


<b>Standard Operating Procedure (SOP)</b>			
<i>Title:</i> <b>WORKING with COMPRESSED GASES</b>			
<i>Approved by:</i>		<i>Effective Date:</i>	
David A. Brown, Director, EH&S		<i>Revised Date:</i>	
		<i>Section:</i>	<b>CHEM</b>

## 1. Purpose

- Prescribes guidelines for the storage, handling, and use requirements for compressed gases used at WFUSM.
- This document provides information pertinent to the safe storage, use, and handling of compressed gases at Wake Forest University Health Sciences (WFUSM). Unless stated elsewhere in this document, the requirements of this document apply to all principal investigators, faculty, staff, students, tenants, and contractors at WFUSM.

## 2. Physical Hazards

- If the valve were to break off a cylinder, the amount of force present could propel the cylinder through a brick wall.
- Fire and Explosion
  - Primary hazard associated with flammable gases, oxygen, and other oxidizing gases.
  - Can be ignited by static electricity or by a heat source, such as a flame or a hot object.
  - 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.
- High Pressure
  - 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
  - Heavy and awkward to handle.
  - 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.
- Common Compressed Gases:
  - Argon – Acetylene
  - Carbon Dioxide – Freon 12
  - Helium – Hydrogen
  - Nitrogen – Oxygen
  - Propane

## 3. Health Hazards

- Skin: Liquefied compressed gases can cause frostbite injury on contact with unprotected skin.
- Asphyxiation
  - Primary hazard associated with inert gases. 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.
- 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.
  - Wash affected area for at least 15 minutes.
- Chemical Poisoning
  - Primary hazard with toxic gases and liquids.
  - Even in very small concentrations, brief exposures 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.

#### 4. Personal Protective Equipment

- EYE PROTECTION
  - Safety glasses, goggles or face shields must be worn when moving cylinders.
  - Personnel handling acid gases (i.e. chlorine, hydrogen chloride, sulfur dioxide) and alkaline gases (i.e. ammonia, ethylamine) must wear safety glasses with side shields or goggles, acid resistant gloves and aprons (i.e. Neoprene, Viton).
  - Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-2003) and must be equipped with side shields.
  - Wearing contact lenses under some circumstances provides workers with a greater choice of eye and face protection (such as goggles or full-facepiece respirators without prescription inserts) as well as better visual acuity. However, the risk is unknown for contact lens wearers compared with nonwearers working with chemicals listed in the NIOSH Pocket Guide to Chemical Hazards [NIOSH 2004]. OSHA recommends against contact lens use when working with acrylonitrile, methylene chloride, 1,2 dibromo-3-chloropropane, ethylene oxide, and methylene dianiline." [NIOSH Publication No. 2005-139: Current Intelligence Bulletin 59, Contact Lens Use in a Chemical Environment.](#)
- HAND PROTECTION
  - Use disposable nitrile gloves when moving cylinders. Leather gloves are adequate for moving and storing closed containers of liquefied gases.
  - Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.
- LAB COATS, ETC.
  - Closed toed shoes and long sleeved clothing must be worn 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.
- SAFETY SHOWER/EYEWASH
  - Where the eyes or body of any person may be exposed to compressed gases, suitable facilities for quick drench or flushing of the eyes and body must be provided within the work area for immediate emergency use.
  - Bottle type eyewash stations are not acceptable.

#### 5. Designated Area for Use and Containment Devices

- 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 WFUSM EH&S at 716-9375 for further information.

- The fume hood's sash must be in the position where a face velocity of 100 feet per minute is achieved.

## 6. Special Handling Procedures and Storage Requirements

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

## 7. Exposure Monitoring

Users of this chemical are required to notify WFUSM EH&S at 716-9375 so exposure monitoring can be performed to determine exposure level.

## 8. Waste Disposal

Excess compressed gases and all waste material containing compressed gases must be placed in a container which is stored in secondary containment with the

following label "**HAZARDOUS WASTE COMPRESSED GASES**" and disposed through WFUSM EH&S.

## **9. Spill and Accident Procedures**

If spill is greater than 300 ml, do not attempt to clean up the spill. Immediately report the spill to WFUBMC Security at 716-9111 and WFUSM EH&S at 716-9375.

If any exposure or contact to the chemical, rinse affected area under a safety shower/eyewash for 15 to 20 minutes, inform supervisor, and report to WFUBMC Employee Health or Emergency Department.