THE UNIVERSITY OF UTAH
Occupational and Environmental Health and Safety Department
125 South Fort Douglas Blvd Bldg 605 SLC, UT 84113 (801) 581-6590

Revision History:
Revision A: November 2012 - Inception
Revision B: June 2016 – Review conducted, references to EHS changed to OEHS to reflect organizational name change to Occupational Health and Safety - James Stubbs

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OEHS RULE FOR COMPRESSED GAS CYLINDERS

I. PURPOSE:

To establish a procedure for the safe use of compressed gas cylinders on campus in order to prevent injuries, illnesses and losses.

II. REFERENCE:

29 CFR 1910.101 Compressed gases (general requirements)
Compressed Gas Association Pamphlets and Technical Bulletins
UC Center for Lab Safety Standard Operating Procedures

III. SCOPE:

This procedure applies to all campus operations and applies to all compressed gas cylinders.

IV. ROLES AND RESPONSIBLITIES:

Principal Investigators are responsible for:

1. Supervision of compressed gas cylinders in the laboratory.
2. Preparing, providing, implementing, and enforcing required safety procedures and recommendations prescribed in this rule or as noted during a laboratory inspection.
3. Providing gas cylinder operators with training in the proper handling of compressed gases and standard operating procedures related to their use.
4. Ensuring the availability of proper personal protective equipment.
5. Conducting or coordinating compressed gas safety training for personnel who are assigned to an area where lasers are operated.
6. Notifying OEHS immediately in the event of an exposure to a hazardous compressed gas.
7. Ensuring that all compressed gases are included in the laboratory's Chemical Inventory
8. Documentation of all provided training and maintenance of training records.

Gas Cylinder Operators are responsible for:

1. Following all established standard operating procedures without deviation.
2. Inspecting compressed gas equipment prior to use and at the beginning of each procedure, including, but not limited to, inspecting of equipment, such as regulators,

piping, etc. for damage, leak testing of fittings and connections, etc.

3. Notification of the Principal Investigator any departure from established safety procedures. This includes notification of near miss situations as well as exposure/release incidents.

The Occupational and Environmental Health & Safety (OEHS) Department is responsible for:

1. Providing advice and counsel related to the safe handling storage and use of compressed gases.
2. Periodic Review and update of this rule.
3. Providing incident investigation services for incidents involving compressed gasses.

V. PROCEDURE:

The following procedures for the handling, use, and storage of compressed gas cylinders are based upon accident prevention experience and established industrial and governmental standards and best practice. It should not be assumed that every necessary safety precaution is contained herein, or that unusual circumstances may not require further or additional procedures.

A. RECEIVING AND STORAGE

1. Arrange a return agreement with suppliers prior to purchase.
2. Ensure laboratory door caution signage is current each time gases are received. (Contact OEHS for updated Caution Signs).
3. Cylinder contents must be clearly labeled. Color coding, in lieu of labels, does not constitute adequate labeling.
4. Valve caps shall remain in place except during use.
5. Always transport cylinders with valve caps securely in place.
6. Do not accept cylinders which are damaged, not clearly labeled, or do not have a valve protection cap.
7. Keep oxygen cylinders a minimum of twenty feet from flammable gas cylinders or combustible materials. If this can not be done, separation by a non-combustible barrier at least 5 feet high having a fire-rating of at least one-half hour is required.
8. Components used for other gases and purposes must never be interchanged.
9. Cylinders, upon filling, should have current hydrostatic test date (normally less than 5 years old for steel and 3 years old for aluminum) engraved on the cylinder.
10. All gas cylinders shall be secured in an upright position with upper and lower restraints in racks, holders, or clamping devices. *The lower restraint may be exempted only if in consultation with OEHS it is determined impractical.* When cylinders are grouped together, they should be individually secured and conspicuously labeled on the neck area.

11. Do not place cylinders near heat, sparks, or flames or where they might become part of an electrical circuit.
12. Do not store cylinders in exit or egress routes.
13. Store cylinders in a well ventilated area.

