

# CHEMICAL SAFETY GUIDE

## COMPRESSED GASES



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| <b>Document #</b> CHE067-Compressed Gases                                                                                                                                                                                                   | <b>Distribution:</b> External |
| <b>Section:</b> Chemical Safety-Chemical Hygiene Program                                                                                                                                                                                    | <b>Effective Date:</b> 1/2010 |
| <b>Total Pages:</b> 10                                                                                                                                                                                                                      | <b>Revision Date:</b> 1/2025  |
| A laboratory -specific SOP is required for <i>particularly hazardous substance (PHS)</i> and/or any operation involving a <u>High-Risk chemical</u> . PI approval of a lab specific SOP is required for all PHS and/or high-risk chemicals. |                               |

### 1. DESCRIPTION:

Compressed Gases are gases which are stored above atmospheric pressure in metal cylinders.

Safety Data Sheets (SDS) use numbered hazard statements to communicate hazards, although the number may not always be present. The presence of the following hazard information indicates the chemical is an acute toxicant.

| GHS Pictogram | TU Hazard Category | GHS Category         | GHS H-Code | Signal Word |
|---------------|--------------------|----------------------|------------|-------------|
|               | Hazardous          | Gases Under Pressure | H280       | Warning     |

Contact EHRS via [ehrschem@temple.edu](mailto:ehrschem@temple.edu) for questions on the safe management of Compressed Gas Cylinders.

### 2. POTENTIAL HAZARDS:

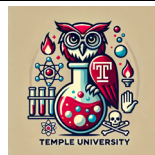
The large amount of potential energy contained in a compressed gas cylinder makes it a potential rocket or bomb if the pressure is released through rupture of the valve or container failure.

Due to the high pressure, exposure to heat or damage to the cylinder or valve can cause the cylinder to rupture. Damaged gas cylinders pose an extreme physical hazard due to the uncontrolled release of gas and the resulting propulsion of cylinder fragments or even the entire cylinder. Due to their weight, cylinders can also cause physical damage if they fall over. Any gas that contains less than 19.5% oxygen can create an oxygen-deficient atmosphere if released into an insufficiently ventilated environment.

Check the Safety Data Sheet (SDS) to determine the specific hazard of the substance, including route of exposure and other hazard classifications. Compressed gases may also be toxic,

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flammable, or explosive. Safety considerations for these properties must also be followed. Follow other hazard specific guidelines as appropriate.

### 3. REQUIRED TRAININGS & INFORMATION:

Before beginning work with Compressed Gases, all laboratory personnel must have completed the following:

- TU Required Trainings (available at [TU-EHSA](#))
  - Initial Safety Training for Researchers
  - Regulated Chemical Waste Management for Laboratories-Annual
- Review the Temple University [Chemical Hygiene Program \(CHP\)](#)
- Review any required Laboratory-specific Standard Operating Procedures (SOPs)
- Review any relevant Safety Data Sheets (SDS) available from the manufacturer or from [EHRM Management System-Search for Safety Data Sheets](#)
- Review the online section on Laboratory Emergencies
- Complete any laboratory-specific training necessary to perform the procedures.
- Place signature on the [Laboratory-Specific Training Checklist](#) to indicate review.

### 4. HAZARD CONTROLS

#### Purchasing:

When possible, look for alternative procedures or reagents that will eliminate the need for the compressed gases, or substitute it for a less toxic chemical.

Avoid purchasing small “lecture bottle” of compressed gases, as these typically cannot be returned to the vendor and disposal of these container is expensive.

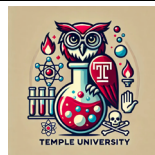
#### CGS System:

The CGA system is an industry standard that ensures that only regulators that are (1) made of the appropriate material and (2) rated for the cylinder gas pressure can be used on a particular cylinder. The CGA system uses 3-digit numerical codes. Each code corresponds to a separate set of dimensions for the connectors, so incompatible regulators will not fit.

On cylinders, the CGA number is typically on the cylinder valve. On regulators, the CGA number is typically listed on where the regulator attaches to the cylinder. The “CGA” prefix may or may not be present. C AAN connection information should also be available from the cylinder vendor. Ensure that the codes on the cylinder and regulator match. Do not manually alter regulators to change the connection type.

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Note that in the CGA system, regulators for flammable, toxic and corrosive gases will have a left-hand thread (aka “reverse thread”) connection.

