



# Compressed Gas Cylinder Guidelines

## Use, Transportation, Storage

These guidelines may be used as a template in developing a lab-specific standard operating procedure for the use/transport/storage of compressed gas cylinders in the lab. For Liquid Nitrogen (Cryogenic Liquid) Guidelines, refer to the Liquid Nitrogen Safety Guidelines on the JABSOM EHSO website.

Annual Review Date:

Principal Investigator:

Phone number:

Room & Building:

Emergency Contact Information:

### STATEMENT OF UNDERSTANDING AND COMPLIANCE

*I confirm that I have read and understand the Compressed Gas Cylinder Guidelines and will comply with the procedures and policies.*

Name/Title

Signature

Date

### INTRODUCTION

These guidelines were developed to address the potential hazards associated with using, transporting, and storing compressed gases at JABSOM Kaka'ako.

Compressed gas cylinders are used in laboratories to store gases that vary from extremely flammable gases to extremely inert gases, and many are stored at very high pressures (up to 2500 PSIG). A sudden release of these gases can cause a cylinder to become a missile-like projectile and projectile cylinders have been known to penetrate concrete-block walls resulting in significant laboratory damage and worker injury. If handled and stored correctly, compressed gas cylinders can be managed safely in the laboratory.

#### Special notes:

- 1) There is a NO-open flame policy at JABSOM Kaka'ako, i.e. no bunsen burners, flame torches, etc. may be used at Kaka'ako.
- 2) The use and storage of all flammable gases and/or toxic gases must be pre-approved by JABSOM EHSO prior to purchasing or bringing on site.

**Definition of Compressed Gas (from Wikipedia online):** A material in a container with an absolute pressure greater than 276 kilopascals (kPa), or 40 psi (pounds per square inch) at 21°C or an absolute pressure greater than 717 kPa (104 psi) at 54°C, or both, or any liquid flammable material having a Reid vapor pressure greater than 276 kPa (40 psi) at 38°C. Helium Gas tanks usually have the highest pressures possible when full around 1000 atmospheres.

During storage, transportation, and when the gas is not in use, a **safety cap** is screwed over the protruding valve to protect it from damage or breaking off in case the cylinder falls over. When the gas in the cylinder is ready to be used, the cap is taken off and a **pressure-regulating assembly** is attached to the stop valve. This attachment typically has a **pressure regulator** with **upstream (inlet) and downstream (outlet) pressure gauges** and a further **downstream needle valve** and **outlet**



**connection.** The **upstream pressure gauge** indicates how much gas is left in the cylinder according to pressure. The **regulator** could be adjusted to control the flow of gas out of the cylinder according to pressure shown by the **downstream gauge**. The **outlet connection** is attached to whatever needs the gas supply. In the US, valve connections are sometimes referred to as 'CGA connections,' since the Compressed Gas Association (CGA) publishes guidelines on what connections to use for what products (e.g., In the USA, an argon cylinder will have a CGA 580 connection on the valve). Gas cylinders are often color coded, but the codes are not standard across different jurisdictions, and sometimes are not regulated. Cylinder color should *not* be used for positive product identification. Gas cylinders have labels affixed to them which identify the product they contain and the label alone should be used for positive identification.

## **HAZARDS**

Compressed gas cylinders can present the following types of hazards:

- **Physical Damage:** Cylinders are very hazardous when exposed to damage from falling over, tipping, heat, electric circuits, motion, vibration, or anything that can cause a weakness or crack in the cylinder wall or shell. Such damage can cause the cylinder to rupture and explode sending sharp metal pieces, like shrapnel, blasting through the area. If the valve of a compressed air cylinder is broken or sheared off, the released pressure will cause the cylinder to act like a rocket, shooting away quickly.
- **Tipping and Falling:** Since cylinders are usually heavy and awkward to handle, they require special care and equipment in handling, securing and transporting so they do not fall or tip over and cause injury.
- **Valve Leakage:** Cylinder valves can leak, causing their contents to discharge. To minimize hazards from leaks, ensure adequate ventilation and proper storage.

*Pictures of the aftermath of a cylinder explosion in a laboratory.*



## **PPE**

Appropriate Personal Protective Equipment (PPE) must be worn when handling gases that are harmful to the skin, eyes or face. Choose clothing and lab coats, etc. that resist penetration or damage by the compressed gas. Workers should wear safety goggles when handling and using compressed gases (safety glasses do not protect against impact hazards). In some cases, a face shield should be worn in combination with safety goggles (safety goggles protect against impact hazards; face shields worn alone do not protect against impact). Closed-toe shoes are required to be worn in the laboratory at all times and must be worn when transporting cylinders. Refer to the specific gas/compressed liquid MSDS for specific PPE recommendations. The supervisor must determine what the appropriate eye and face protection shall be used, what type of gloves shall be used, what type of lab coat, etc. shall be used.

