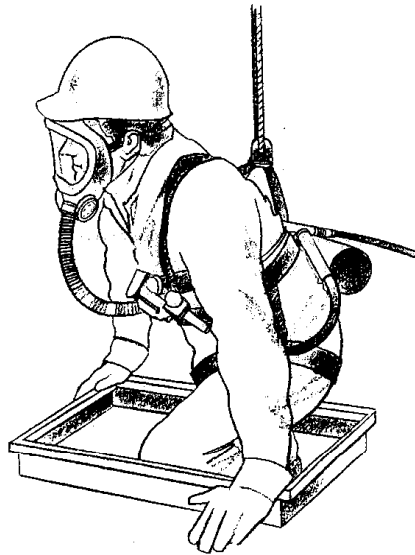
Oxygen Deficient Atmospheres

An oxygen deficient atmosphere does not have enough oxygen in the air to supply the body. You can survive only a few minutes without enough oxygen.



- Normal air contains 21% oxygen, 78% nitrogen, and 1% of other gases.
- An atmosphere that is oxygen deficient has *less than 19.5% oxygen*.

Oxygen deficient atmospheres can only be detected by monitoring the air.



- You may not be aware that you are in an oxygen deficient atmosphere because the lack of enough oxygen affects your judgment and logic. An oxygen deficient atmosphere can also affect your muscular coordination and sense of hearing, touch, and location. Continued exposure may lead to unconsciousness and even death.

- Oxygen deficiency can be created by chemical reactions, fire, or in enclosed places.

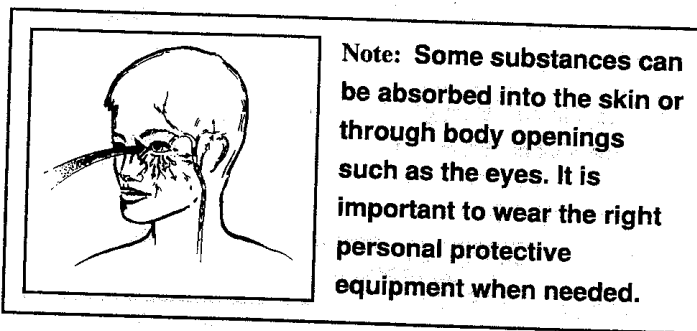
- An oxygen deficient atmosphere is most likely to happen in confined spaces such as manholes, sewers, ship holds, silos, and tanks to name a few.

Respiratory Hazards (continued)

Gases and Vapors

Gases are airborne contaminants that are invisible at room temperature. Gases can be hard to detect because they can be colorless, odorless, and tasteless.

Vapors are invisible contaminants formed when a liquid or solid evaporates. Vapor producing activities include painting, refining, and solvent cleaning.



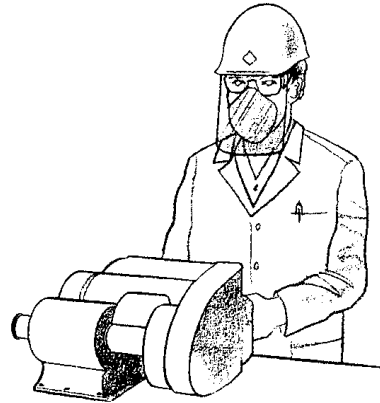
Gases and vapors can be absorbed into the blood stream and cause blood disorders, heart disease, cancer, birth defects, and damage to organs. They may also result in disability or death.

Respiratory conditions due to toxic agents are the third leading cause of occupational illnesses, according to a recent study.

Particulate Contaminants

There are many kinds of particulate contaminants, including dust, mist, fog, fumes, and smoke.

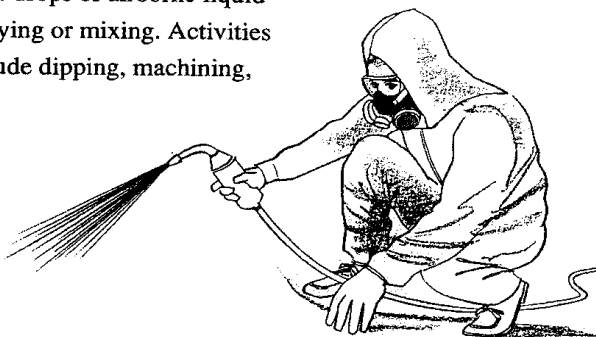
Dusts: Dust is made up of solid airborne particles that can vary in size. Some activities that produce dust include crushing, drilling, grinding, milling, sanding, and mixing. Dust particles are usually larger than fumes.



