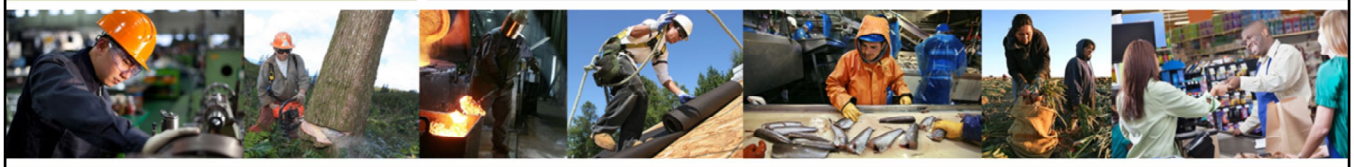
Washington State Department of
Labor & Industries

Supplied Air Respirators

Airline respirators and SCBAs



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All photos from Adobe Stock unless otherwise indicated

We are providing this training because you wear supplied air respirators as part of your job duties. Supplied air respirators work differently from air-purifying respirators. They provide clean air rather than filtering out contaminants from dirty air. This training will cover when they must be used, what their capabilities and limitations are, how they work and the importance of good air quality."

This is limited training

This module is introductory training for employees who wear supplied air respirators.

The two main types of supplied air respirators are covered in this module. Abrasive blasting hoods or re-breather type respirators are not covered.

This module only covers basic facts of supplied air respirators and is not complete training by itself.

You will also be given hands-on training with the respiratory equipment you use.

Supplied air respirators are used in situations where high levels of toxic air contaminants or lack of oxygen cannot be controlled by other means. Since highly toxic air contaminants or lack of oxygen can be life-threatening, the protection provided by supplied air respirators is high level, as long as users know the limitations of these respirators and are properly trained on their use.

What are supplied air respirators?

Photo from Drager

Airline respirator – air from a compressor

SCBA (self-contained breathing apparatus) – air from a tank

Supplied air respirators provide positive pressure inside the facepiece at all times

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Since supplied air respirators provide positive air pressure inside the facepiece at all times, air contaminants cannot enter the facepiece, making them more protective then cartridge respirators.

Airline respirators are connected by a hose to an air compressor or air pump which provides unlimited supply of air as long as the compressor operates. They can also be connected to a series of large air tanks which provide many hours of air. Great care must be taken to be sure the compressor provides clean air. More about that later. SCBA have tanks strapped on the back with a 30 to 60 minute supply of air under pressure. These are typically used by firefighters or in emergency situations. Both types require hands-on training and regular practice to be able to use properly.

Conditions where supplied-air respirators are required

- Oxygen deficiency
- High levels of toxic chemicals in the air – above “IDLH” levels
- Other conditions of high levels of highly toxic chemicals in the air
- Firefighting

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Unlike air-purifying respirators (cartridge-type respirators or dust masks), supplied air respirators provide a high degree of protection for the user in these life-threatening situations. DOSH regulations require the use of supplied air respirators in the situations listed. If air contaminant or oxygen levels are unknown and testing can’t be done in confined spaces, emergency spills or leaks or at hazardous waste sites, it must assumed that IDLH levels are exceeded and supplied air respirator must be worn. In these high risk situations, you must assume the worst unless you have evidence otherwise. Firefighting is a special case and firefighters routinely use SCBAs. Firefighters are covered by separate regulations. More about oxygen deficiency and “IDLH” in the slides following.

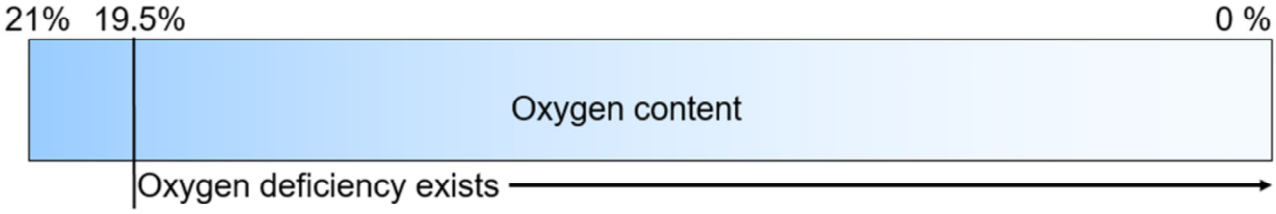
What is oxygen deficiency?

