

## COMPRESSED GAS SAFETY PROGRAM

### Purpose, Application, and Scope

Wichita State University (WSU) department of Environmental Health and Safety has developed this Program to cover general procedures for the safe handling and storage of all compressed gas cylinders and provide recommended safe practices for the handling, storage, and transport of cylinders.

This Program applies to all WSU faculty and staff that use, handle, store or transport compressed gas cylinders.

### Definitions

**Asphyxiant gas** --- A gas, usually inert, that may cause suffocation by displacing oxygen in the air necessary to sustain life or is labeled by the DOT as Division 2.2.

**Compressed gas** --- A gas or mixture of gases having an absolute pressure exceeding 40 psi at 70 degrees F; or a gas or mixture of gases having an absolute pressure exceeding 104 psi at 130 degrees F regardless of the pressure at 70 degrees F; or a liquid having a vapor pressure exceeding 40 psi at 100 degrees F.

**Corrosive gas** --- A gas that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact or is labeled by the DOT as Division 2.3 and Division 8 (Corrosive).

**Cryogenic fluid** --- A refrigerated liquefied gas having a boiling point colder than -90 degrees C (-130 degrees F) at 14.7 psi, or which the DOT requires the Division 2.2 label for non-flammable, non-poisonous compressed gas-including compressed gas, liquefied gas, pressurized cryogenic gas, compressed gas in solution, asphyxiant gas and oxidizing gas.

**Flammable gas** --- A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air greater than 12 percent by volume, regardless of the lower limit; or one for which the DOT requires their red flammable label or is labeled Division 2.1.

**Inert gas** --- Gases that do not readily react with other chemicals.

**Oxidizer gas** --- A gas that is non-flammable but can support and vigorously accelerate combustion in the presence of an ignition source and a fuel or is labeled by the DOT as Division 2.2 and Division 5.1 (Oxidizer).

**Toxic gas** --- A gas that has a median lethal concentration in air of 2,000 parts per million or less by volume of gas; or gas which the DOT requires the white poison label or is labeled as Division 2.3 "Gas poisonous by inhalation" because it is known to be so toxic to humans as to pose a hazard to health during transportation; or a gas that has an NFPA Health Hazard Rating of 3 (Toxic) or 4 (Highly Toxic).

### **Roles and Responsibilities**

**EHS Department** is responsible for the following:

- Ensures that a written program is in place
- Reviews the program periodically and monitors to ensure compliance with this program
- Ensures that employees receive appropriate training, and that training is documented

**Manager/Supervisor** is responsible for the following:

- Ensures that employees comply with the guidelines established by this program
- Ensures that employees complete required training, and that training is documented
- Identify and correct hazards associated with the handling, transportation, and storage of compressed gas cylinders.

**Employees** are responsible for the following:

- Complies with this program
- Completes required training
- Identify and correct hazards associated with the handling, transportation, and storage of compressed gas cylinders.

### **ELEMENTS OF THE PROGRAM**

#### **Inspection**

When a gas cylinder is received, it shall be inspected by the user for the following:

- A stamped hydrostatic test date within the last five years
- A stenciled or labeled identification of its contents
- Presence of a Valve protection cap
- Signs of damage or leakage.

If the test date, identification, markings, or cap are not in order, if the cap is rusted or inoperable, or if the cylinder is damaged it shall be taken out of service and returned to the manufacturer for repair or disposal.

#### **Labeling**

- All compressed gases received, used, or stored must be labeled according to the United States Department of Transportation (DOT) and the Occupational Safety and Health Agency (OSHA) Hazard Communication regulations. Each cylinder must be marked by label or tag with the name of its contents. Such identification shall be stenciled or stamped on the cylinder or placed on a label. The primary identifier of cylinder contents is the label.
- Never rely on the color of the cylinder for identification. Cylinder colors may vary depending on the supplier.
- All gas lines leading from a compressed gas supply shall be clearly labeled to identify the gas.
- When a cylinder becomes empty, it must be marked EMPTY and stored apart from full cylinders while waiting to be removed.

