

Toxic Gas FactSheet

What is Toxic Gases?

Toxic gases are gases with hazardous physiological effects when inhaled. The National Fire Protection Association, classified gases into four classes based on the LC50. The most hazardous highly-toxic gases are rated Class 4, hazardous toxic gases are rated Class 3 and moderately-toxic gases are rated as Class 2 hazardous gases while in GHS the escalation is inverted as shown below.

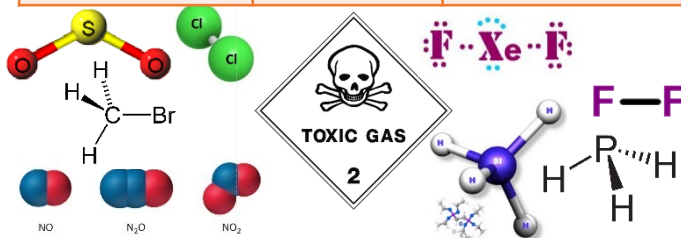
Pure Gas LC50 (ppm)	<200	1000	2000	3000	5000
CFC Toxic Gas Classes	Highly Toxic	Toxic			N/A
NFPA Health Hazard Classes	4		3		2
GHS Health Hazard	1	2	3		4

LC50: It is a standard measure of the toxicity of the gas that kills 50% of the animal test population in a specified period through exposure via inhalation
NFPA - National Fire Protection Association
CFC: The California Fire Code
GHS: The Globally harmonized system

What are the sources of Toxic Gases?

1 Most common Toxic Gases on campus

Anhydrous Ammonia	Fluorine	Nitrous Oxide
Boron Trichloride	Hydrogen Bromide	Nitrogen Dioxide
Boron Trifluoride	Hydrogen Chloride	Phosphine
Carbon Monoxide	Hydrogen Sulfide	Silane
Chlorine	Methyl Bromide	Silicon Tetrafluoride
Diborane	Methyl Mercaptan	Sulfur Dioxide
Dichlorosilane	Nitric Oxide	Xenon Difluoride

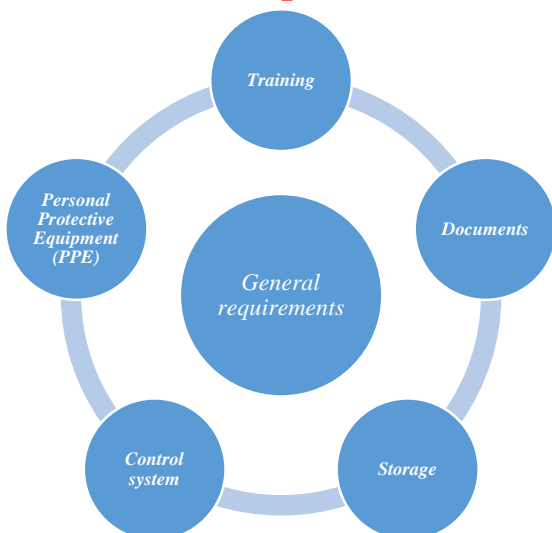


2 TG can be releases as a secondary hazard e.g. as by-products resulting from other reactions or accidents.

Any	+	Any	→	Toxic Product
Arsenic compounds		Any reducing agent		Arsine
Azides		Acidic compounds		Hydrogen azide
Cyanides		Acidic compounds		Hydrogen cyanide
Hypochlorites		Acidic compounds		Chlorine or Hypochlorous acid
Nitrates		Sulfuric acid		Nitrogen dioxide
Nitric acid		Copper, brass, any heavy metal		Nitrogen dioxide (Nitrous fumes)
Nitrites		Acidic compounds		Nitrous fumes
Phosphorus		Caustic alkalis or reducing agents		Phosphine
Selenides		Reducing agents		Hydrogen Selenide
Sulfides		Acidic compounds		Hydrogen sulfide
Tellurides		Reducing agents		Hydrogen telluride

How to use a Toxic Gas?

General Requirements



DETERMINE what requirements must be met:

1. Is the material compressed gas?
2. Is the material exempt from TG program requirements based on their toxicity and volatility?
3. Can the material be used in diluted concentrations?

General Requirements

Administrative Control

Training

- Lab Safety Fundamentals
- Compressed Gas Training

Documents

- Standard Operating Procedures
- Safety Data Sheets
- Emergency Response Procedures
- EH&S Toxic Gas Program

Engineering Controls

1 Storage

- Indoor storage must be in an exhausted enclosure or cabinet or separated ventilation room
- Gas cylinders must be double chained
- Lecture bottles must be secured upright to a stable surface
- Outdoor storage is allowed temporarily in a well ventilated area

3 Reaction Vessel

- Reaction vessel or chamber must be located inside an exhausted enclosure like a fume hood
- Depending on the process and gas type, additional engineering controls may be required such as RFOs, gas detection systems, automatic shut-offs

5 Ventilation Monitoring

- Ventilation monitor is needed for any gas cabinet or fume hood that toxic gas is stored inside.
- this monitor includes audible and visual alarms, magnehelic gauge or any other devices that indicate well ventilation.

7 Gas Monitor

- Continuous electronic gas monitors or portable gas detector can be recommended by EH&S on a case by case basis.
- More commonly required for continuous operations and gases with poor warning properties
- Gas monitor must detect concentrations at or below the Permissible Exposure Limit (PEL).

Personal Protective Equipment (PPE)

Always **REQUIRED**

- Eye protection such as safety glasses with side shield
- Skin protection such as long pants and shirts and closed-toe and closed-heel shoes

Sometimes **REQUIRED**

- Hand Protection
- Steel-toed shoes
- Respiratory protection

Emergency Reponse Guideline

All laboratories using toxic gases must have an plan addressing accidental release and emergency. In the event of an accidental toxic gas release, the emergency procedure outlined in the UCI Emergency Action Plan should be implemented. If the toxic gas release cannot be stopped quickly by safely closing the cylinder valve, then **911** should be called, with the caller providing the dispatcher with the name of the gas and the release location.

Purchasing & Acquisition

All toxic and highly toxic gas purchases must be ordered through the UCI Purchasing Department as a high value requisition and require approval from EH&S.

Cylinder Disposal

Disposal of lecture bottles must be through EH&S. To request a pick up, please visit: <https://ehs.uci.edu/> Empty gas cylinders must be labeled properly as "Empty". Empty cylinders still contain some quantity of toxic gas, and must be placed in an exhausted enclosure or a fire code compliance gas storage room. Depleted gas cylinders must be returned to the vendor.

"EH&S"

The department of Environmental, Health and Safety (EH&S) assist the research laboratories by performing evaluations of toxic gas and offers advice on the requirement of the toxic gas program and address California Fire Code (CFC) requirements. Contact EH&S at (824-3589) or email to karimik1@uci.edu

2 Gas Regulators and Lines

- All regulators, valves and lines must be chemically compatible with the gases being used
- Pressurized gas regulator and line system must be leak tested before use
- All regulators must be compatible with the size and type of gas cylinder

4 Ventilation Line

- Purge vents must be connected to an exhaust system that discharges to a safe location
- Significant emissions of toxic gas needs additional treatment system such as scrubber and absorbent

6 Fire Detection System

- Depends on the class of toxic gas, an approved automatic fire detection system is required to be installed in rooms or areas.

8 Alarm Location

- Gas supply location
- Gas operating room
- Out side the gas use or storage room (i.e. hallway corridor).

