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| **Standard Operating Procedure (SOP) for Using Toxic Gases in the Laboratories** |
| Branch/Institute (IC):Laboratory: | Effective Date: |
| PI/Overseeing Official: | Email: |
| Revision Date: | Reviewed/Approved by: |
| **COMPLETE THE HIGHLIGHTED ITEMS**  |
| **1 HAZARDS** |
| **Chemical Name** (s): *name of the gas***Routes of Exposure:** Inhalation, absorption, ingestion, and injection**Potential Hazards (refer to the SDS):***(List the hazards associated with the chemicals and equipment)*  Review the safety data sheet (SDS) for all the chemicals. **Attach SDS(s) to this SOP.**  |
| **2 EXPOSURE LIMITS** |
| *(As applicable, list the Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) of the chemical(s) if known.* **(refer to SDS Section 8):** |
| **3 EQUIPMENT AND PROCESS** |
| Describe briefly the equipment and process:  |
| **4 PLANNING AND PRE-APPROVALS** |
| **Before Ordering Toxic gases**:* Contact DS ([IC Safety Specialist](https://ors.od.nih.gov/sr/dohs/safety/laboratory/Pages/safety_health_specialists.aspx)) for a risk assessment of the space to ensure the planned use locations have appropriate ventilation and meet other safety requirements.
* Select appropriate regulators compatible with the gas.

**Identifying a location for the storage**:* Away from heavy traffic areas and isolated in a room.
* Ensure the location has appropriate ventilation.
* Away from return air vents.

*The PI/supervisor must conduct a hazard assessment to identify the hazards and develop exposure control strategies.* *Some of the highly toxic gases may require continuously ventilated enclosures for storage. If you need assistance in selecting appropriate PPE, contact your* [*IC Safety Specialist*](https://ors.od.nih.gov/sr/dohs/safety/laboratory/Pages/safety_health_specialists.aspx).**Pre-approval** from the Division of Safety: *contact your* [*IC Safety Specialist*](https://ors.od.nih.gov/sr/dohs/safety/laboratory/Pages/safety_health_specialists.aspx). |
| **5 TRAINING** |
| * Training on using the instrument(s)/gas tank/process/regulators (review of manufacturer’s operating manual for all the processes including regulators/regulator change, maintenance etc.), review of SDSs and a review of this SOP will be provided by the PI/supervisor to personnel using the toxic gas.
* Hazard communication or [Lab Safety training](file:///C%3A%5CUsers%5Ccwertheim%5CDesktop%5CLab%20Safety%20training)
* Review of [NIH Compressed Gas Health and Safety Guidelines](file:///C%3A%5CUsers%5Cdiallomab%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5C9TC1HLGP%5CCompressed%20Gas%20and%20Cryogen%20Safety%20Guideline%20Document)
* Handling, storage, and management of compressed gases
* Emergency response plan and audio-visual monitoring systems if any
* Policies on working alone and prior approvals
* Specify any lab-specific training and approval process

*The pre-approval process consists of training, verification of the competency to perform the task, and responding to an emergency etc.* |
| **6 ENGINEERING / VENTILATION CONTROLS**  |
| The gas cylinder must be secured properly by following NIH guidelinesWork involving the use of *name of the gas* will be performed in a:[ ]  chemical fume hood[ ]  snorkel hood[ ]  other, see below\*\*Describe in detail the type of ventilation used.*Click here to enter text* **Work outside of a fume hood or approved exhausted containment requires Division of Safety (DS) review to identify additional risks and/or the need for additional protection.** |
| **7 ADMINISTRATIVE CONTROLS** |
| *(As applicable, describe work practice controls used for the procedure.)* *Examples: Designated areas (for highly toxic gases), not working alone, etc.*General Guidelines for working with toxic gases:1. Review the Safety Data Sheets (SDS) to understand the hazards and determine safe use guidelines.
2. Work only under a fume hood or other DS-approved ventilation system.
3. An emergency response procedure must be in place, and everyone working in the area must be trained on the procedures.
4. Standard Operating Procedures (SOPs) shall be developed when using toxic gases. These SOPs shall include emergency response and training for all involved employees.
5. Only trained employees are allowed to work with highly toxic gases.
6. Container Storage Areas must be **posted with the hazard class, the name of the gases stored, and emergency contact information** ([Compressed Gas Storage Area Sign](https://ors.od.nih.gov/sr/dohs/Documents/sign-compressed-gas-safety.pdf) and [Toxic Gas Sign](https://ors.od.nih.gov/sr/dohs/Documents/sign-toxic-gas.pdf)).
7. **Never leave operations unattended.**
8. It is recommended not to work alone with toxic gases.
9. It is recommended to establish an after-hours work approval from the PI.