### **Handling**

When handling and transporting compressed gas cylinders the following shall be followed at all times:

- Wear the appropriate PPE
- Cylinders must always be transported on wheeled cylinder carts with retaining straps or chains
- Compressed gas cylinders must be transported with protective caps in place
- Do not lift or move the cylinder by the cap and Regulators shall be removed
- Never drop, bang, or strike cylinders against each other or other objects
- Only one cylinder shall be handled at a time unless a two-cylinder cart is used, and each cylinder is restrained by its own chain
- Do not allow grease or oil to come in contact with oxygen cylinder valves, regulator, gauges, or fitting. Oxygen cylinders and apparatus must be handled with clean hands and tools
- Open cylinder valves slowly, directed away from your face
- Do not attempt to refill compressed gas cylinders

### **Storage**

Compressed gas cylinders must be stored correctly to prevent in case of a container breach. The following precautions must be taken during storage:

- All cylinder storage areas must prominently marked with hazard class or the name of the gasses to be store, e.g. Flammable Gas Storage Area, and “No Smoking” signs posted where necessary
- Cylinders must be stored in a cool, dry, well-ventilated area

- Cylinders must be stored upright, with caps in place, and secured by chains, straps or in racks to prevent falling/tipping
- Restraints must be fastened on the upper half of the cylinder – above the center of gravity
- Where gasses of different types are stored at the same location, cylinders (empty or full) shall be grouped by type of gas, flammable gases must be stored separately from oxidizing gasses by a distance of 20 feet or a 5-foot high, one-hour fire rated wall
- Do not expose cylinders to corrosive materials such as corrosive gas or other combustible materials
- Segregate full and empty cylinders; use the first in first out inventory control method
- Store cylinders away from heavily trafficked areas and emergency exits
- Visually inspect stored cylinders on a routine basis to identify problems before an emergency occurs.

### **Usage Procedures**

The following precautions must be used to prevent injuries caused by the improper use of compressed gasses and cylinders.

- Know and understand the hazards associated with the gasses and equipment being used
- Use only regulators approved for the gasses and cylinders in use
- Never mix gasses in a cylinder
- Do not allow cylinders to become part of an electrical circuit
- Use non-sparking tools (brass) when working with flammable/explosive materials
- Prevent sparks and flames from contacting cylinders
- Do not discharge the contents from any gas cylinder directly towards people
- Open cylinder valves slowly and carefully after the cylinder has been connected
- Never use compressed gasses in a confined space
- Never use compressed gas to dust off equipment or clothing

### **Specific Gases Handling Procedures**

#### Flammable Gases

The following information applies to the use and handling of flammable gases. Some examples include acetylene, hydrogen, methane, propane, and isobutane.

- Flammable gases must be stored in well-ventilated areas away from flammable liquids, combustible materials, oxidizers, open flames, sparks or other sources heat or ignition

- A portable fire extinguisher (carbon dioxide or dry chemical powder type) must be available for fire emergencies where flammable gas is stored
- Spark-proof tools shall be used when working with flammable gas cylinders
- In the event of an emergency involving a flammable gas, such as a gas leak, fire, or explosion, personnel must immediately evacuate the area. Do not attempt to extinguish burning gas if the flow of product cannot be shut off immediately without risk
- All lines and equipment associated with flammable gas systems must be grounded and bonded
- Acetylene shall not be utilized in lines or hoses at a pressure exceeding 15 psi

### Oxidizing Gases

Oxidizing gases are non-flammable but in the presence of an ignition source and fuel can support and vigorously accelerate combustion. Examples include Oxygen, Chlorine, Fluorine, and Nitrous oxide.

- All equipment used for oxidizing gases must be cleaned with oxygen compatible materials free from oils, greases, and other contaminants (hydrocarbons and neoprene are not oxygen-compatible; PTFE Teflon is compatible. The equipment must state that it is oxygen compatible). Do not handle the cylinder with oily hands or gloves
- Oxidizers shall be stored separately from flammable gas containers or combustible materials. A distance of 20 feet or a non-combustible barrier at least 5 feet high and having a fire rating of a least one hour is the minimum separation requirement
- Oxygen and acetylene may be stored together if it is reasonably anticipated that the gas will be used in the next 24 hours

### Corrosive Gases

The following information is provided for corrosive gases. Examples include chlorine, hydrogen chloride, fluorine, hydrogen fluoride, hydrogen sulfide, carbon monoxide, and carbon dioxide.