B. TRANSPORT

1. Cylinder handlers must always wear certain minimum personal protective equipment prescribed by OSHA: Gloves to protect the hands against common pinching injuries. Safety glasses to protect the eyes against injuries associated with pressure release. Safety shoes with metatarsal supports to protect against foot injuries from falling cylinders.
2. Always use carts or hand trucks designed for cylinder transport. Refrain from sliding, dragging or rolling cylinders on edge.
3. A cylinder's cap should be screwed all the way down on the cylinder's neck ring and should fit securely. Do not lift cylinders by the cap. The cap is for valve protection only.
4. Cylinders shall not be transported with the regulator attached to the cylinder.
5. Cylinders shall be secured at all times, unless actively moving from one secured point to another; such as, moving the cylinder from a secured position in a truck to a secured position on a transfer dolly or lift gate.
6. Only one cylinder should be handled (moved) at a time. Equipment specifically designed to handle more than one cylinder securely is exempted from this requirement.

C. USE

1. Only properly trained personnel should handle compressed gas cylinders.
2. Only Compressed Gas Association (CGA) fittings and components are permitted for use with gas cylinders. Only use regulators approved for the type of gas in the cylinder. Do not use adapters or fittings to interchange or modify regulators.
3. Contents of the cylinder must be labeled as installed including hazard class (e.g., poison, flammable, inert, etc); the label facing the wall is not acceptable. Cardboard labels secured on the neck of the cylinder with wire serve this purpose well.
4. Ensure all connections are tight via leak testing. Cylinders, connections, and hoses should be checked regularly for leaks. Use a flammable gas leak detector (for flammable gases only) or soapy water, or a 50% glycerin-water solution and look for bubbles. At or below freezing temperatures, the glycerin solution should be used instead of soapy water. [Note: When the gas to be used in the procedures is a flammable oxidizing or highly toxic gas, the system should be checked first for leaks with an inert gas (helium or nitrogen) before introducing the hazardous gas.
5. Ideally leak tests should be witnessed by a third party (e.g., department Safety Coordinator or designee, safety committee representative, etc.) and logged; e.g., written in research notebook with time and date. The intent is to have historical information in one retrievable location.
6. When a special wrench is required to open a cylinder or manifold valve, the wrench shall be

left in place on the valve stem when in use; this precaution is taken so the gas supply can be shut off quickly in case of an emergency; and that nothing shall be placed on top of or near a cylinder that may damage the safety device or interfere with the quick closing of the valve.

7. After installing an approved regulator, back off the pressure adjusting screw/handle of the regulator, open the cylinder valve slowly and away from the direction of people (including yourself). Never force a gas cylinder valve. If the valve cannot be opened by the wheel or small wrench provided, the cylinder should be returned; d*o not attempt to repair a cylinder valve or regulator yourself.* Never open a valve without the regulator in place.
8. No attempt shall be made to transfer gases from one cylinder to another, to refill cylinders, or to mix gases in a cylinder in the laboratory.
9. Keep cylinder valves, regulators, couplings, hoses, and apparatus clean and free of oil and grease.
10. Compressed gases must not be used to clean your skin or clothing.
11. Never heat cylinders to raise internal pressure.
12. Use flashback connectors and reverse-flow check valves to prevent flashback when using oxy-fuel systems.
13. Do not leave regulators in a pressurized condition if the system is not in use.
14. Regulators must be removed when moving cylinders, when work is completed, and when cylinders are empty.
15. Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.
16. Always leave at least 30psi minimum pressure in all "empty" cylinders.
17. Label all cylinders when “Empty”. All cylinders are to be considered full unless labeled as empty by the user. Empty cylinders must be returned to the supplier and not accumulated.
18. Before moving a cylinder to the storage area or point of use or before returning the cylinder to the supplier, ensure the following: The outlet valve is fully closed. The outlet valve dust plug or pressure cap is on tight for cylinders equipped with these protection devices. The valve protection cap is properly secured in place on cylinders with neck threads.

