Division of Safety Fact Sheet on **Compressed Gases**

National Institutes of Health (NIH) • Office of Research Services (ORS) • Division of Safety (DS)

Why a Compressed Gas Safety Program?

Compressed gases can be very dangerous due to their unusual characteristics, such as high pressure, flammability, toxicity, and physical hazards. Improper handling, storage, and use could lead to catastrophic events such as oxygen-depleted atmospheres, fires, or adverse health effects. Proper protection, storage, and management of compressed gases are critical for the protection of personnel and property from structural damage, severe injury, and even death.

Before beginning work with Compressed Gases

- Review the Safety Data Sheet (SDS) of each compressed gas to understand the physical, health hazards and environmental hazards associated.

- Ensure that the planned storage/use locations have appropriate ventilation and there are enough suitable restraints and mounts for the number of tanks received and used.
  - If the intended storage or use area does not have suitable restraints for gas cylinders, please contact your building/facility maintenance or place a work request with ORF at ORF Service Request.
  - Contact the cylinder supplier for the purchase of appropriate cylinder accessories (e.g., case holder, mounts, brackets, straps, etc.).
- Ensure compatible piping, regulator, etc., are available. Never attempt to fit incompatible equipment to a cylinder.
- If the gas is highly hazardous, such as toxic, flammable, corrosive etc. contact your Safety Specialist for a risk assessment.
- Look for visible or apparent signs of leaks (odor, visible fumes, damage to the cylinder, or hissing sound etc.).
- Inspect all cylinders to ensure they are not damaged/dented and are properly labeled. **Do not accept cylinders that are rusted, unlabeled, mislabeled, or damaged**.
- When accepting the cylinder ensure the "Full" tag is attached to the cylinder. If a lab is missing a tag after delivery and inspection, they should ask the vendor to provide the tag.

Ensure the cylinder markings and labels remain visible when secured and are not worn away, obscured, or altered. Color coding is not an acceptable method of labeling cylinders. Refer to Division of Safety (DS) Compressed Gas Guidelines for details.

Requirements for Working with Compressed Gases

1. **Training**: All personnel working with compressed gases should receive training from their PI/supervisor on standard operating procedures (SOP), SDS, safe storage and handling, including how to change and check regulators/valves, check connected tubing, safely moving cylinders, and emergency response.
2. **Transport:** Use appropriate equipment (e.g., a cylinder cart) to transport cylinders; never roll, slide, drag, drop, or lift them by the valve; do not transport with a regulator attached; always secure cylinders during transport, storage, and use; use freight elevators when available, and if a passenger elevator is necessary, do not ride with other passengers.
3. **Storage:** Never store cylinders near elevators, gangways, exits, egress routes, etc., or heat sources and electrical panels. Protective caps should **always** be kept on cylinders when not in use. **Never store or use** compressed gases in cold rooms or environmental chambers. These are enclosed areas and typically have recirculating air supply which can result in an oxygen deficient environment.
4. **Signage:** Signage should be posted near compressed gas storage areas. Additional signage is required for specialty hazardous gases like flammable, toxic, corrosive, oxidizers, etc.
5. **Labeling:** "Full" and "Empty" cylinders must be labeled as such and stored separately. **Do not** store reserve cylinders (cylinders that are not connected through the regulator to a process and one additional standby) in the lab. Contact the supplier of the cylinder to schedule a pick-up of empty cylinders.
6. **Secure:** Gas cylinders **must always** be secured in racks, holders, stands, or clamping devices. Ensure the securing devices are placed appropriately at 2/3 the height of the cylinder to safely secure the cylinder. Secure cylinders individually or a maximum of two cylinders of the same size within one chain/strap. If cylinder holders or racks are used, they **must** be secured (bolted) to the floor/wall. If a cylinder is mounted to a lab bench, it must be strong enough for the size and weight of the cylinder**. Labs are responsible for the purchase of these devices.**

Division of Safety Fact Sheet on **Compressed Gases**

National Institutes of Health (NIH) • Office of Research Services (ORS) • Division of Safety (DS)

Special Hazard Considerations in Compressed Gases

If the gases are corrosive, flammable, or toxic, they must be segregated by hazard class and separated from incompatible gases.

- Oxidizers (including oxygen) must be stored at least 20 feet from flammable gases or separated by a flame-resistant barrier at least 5 feet high with a minimum 30-minute fire rating.
- Require appropriate signage (Flammable Gases, Toxic Gases, Oxidizing Gases. and Corrosive Gases) and SOPs for these gases **(Flammable Compressed Gases SOP and Toxic Compressed Gases SOP).** Some of the flammable and highly toxic gases require continuously ventilated enclosures for storage and chemical-specific continuous monitoring. Consult with your Safety Specialist.
- When working with flammable gases these systems should be grounded and bonded.

Disposal of Empty Cylinders

Contact the compressed gas supplier printed on the cylinder to dispose of your empty or excess cylinders.

- If the lab or researcher has unknown and unwanted cylinders from a previous occupant, contact the supplier listed on the tank to arrange pickup.

Storage, transport, and safe handling requirements apply to empty cylinders too.

Compressed Gas Leak and Emergency Management Plan

Emergency Plan: Plans should be developed to address leaks before purchasing the gas cylinders. Consult Compressed Gas Guidelines for additional safety procedures and recommended methods for responding to leaks and emergencies. Emergency plans for toxic and flammable gases must have approval from DS.

Compressed Gas Leak: Flammable, Toxic or Corrosive

If there is a leak of a non-inert gas outside of a ventilated enclosure that will contain the gas, immediately activate the building fire alarm system and evacuate the building. Call the Fire Department Immediately.

- Bethesda-call NIH Fire at **911 from campus phone (301-496-9911 from a cell phone**),
- IRF Fredrick- dial 0 for the PMO dispatcher
- RML - dial 0 from a landline or 406-363-9400 from a cell phone, and
- **Baltimore –** call IC specific safety hotlines**.**

Compressed Gas Leak: Inert Gas

If closing the cylinder valve cannot stop the leak and it is an inert gas (e.g., nitrogen, argon, etc.), evacuate the area and restrict access. Call the NIH Fire Department.

- Bethesda at 911 from a campus phone, (**301-496-9911 from a cell phone) for the Bethesda Campus,**
- IRF Fredrick - dial 0 for the PMO dispatcher
- RML - dial 0 from a landline or 406-363-9400 from a cell phone
- Baltimore – call IC specific safety hotlines.
- Contact your supplier and return all problem cylinders.

Oxygen Monitoring

Compressed gases are simple asphyxiants with the potential to displace oxygen from the air. Some areas where compressed gases are handled may require oxygen monitoring. Detailed information is available at Oxygen Monitoring Webpage. Laboratories must purchase and maintain required gas monitoring devices, while DS conducts personal and periodic exposure monitoring; contact your safety specialist for an evaluation.

Cryogen and CO2 Safety

Cryogen Safety Fact Sheet has detailed information on safe handling of cryogenic materials such as liquid nitrogen.

Refer to the DS CO2 Safety Poster for general information and safety guidelines for the use and storage of CO2 and dry ice.