Lecture Bottles – Compressed Gases

Standard Operating Procedure

Revision Date: 12/13/23

This standard operating procedure (SOP) outlines the handling and use of lecture bottle. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling lecture bottles. *All laboratory workers must read and understand the*[*Laboratory Emergencies SOP*](https://ehs.umich.edu/wp-content/uploads/2022/05/LaboratoryEmergencyProceduresSOP.docx)*prior to commencing any work in a laboratory.*

# Description [Provide additional information as it pertains to your research protocol]

Lecture bottles, which are very small compressed gas cylinders, typically 12-18 inches (300-460 mm) long and 2-3 inches (25-76 mm) in diameter

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

Hazards associated with compressed gases include toxic gas exposures, explosions, oxygen displacement, fires, and physical hazards due to the high pressures inside the cylinders. Check the Safety Data Sheets (SDS) for more information. Safety recommendations provided by the supplier must be followed.

There is a potential overpressure hazard with the long-term storage of carbon steel cylinders containing liquid anhydrous hydrogen fluoride (AHF). AHF in such a cylinder reacts very slowly with the iron in the steel to form iron fluoride and hydrogen. The hydrogen collects in the vapor space and builds up pressure.

# Engineering Controls [Provide additional information as it pertains to your research protocol]

For toxic gases, perform work under a fume hood or ensure that the delivery system or experimental apparatus using hazardous gases is enclosed and connected to an exhaust ventilation system. Ensure that the room where compressed gases are being used has sufficient ventilation, e.g., at least six air changes per hour (ACH).

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

All compressed gas cylinders shall be legibly marked with the name of the gas or gas mixture and the primary hazard associated with that chemical, e.g., flammable, oxidizer, etc. Do not accept a cylinder without a proper label. The gas cylinder must also be tagged or labeled with either “full” “in use” or “empty.”

* Inspect lecture bottles and regulators prior to use for integrity. Do not use if corroded, gouged, bulging, pitted, or damaged. Check connections and hosing/tubing for leaks and integrity.
* Lecture bottles must be properly secured and upright. Commercially sold lecture bottle stands are available.
* Use engineering controls for toxic gases, e.g., chemical fume hoods.
* Only use regulators and tubing appropriate for the type of gas and that comply with the manufacturer’s instructions.
* Never leave pressure on a hose or line that is not being used.
* Cylinders of flammable gas must be away from sources of heat or ignition, oxidizers, combustibles, and other incompatibles at a distance of at least 20 feet unless separated by a one-hour, fire-rated wall.
* Ensure the nearby availability of an eyewash station and emergency shower when working with corrosive gases.
* Never heat a cylinder to raise the pressure of the gas.
* Refilling, repair, or alteration of the cylinder is prohibited.
* Do not place cylinders where they might become part of an electrical circuit or allow them to come into contact with an electrically energized system.
* Follow purging procedures, if available.
* When using highly flammable or toxic gas, check delivery system using an inert gas prior to introducing the hazardous gas.
* Remov any damaged, defective, unused, or empty cylinders from lab space.
* For lecture bottles of anhydrous hydrogen fluoride, dispose of within 2 years of purchase.
* Refer to [EHS’s Compressed Gas](http://ehs.umich.edu/wp-content/uploads/2016/03/Compressed_Gas_Use.pdf) hazard guideline or consult with your EHS representative regarding maximum allowable quantities of compressed gases.

Restricted hazardous gases must be approved by EHS, prior to purchase. See the hazard guideline for [compressed gas](http://ehs.umich.edu/wp-content/uploads/2016/03/Compressed_Gas_Use.pdf) use on the EHS website or contact your EHS representative for more information. The [Restricted Hazardous Gases Authorization form](https://docs.google.com/forms/d/e/1FAIpQLSflBGaF3LedmhouKl3Hd4_JGCd6nX-bk_ZYDfDEuqDvjLw2-A/viewform?vc=0&c=0&w=1) can be used to request approval to purchase a restricted gas.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

Safety glasses must be worn for all work involving compressed gas cylinders. If the compressed gas is corrosive, safety goggles and proper gloves must also be worn. Perform a Personnel Protective Equipment (PPE) assessment in accordance with the [U-M Chemical Hygiene Plan](http://ehs.umich.edu/research-clinical/chemical/) to determine the level of protection needed for the task.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Lecture bottles must be stored in an upright position because lecture bottles are more susceptible to damage and leaks when stored on their side. Lecture bottle holders can be purchased from compressed gas supply companies.
* Segregate incompatible gases such as flammable and oxidizing gases.
* Store toxic gases in a fume hood or gas cabinet (from time of receipt until disposal).
* Regulators must be removed during storage.
* Cylinders shall be maintained at temperatures below 125°F (50°C) or within of the temperature range specified by the manufacturer and stored out of direct sunlight.
* Never drop, bang, or strike cylinders against each other or other objects.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Contact the supplier to obtain specific guidelines for shipment of lecture bottles to be returned to them. Avoid purchasing non-returnable lecture bottles, or from suppliers who do not accept returned lecture bottles with unused or empty contents. Contact EHS Hazardous Materials Management (HMM) at (734) 763-4568 to arrange for the removal of lecture bottles that cannot be returned to the supplier. If the cylinder is empty, write “empty” on the outside of each cylinder and place in a cardboard container and attach a completed [hazardous waste manifest](http://ehs.umich.edu/haz-waste/chemical-waste/).

# Training of Personnel

All personnel are required to complete the ***General Laboratory Safety Training*** session (**BLS025w** *or equivalent*) via the [EHS My LINC](http://ehs.umich.edu/education/) Web page. Furthermore, all personnel shall read and fully adhere to this SOP when handling lecture bottles.

# References

Chemical & Engineering News (28 Apr 1997) Vol. 75, No. 17, pp. 6.

# Certification

I have read and understand the above SOP. I agree to contact my Lab Director if I plan to modify this procedure.

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### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

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| Date | Revision |
| 09-14-18 | EHS name and logo were added, updated the formatting, and revised the content under Exposure/Unintended Content (AKJ). |
| 02-25-19 | Updated web links |
| 12-13-23 | Updated web links, and grammatical errors. Removed spill procedure sections. Added content under Potential Hazards and added a reference. |