VCU Office of Environmental Health and Safety
Virginia Commonwealth University

# *Compressed Gas Cylinder Safety*

**I. Background.** Due to the nature of gas cylinders, special storage and handling precautions are necessary. The hazards associated with compressed gases include oxygen displacement, explosion hazards, toxic effect of some gases, as well as the physical hazards of a ruptured cylinder. There are almost 200 different types of materials in gas cylinders including atmospheric gases, fuel gases, refrigerant gases, poison gases and miscellaneous gases. Compressed gases are usually divided into six basic categories, with some gases falling into more than one classification. The categories are as follows:

- Flammable Gases
- Oxygen and Oxidizing Gases
- Acid and Alkaline Gases
- Highly Toxic Gases
- Cryogenic Liquefied Gases
- Inert Gases

A sudden release of these gases can cause a cylinder to become a missile-like projectile, destroying everything in its path. Cylinders have been known to penetrate concrete-block walls. To prevent such a dangerous situation, there are several general procedures to follow for safe storage and handling of a compressed gas cylinder:

## II. Identification of Contents of Compressed Gas Cylinders.

A. The contents of any compressed gas cylinder should be identified clearly so as to be easily, quickly, and completely determined by any laboratory worker.

B. A durable label should by provided that cannot be removed from the compressed gas cylinder.

C. No compressed gas cylinder should be accepted for use that does not identify its contents legibly by name.

D. Color-coding is not a reliable means of identification; cylinder colors vary from supplier to supplier, and labels on caps have no value because many caps are interchangeable.

E. Tags should be attached to the gas cylinders on which the names of the users and dates of use can be entered.

F. If the labeling on the gas cylinder becomes unclear or defaced so that the contents cannot be identified, the cylinder should be marked "contents unknown" and the manufacturer contacted regarding appropriate procedures.

## III. Transporting gas cylinders.

A. Cylinders transported by truck must be fastened securely in an upright position so that they will not fall or strike each other.

B. Cylinders should not be transported without safety caps. A cylinder's cap should be screwed all the way down on the cylinder's neck ring and should fit securely. Do not lift cylinders by the cap. The cap is for valve protection only.

C. Cylinders should not be transported with the regulator attached to the cylinder.

D. Always use a cylinder cart to move compressed gas cylinders. Refrain from sliding, dragging or rolling cylinders on edge.

E. Only one cylinder should be handled (moved) at a time.

## IV. Storage of Compressed Gas Cylinders.

A. Cylinders should not be allowed to drop nor be struck violently.

B. Cylinders should be properly secured at all times whether attached to a wall, cylinder truck, cylinder rack, or post.

C. Liquefied flammable gas cylinders should be stored in an upright position or such that the pressure relief valve is in direct communication with the vapor space of the cylinder.

D. Caps used for valve protection should be kept on the cylinders at all times except when the cylinder is actually being used or charged.

E. Cylinders should not be used for rolling, supports, or any purpose other than the transportation and supply of gas.

F. Cylinders should be stored in a well-ventilated area away from flames, sparks, or any source of heat or ignition. Keep cylinders away from electrical circuits.

G. Cylinders should not be exposed to an open flame or to any temperature above 125 degrees F.

H. Oxygen cylinders (empty or full) in storage should be separated from fuel-gas cylinders and combustible materials by a minimum distance of 20 feet or by a barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

I. Flammable gas cylinders should not be stored with oxygen or nitrous oxide cylinders or adjacent to oxygen charging facilities.

J. Full and empty cylinders of all gases should be stored separately and identified by signs to prevent confusion.

K. Cylinders may be stored outdoors but should be protected from the ground to prevent bottom corrosion. Where extreme temperatures prevail, cylinders should be stored so they are protected from the direct rays of the sun.

L. Cylinders should not be exposed to continuous dampness, stored near salt or other corrosive chemicals or fumes. Corrosion may damage cylinders and cause their valve protection caps to stick.

M. Do not charge, ship, or use any cylinder which is not provided with a legible decal that identifies its contents.

## V. Use of Compressed Gas Cylinders.

A. Know and understand the properties, uses, and safety precautions of the gas before using the cylinder. Common poison or highly toxic gases that may be found at VCU include:

1. arsine ($AsH_3$)
2. ethylene oxide (EtO)
3. hydrogen cyanide (HCN)
4. nitric oxide (NO)

5. phosphine (PH3)

B. Always use the proper regulator for the gas in the cylinder. Always check the regulator before attaching it to a cylinder. If the connections do not fit together readily, the wrong regulator is being used.

C. Before attaching cylinders to a connection, be sure that the threads on the cylinder and the connection mate are of a type intended for the gas service.

D. Do not permit oil or grease to come in contact with cylinders or their valves.

E. Wipe the outlet with a clean, dry, lint-free cloth before attaching connections or regulators. The threads and mating surfaces of the regulator and hose connections should be cleaned before the regulator is attached.

F. Attach the regulator securely before opening the valve wide. Always use a cylinder wrench or another tightly fitting wrench to tighten the regulator nut and hose connections.

G. Open cylinder valves SLOWLY. Do not use a wrench to open or close a hand wheel type cylinder valve. If it cannot be operated by hand, the valve should be repaired.

H. Stand to the side of the regulator when opening the cylinder valve.

I. Do not attempt to repair cylinder valves or their relief devices while a cylinder contains gas pressure. Tag leaking cylinders or cylinders with stuck valves and move to a safe, secure outdoor location.

J. Close valves on empty cylinders and mark the cylinder "empty" with the initials "M.T."

## VI. Things Not To Do:

A. Never roll a cylinder to move it.

B. Never carry a cylinder by the valve.

C. Never leave an open cylinder unattended.

D. Never leave a cylinder unsecured.

E. Never force improper attachments on to the wrong cylin

F. Never grease or oil the regulator, valve, or fittings of an

G. Never refill a cylinder.

H. Never use a flame to locate gas leaks.

I. Never attempt to mix gases in a cylinder.

J. Never discard pressurized cylinders in the normal trash.

**VII. Disposal.** Disposal of poison gas cylinders can often cause problems. If the cylinder cannot be returned to the manufacturer, VCU can face large disposal costs ($1,000 per cylinder or more). Even cylinders that can be returned must be shipped on a vehicle which cannot simultaneously carry any other hazardous materials or foodstuffs. Contact OEHS when disposal of cylinders in eminent.

*For additional information refer to NFPA 55 Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders and NFPA 45 Fire Protection for Laboratories Using Chemicals. OSHA has regulations governing the use of compressed gases. These regulations refer to specific Compressed Gas Association educational materials. The inspection of gas cylinders is discussed in 29 CFR 1910.101, Compressed Gases. DOT has regulations covering the transportation of compressed gases by rail, highway, aircraft, and waterway.*

**For more information on compressed gas cylinders or to arrange a site visit, contact OEHS at 828-1392.**

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