NOTE: OEHS discourages the use of lecture bottles if other cylinders are available. Lecture bottles are very difficult to dispose of and they use universal threads and valves (some of which are interchangeable), thus increasing the potential for unintentional mixing. If lecture bottles are used, label all associated equipment with the gas name to prevent unintentional mixing.

Special Use Considerations

The use of certain high or special hazard compressed gases requires specific procedures in addition those detailed here. This category may include highly flammable or corrosive gases, cryogenics, pyrophorics, highly toxic gases and others, including but not limited to, hydrogen, liquid nitrogen and silane. See Appendix A for examples.

V. EMERGENCY PROCEDURES

If a cylinder leak cannot be stopped by tightening the valve gland or packing nut, follow the appropriate guidelines below, contact OEHS by calling 801-581-6590, after hours contact University Police dispatch at 801-585-2677 describe the situation and ask them to page OEHS on-call personnel.

If the release of the gas creates a situation which you believe places occupants within the building in imminent danger, leave the area immediately, closing doors behind you as you go, initiate building evacuation by activating the nearest fire alarm pull station as you leave the building, once in a safe location contact University Police by calling 911 (9-911 from a campus phone) or 801-585-2677.

A. POISON GASES

1. Immediately leave the room, close the door(s), pull the nearest fire alarm pull station, evacuate the area and call OEHS at 801-581-6590 or University Police. Tell the person where responders should meet you. Explain that you have a cylinder of poison gas that is leaking. Tell them the location of the leaking cylinder.
2. Meet responders as they arrive to explain the situation.
3. Once the situation is stabilized, work with OEHS to contact the supplier for disposal.

B. FLAMMABLE OR OXIDIZING GASES

1. Turn off all sources of ignition in the room before leaving if safe to do so and shut offs are accessible. Do not operate light switches or other electrical equipment.
2. Leave the room, close door(s), pull the nearest fire alarm pull station, evacuate the area and call OEHS at 801-581-6590 or University Police. Tell the person where responders should meet you. Explain that you have a cylinder of flammable gas that is leaking. Tell them the location of the leaking cylinder.
3. Meet responders as they arrive to explain the situation.
4. Once the situation is stabilized, work with OEHS to contact the supplier for disposal

C. INERT GASES

1. Place the cylinder in a well-ventilated location, preferably an outdoor cylinder storage area and contact the vendor for removal.

VI. CONTACTS

Questions about this Rule and any related Rules, Procedures and Guidelines should be directed to Environmental Health and Safety, at 801.581.6590 or questions@ehs.utah.edu.

APPENDIX A
EXAMPLES OF SPECIAL USE PROCEDURES

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Standard Operating Procedure (SOP) for Handling Cryogenic Liquids

Highlighted Sections must be completed by the PI or Lab Supervisor/Manager/etc. Once all sections are completed the procedure must be reviewed and approved by the cognizant PI for the lab. The procedure should be reviewed annually and the review recorded in the review history table. This procedure should be included in the SOP appendix of the lab's chemical hygiene plan.

This SOP has been prepared for the _____ lab in
Building _____ Room Number(s) _____

Prepared by: _____

Approved by:
PI Name: _____

Review History:

Review Date	Name of reviewer	Signature of reviewer

Scope:

This procedure applies to the use and handling of cryogenic liquids in the lab space(s) identified above on the University of Utah campus.

Specific Safety and Environmental Hazards:

Cryogenic liquids are those with a boiling point of less than -60°F [-51°C] [222K]). Contact with these very cold liquids can cause serious tissue burns. The vapor from cryogenic liquids can also be extremely cold and cause burns. In addition to the potential for tissue damage, many cryogenic liquids are oxygen displacers, meaning that they have the potential to drive oxygenated air from a given space producing an oxygen deficient environment. Proper handling and management of these materials is critical to the safety and health of lab personnel.

