**Lab-Specific Standard Operating Procedures for General Hazard Classes: Compressed Gas Cylinders**

**Introduction**

The hazard class Standard Operating Procedures (SOPs) provided by University Health and Safety (UHS) are intended as a voluntary resource to provide general guidance on how to work with these materials and to provide a template for laboratories to customize to fit their needs.

These SOPs templates should be used for materials with one hazard class and for procedures and materials requiring only basic PPE (i.e., lab coats, goggles, and nitrile gloves).

For more complex procedures and materials with multiple hazards these templates can be used as guidance when conducting your lab’s own risk assessment, and writing procedure specific SOPs.

If you have any questions about writing Standard Operating Procedures, chemical safety, hazard assessment, or any other research safety questions, contact your Departmental Safety Officer (DSO) or call your UHS Research Safety Professional (612) 626-6002.

**Instructions**

All text or spaces in yellow are intended for customization by your laboratory. Fill in the information needed, customized for your lab’s accepted practices, materials used, available resources, etc. Consider which materials your lab uses in the hazard class, and what your lab is experienced with and feels comfortable handling. You can also add any specific information, best practices, or other lab-specific information you would like.

If you are unsure if a specific material or procedure requires its own SOP, contact UHS for guidance.

When complete, ensure the SOP is approved by the lab’s PI and added to your lab’s safety manual and annual training. SOPs should be reviewed with all lab members annually, and should be reviewed and updated at a minimum of every 3 years.

**Lab-Specific Standard Operating Procedure**

**Safe Use and Handling of Compressed Gas Cylinders**

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| ***PI:*** | *Knope, L.* | ***Lab Location:*** | *Boynton W-132* |
| ***Issue Date:*** | *9/12/2016* | ***Revision Date:*** | *9/12/2019* |
| ***Prepared by:*** | *Wyatt, B.* | ***Approved by:*** | *Perkins, A.* |

***Hazard Identification***

All gas cylinders must be labeled at a minimum with the name of the contents and the word “Compressed Gases” or the GHS pictogram for gases under pressure, pictured to the right. Information on the hazards of specific materials can be found in their SDS.

Examples of gas cylinders in use in the [lab name] include:

* Example 1
* Example 2
* Example 3

***Risk Assessment***

The primary risks of working with gas cylinders is physical hazards created by the pressurization of the gas and the potential for a cylinder leak or rupture.

This SOP alone should not be used for any gas that has another hazard class, such as flammable gases, toxic gases, etc. The information in this SOP should be used along with the SOP for the other hazard class as a reference for your lab when writing your own SOP for those types of material.

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| **Lab-Specific Working Limits** |
| **Maximum Storage Amount** | *List the maximum volume of compressed gas that is allowed to be stored in your lab. Include limits on specific materials, such as flammable gases, if applicable.* |
| **Working Pressure Range** | *List the range of pressures where your lab allows work with this hazard class.* |

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| **Transfer and Transportation Limits** |
| **Maximum Flow Rate** | *List the maximum rate of flow for gases that your lab uses.*  |
| **Maximum Use Out of Hood** | *List the amount of gas your lab allows to be used or vented outside of a fume hood.* |

***Control Plan***

*Storage and Transport*

* Keep gas cylinders away from heating sources, including sunlight, heating components, boilers, steam pipes, etc. Otherwise, this may cause a rise in pressure and potentially explode.
* Keep gas cylinders away from temperatures below -20°F, unless designed for that use.
* Do not store gas cylinders in the same cabinet as corrosive materials, even if the gas is corrosive itself.
* Only move gas cylinders when they are securely strapped down to an approved cylinder cart.
* Always secure gas cylinders in an upright position, even when they are not in active use or transport. Straps need to be substantial, placed between the middle and the top curve of the cylinder, and should attach the cylinder to a stable structure, such as a wall or lab bench. Cylinders should not be secured to movable furniture or anything unstable.
* Wear the proper PPE when moving and working directly with cylinders – gloves, safety glasses, and hard-toed shoes.
* Use protective valve caps on cylinders when they are in transit or not in use.
* Handle gas cylinders carefully – do not drop them, strike them against things, or roll them along the ground.
* Lecture bottles and round-bottom cylinders are not required to be stored upright, but they must be stored somewhere secure (i.e., where they won’t fall off a shelf or roll off a table).
* Transfilling (filling your own gas cylinders from another source) or gas mixing of gasses in cylinders has specific requirements that must be followed. **Contact UHS at (612)-626-6002 for further guidance.**
* If you are moving containers between campuses or will be shipping any material, contact UHS at (612)-626-6002 before doing so.