An oxygen deficiency can be life-threatening

Normal air contains 21% oxygen. A space with oxygen content below 19.5% is "oxygen deficient".

Lack of oxygen can cause immediate collapse and death.

Oxygen deficiency can occur in confined or enclosed spaces or areas of large chemical leaks.



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Oxygen deficiency can occur in confined spaces or in chemical or fuel storage tanks.

Effects of oxygen deficiency

% Oxygen	Symptoms
19.5% - 16%	Fatigue, mild impaired coordination
16% - 12%	Increased breathing rate and pulse; impaired coordination, perception
12% - 10%	Further increased breathing rate, blue lips, mental confusion
10% - 8%	Fainting, nausea, vomiting, mental confusion within minutes, collapse
8% - 6%	Collapse, death within 8 minutes
6% - 0%	Coma within 40 seconds, death

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There are not warning signs of oxygen deficiency other than the effects it has on you. You can't see it or smell it. If a person enters a space with oxygen levels below 10 %, the first sign of oxygen deficiency is that they will suddenly collapse. Even though most people will not collapse in oxygen deficiency as low as 16%, impaired judgment and coordination can put them at greater risk of injury. In addition, a person with heart or lung problems may experience more severe symptoms at higher levels of oxygen than a healthy person.

What is "IDLH"

IDLH
IMMEDIATELY DANGEROUS to LIFE or HEALTH

"IDLH" means immediately dangerous to life or health.

Many chemicals have a listed IDLH level.

Oxygen deficiency is also IDLH.

IDLH conditions can occur in confined spaces, large chemical spills or leaks, and fires.

NIOSH Table of IDLH Values

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IDLH is defined as " an atmospheric condition that would cause an immediate threat to life, or cause permanent or delayed adverse health effects or interfere with an employee's ability to escape". In other words, the amount of chemical in the air is so high, it will cause death or permanent harm. The National Institute of Occupational Safety & Health (NIOSH) has a published list of IDLH levels for a large number of chemicals.

In addition to confined spaces, IDLH conditions can occur in enclosed spaces such as rooms or buildings with little or no ventilation where there has been a chemical release of a highly toxic chemical. In most workplaces, IDLH conditions rarely occur. However, confined spaces are a notable exception - IDLH conditions commonly occur in sewers or tanks where welding is done or in tanks that contain residues of chemicals or fuel. Rusting inside empty steel tanks can result in oxygen deficiency. Any entry into tanks or other confined spaces should not be done until the tank is completely ventilated, or air monitoring for oxygen content or air contaminants is done.

[You can discuss your locations or tasks where IDLH conditions may exist here]

Example of IDLH - Hydrogen Sulfide (H_2S)

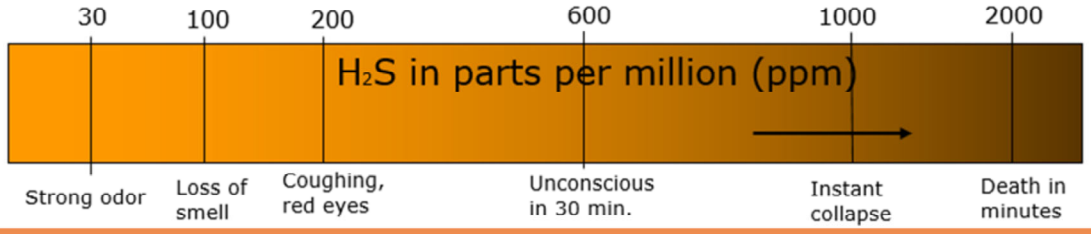
Hydrogen sulfide gas is commonly found in sewers.

It can be instantly fatal at higher levels in a confined space.

IDLH level is 100 ppm.

Disturbing sewage sludge can release more hydrogen sulfide gas.

Supplied air respirators are normally needed to enter sewers.



