

## Nitrogen — Hazard and Safeguard

This Beacon is not focused on a single incident, but on incidents that continue to occur across industry — nitrogen asphyxiation. A June 2003 U.S. Chemical Safety Board (CSB) bulletin reported nitrogen asphyxiation incidents in U.S. industry resulting in 80 deaths from 1992 to 2002. These incidents occurred in many different workplaces — industrial plants, laboratories, and medical facilities. Many involved contractors. The pictures, taken from CSB reports, show examples of the kind of places where a dangerous concentration of nitrogen could accumulate.

While nitrogen itself is not toxic, a high nitrogen concentration in the air you breathe will starve your body of the oxygen needed to sustain life. Seventy-eight percent of the air we normally breathe is nitrogen, and oxygen makes up most of the rest. People cannot function well when the nitrogen concentration is more than 84% (16% oxygen). Their judgment may be impaired and they may not recognize that they are in danger. At 94% nitrogen concentration, death is likely in a few breaths.

On the positive side, nitrogen is an inert gas that reduces fire potential by eliminating the oxygen required for a fire. For this reason nitrogen is commonly used to purge piping and equipment used in flammable material service.



Effects of Oxygen Deficiency on the Human Body \*

% Oxygen	Effect
20.9	Normal
19.5	Legal minimum concentration for humans (U.S. OSHA)
15–19.5	Decreased ability to work; early symptoms in persons with heart, lung, or circulatory problems
12–15	Increased pulse rate and respiration, impaired judgment
10–12	Further increase in pulse and respiration, giddiness, poor judgment, blue lips
8–10	Mental failure, nausea, fainting, vomiting, unconsciousness
6–8	8 minutes - 100% fatalities; 6 minutes - 50% fatalities
Less than 6	Coma in 40 seconds, convulsions, breathing stops, death

\* Adapted from Yanisko, P., and D. Kroll, "Use Nitrogen Safely," *CEP*, Mar. 2012, pp. 44-48.

## What Can You Do?

- Know where nitrogen gas is vented. It should be outdoors or to a system designed to safely receive nitrogen.
- Where nitrogen is used, consider monitoring the oxygen concentration in the area to ensure that it does not drop below safe levels.
- Know where nitrogen is used in your plant, and make sure that all nitrogen pipes are clearly labeled.
- Inspect hoses used in nitrogen service as you would any hose containing toxic gas. Do not use a hose found to be leaking.
- Never assume the oxygen concentration in a vessel or any

- other confined space is acceptable. Always measure it before working near a vessel opening or inside any confined space.
- Make sure that the ventilation systems in your plant are working correctly. They are not just for comfort — they also remove potentially hazardous air contaminants.
- Recognize that a confined space can be created by temporary obstructions, such as plastic or canvas tarps or other temporary weather-protection enclosures.
- Read the U.S. Chemical Safety Board bulletin on nitrogen asphyxiation, available at [www.csb.gov](http://www.csb.gov).

**Be aware of nitrogen and other inert gas hazards!**

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