Fumes: Fumes are small metal particles given off when metals are heated, such as in furnace work, casting, galvanizing, smelting, soldering, and welding.

Respiratory Hazards (continued)

Mists: Mists are small drops of airborne liquid usually formed by spraying or mixing. Activities that produce mists include dipping, machining, and spray painting.



Fog: Fog is a mist concentrated enough to block your vision.

Smoke: Smoke is made up of gases, vapors, particles, and liquid aerosols that are produced by burning or chemical reaction. Smoke is often concentrated enough to block your vision.

Though most particulates may not be large enough to see, they can become imbedded in the respiratory system's membrane and cause scar tissue to form. This prevents the oxygen from being passed into the blood system and could make breathing more difficult, resulting in an emphysema like condition.

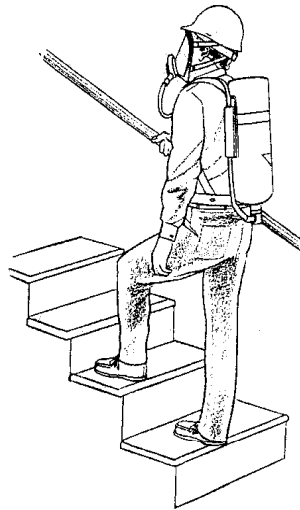
Respirator Selection

There are two groups of respirators:

air purifying respirators clean the contaminated air



and **air supplying respirators** supply fresh air to breathe.



Respirator face pieces also come in different sizes, such as half mask and full face piece. It is important to know the type of respiratory hazard you face to select the proper respiratory protection.



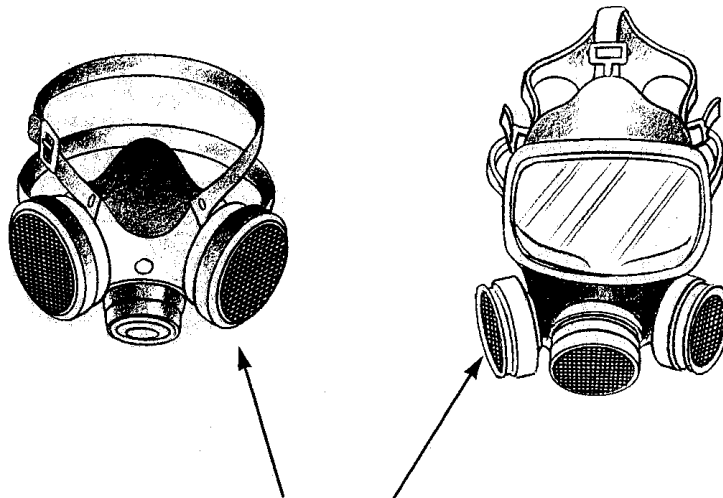
Before you can wear a respirator in the work environment, you must have a medical examination. Periodic checkups should follow at least once a year to determine if you have any health changes.

Not everyone is able to wear a respirator. Conditions such as allergies, asthma, bronchitis, claustrophobia, emphysema, high blood pressure, heart conditions, and facial abnormalities such as scars could interfere with the safe use of a respirator.

Air Purifying Respirators

Air purifying respirators clean contaminated air by removing hazards in the air when it passes through an air purifying element. Air purifying respirators have two basic components:

- 1) A mask that covers your mouth and nose or your full face;



- 2) A filter or cartridge to trap contaminated air.

Air purifying respirators use different canisters or filters, depending on the hazard. They do not supply fresh air; They only clean the existing contaminated air. Because they do not supply fresh air, air purifying respirators must **never** be used in oxygen deficient environments.