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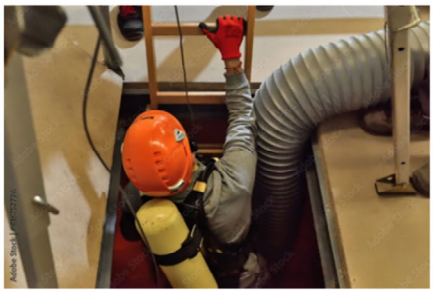
[Optional slide for employee who must enter sewer lines or sewage treatment plant tanks.]

To safely enter a space with an IDLH atmosphere:

- must use a supplied air respirator,
- must have at least one or two standby persons at entrance,
- standby employees must be trained to conduct emergency rescue,
- appropriate retrieval equipment may be needed.



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Only well-trained persons can enter an area with IDLH conditions. Entering a confined space or enclosure that has chemicals above their IDLH level is a high-risk activity and the highest form of respiratory protection must be worn. Entry should only be done when there is no alternative, or when someone is injured and must be rescued. Entry into a confined space requires a confined space program using written permits. Firefighters deal with these conditions on a regular basis, but the average employee does not.

Two standby persons are normally required by DOSH rules. One standby person is allowed if it can be shown that the IDLH condition is well known and will remain stable, and the one standby person can adequately monitor and communicate with employees in the IDLH area and initiate rescue.

[optional] The policy at our company is to use [one or two] standby person(s).

Escaping an IDLH Atmosphere

In IDLH conditions, a worker may need to escape or immediately leave the area.

An SCBA allows escape at any time.

Airline respirators need a small escape bottle of air attached at the waist.

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The small escape bottle contains about 5-7 minutes of air giving the wearer enough time to move out of danger. Escape cylinder can only be used for escape, never for entering an area that is IDLH.

Escape-only supplied air respirators

Escape-only respirators can be used in situations where chemical releases might occur, but the air is normally uncontaminated.

Photo by NASAKennedy in Creative Commons

They provide 5 to 10 minutes of clean air from a small tank.

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These can't be used for entry – going in a room to turn off a valve or make a repair. A regular supplied air respirator would be necessary for that task. Escape-only respirators contain just 5-10 minutes supply of air, enough time to exit a room or building where there has been a major chemical leak or spill. These are sometimes used in chemical plants.

Supplied air respirator selection

Conditions	Type of Respirator
IDLH conditions or oxygen deficiency	SCBA or airline with escape bottle
Dust/chemical levels up to 1000 times PEL	Airline with tight-fitting full facepiece or full hood
Dust/chemical levels up to 50 times PEL	Airline with tight-fitting half facepiece
Dust/chemical levels up to 25 times PEL	Airline with loose facepiece

PEL = permissible exposure limit

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This table shows levels of protection provided by several types of supplied air respirators from most protective to least protective. “PEL” means “permissible exposure limits”. The above table assumes that the airline respirator either has continuous flow of air or a pressure-demand regulator. Another point to remember is that for a few toxic chemicals, the IDLH level can actually be less than 1000 times the PEL.

Airline respirator advantages and limitations

Advantages –

- ✓ continuous air supply,
- ✓ lightweight,
- ✓ less maintenance,
- ✓ don't need to buy tank air

Limitations-

- ✓ tied to a 300 ft. hose,
- ✓ depends on output of compressor,
- ✓ needs an attached escape bottle in IDLH conditions

Photo from Scott Safety

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More facts about airline respirators

Airline respirators are either constant flow or pressure demand, providing positive pressure inside the facepiece at all times.

Pressure demand means air is provided as needed by a pressure regulator.

These respirators provide 4 cfm of air pressure for tight fitting facepieces, or 6 cfm for loose-fitting facepieces.

Photo from Honeywell/North

Loose-fitting airline respirator

CFM – cubic feet per minute

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Loose-fitting airline respirators can be cooler and more comfortable than tight-fitting airline respirators. However, they cannot be used in IDLH conditions or if the amount of air contaminants are greater than 25 times the permissible exposure limits of the air contaminants.

SCBA advantages and limitations

Advantages

- ✓ highest form of protection,
- ✓ can be used anywhere,
- ✓ allows unrestricted mobility

Limitations

- ✓ heavy & bulky,
- ✓ limited air supply(30 - 60 min.),
- ✓ extensive training required,
- ✓ high maintenance

Using SCBAs

SCBAs are sophisticated respirator equipment used for possible or actual life-threatening situations.

