

Hazards of High Oxygen Concentration

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Fifty years ago, on January 27, 1967, a fire killed all three crew members (Virgil "Gus" Grissom, Edward White, and Roger Chaffee) in the command module (CM) of the Apollo 1 space capsule during a test while on the launch pad. The CM atmosphere was 100% oxygen at 16.7 psia (1.15 bar). The most likely ignition source was from electrical wiring. **Materials that are hard to ignite in air burn rapidly in a high or pure oxygen environment**

High oxygen concentration has been a contributing factor in industrial incidents. Here are some examples:

- A steelworker attempted to repair a car which had a blockage in the fuel line. He used oxygen to clear the blockage and the fuel tank exploded killing one person.
- After maintenance work, a pipeline in oxygen service was degreased and blown dry. However, instead of dry nitrogen, compressed air containing residual lube oil from the air compressor was used. Some oil 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. Ignition was believed to be caused by compression at a closed valve.
- In oxygen gas cylinders (used in welding, hospitals, diving), regulator fires have been reported when oxygen contacted contaminants. Passage of oxygen through the regulator valve creates heat. Any combustible material such as an incorrect gasket material, dirt, oil, grease (even an insect!) can ignite.



Apollo Command Module



Section of CM interior after fire



Did you know?

- The presence of oxygen above the 21% found in air will widen the fuel concentration range in which an explosion is possible.
- **Autoignition temperature (AIT) and minimum ignition energy (MIE) are lowered markedly by higher oxygen content.** Substances ignite more readily, burn faster, generate higher temperatures, and are difficult to extinguish.
- Textiles, even hair, can trap gases. If such material has absorbed oxygen, it may burn in a flash (literally!).

What can you do?

- **Never use oxygen for blowing equipment clean or dry.**
- Use only 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 all your plant procedures to ensure that there is no contamination of piping, valves, fittings, or other equipment in pure or concentrated oxygen service.
- Take extra care to avoid all sources of ignition near equipment containing oxygen.
- In a confined space, either a higher or lower oxygen concentration than normal should be investigated.
- If people have been exposed to oxygen or oxygen enriched air, get them away from ignition sources and keep them in fresh air.
- Suppliers and industry groups issue guidelines on safe oxygen use. Study these guidelines and discuss them with your co-workers if oxygen is used in your plant.

Oxygen – necessary for life but hazardous if not controlled!