1.0 Purpose and Scope
The purpose of this procedure is to provide guidance for the safe handling, storage, and use of compressed gas cylinders. Compressed gases can expose users to both chemical and physical hazards. Compressed gas cylinder contents can be toxic, flammable, oxidizing, corrosive, and/or inert. Chemicals that are in gaseous form and pressurized, can quickly spread throughout a space. Pressurized cylinders can become high speed projectiles if the cylinder valve is broken off.

This procedure applies to all WHOI personnel that are involved in handling, storing, and using compressed gas cylinders. All users of compressed gas cylinders should review this procedure and the applicable Safety Data Sheet (SDS) and implement applicable hazard control measures.

2.0 Roles and Responsibilities

2.1 Environmental, Health and Safety (EH&S) Office
• Maintain, oversee and assist with implementation of this procedure.

2.2 Principal Investigator (PI) / Supervisor
• Review and implement this procedure.
• Conduct a hazard analysis of handling, storing, and using compressed gas cylinders and implement appropriate control measures.
• Provide training in the safe handling, storage, and use of compressed gas cylinders to personnel.
• Ensure personnel comply with this procedure.
• Minimize the size and quantity of compressed gas cylinders used and stored at WHOI.

2.3 Compressed Gas Cylinder Users
• Review and implement this procedure and follow instructions from PI/supervisor.

3.0 Safe Handling Practices
• Ensure cylinders are properly labeled when received. Do not accept cylinders that are not labeled. Do not add, remove, or alter any cylinder markings or labels.
• Wear eye protection, safety shoes, and work gloves when handling cylinders.
• When a cylinder or valve is corroded or malfunctioning contact the gas supplier for assistance. EH&S and Procurement should also be notified about this issue.
• Do not modify or repair any part of the cylinder, including the pressure relief device and valve.
• Use a gas cylinder hand truck or approved lifting device to move cylinders. Properly secure cylinders to transport device. Never lift cylinders by the valve cap.
• Valve caps shall be in place and hand tightened when cylinders are in storage or being transported.
• Cylinders should not be used as rollers, supports, or for any purpose other than to contain and use the contents, as received from the supplier.

4.0 Safe Storage Practices
• Minimize the number of cylinders in use and storage with a just-in-time ordering process.
• Avoid storing cylinders in hallways, near elevators, heavily traveled areas, or near exits. Cylinders must not obstruct exit routes, electrical panels, or emergency equipment.
• Cylinders must not be stored where moving objects may strike or fall on them.
• All cylinders in service or storage must be secured to prevent falling or rolling. Store in an upright position and secure with a bracket, chain, or low-stretch strap around the upper third of the cylinder (above the center of gravity) or with equivalent method.
• Store and use cylinders in well ventilated locations that do not exceed 125°F or 52°C.
• Storage areas must be prominently posted with the hazard class or the name of the gases stored (e.g., Hydrogen-Flammable Gas-No Smoking-No Open Flames).
• Empty cylinders should be segregated from full cylinders and shall be marked or tagged EMPTY.
• Cylinders should not be placed where they may become part of an electrical circuit.

5.0 Safe Use Practices
• Never use a compressed gas cylinder when the contents are unknown.
• Gas delivery lines must be clearly labeled to identify the gas.
• Valves shall be kept closed at all times except when the cylinder is in use. Valve outlets should be pointed away from personnel when the valve is being opened.
• Use a check valve to prevent reverse flow into cylinder.
• Ensure that the regulator and valve fittings are compatible and free of dust and dirt.
• Do not use Teflon tape or other sealants when attaching regulators.
• Slowly open the valve. If there is difficulty operating a cylinder valve, discontinue use and contact the supplier. EH&S office and Procure should also be notified about this issue. Open the valve all the way to the open position and then close it a quarter turn back. This will help prevent the valve from being stuck open.
• Never insert an object into valve cap openings. Doing so may damage the valve causing a leak to occur.
• Do not tamper with or modify valves, regulators, or safety devices.
• Do not direct compressed gas streams toward any person. This could cause serious injury to the eye or body.
• Piping, regulators, and other apparatus shall be kept gas tight to prevent leakage. Use a compatible leak test solution or an appropriate leak detection instrument to test connections.
• Before a regulator is removed, close the container valve and relieve the regulator of gas pressure. Regulators, gauges, hoses, and other apparatus provided for use with a particular gas shall not be used on cylinders having different chemical properties or service pressure ratings unless information obtained from the gas supplier indicates that this can be done safely.