SCBAs should not be used without extensive hands-on training and frequent re-training.

Most SCBA manufacturers or distributors provide this training.

In the case of a large chemical spill or leak, it may be safer to call professional emergency responders.

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SCBAs are most often used by fireman to enter burning buildings or perform rescues in confined spaces known or suspected to contain hazardous atmospheres. SCBA cylinders must be DOT approved and recertified periodically.

Air quality for supplied air respirators

Air for breathing must be “Grade D” air:

- Oxygen content of 19.5-23.5 percent,
- Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less,
- Carbon monoxide content of 10 parts per million (ppm) or less,
- Carbon dioxide less than 1000 ppm,
- No noticeable odor.

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Air for SCBA tanks is normally provided by professional vendors who make sure the air meets Grade D specifications.

Two options for airline respirators

Oil-lubricated compressor

Ambient air pump

Ambient air pumps and asbestos removal

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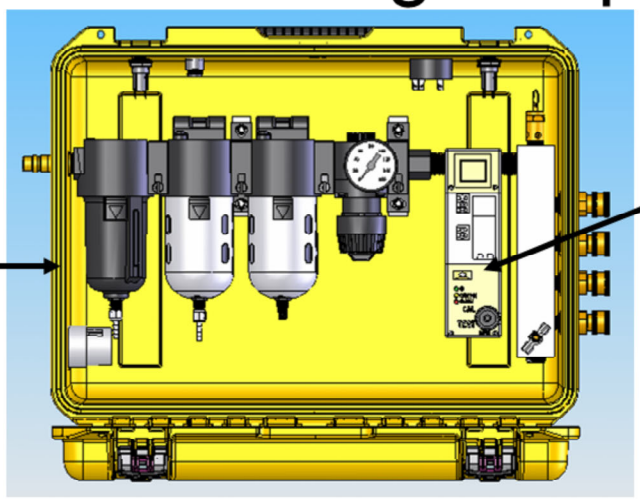
Ambient air pumps are powered by electricity and need to be located in fresh air away from any vehicle or other source of carbon monoxide or air contaminants. Oil lubricated compressors, with fuel powered engines can be used in locations with no access to electricity, but must include extra equipment to assure Grade D clean air.

Ambient air pump used for asbestos removal must provide at least 6 cubic feet per minute of air to the facepiece. This is a requirement unique to Washington state.

Grade D breathing air quality



If breathing air comes from an oil-lubricated compressor, air filters and a carbon monoxide monitor are required.

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Although high-temperature alarms can be used in lieu of a carbon monoxide monitor for Grade D breathing air, they are not recommended because they don't always work as well as a carbon monoxide monitor.

Storage and maintenance

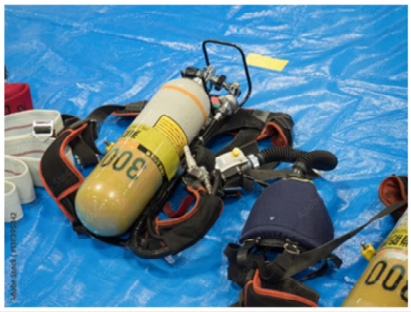
Store facepiece and regulator in clean, dry place.

Coil up airline hose and store in protected area to prevent damage.

Clean as needed before storage – especially the inside of the facepiece.

Inspect facepiece and hose for damage and replace as needed.

Replacement parts must be the same brand.



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Replacement parts from different brands of supplied air respirators cannot be used since they will not be exact matches and may fail in use. Repairs of SCBA valves, regulators or alarms can only be done by the manufacturer's trained representative.

Where we require the use of supplied air respirators

Describe areas or work situations where supplied air respirators must be used

What supplied respirators we use

Describe or show the supplied air respirators used at worksites

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Hands-on training with the specific supplied air respirators can occur here.

How we provide grade D air to our supplied air respirators

Describe or show the source of Grade D air for supplied air respirator in use

Additional Information

Risk of using plant air

CDC/NIOSH – A guide to atmosphere-supplying respirators

L & I respirator regulations - WAC 296-842