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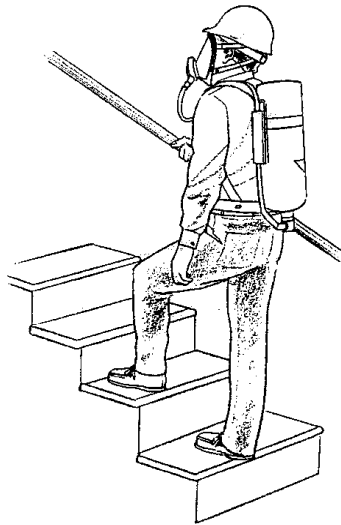
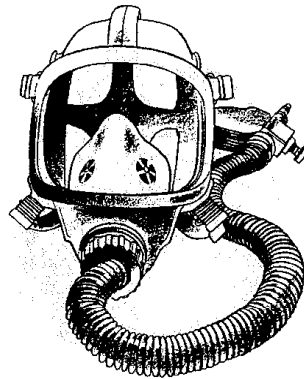
COLOR	USED FOR:
Black	Organic vapors
Yellow	Organic vapors, chlorine, sulfur dioxide, hydrogen chloride
White	Chlorine, hydrogen chloride, sulfur dioxide
Green	Ammonia, methyiamine
Purple	Dusts, mists, fumes
Purple/black	Dusts and organic vapor
Purple/yellow	Organic vapors, acid gases, dusts
Purple/white	Acid gases, dusts
Purple/green	Ammonia, methyiamine, dusts

Cartridges on air-purifying respirators are made to filter out specific contaminants. What works for one chemical may not work for another. When in doubt, read the box the cartridges came in or consult manufacturer or competent safety personnel.

Air Supplying Respirators

When the oxygen content in the air drops below 19.5%, the atmosphere is oxygen deficient and is considered immediately dangerous to life or health (IDLH). In these cases, an air supplying respirator must be used. Air supplying respirators are also used in situations when the atmosphere or the hazards it may pose is unknown. Air supplying respirators provide clean, breathable air to the face piece that does not come from the contaminated air in the environment. When using an air supplying respirator, you must be careful not to pinch the air hose or expose it to sharp objects. There are three types of air supplying respirators:

•**Air Line:** Air line respirators supply you with clean air through a hose from a compressor or through large diameter tubing with its air inlet placed outside the hazardous work area. They are used in areas with high concentrations of hazards or where air purifying respirators would not offer enough protection.



•**Self Contained Breathing Apparatus (SCBA):** Self contained respirators allow you to move around more easily because the supply of clean air that you breathe in is carried in a tank on your back.

The clean air flows through a regulator to your mask for complete protection from hazards, including oxygen deficiency. The air supply of self contained units is rated for various lengths of operation. This also depends on your size, physical condition, and type of work activity being performed. An alarm sounds when the air supply is low.

Proper Fit

You must be fit tested before you are assigned a proper fitting respirator. A face piece is designed to form a complete seal with the face. Fit testing is done to ensure that the respirator you wear will form a proper seal to your face so contaminated air does not enter. There are two types of fit tests:

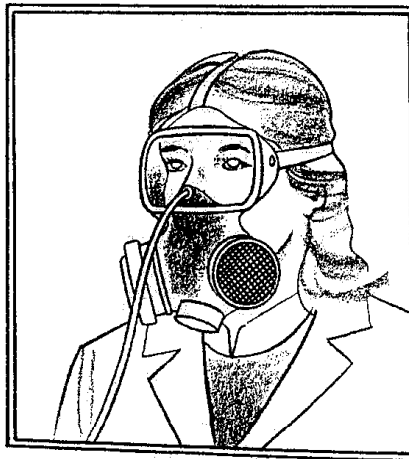


Qualitative Fit Test

During a qualitative fit test, you are exposed to a test agent such as an odorous chemical or an irritant smoke while you are wearing your respirator. If you can smell the odor or if your nose or throat become irritated, that particular respirator fails the test.

Quantitative Fit Test

During a quantitative fit test, the air inside your face piece is sampled by a probe attached to the respirator. While you are simulating workplace movements, the sampled air is analyzed by an electronic instrument that is connected to the probe with a tube. This instrument measures the difference between the air outside the face piece and the air inside. Leakage cannot exceed federal regulations or the respirator fails the test.



Fit Checks

Fit checks should be performed every time you use a respirator before entering the hazardous atmosphere. Two types of fit checks are positive and negative fit checks. A fit check does not use a test agent like the fit test. It is performed by the respirator wearer to determine if the respirator fits properly and is forming an effective seal.