- Keep exposure to gas as low as possible. Use fume hood or other vented enclosure when possible. Avoid contact with skin and eyes
- Wear safety goggles when handling compressed gas cylinders that contain corrosives
- An emergency shower and eyewash must be installed within 10 seconds where corrosive materials, including corrosive gases, are used
- An emergency response procedure must be in place and everyone working in the area must be trained on the procedure

### Toxic and Highly Toxic Gases

In addition to the general guideline, the following measure shall be taken when handling toxic and highly toxic gases.

- Toxic and highly toxic gases shall not be stored or used outside of laboratories
- Large cylinders of toxic and highly toxic gases must be stored in gas cabinets, exhausted enclosures, or gas rooms
- Keep exposure to toxic and highly toxic gases as low as possible. Use in a fume hood or other vented enclosure when possible. Avoid contact with skin and eyes
- A gas detection system with visible and audible alarms to detect the presence of leaks must be installed for all toxic and highly toxic gases that exceeds the maximum allowable quantities
- Contact EHS if assistance is needed or specifics on gas monitoring system requirements and maximum allowable quantity limits
- An emergency response procedure must be in place and everyone working in the area must be trained on the procedure

#### Asphyxiant Gases

- Do not store asphyxiant gases in areas without ventilation. This includes environmental chambers that do not have a fresh air supply or exhaust
- An oxygen detection device must be present when the calculated oxygen concentration is less than 18% if the full contents of the cylinder were released
- Any gas that has the potential to displace oxygen in sufficient quantities can cause asphyxiation. Only persons trained and qualified in the use of a self-contained breathing apparatus with adequate backup shall respond to an inert gas leak or enter an area where an asphyxiant gas could be present. Shut off the source of the gas leak if there is no risk to personnel and ventilate the area. If a person has symptoms of asphyxiation, move victim to fresh air and obtain proper medical attention

#### Cryogenic Liquids

Cryogenic liquids and their boil-off vapors rapidly freeze human tissue and cause embrittlement of many common materials which may crack or fracture under stress. All cryogenic liquids produce large volumes of gas when they vaporize and may create oxygen-deficient conditions. Examples of common cryogenic liquids include liquid nitrogen, oxygen, hydrogen, and helium. The following information applies to the use and handling of cryogenics.

- Wear face shield and chemical safety goggles when dispensing from cylinder or dewar
- Wear appropriate insulated gloves to protect from the extreme cold when handling cryogenic containers. Gloves need to be loose fitting so that they can be readily

removed in the event liquid is splashed into them. Never allow an unprotected part of the body to touch uninsulated pipes or containers of cryogenic material

- Keep liquid oxygen containers, piping, and equipment clean and free of grease, oil, and organic materials
- Do not store cylinders or dewars in environmental chambers that do not have fresh air ventilation. A leak or venting from the container could cause an oxygen deficient atmosphere
- In the event of skin contact with a cryogenic liquid, do not rub skin; place the affected part of the body in a warm bath (not to exceed 105 degrees F). If a burn is significant, seek medical attention

### Oxygen

Every user should understand that oxygen can be dangerous if not used correctly. Oxygen makes things burn more easily and can even explode. Following these safety guidelines will help reduce risks associated with oxygen.

- Oxygen in not compressed air, it is oxygen
- Keep oxygen tanks (cylinders) away from all heat sources, including radiators, heat ducts, stoves, fireplaces, matches, and lighters
- Do not permit open flames, sparks, or burning materials in the area where oxygen is being used
- Keep oxygen cylinders secure at all times
- Oxygen can ignite organics such as grease (without a flame)
- Never use oxygen as a substitute as a “compressed air” to run pneumatic tools, in oil heating burners, to start internal combustion engines, to blow out pipelines, or to create pressure for ventilation
- Oxygen cylinder valves should be opened all of the way during use
- Do not smoke when oxygen or fuel gases are present. Smoking can cause a fire or explosion

### **Training**

All employees affected by this policy shall be trained in compressed gas cylinder safety. The training shall include cylinder identification, inspection, handling, storage, use, and transportation.

As with any chemical, read the gas’s safety data sheet before you begin using the gas.



*Environmental, Health and Safety*