1 Introduction

Compressed gas cylinders can present a variety of hazards due to their pressure and/or contents. One of the contributing factor to these hazards is gas leak due to malfunction of the equipment or damaged connecting pipes. It is the intent of this SOP to provide information on the response procedures to be taken in case of a gas leak. This SOP must be read in conjunction with the department's SOP on Safe Use of Compressed Gas Cylinders.

2 Scope

This SOP applies to all staff and students in Department of Physics who use compressed or liquefied gases.

3 Responsibility

The Principal Investigator (PI) or supervisor must ensure that this SOP is communicated to all staff and students using compressed gases and understand the proper gas leak response procedures.

4 Types of Compressed Gases

A gas cylinder is a pressure vessel used to store gases at high pressure. The three main types of compressed gases that are stored in gas cylinders are liquefied gas, non-liquefied gas and dissolved gas.

1. Liquefied gases are gases that become liquids at room temperature when compressed at high pressure in a cylinder. Examples are carbon dioxide, ammonia, chlorine, etc.
2. Non-liquefied gases are gases that remain gases at room temperature even at high pressure. Examples are nitrogen, argon, carbon monoxide, helium, hydrogen, methane, oxygen, etc.
3. Dissolved gases are gases that are dissolved in a volatile solvent in order to stabilize them. Acetylene is a good example of a dissolved gas. It is usually dissolved in acetone.

5 Classifications of Compressed Gases

Flammable or combustible - Gases are flammable if their flashpoints (temperature above which there is not sufficient vapors given off to ignite) are lower than room temperature. In these situations there is an ever present danger of fire or explosion. Examples are acetylene, butane, ethane, ethylene, hydrogen, isobutene, methane, propane, etc.

Corrosive - A gas that causes visible destruction or permanent changes in skin tissue at the site of contact. Exposure to corrosive gas affects can be compounded due to the nature of the material. Examples are ammonia, boron trifluoride, chlorine, hydrogen chloride, methylamine and etc.

Poisonous – Exposure to poisonous gases and vapors can go unnoticed for long periods of time. Common poison or highly toxic gases include: arsine, ethylene oxide, hydrogen cyanide, nitric oxide, phosphine, etc.

Inert - An inert gas is a non-reactive gas and is usually a member of the noble gas family. Examples include helium, neon, argon, nitrogen, xenon, krypton, and radon.

6 Main Hazards Associated with Gas Leaks

- Asphyxiation caused by gas leaks.
- Poisoning from inhalation of toxic gas.
- Injuries resulting from contact with the released gas or fluid (such as chlorine).
- Fire resulting from the escape of flammable gases.
- Contents under pressure presenting mechanical and projectile hazards and may explode in heat or fire.

7 Main Causes of Gas leaks

- Poor installation or maintenance.
- Faulty equipment and/or design, e.g. badly fitting valves or regulators.
- Poor handling of gas cylinders.

8 Emergency Response Procedures

8.1 Simple Compressed Gas Leaks – presents minimal or no inhalation or fire hazards.

- Be aware that gases can accumulate and displace oxygen in a space that is not well ventilated. This is an asphyxiation hazard.
- Remove ignition sources if gas is flammable.
- Restrict access to the area.
- Place cylinder in or next to a fume hood if possible.
- Tighten fittings on cylinder.
- Locate leak with soapy water.
- If cylinder is still leaking, contact the supplier for additional information and suggestions.
- If a fume hood is not available and there is a direct route outdoors, a plastic bag may be placed over the slowly leaking valve and sealed with duct tape to hold it in place. Then move to the outdoor location using an appropriate cylinder cart.
- Notify your supervisor.
- Contact department safety committee officer

8.2 Major Compressed Gas Leaks - presents a large or uncontrollable leak or fire hazard, involves an acutely toxic gas, and/or more than minimal personal risk.

- Alert other occupants and have them evacuate the area.
- Call Campus Security 68741616.
- Turn off all ignition sources.
- Ventilate the affected area, if it is possible to be done safely, by pushing the emergency ventilating button prior to leaving the area.
- Leave fume hoods running.
- Provide information to emergency responders.
- Contact department safety committee officer

9 Additional Information - Safe Use of Regulators

- A regulator is a device that receives gas at a high pressure and reduces it to a much lower working pressure.
- Regulators are gas specific. Be sure to use the proper regulator for the gas tank 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 or gasket could be missing.
- Check leakage by bubble soak test.
- Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator.
- Regulators shall be removed from the cylinder during transport.
- Two stage regulators are commonly used in most labs. The gauge closest to the tank itself is the main gauge. It provides the total pressure reading of the gas in the tank. The primary stage should be kept closed whenever the gas tank is not actually in use. The second stage allows careful control and release of a lower constant pressure of gas. The reading on the second gauge provides an indication of the actual pressure of the gas being released from the tank.

10 Incidents & Near Misses

All near misses and incidents must be reported to your PI and department safety officer immediately.

A formal report must be filed to the accidents/incidents reporting site at this link https://wws.nus.edu.sg/airs/report.aspx within 24 hours.

For emergencies, please call Campus Security at 68741616

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