### Engineering Controls:

- Only use compressed gases in well-ventilated environments. Do not use compressed gases in under-ventilated or non-ventilated areas such as cold rooms.
- If vacuum lines or pumps are utilized, use vacuum filters, cold traps, or other appropriate control measures to prevent contamination of the vacuum systems.
- All tubing or ducting carrying exhausted gas must go to a chemical fume hood or other laboratory ventilated exhaust system.
- Supplemental equipment such as blast shields should be used when working with chemicals or processes that may result in explosions or pressure releases.
- Consider the use of a glove box, toxic gas cabinet or other local exhaust in order to further contain hazards as appropriate.

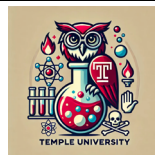
### Administrative Controls-General:

- Gas and gas cylinders **must** be used and stored in well-ventilated areas (i.e., lab ventilation having a minimum of six air changes per hour).
- Contact Environment, Health & Radiation Safety (EHRS) [ehrschem@temple.edu](mailto:ehrschem@temple.edu) to determine if the ventilation is adequate or if an oxygen-deficiency monitor or other alarm devices are needed.
- Never work alone. At least one other person familiar with the hazards of the gas must be present in the laboratory.
- Work with these chemicals must be performed in an area that is within 10 seconds (~ 55 feet) of a functioning safety shower and emergency eyewash.
- Verify and review your experimental setup and procedure before beginning work. Check that all equipment and piping/tubing used with compressed gas is rated for both the type of gas and the pressure of gas used.
- Ensure all equipment is functioning properly.
- Inform your colleagues about the compressed gas and where it will be used.
- Use the smallest necessary amount of the compressed gas.
- Consult with your PI before scaling up procedures involving compressed gases.
- If compressed gases are to be used in research animals, ensure that they are listed on the laboratory’s IACUC protocol.

### Administrative Controls-Chemicals Categorized as a Particularly Hazardous Substance (PHS) or a “High-Risk” Chemical:

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These chemicals require the following to reduce the risk of exposure to laboratory personnel:

- Development of a laboratory-specific Standard Operating procedure (SOP)
- Establishments of a designated area. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.
- Use of a containment device such as chemical fume hoods or glove boxes.
- Procedures on the safe removal of contaminated waste.
- Decontamination procedures.
- Restrictions on working alone with compressed gases.
- Required PI approval before starting use.
- Special laboratory specific signs or labels indicating warnings or work practices to be followed.
  - A “High Hazard Substance Sign” must be posted in the designated area. Signs are available via EHRS.

Designated area locations, applicable work practices, and information regarding the general handling must be included in the laboratory-specific SOP and be communicated to laboratory personnel through laboratory specific training provided by the PI prior to beginning work.

### 5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Follow the PPE recommendations listed in this guideline, Safety Data Sheets (SDS) and/or any required laboratory-specific SOPs for specific PPE recommendations. This should include at a minimum:

#### **Skin and Body Protection:**

Long pants (or equivalent) completely covering legs, closed toed shoes, and a traditional lab coat or flame resistant Nomex® lab coat when working with flammables.

#### **Hand Protection:**

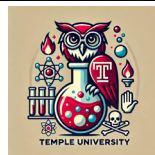
Gloves must be worn when handling compressed gases. If glove contact is anticipated, consult the SDS, and/or the lab specific SOP to determine whether the material or process requires alternative hand protection. Thicker gloves should be used for longer operations, larger quantities, or direct contact.

#### **Eye Protection:**

Eye protection in the form of ANSI Z87.1-compliant safety glasses with side shields must be

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always worn when handling compressed gases. Safety goggles and/or face protection must be worn when there is the potential for a splash hazard or working with large quantities.

### **Additional Hygiene Measures:**

If hazardous chemicals come into contact with gloves, immediately dispose of the affected gloves as hazardous waste. If hazardous chemicals come into contact with reusable PPE (lab coat, etc.) immediately remove the affected PPE, then dispose of it or submit it for laundering.

Additional PPE may be required depending on the specific operations involving your experimental procedures.

## **6. STORAGE, HANDLING & TRANSPORTATION**

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Always follow the manufacturer's recommendations for storage and handling.