6.0 Precautions for Flammable Gases
Definition: Gases having any flammable range with air at 20°C (68°F) and at standard pressure of 101.3 kPa (14.7 psi). Aerosols are not classified as a flammable gas.
• Flammable gases shall be stored in well-ventilated areas away from oxidizers, open flames, sparks, and other heat and ignition sources.
• All lines and equipment associated with flammable gas systems shall be grounded and bonded.
• Cylinders containing flammable gases (empty or full) that are not in use must be separated from cylinders containing oxidizers (empty or full) by a minimum distance of 20 feet or by a barrier at least 5 feet high which has a fire-resistance rating of at least one-half hour. (5/8” sheetrock provides at least a ½ hour fire rating). NOTE: Flammable cylinders that are in use (i.e., with regulators and associated piping/hoses attached) may be adjacent to oxidizers that are in use.
• A maximum of two full-size cylinders of flammable gas are permitted in one lab or work area without prior review and approval by the EH&S Office.
• If possible, use flow restrictors or limiters to prevent a sudden flow of gas in the event of a rupture or leak.
• An open flame must never be used to detect leaks of flammable gases.
• Acetylene cylinders must be stored/handled with valve end up.

7.0 Precautions for Toxic Gases
Definition: Means a gas which is classified as acutely toxic, mutagenic, carcinogenic, or a reproductive toxin.
• Cylinders larger than lecture bottles (approximately 2”x15”) must be kept in a certified gas cabinet or other equivalent engineered enclosure that vents directly outside. Lecture bottle sized gas cylinders should be used and stored in a fume hood or ventilated enclosure.
• Gas detection systems may be required in labs or work areas that use toxic gases. Contact the EH&S Office for assistance.

8.0 Precautions for Oxygen and Oxidizing Gases
Definition: Means a gas that can cause or contribute to the combustion of other material.
• Do not permit oil or grease to come in contact with compressed oxidizing gases, regulators or fittings.
• Do not store or use near flammable solvents, combustible materials or near unprotected electrical connections, heat, and other sources of ignition.

9.0 Precautions for Corrosive Gases
Definition: When in contact with living tissue, causes destruction of the tissue by chemical action.
• Cylinders should be periodically checked to ensure that the valve has not corroded. If a cylinder or valve is noticeably corroded, the gas supplier should be contacted for assistance. EH&S and Procurement should also be notified about this issue.
• Use caution if flow does not immediately start when a valve is opened slightly. If the valve or delivery system could be obstructed, contact the gas supplier for assistance. EH&S and Procurement should also be notified about this issue.

10.0 Procedures for Leaking Cylinders
Toxic gas - If the cylinder is in a fume hood or vented enclosure, evacuate the immediate area and call X2911. If it is possible that a toxic gas could enter an enclosed space and expose personnel, warn others, immediately leave and close the door(s), activate the nearest fire alarm pull station, and call X2911 (508-289-2911 from cell) from a safe location to report the emergency.

Flammable or oxidizing gas - Follow the same steps for toxic gas and, if it can be done safely, attempt to shut off ignition sources and/or isolate the leak prior to evacuating the space.

Inert Gas - Warn others and evacuate the area if you are in an enclosed space without adequate ventilation, as this could create an asphyxiation hazard. Call X2911 from a same location to report to the emergency. If the leak is small and you are in a well ventilated location, you may attempt to stop the leak.