



## No warning with deadly lack of oxygen in air

A worker enters an enclosed area and collapses. Another worker rushes in to rescue the first worker. Both workers die.

A worker enters a confined space. When he doesn't come out, a co-worker goes after him. A third worker tries to hold his breath and rescue both. All three workers die.



### How would lack of oxygen affect me?

Working in an atmosphere with oxygen levels less than 17% can produce symptoms that might prevent you from escaping. If oxygen levels are lower than 10%, taking just one breath might make you unconscious almost immediately. You might not even have time to call out for help! The table shows some of the symptoms associated with oxygen deficiency.

#### Symptoms of oxygen deficiency

Percent of oxygen in the air	Symptoms in workers
20.9	Normal air—no symptoms
16	Increased heart and breathing rates Some impairment in judgment and coordination
14	Fatigue Emotional upset Impaired judgment and coordination
12	Very poor judgment and coordination Nausea and vomiting Impaired respiration (may cause heart damage)
Less than 10	Nausea and vomiting Loss of all movement Unconsciousness Convulsions Death

This table is adapted from *CSA Standard Z94.4-02, Selection, Use and Care of Respirators*.

### What's happening in these incidents?

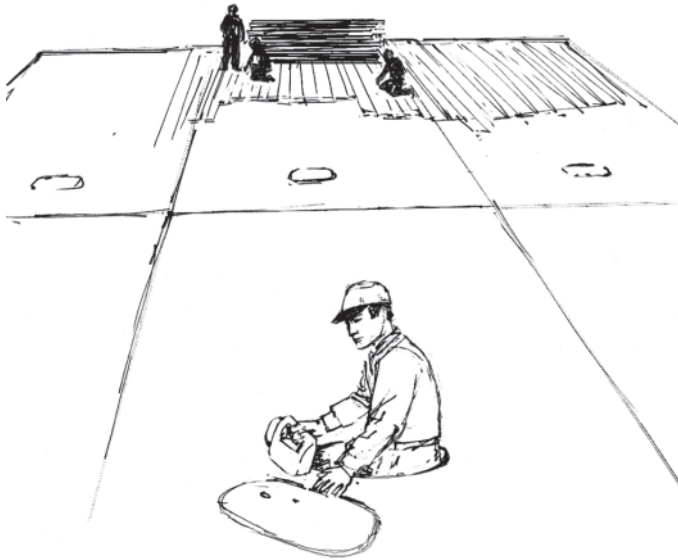
These scenarios are based on real incidents where workers have died because of oxygen deficiency. Oxygen deficiency is a lack of oxygen in the air we breathe. Normal air has about 20.9% oxygen. The Occupational Health and Safety Regulation defines oxygen deficiency as air with less than 19.5% oxygen by volume.

### Can I tell if the air doesn't have enough oxygen?

Some toxic gases irritate your lungs or have a taste or smell to warn you that they are present. But air that is low in oxygen has no warning properties: you can't smell, taste, or see any difference when air doesn't have enough oxygen. By the time you feel faint or dizzy, you may not have enough energy or alertness to escape. If the oxygen level falls below 20.9%, then there is something affecting the air and further investigation is required.

## What places might have air with oxygen deficiency?

Confined spaces and enclosed spaces both might have air without enough oxygen. Some examples are holds on barges, sewer systems, wells, grain silos, and process vessels. Lack of oxygen is a leading cause of death among workers entering confined spaces and among those attempting to rescue workers in confined spaces. An enclosed space may not have all the characteristics of a confined space, but it could have a hazardous atmosphere, including oxygen deficiency.

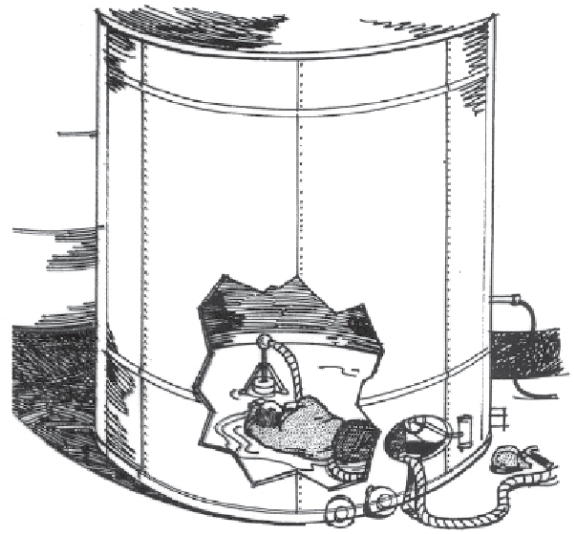


*The flotation compartment of a barge may not have enough oxygen to sustain life.*

## What causes oxygen deficiency?

Here are some common causes of oxygen deficiency:

- Oxygen is used up when metals rust.
- Oxygen is used up during combustion—for example, by propane space heaters, during cutting or welding, and by internal combustion engines.
- Oxygen is replaced by other gases used in industrial processes—for example, welding gases or gases forced into the space to prevent corrosion.
- Oxygen is replaced by gases leaking into an enclosed space through drains or other openings.
- Micro-organisms use up oxygen—for example, in sewer lines and fermentation vessels.



*During cleaning and purging, nitrogen displaced the oxygen in this storage tank.*

## How do I know if there is enough oxygen in the air?

The only way to know for certain is to test the amount of oxygen in the air with a properly calibrated oxygen monitor. Someone trained to use the monitor must test the air. In some situations, a permanently mounted monitor may be required. (As well as testing for oxygen, a trained person may also need to test for toxic gases or other dangerous conditions.)



*An oxygen monitor will show the percentage of oxygen in the air.*

## How can more oxygen be added to the air?

A trained person on-site can determine the best way to replace oxygen-deficient air with air that is safe to breathe. Mechanical ventilation with industrial fans may be required bring in sufficient breathable air. Only a trained person can assess the hazard and the best way to control the risk. Before anyone enters without a respirator, the air must be retested to make sure the air is no longer oxygen-deficient. However, sometimes the air cannot be made safe to breathe without a respirator, especially if rescuers must enter quickly.

## How can I enter an area with oxygen deficiency?

If you must enter an oxygen-deficient space, you must have a safe supply of air to breathe. Use a supplied-air respirator (a respirator with a separate air supply). You cannot hold your breath and safely enter an oxygen-deficient atmosphere. You must be trained to enter a hazardous location and to use your respirator. If someone appears to have collapsed where there may be an oxygen-deficient atmosphere, you must stay out and called trained rescuers who have the proper equipment to enter. Tragically, without that equipment, attempts to save someone in an oxygen-deficient atmosphere most often result in more people dying.



*In an oxygen-deficient atmosphere, you must use a respirator that supplies breathable air with the oxygen you need.*



*A respirator with a filter or cartridge will not protect you from oxygen deficiency. These respirators cannot add oxygen to the air you breathe.*

## Where can I get more information?

For information on hazardous atmospheres, including oxygen deficiency, see [Hazards of Confined Spaces](#) (PDF 593kb). For information on safe entry into confined spaces, see [Confined Space Entry Program: A Reference Manual](#) (PDF 1.8mb). The information on making the atmosphere safe applies to enclosed spaces as well as to confined spaces.

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