### **Storage:**

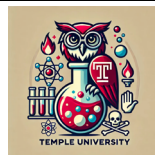
- Cylinders must be stored in an upright position.
- Cylinders (full or empty) must be secured by chains, straps, or other sturdy tie downs during storage and transport.
- Cylinders must be grouped by type of gas, and the groups segregated as to compatibility.
- Full cylinders must be separated from empty cylinders within the storage area.
- Flammable gases must be separated from oxidizing gases.
- Cylinders must not be stored at temperatures above 125 °F. or in direct sunlight, or outside of the temperature range specified by the manufacturer.
- Cylinder valves must be kept closed when not in use.
- Removable caps must be always kept on cylinders, except when cylinders are in use.
- Cylinders must be protected against tampering and damage.
- Cylinders must not be stored near combustible materials.
- Cylinders must not be refilled except by authorized suppliers.
- Open flames and smoking must not be permitted in areas where oxygen is used or stored. "No Smoking" and "No Open Flames" signs shall be conspicuously posted in these areas.
- Cylinders must not be used or stored in cold rooms or other unventilated enclosures.

### **Handling:**

- All compressed gas cylinders must be legibly marked by stenciling, stamping, or label with at least the chemical name or commonly accepted name of the material contained. In addition, cylinders should bear the approved markings of the Department of Transportation

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stamped in the metal at the top of the cylinder.

- Check connections and hoses regularly for leaks using a specific monitoring instrument or soapy water (or equivalent).
- Replace valve caps when cylinders are not in use or before moving.
- Remove damaged or defective cylinders from service (contact the cylinder vendor for assistance).
- Remove unused or empty cylinders from lab space.
- Never use Teflon tape on any CGA regulator. This will interfere with the seal between the regulator and the cylinder and cause a leak. Grease and oil must also not be used on CGA connections.
- Never use a cylinder without a regulator or other pressure/flow control device attached.

### Transportation:

- When moving compressed gas cylinder, use carts designed for this purpose. Ensure cylinder are restrained during transport.

## 7. INSPECTING CYLINDER AND ASSOCIATED EQUIPMENT PRIOR TO USE

### Cylinders labels:

- The name of the gas or gas mixture and the primary hazard associated with that chemical (flammable, oxidizer, etc.) is on the cylinder and legible.

**NOTE:** Do not accept a cylinder without a proper label; contact the manufacturer or supplier. Labels for associated equipment: Present and legible.

### Cylinder mounting and restraining devices:

- Any signs of damage or loss of integrity.

### Cylinder:

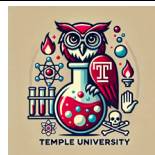
- Any corrosion, pitting, cuts, gouges, bulges, neck defects and general distortion?
- Any leaks?

**NOTE:** If a cylinder is leaking and the cylinder contains a hazardous material, then complete the following steps:

- Contact TUPS at 1-1234 from any campus phone.
- Evacuate the area until the emergency responders arrive.

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### Connections and hoses:

- Any leaks, damage to or cracks in the connections or hoses?

**NOTE:** To check for leaks using a specific monitoring instrument or soapy water (or equivalent).

### Regulators and valves:

- Confirm with the gas supplier that the regulator is the appropriate regulator.
- Any damage, cracks, corrosion, leaks, or other defects?

**NOTE:** When removing a pressure relief device (burst disk), first close the cylinder valve, then release the pressure from the cylinder.

**NOTE:** To check cylinder burst disks and connections for leaks, use a soapy water solution for cylinders containing argon, nitrogen, hydrogen, or air. For other gases, consult the gas supplier.

### Delivery system when using highly flammable or toxic gas:

**NOTE:** When using highly flammable or toxic gas, evaluate the delivery system using an inert gas prior to introducing the hazardous gas.

## 8. WASTE DISPOSAL PROCEDURES

All compressed gas cylinders **must** be returned to the gas supplier or properly disposed of as a *regulated chemical waste* through EHRS.

### Accumulation Limits:

A maximum of five (5) empty, unused, expired and/or unwanted compressed gas cylinders may be accumulated in a laboratory (Satellite Accumulation Area (SAA)).

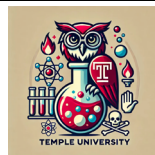
All compressed gas cylinders that contain an acutely toxic gas must be removed for disposal within three (3) days.

### Specific Instructions:

- Close and tighten valves and replace safety caps on cylinders.
- Leave some positive pressure (a minimum of 20 psig) in the empty cylinder to prevent "suck

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back" and contamination.

- Contact the vendor or supplier to obtain specific guidelines for shipment of compressed gas cylinders to be returned to them.
- If the compressed gas cylinder or lecture bottles cannot be returned to the vendor or supplier, contact EHRS to arrange for removal of cylinders. Refer to the section below for more instructions.
- Write "Empty" or "MT" on the outside of each empty compressed gas cylinders and lecture bottle.
- If applicable, place lecture bottles that will be picked up by EHRS in a box.

