


Standard Operating Procedure (SOP)

Title: Working with Compressed Gases		
Approved by: 	Effective Date: 092906	SOP #
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PURPOSE

Prescribes guidelines for the storage, handling, and use requirements for compressed gases used at WFUHS.

SCOPE

This document provides information pertinent to the safe storage, use, and handling of compressed gases at Wake Forest University Health Sciences (WFUHS).

Unless stated elsewhere in this document, the requirements of this document apply to all principal investigators, faculty, staff, students, tenants, and contractors at WFUHS.

GENERAL

- Cylinders of compressed gases can pose a chemical and physical hazards (see HAZARDS ASSOCIATED WITH COMPRESSED GASES).
- If the valve were to break off a cylinder, the amount of force present could propel the cylinder through a brick wall. For example, a cylinder of compressed breathing air used by SCUBA divers has the explosive force of 1 1/2 pounds of TNT.

Common Compressed Gases

Common Compressed Gases	
Argon	Acetylene
Carbon Dioxide	Freon 12
Helium	Hydrogen
Nitrogen	Oxygen
Propane	

PERSONAL PROTECTIVE EQUIPMENT

- PPE such as gloves, eye protection, and safety shoes shall be used when moving cylinders. After inspection and leak testing, when the valve is shut and the protective cap is in place, respiratory protection is not normally needed when moving and storing cylinders.
- Personnel handling acid gases (i.e. chlorine, hydrogen chloride, sulfur dioxide) and alkaline gases (i.e. ammonia, ethylamine) shall wear safety glasses with side shields or goggles, acid resistant gloves and aprons (i.e. Neoprene, Viton), long sleeves, and trousers.
- Liquefied compressed gases can cause frostbite injury on contact with unprotected skin. Personnel handling these gases shall wear safety glasses with side shields, goggles, or face shield, insulated gloves with gantlets and long sleeves. Gloves shall be loose fitting. Leather gloves are adequate for moving and storing closed containers of LIQUEFIED gases.

STORAGE LIMITS

Laboratory storage of compressed gas is limited to one cylinder of each gas used. Other types of use areas shall have limits agreed upon by the user and WFUHS EH&S.

USE AND STORAGE OF COMPRESSED GASES

- Whenever possible, use flammable and reactive gases in a fume hood or other ventilated enclosure. Certain categories of toxic gases must always be stored and used in ventilated enclosures. Contact WFUHS EH&S at 716-1221 for further information.
- Always use the appropriate regulator on a cylinder. If a regulator will not fit a cylinder's valve, replace the cylinder, not the regulator. Do not attempt to adapt or modify a regulator to fit a cylinder for which it was not designed. Regulators are designed to fit only specific cylinder valves to avoid improper use.
- Inspect regulators, pressure relief devices, valves, cylinder connections, and hose lines frequently for damage.
- Never use a cylinder that cannot be positively identified. Color-coding is not a reliable way of identifying a cylinder because the colors can vary from supplier to supplier.
- Do not use oil or grease on any cylinder component of an oxidizing gas because a fire or explosion can result.
- Never transfer gases from one cylinder to another. The gas may be incompatible with the residual gas remaining in the cylinder or may be incompatible with the cylinder material itself.
- Never completely empty cylinders during lab operations; rather, leave approximately 25 PSI of pressure. This will prevent any residual gas in the cylinder from becoming contaminated. However, if the cylinder is non-returnable, call EH&S for instructions.
- Place all cylinders so that the main valve is always accessible.
- Close the main cylinder valve whenever the cylinder is not in use.
- Remove regulators from unused cylinders and always put the safety cap in place to protect the valve.
- Always secure cylinders, whether empty or full, to prevent them from falling over and damaging the valve (or injuring a person). Secure cylinders by chaining or strapping them to a wall, lab bench, or other fixed support.
- Oxygen should be stored in an area that is at least 20 feet away from any flammable or combustible materials, or it must be separated from them by a non-combustible barrier at least 5 feet high with a fire-resistance rating of at least a 1/2 hour.
- To transport a cylinder, put on the safety cap and strap the cylinder to a hand truck in an upright position. Never roll a cylinder.
- Always clearly mark empty cylinders and store them separately.
- Be careful while handling compressed gas cylinders and never drop or strike a cylinder against anything.
- Use only wrenches or other tools supplied by the cylinder supplier to open a valve. *Open cylinder valves slowly.*
- Only compatible gases should be stored together in a gas cylinder cabinet.

- Flammable gases must be stored in properly labeled, secured areas, away from possible ignition sources and oxidizing gases.
- Do not store compressed gas cylinders in areas where the temperature can exceed 125°F.

HAZARDS ASSOCIATED WITH COMPRESSED GASES

Asphyxiation

- Simple asphyxiation is the primary hazard associated with inert gases. Because inert gases are colorless and odorless, they can escape into the atmosphere undetected and can quickly reduce the concentration of oxygen below the level necessary to support life.
- The use of oxygen monitoring equipment is strongly recommended for enclosed areas where inert gases are being used.
- If oxygen concentrations fall below 19.5%, self-contained breathing apparatus (SCBA) must be used.

Fire and Explosion

- Fire and explosion are the primary hazards associated with flammable gases, oxygen, and other oxidizing gases.
- Flammable gases can be ignited by static electricity or by a heat source, such as a flame or a hot object.
- Oxygen and other oxidizing gases do not burn, but will support combustion of flammable materials.
- Increasing the concentration of an oxidizer accelerates the rate of combustion.
- Materials that are nonflammable under normal conditions may burn in an oxygen-enriched atmosphere.

Chemical Burns

- Corrosive gases can chemically attack and eat away various materials, including fire-resistant clothing.
- Some gases are not corrosive in their pure form, but can become extremely destructive if a small amount of moisture is added.
- Corrosive gases can cause rapid destruction of skin tissue.

Chemical Poisoning

- Chemical poisoning is the primary hazard with toxic gases and liquids.
- Even in very small concentrations, brief exposure to these gases can result in serious poisoning injuries.
- Symptoms of exposure may be delayed.

Cold Burns

- Rapidly escaping inert gas from a cylinder can also cause cold burns.

High Pressure

- All compressed gases are potentially hazardous because of the high pressure stored inside the cylinder.
- A sudden release of pressure can cause injuries by propelling a cylinder or whipping a line.

Improper Handling of Cylinders

- Cylinders containing compressed gases and chemicals are heavy and awkward to handle.
- Improper handling of cylinders could result in sprains, strains, falls, bruises, and broken bones.
- Other hazards such as fire, explosion, chemical burns, poisoning, and cold burns could occur if gases accidentally escape from the cylinder due to mishandling.

Leaks

- Always check hose connections for possible leaks.

FIRST AID

Chemical Burns

- Wash affected area for at least 15 minutes