

Compressed Gas Cylinder Safety

General

Compressed gas cylinders are located in many of the laboratories around campus. They are a serious potential hazard for all employees who may be nearby or anyone who may handle them.

Outline of Safety

Inspection

When gas cylinders are received, they should be inspected by the user for the following:

- a. A stamped hydrostatic test date within the last 5 years
- b. A label identifying the contents
- c. Presence of a valve cap
- d. Signs of any damage or leakage

If any of these are not in proper order then the cylinder should be rejected and returned.

Labeling

All compressed gas cylinders must be marked by a label or tag with the name of its contents. Do not accept cylinders without the appropriate labels. Contact the purchaser (Aline) so the cylinder can be replaced by the supplier.

Never rely on the color of the cylinder to identify the contents. Colors may vary between different suppliers. Labels on cylinder caps are equally unreliable because they are easily switched.

When a cylinder is empty it must be marked as "EMPTY" and moved to the storage for empty cylinders. The empty cylinder storage is located on the ground floor of the Research building next to the loading dock. Afterwards notify the purchaser (Aline) so they can contact the supplier to pick up the cylinder.

Storage areas shall be prominently posted with the hazard class or name of the gases stored.

General Precautions

Two types of hazards are present with compressed gas cylinders: chemical and physical. Chemical hazards are associated with the contents in the cylinders (i.e. corrosive, toxic, flammable, etc.) The physical hazards are associated with the high pressures of the gas.

Compressed gas cylinders should only be handled by people who are trained and familiar with the hazards. Always study and understand the safety data sheet (SDS) of each cylinder content in your work space.

The following precautions should always be observed when using compressed gas cylinders:

- a. Only properly trained employees are allowed to handle or use compressed gas cylinders
- b. Cylinders must not be used for any purpose other than to contain and use the contents as received
- c. Users will keep open flames and heat sources away from gas cylinders
- d. If a cylinder is exposed to fire, contact the purchaser/supplier immediately
- e. Cylinders should not be exposed to extreme temperatures
- f. Do not attempt to repair or alter the gas cylinders
- g. Cylinders are not to be stored near electrical hazards
- h. Periodically check the integrity of tubing
- i. If there is any damage visible (i.e. corrosion, dented, cut, etc.) notify the purchaser/supplier
- j. Do not refill compressed gas cylinders
- k. Do not refill disposable gas cylinders including lecture bottles

Handling Cylinders

The procedures for handling compressed gas cylinders are as followed:

- a. Cylinders are to be moved with a hand truck or cart specifically designed for gas cylinders
- b. Cylinders are to be stored and used upright
- c. Cylinders are to be properly secured by suitable racks, straps, chains, or stands to prevent them from being knocked over
- d. Never drop or strike a cylinder with each other or other objects
- e. Regulators should be removed and a valve cap used before moving the cylinder
- f. Do not lift or move a cylinder by the valve cap
- g. Handle only one cylinder at a time unless a properly designed two cylinder cart is used

Valve Caps and Regulators

- a. Valve caps should always be used and hand tight except when cylinders are in use or connected for use
- b. Never force on a cap. They should be hand tight
- c. Never use a cylinder without a regulator
- d. Regulators are gas specific. Double check that the regulator and valve fittings are compatible
- e. Never permit the gas to enter the regulator suddenly. Before opening cylinder valve, check that the adjusting screw of the regulator is released
- f. Never use adapters directly on cylinders
- g. Routinely inspect regulators to ensure proper function. If a problem is found remove from service and contact your PI or safety committee if a new regulator is needed

Storage

Compressed gas cylinders are potential projectiles if the valve is damaged. Leaking cylinders can cause an environmental hazard or create oxygen deficient environments. Proper storage is paramount for continued safety. The following guidelines should always be followed when storing compressed gas cylinders:

- a. All cylinder storage areas must be marked with the hazard class or name of the gasses
- b. Always secure gas cylinders upright to a wall, hand truck, rack or post, or lab bench. If secured to a lab bench, the bench must be able to support the weight of the cylinder
- c. Never use hand trucks as storage
- d. Cylinders with a water volume less than 1.3 gallons (5 L) are allowed to be stored horizontally

- e. Cylinders are to be grouped by the type of gas (i.e. flammable, oxidizer, corrosive, etc.)
- f. Full and empty cylinders are to be stored separately
- g. Cylinders should be stored in well ventilated areas away from sparks, flames, or any other extreme environments
- h. Oxygen cylinders should never be stored in the same vicinity as flammable gases. A minimum of 20 feet distance between or a 5 foot high firewall rating of at least 1 hour.
- i. Cylinders should be stored away from emergency exits and kept well-drained, well-ventilated, cool, and protected from weather.
- j. Restraints should be fastened above the center of gravity (upper half of the cylinder)

Specific Gas Procedures

Flammable Gas

Examples of flammable gases include methane, hydrogen, and propane. The listed procedures applies to all gases that are considered flammable:

- a. Must be stored in well-ventilated areas away from flammable liquids, combustibles, oxidizers, open flames, sparks or any other sources of heat or ignition
- b. A fire extinguisher (CO₂ or dry chemical powder type) should be easily accessible where flammable gas is stored
- c. In the event of an emergency involving flammable gas, such as a leak, fire, or explosion, personnel should evacuate the area immediately. Do not attempt to extinguish burning gas if the flow cannot be shut off immediately without risk
- d. All lines and equipment using flammable gas must be grounded and bonded

Oxidizing Gas

- a. Oxidizers should be stored separately from flammable gases. A minimum of 20 feet between or a firewall rated for 1 hour is required
- b. Oxygen and acetylene may be stored together if it is considered in use or will be used in the next 24 hours

Corrosive Gas

Examples of corrosive gas include chlorine, hydrogen chloride, fluorine, hydrogen fluoride, carbon monoxide, and carbon dioxide.

- a. Use in a fume hood or other vented enclosure when possible
- b. Avoid contact with skin and eyes
- c. Wear safety goggles
- d. Know where the nearest emergency shower and eyewash station is located
- e. There should be an emergency response procedure in place for everyone working in the area

Toxic Gas

Toxic and highly toxic gases require special considerations due to their health hazards.

- a. The safety committee should be informed before purchasing
- b. Toxic gases are never to be stored or used outside of laboratories. They are to be picked up immediately upon delivery.
- c. Large cylinder are required to be stored in gas cabinets or exhausted enclosures
- d. A gas detector should be used with visible and audible alarms

- e. An emergency response procedure should be in place for everyone working in the area

Training

All employees that are exposed to compressed gas cylinders must be trained. The user should be trained to understand the following:

- Cylinder inspection and identification
- Safe handling, storage, and use
- Proper cylinder transportation
- Emergency response plans

Cylinder Surface Disinfecting

To prevent the spread of contagious diseases, such as COVID-19, the U.S. Centers for Disease Control (CDC) has issued guidelines for disinfecting medical gas cylinders. As per these guidelines, the external surface of all gas cylinders must be disinfected before distributing to laboratories and returning to the supplier. Following CDC guidelines, all cylinders received and returned to the empty cylinder storage area must be disinfected according to the following procedure:

- A spray bottle of 70% isopropyl alcohol and paper towels are present within the empty tank cylinder area.
- All new and empty cylinders must be sprayed with 70% isopropyl alcohol and the entire surface must be wiped down with clean paper towels before the cylinder is placed in the empty tanks area.
- Dispose of the used paper towels into the trash can. Never reuse paper towels.
- Contact Javier Rojas (jarojas@carnegiescience.edu) for any questions regarding cylinder management or inventory of cleaning supplies.

Revisions

Latest revision: **April 3, 2020**