

High Oxygen Concentrations Can Be Hazardous

A fire in the Apollo 1 command module killed all three crew members during a launch rehearsal test on Jan. 27, 1967. The atmosphere of the command module was 100% oxygen at 16.7 psia (1.15 bar). Materials that are hard to ignite in air burn rapidly in high- or pure-oxygen environments. The source of ignition was likely a problem in the electrical wiring.

High oxygen concentration has also been a contributing factor in industrial incidents:

- A steelworker was attempting to repair a car that had a blockage in the fuel line. He used oxygen to clear the blockage, and the fuel tank exploded, killing a person nearby.
- Following maintenance work, plant staff degreased and blew dry a pipeline in oxygen service. Instead of using dry nitrogen to dry the pipeline, the individual used compressed air, and residual lube oil from the air compressor was deposited as a thin film inside the pipe. After the pipe was put back into service, the oil-oxygen mixture ignited and the pipe ruptured. The cause of the ignition was believed to be compression at a closed valve.
- Regulators on oxygen gas cylinders can catch fire if the oxygen comes in contact with a contaminant. Oxygen passing through the regulator valve creates heat. An incorrect gasket material, dirt, oil, grease, or even an insect can serve as fuel for a fire.



▲ The command module of Apollo 1.



▲ The inside of the command module after the fire.

Did you know?

- Concentrations of oxygen above the 21% found in air widen the fuel concentration range in which an explosion is possible.
- Higher-than-normal oxygen concentrations significantly lower the autoignition temperature (AIT) and minimum ignition energy (MIE). This means that substances will ignite more readily, burn faster, generate higher temperatures, and be more difficult to extinguish.
- Textiles, and even hair, can absorb gases, which makes them more flammable and they may burn in a flash (literally!).

What can you do?

- Never use oxygen to blow equipment clean or dry.
- Only use equipment, materials, gaskets and fittings, lubricants, sealing liquids, and other components that are specifically approved for oxygen service.
 - Keep equipment for oxygen service clean. Follow your plant's procedures to ensure that piping, valves, fittings, and other equipment are free of contaminants.
 - Be aware of sources of ignition and keep them away from equipment that contains oxygen.
- Investigate oxygen concentrations that are higher or lower than normal when working in a confined space.
 - Move people who have been exposed to oxygen or oxygen-enriched air away from ignition sources and into fresh air.
 - Study guidelines on safe oxygen use provided by suppliers or industry groups and discuss them with your coworkers if oxygen is used in your plant.

Oxygen — necessary for life but hazardous if not controlled!

©AIChE 2017. All rights reserved. Reproduction for non-commercial, educational purposes is encouraged. However, reproduction for any commercial purpose without express written consent of AIChE is strictly prohibited. Contact us at ccps_beacon@aiche.org or 646-495-1371.