#### Removal:

1. Ensure that a properly completed "Hazardous Waste" tag is affixed to the cylinder. Tag must include the following:
  - a. Generator information is accurate.
  - b. Applicable Waste Stream is checked: **Other: Compressed Gas Cylinder**
  - c. Applicable Hazards are identified: **Ignitable, Corrosive, Toxic or Reactive (as applicable)**
  - d. All chemical constituents and amounts (%) are included on the tag.
2. Submit a Chemical Waste Pickup Request Form prior to exceeding the accumulation limits.
3. EHRS will typically process a completed and accurate waste request within 3 days.

Contact EHRS via [ehrschem@temple.edu](mailto:ehrschem@temple.edu) for tags, collection containers and for any questions regarding proper waste disposal. Refer to Chemical Waste Management Program (CWMP) for more information.

## 9. EMERGENCIES

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**In the event of an emergency** – Call Temple University Public Safety (TUPS) at (215) 214-1234 & EHRS at (215) 707-2520.

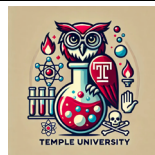
#### Health-Threatening Emergencies

1. Contact TUPS at 1-12234 from a campus landline phone or 215-203-1234 from a cell phone.
2. Go to the Temple University Hospital or nearest emergency room. Bring a copy of the SDS for the chemical.

Temple University Hospital Emergency Department  
Broad & Ontario Streets  
Philadelphia, PA 19140

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3. Notify your PI and Temple University-Human Resources-Absence Management
4. Notify EHRS at 215-707-2520 or [ehrs@temple.edu](mailto:ehrs@temple.edu) as soon as possible, but within 8 hours of the incident.

#### **Non-Health-Threatening Emergencies**

1. Notify your PI and Temple University-Human Resources-Absence Management.
2. If necessary, go to Temple University Employee Health Services. Bring a copy of the SDS for the chemical.

Temple University Employee Services on Main Campus  
1700 N. Broad Street, 4th floor  
Philadelphia, PA 19122  
Tel:215-204-2679

#### **Additional Instructions:**

##### **Skin exposure to a chemically hazardous gas**

Rinse body thoroughly using a safety shower for at least 15 minutes. If feasible, remove any contaminated or potentially contaminated clothing and/or jewelry.

##### **Eye contact or dust/particles blown into eye.**

Rinse eyes thoroughly using an eyewash station for at least 15 minutes, occasionally lifting up the upper and lower eyelids to allow rinsing of the area beneath the eyelids. Remove contact lenses if possible.

##### **Inhalation of chemical**

Move into fresh air.

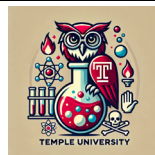
#### **Fires:**

If a small fire occurs, you are trained in the use of fire extinguishers, and you feel safe doing so, use a fire extinguisher to put out the fire. If a single extinguisher cannot put out the fire, activate a fire alarm and evacuate the area. Wait for emergency responders to arrive so that you can provide information about the fire.

If any gas cylinders are directly exposed to the fire, DO NOT attempt to put out the fire.

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Evacuate the area and activate a fire alarm.

Refer to Laboratory Emergencies for additional information.

### 10. RESPONSE TO A GAS RELEASE

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1. Assess the extent of the gas release and its hazards. DO NOT enter the area if you cannot assess the conditions of the environment well enough to be sure of your own safety.
2. If the gas release poses a chemical hazard (due to toxicity or reactivity) or if a significant amount of gas was released into the room, evacuate the room.
3. ***Immediately contact TUPS at 1-1234 or 215-204-1234.***
4. If safe to do so, help contaminated or injured persons evacuate.
5. Keep others from entering the area (e.g., use caution tape, barriers, etc.).
6. Stay away from the release area and give the building ventilation time to dissipate the gas.
7. Report the spill to EHRS at 215-707-2520 or [ehrs@temple.edu](mailto:ehrs@temple.edu) if you are not sure if the atmosphere is safe to enter.

Refer to Laboratory Emergencies for additional information.

### 11. REFERENCES

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1. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards. National Research Council, Updated Version-2011
2. 29 CFR 1910.1250-Occupational Exposure to hazardous chemicals in laboratories.
3. Temple University Chemical Hygiene Plan