Trent University

Standard Operating Procedures

  

Poisonous and Corrosive Gases

*This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with this chemical(s) or procedure. This SOP is generic in nature and only addresses safety issues specific for this chemical(s) or procedure. In some instances, several general use SOPs may be applicable for a specific chemical. . Upon completion, forward this SOP to the ESHO, Human Resources for approval.*

**Introduction**:

**Poisonous gases** are those gases that are sufficiently toxic and/or reactive to meet one of the definitions given below.  They include **acutely toxic** and **corrosive** gases.

**Inert** compressed gases such as nitrogen, argon, and carbon dioxide are not considered "Hazardous Gases" for the purpose of this SOP.

**Toxicology**:

There are two categories of Poisonous Gases included in this SOP.  Examples of each Poisonous and Corrosive gases are included in a list below.

**Acutely Toxic Gases**

The definition of a toxic and highly toxic gas is related to the lethal concentration where 50% of a sample population of albino rats die after exposure. This value is referred to as the LC50, with the levels defined as follows:

**Toxic Gas**

* A gas with a median lethal concentration (LC50) in air of more than 200 ppm, but not more than 2,000 ppm by volume of gas.
* Classified as WHMIS Category 2 for Acute Toxicity

***Highly* Toxic Gas**

* A gas with a median lethal concentration (LC50) in air of 200 ppm or less.
* Classified as WHMIS Category 1 for Acute Toxicity

**Corrosive Gases**

* Corrosive gases cause visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact.
* The magnitude of the effect is related to the solubility of the material in the body fluids.
* Highly soluble gases such as ammonia or hydrogen chloride can cause severe nose and throat irritation, while substances of lower solubility such as nitrogen dioxide, phosgene, or sulfur dioxide can penetrate deep into the lungs.
* Corrosive gases also can corrode metals.
* Warning properties such as odor or eye, nose or respiratory tract irritation may be inadequate with some substances.  Do not rely upon these symptoms as warning of overexposure.

Examples of Acutely Toxic and Corrosive Gases

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| **Acutely Toxic Gases** |  |  |
| Arsenic pentafluoride | Arsine | Boron trifluoride |
| Chlorine | Diazomethane | Diborane |
| Fluorine | Methyl mercaptan | Oxygen difluoride |
| Phosgene | Phosphine | Phosphorus pentafluoride |
| Selenium hexafluoride | Silicon tetrafluoride |  |
|  |  |  |
| **Corrosive Gases** |  |  |
| Ammonia | Chlorine | Hydrogen chloride |
| Methyl Amine | Sulphur Dioxide |  |

**Exposure Control**: refer to the SDS and the Ontario OHS Regulation 833 for specific gas exposure limits.

**Engineering Controls:**

#### All components of a system connected to a compressed gas cylinder must be pressure-rated to withstand the maximum pressure capable of being delivered by the cylinder or the maximum output pressure of the regulator that is connected to the cylinder valve.

#### Fume hood

Work with hazardous gases must be performed inside of a fume hood or with another means of dedicated exhaust that has been reviewed and approved by Risk Management.

#### Safety shielding

Safety shielding is required any time there is a risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of hazardous gases which pose this risk should occur in a fume hood with the sash in the lowest feasible position.

#### Glove (dry) box

Some processes involving acutely toxic gases may be performed in a properly vented glove box rather than a fume hood.

#### Gas Alarms

Continuous-monitoring gas alarm systems are required for some hazardous gases. The EHS officer will assess the need for gas monitoring as part of the hazard assessment that will be done before approving use of the hazardous gas.

#### Leak testing

Hazardous gas systems must be leak tested using inert gas and leak detection solutions such as Snoop(TM) before use.

#### Gas trapping and Scrubbing

To prevent environmental pollution and damage to equipment it may be necessary to trap and or scrub exhaust from processes which utilize corrosive gases even when working in the fume hood.  Contact EHS for assistance with design and set-up of gas neutralization processes.

When corrosive gases are to be discharged into a liquid, a trap, check valve, or vacuum break device must be employed to prevent dangerous reverse flow.

#### Purging

Regulators and valves must be closed when the cylinder is not in use and flushed with dry air or nitrogen after use.

All piping and tubing must be flushed with inert gas after process is complete and before opening any component of the system to ambient air.

**Personal Protective Equipment:**

**Eye protection:** refer to the chemical specific SDS

**Skin protection:** refer to the chemical specific SDS

**Respiratory protection:** refer to the chemical specific SDS

**Handling Procedures:**

Proper storage and transport of**compressed gases** must be determined by assessing all of the hazards and physical properties of the chemical. General Storage and Transport guidance for compressed gases is given in Compressed Gases and Cyrogenic Liquids section of the Science Safety Program.  All requirements for storage, transport, and securing of gas cylinders apply to hazardous gases.

### Gas Storage Cabinets

Risk Management will determine the need for ventilated gas storage cabinets based on the gas quantity, gas hazards, and location.

**Emergency Response:**

**Gas Leaks**

If you observe or suspect that hazardous or inert gas is leaking:

1. Attempt to turn off the cylinder at the cylinder valve if it is safe to do so
2. If you are unable to turn off the gas or have any doubts, evacuate the area and contact EHRS immediately
3. Prevent others from entering the area of the suspected gas leak until responders arrive

**Do not hesitate to call Campus Security for assistance with compressed gas leaks or exposure concerns**. 705 748-1333

Contact Emergency services (911) only if the leak involves a fire, imminent risk of fire, an injury requiring an ambulance, or if there is a hazard that may affect others in the building.

**Disposal of Waste:**

* Wash hands thoroughly with soap and water after handling any chemical and whenever you leave the lab.
* Use good housekeeping practices to avoid contamination of surfaces, garments, personal belongings, and self.
* Decontaminate all surfaces that have come in contact with **corrosive gas**.  See the chemical Safety Data Sheet or contact EHRS for assistance with determining an appropriate decontamination method.
* Whenever possible, contact the gas vendor to return empty cylinders or unneeded quantities of gas in cylinders.
* When it is not possible to return the cylinder or unused gas, contact EHRS for assistance with disposing of cylinders.

**Please list the compounds used by this research group which are covered by this procedure. The list should also include the building/room where they are used.**

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**Lab Specific Protocol/Procedure:**

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I agree that I have read this SOP and will follow the procedures described in this SOP and on the SDS. Any deviation from this SOP or the SDS will only occur if it is to make a safer situation.

Principal Investigator’s Signature/Date

**Upon completion forward to the Environmental Health and Safety Officer, Human Resources**

**EHSO approval: Signature/Date**

**Revision date: Dec. 2019**