Negative Fit Check

To perform a negative fit check, put the face piece on and adjust the straps for a comfortable fit. Place your palms over the inhalation inlets to prevent any air from getting in. Inhale slowly and hold your breath for about 10 seconds. The face piece should collapse inward. If it does and no leaks are felt outside, the fit should be secure.

Positive Fit Check

To perform a positive fit check, close off the exhalation valve with the palm of your hand and blow out slowly into the face piece. Hold your breath for about 10 seconds. The face piece should bulge out slightly. While holding your breath, check for air leaks between your face and the seal. If no leak can be detected and the face piece bulges out slightly, the fit should be secure.



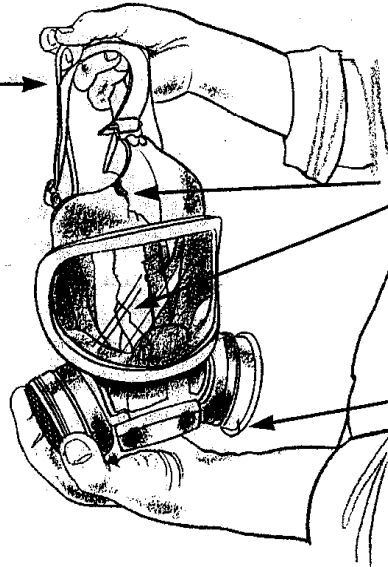
Facial hair such as beards and sideburns must be removed if they interfere with the seal. Facial scars, glasses, goggles, and hats could also interfere with an effective seal.

**It is important to remember that a fit check
is not a fit test.**

Inspection

You must carefully inspect your respirator before and after each use to make sure it is not damaged or worn. Emergency use respirators should be inspected at least once a month and after each use.

- Check the headstraps for loss of elasticity and signs of wear such as cracking, tears, and loose or broken buckles.



- Inspect the face piece or mask for cracks, holes, tears, dirt, and distortion.

- Look for missing or worn gaskets.

- Check the input and output valves for missing or worn valve covers, cracks, and dirt.

- Check air supplying respirators for damaged air hoses, and loose or damaged air hose connections. Also, make sure your air tanks are full and your regulator is working properly.

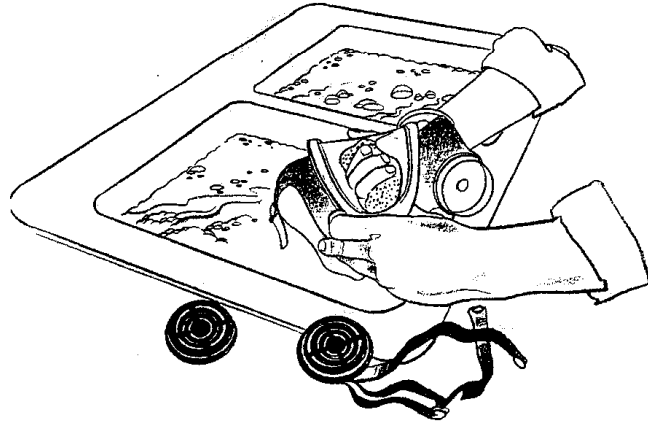
- Check air purifying respirators for any worn filter threads. Cartridges and filters should also be checked for expiration date or excessive use and replaced whenever breathing becomes difficult.

Damaged or worn parts must be repaired or replaced immediately by qualified personnel. Never use a respirator that isn't working properly. If you do, you could be exposed to contaminants in the air. Your respirator is your protection from harmful health hazards.

Care and Maintenance

Proper care and maintenance of your respirator will help keep it in good working order. Your respirator should be cleaned and disinfected regularly.

Following the manufacturer's directions, disassemble your face piece and wash it in warm water using a mild detergent containing bactericide. Do not wash the filters and cartridges. Use a soft brush to remove dirt, if needed.



Rinse the face piece in clean, warm water. Then treat it with a disinfectant and rinse again to remove all traces of detergent and disinfectant. Allow the face piece to air dry on a clean surface in a designated area. Do not wipe dry or use drying appliances.

Never tamper with your respirator, filters, or cartridges. Do not punch holes in the filter or substitute parts from different makes.