***Restricting access* (Yes/No)****Special Handling Procedures and Storage Requirements, if any (***brief description of the process***)***e.g., at the end of each work process, the main cylinder valve is turned to the off position. All pressure is allowed to leave the regulator. The needle valve is closed for safety.* |
| **8 PERSONAL PROTECTIVE EQUIPMENT**  |
| *PIs/supervisors are responsible for identifying appropriate PPE required for various activities and ensuring that the workers are complying with the PPE recommendations.**If you need assistance in selecting appropriate PPE, contact your* [*IC Safety Specialist*](https://ors.od.nih.gov/sr/dohs/safety/laboratory/Pages/safety_health_specialists.aspx).List all PPE used- (*refer to SDS)** Hand protection: chemical-resistant gloves
* Lab coat or coveralls: (*fire-resistant or NOMEX lab coat required for working involving flammable materials).*
* Eye protection: safety glasses with side shields or safety goggles. Additional protection, like a face shield, may be required depending on the nature of the work.
* Respiratory protection, if any, when engineering and other controls cannot reduce exposures. DS approval is required for the use of respirators, including N95. Contact DS to conduct a risk assessment ( [Respiratory Protection Program](https://ors.od.nih.gov/sr/dohs/Documents/respiratory-protection-program.pdf) (RPP) ).
* Never take PPE outside to prevent spreading contamination.

**Gloves must be changed immediately if contaminated, torn, or punctured! Practice safe glove removal techniques! Wash hands thoroughly after removing the PPE.**  |
| **9 MONITORING** |
| *(As applicable, describe any monitoring needed for the procedure.) Consult with* [*IC Safety Specialist*](https://ors.od.nih.gov/sr/dohs/safety/laboratory/Pages/safety_health_specialists.aspx) *to identify monitoring requirements.**Personnel exposure monitoring.* *Oxygen monitor equipped with visual and audio alarm if used*: (refer to [NIH Oxygen Monitoring](https://ors.od.nih.gov/sr/dohs/safety/Pages/oxygen.aspx) guidelines)*Gas specific/spill/release monitoring*.* A gas detection system with visible and audible alarms to detect the presence of leaks, etc., must be installed for all toxic and highly toxic gases with hazard rating 3 or 4 (in compliance with NFPA 55 Guidelines).
* Emergency power must be provided for the gas cabinet exhaust, system shut-offs, monitoring, alarms, and associated components.
* Gas detection and alarm systems must be serviced and maintained according to the manufacturer’s guidelines.
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| **10 DECONTAMINATION AND WASTE DISPOSAL** |
| *Specify decontamination procedures.* * Any chemical waste, including contaminated debris (i.e., waste, scraps, dust, wipes, any contaminated materials, including disposable gloves, lab coats, etc.) must be disposed of as hazardous waste.