*Set-Up and Active Work*

* When setting up gas supply systems, joints should not be greased.
* When using gas supply systems, you should regularly check all parts to ensure that there are no signs of degradation or damage. This includes the cylinder, valve, and the rest of the supply system.
* When setting up a gas supply system for the first time or after changing a cylinder, the entire system should be checked for leaks to ensure safety. Check at regular intervals during regular work as well. A mixture of soap and water is useful for this. For highly hazardous gases, perform leak checking with an inert gas, such as helium or nitrogen first, before using the highly hazardous gas in the system.
* Build a purge step into all experimental procedures to ensure that no gas is left in the tubing. This is especially important if you are disconnecting the tubing, removing it from a fume hood, or using it elsewhere.
* Include procedures for how to report or repair damage to a gas cylinder. Include who to tell, who to call, or how to get replacement parts.
* Be aware that liquid nitrogen cylinders may vent briefly as part of normal operation –don’t be alarmed.

*Exposure Controls*

* Use the material in a fume hood if possible.
* Only use gas cylinders in a well-ventilated area. Avoid small spaces, closets, cold rooms, and other rooms with poor ventilation. All gases, even non-hazardous ones, are capable of causing asphyxiation by replacing oxygen in enclosed spaces.
* If the gas has another hazard class, use appropriate exposure controls for that hazard class.

**Minimum PPE Requirements**

PPE requirements include:

* Lab coat (if applicable to your lab)
* Safety glasses/goggles (if applicable to your lab)
* Nitrile gloves (if applicable to your lab)
* Additional PPE (if applicable)

If procedure or material-specific PPE is required beyond the minimum listed above, another SOP should be available for that procedure or material. (Example: neoprene gloves, etc.)

***Spill & Accident Planning/What-If***

During lab-specific training, researchers should be informed where fire extinguishers, safety showers, alarm pull stations, and egress routes are. All labs are set up so that this emergency equipment is readily available and near exits.

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| **Lab-Specific Emergency Response Procedures** |
| **Leak** | *Describe your lab’s plan for responding to leaks of the cylinders you regularly use. This may include moving the cylinder to a well-ventilated, isolated location, calling the manufacturer, or evacuating the building. If the leak is flammable, toxic, a stench chemical, or is large enough that you cannot attempt to control it on your own, contact DEHS for assistance at (612) 626-6002.* |
| **Utility Failure** | *Describe lab-specific procedures related to gas cylinders for responding to a power, water, or gas outage.* |

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| **Route of Exposure** | **Signs/Symptoms of Exposure** | **First Aid/Response** |
| **Inhalation** | These signs/symptoms will vary depending on the specific gases in use. Consult the SDS or a specific material SOP for more information. | Move person to fresh air. Seek medical attention if symptoms do not improve. |
| **Eye Absorption/Contact** | Use emergency eyewash and rinse eyes for a minimum of 15 minutes. |
| **Skin Contact** | Remove contaminated gloves or clothing, wash with soap and rinse. If major exposure, use safety shower. |
| **Ingestion** | Ingestion is unlikely in the standard lab setting. | Seek medical attention. |
| **Injection** | Injection is unlikely in the standard lab setting. | Seek medical attention. |

All injuries, or damage to the facility must be reported to and investigated by DEHS. Injuries which require medical treatment require a First Report of Injury (FROI) to be filed.

***Waste Storage and Disposal***

* Empty gas cylinders should have “Empty” and the date emptied written on them. Do not remove the labeling or hazard markings.
* Empty gas cylinders should be treated as if they were still full, as residual pressure can still be dangerous. They should have protective valve caps and be stored in an empty cylinder storage area until they can be disposed of.
* Gas cylinders should be disposed of through the hazardous waste program, or returned to the manufacturer for refill if possible. Include instructions in your procedure for how to send cylinders back to the manufacturer, or how to dispose of them otherwise.
* Gas cylinders do not necessarily have to be empty for disposal. Contact your Research Safety Professional for more information or guidance.
* [General Guidance to Hazardous Waste Pickup](https://dehs.umn.edu/hazardous-waste-disposal-procedures)

In theKnope lab, empty gas cylinders are stored: *list the location of your hazardous waste storage area(s).*