## **LABELS AND MARKINGS**

Compressed gas cylinders shall be legibly marked for the purpose of identifying the gas content with either the chemical or the trade name of the gas. Such markings shall be by means of stenciling,



stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be located on the shoulder of the cylinder (OSHA Standard 29 CFR 1910.253 (b) (1) (ii)):

- A durable label must be provided that cannot be removed from the compressed gas cylinder.
- Compressed gas cylinders that do not clearly identify its contents by name shall not be accepted for use.
- 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.
- Gas cylinders should be tagged with the PI/user/department name and dates of use upon delivery acceptance.
- If the labeling on the gas cylinder becomes unclear or defaced so that the contents cannot be identified, the cylinder shall be marked “contents unknown” and the manufacturer must be contacted.

### **TRAINING**

Employees assigned to the handling of compressed gas cylinders should be properly trained. Serious accidents may result from the misuse, abuse, or mishandling of gas cylinders.

### **HANDLING**

Handle compressed gas cylinders as if they are high-energy sources and therefore “potential explosives.”

- Compressed gas cylinders must always be transported on wheeled cylinder carts with retaining straps or chains.
- Cylinders shall not be banged, dropped or permitted to strike each other or against other hard surfaces.
- Do not use valve-covers to lift cylinders; valve-covers could be damaged and become unattached causing the cylinder to drop on a hard surface possibly resulting in an explosion.
- Never use compressed gas to dust off surfaces or clothing. This could cause injury to the eyes or body and create a fire hazard. Clothing can become saturated and burst into flames if touched by an ignition source such as a spark.

### **STORAGE**

Proper storage of compressed gas cylinders will minimize hazards. To ensure proper storage, ensure the following are followed:

- Store cylinders upright and secure them with a chain or strap to a stationary building support or secure them to a cylinder cart to prevent cylinders from tipping or falling.



Floor Stands



Bolted Wall Strap



Chained in a Rack

- Store cylinders in a dry, well-ventilated area away from flames, sparks, or any source of heat or ignition.



- Cylinders should not be exposed to continuous dampness, stored near salt or corrosive chemicals or fumes. Corrosion may damage cylinders and cause their valve protection caps to stick.
- Place cylinders in a location where they will not be subject to mechanical or physical damage, heat, or electrical circuits to prevent possible explosion or fire.
- Mark empty cylinders and segregate from full cylinders.
- Caps used for valve protection shall be kept on the cylinders at all times, except when the cylinder is actually being used or charged.
- Never plug, remove or tamper with any pressure relief device. Under normal conditions, these containers will periodically vent the product.
- Cylinder storage areas should have adequate ventilation to prevent injury or death in case of leaks and signage to indicate the potential hazards.
- Cylinder storage areas should be marked with proper precautionary signs, such as “Flammable gas”.
- Liquefied flammable gas cylinders shall be stored in an upright position, or such that the pressure relief valve is allowed to remain in the gas phase. (Cylinders loaded with liquefied gas are not completely filled; a small vapor space is left to allow for expansion if the cylinder is heated.) *Prior approval is required for flammable gases.*
- Flammable gas cylinders should not be stored with oxygen, or nitrous oxide cylinders, or adjacent to oxygen charging facilities.
- Oxygen cylinders shall be kept at a minimum of 25 feet away from fuel-gas cylinders, such as acetylene and combustible materials, or separated by a non-combustible barrier (i.e. a wall, door) at least 5 feet high with a fire-resistance rating of at least one-half hour.

## **TRANSPORT**

Only trained employees or vendor delivery personnel should safely transport all compressed gas cylinders throughout the building:

- Always use a cylinder cart to move compressed gas cylinders. Do not slide, drag or roll cylinders on their edge.
- Only one cylinder should be handled at a time unless a transport cart allows for the transport of multiple cylinders at one time.
- Cylinders transported by wheeled truck must be fastened securely in an upright position so that they will not fall or strike each other.
- Cylinders must not be transported without safety caps. A cylinder’s cap shall be screwed all the way down on the cylinder’s neck ring and fit securely.
- Regulators shall be removed from the cylinder during transport.



## **INCIDENTS & NEAR MISSES**

Report ALL near misses and incidents to your supervisor and JABSOM EHSO immediately.