**Refer to the** [NIH Waste Disposal Guide](https://orf.od.nih.gov/EnvironmentalProtection/WasteDisposal/Documents/NIH-Waste-Disposal-Guide-2022-508Ready.pdf) **for waste management and disposal.**  |
| **11 GAS STORAGE** |
| *Gas cylinders must always be secured in racks, holders, or clamping devices. Measure 2/3 up the straight side (distance below cylinder shoulder) of the cylinders to mark the height on the mounting wall for the mounting bracket. Fasten cylinders individually or up to a maximum of two cylinders of the same size within one chain/strap in a well-ventilated area.***Recommended storage for toxic gases**: Store all toxic gases with a health hazard rating of 3 or 4 in a continuously mechanically ventilated gas cabinet or other exhaust enclosures. **Labeling for storage areas*** [Appropriate signage](https://ors.od.nih.gov/sr/dohs/Documents/sign-toxic-gas.pdf) indicating the hazard, PPE requirements, and any other pertinent information should be posted at the outside door and entry points to areas where toxic gases are handled or stored. Consult with [*IC Safety Specialist*](https://ors.od.nih.gov/sr/dohs/safety/laboratory/Pages/safety_health_specialists.aspx)
* Store only those “cylinders in use” in the lab. (One cylinder connected to the regulator and another one as a spare).
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| **12 TRANSPORTATION PROCEDURES** |
| ***Describe if any:*** |
| **13 SPILL AND EMERGENCY PROCEDURES** |
| ***D****evelop an emergency response plan:* Emergency PlanAt a minimum, the plan should specify the following:* Alarm System & Evacuation Procedure.
* Response Personnel.
* Emergency Equipment.
* Containment or disposal methods.

**Include the location of available safety equipment in the lab(s).** Location of Eyewash: Location of Safety Shower: Location of Fire Extinguisher:

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| **Emergency medical help and spills:** All spills involving PHS are **high-level hazard spills** | Contact Emergency Services/Fire Department. Delete not applicable location information.**Bethesda, MD -** call911 on campus, 9-911 off campus**;** 301-496-9911 (cell phone)**Baltimore, MD -** 911 **Frederick, MD -** 911**Hamilton, MT -** 911**Research Triangle Park, NC -** 911 (landline), 919-541-2800 (cell phone) |

Do not reenter the room until the fire department or appropriate authorities have cleared the space for reentry. |
| **14 EXPOSURE PROCEDURES** |
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| **For eye & dermal exposure**, wash immediately under eyewash or safety shower for at least 15 minutes. | Seek **emergency medical help** if needed as described above.The injury/exposure should be immediately reported to your supervisor and local OMS clinic: Delete not applicable location information.**Bethesda, MD**: Building 10, Room 6C306; (301) 496-4411**Baltimore, MD**:251 Bayview Blvd., BRC 01B210; (667) 312-5843 **Frederick, MD:** 8200 Research Plaza, Room 1B116; (301) 631-7233**Hamilton, MT:** 903 South 4th Street, Room 5202; (406) 375-9755**Research Triangle Park, NC:** 111 T W Alexander Drive, Building 101, Room E111; (984) 287-4178 |

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| **15 TRAINING ATTESTATION** |
| All individuals working with toxic gases must be trained on the operation, this SOP, emergency response plan, and appropriate use of gas regulators before starting work and reviewed at least annually or whenever there is a significant change in processes or procedures. They must also be trained on the *name of the gas* SDS, and all documents must be readily accessible in the laboratory. Additionally, personnel must remain current on the review of the [Chemical Hygiene Plan (CHP)](https://ors.od.nih.gov/sr/dohs/Documents/chemical-hygiene-plan.pdf). All training must be documented and maintained by the PI or their designee.  |

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| **Review and Acknowledgment: I have read, asked questions (as needed), and fully understand the hazards listed and will adhere to the safe working requirements for the procedures/materials described herein and the corresponding SDS.** |
| **Documentation of Training****Standard Operating Procedure for  *name of the gas*** |
| Employee Name | SOP Training Date | Signature |
| Click here to enter name. | Click here to enter a date. |  |
| Click here to enter name. | Click here to enter a date. |  |
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