Protective Equipment and General Safety Procedures:

Handling of cryogenics liquids requires specific personal protective equipment. The following is the minimum acceptable protective equipment that must be used when handling cryogenic liquids:

1. Splash goggles or face shield

2. Laboratory Coat
3. Long Pants
4. Closed Toe shoes
5. Insulated cryogenic gloves with long cuffs
6. Cryogenic apron

In addition to the PPE listed above, the following general safety procedures must be followed when handling cryogenic liquids:

1. NEVER ride in an elevator with a container of a cryogenic liquid. The procedure found in appendix A of this SOP shall be used for ALL elevator transport of cryogenic liquids.
2. Do not touch un-insulated surfaces cooled by liquid nitrogen or by the vapor of liquid nitrogen. The flesh could become stuck to the cold surfaces and tissue damage may result while in contact with the surface as well as when it is pulled away.
3. Splashing may occur when cryogenic liquids are dispensed into a warmer container. Extreme care should be taken to protect sensitive tissues such as eyes.
4. Store and use only in areas with adequate ventilation. Do not store in a confined space. Cryogenic containers are equipped with pressure relief devices to control internal pressure. Under normal conditions these containers will periodically vent product. Do not plug, remove, or tamper with pressure relief device.
5. Never allow any unprotected part of the body to touch un-insulated pipes or vessels, which contain cryogenic fluids. The extremely cold metal will cause the flesh to stick fast and tear when one attempts to withdraw from it.
6. Follow the procedure detailed below every time cryogenic liquids are handled. Shortcuts or alteration of the procedure without the approval of the PI is not acceptable.
7. Complete and document all required training with your laboratory PI.

Specific operating procedures:

The following procedure applies to the use of [Insert name of cryogenic liquid e.g. Liquid Nitrogen]

1) Don all required PPE as listed above. PPE is stored [Insert detailed PPE storage location]

2) [Insert a detailed, step-by-step procedure for the use and handling of the identified cryogenic liquid]

3) …

4) …

5) Etc

Note: If multiple cryogenic liquids are used in this lab space in different procedures separate procedures should be prepared for each liquid.

Storage locations:

[Identify where the cryogenic liquid(s) is(are) stored – be specific]

Liquid	Amount	Storage Location

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Appendix A

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Elevator transport of cryogenic liquids

Due to the potential for cryogenic liquids (other than liquid oxygen) to rapidly evaporate and displace oxygen within a contained space such as an elevator, the following guidelines must be followed when transporting any quantity of cryogenic liquid in an elevator.

1. Position a person at the elevator entrance of each floor to bar entry to anyone who wishes to enter the elevator. Cryogenic liquids always ride alone.
2. Place the container of cryogenic liquid in the elevator in a secure manner that will prevent tipping, spills, etc.
3. Press the call button for the destination floor.
4. Immediately exit the elevator – DO NOT RIDE IN THE ELEVATOR.
5. Meet or have someone meet the container at the destination floor to remove the container from the elevator.
6. Notify any people posted that the container has been removed from the elevator.

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Reminder: Liquid Nitrogen Rides Alone

Never Ride in an Elevator with liquid nitrogen. No matter what, not even with small quantities.

Why Not?

Liquid nitrogen readily returns to its gaseous state. Gaseous nitrogen displaces oxygen. Imagine being stuck in a broken down elevator with a liquid nitrogen dewar that is continually off-gassing and displacing the limited supply of oxygen in the elevator. It's a situation that has the potential to become dangerous, even fatal, rather quickly.

How to transport liquid nitrogen in an elevator:

1. Post a person at the elevator entrance on every floor that the container will pass to stop people from entering the elevator
2. Place the container in the elevator
3. Press the call button for the destination floor
4. Immediately exit the elevator
5. Meet (or have someone meet) the elevator at the destination floor to remove the container
6. Notify any people posted that the container has been removed from the elevator

What About Small Quantities?

Same procedure as above...

...or...

You can simply carry it up or down the stairs

For more Information Contact:

Department of Environmental Health and Safety
THE UNIVERSITY OF UTAH

801-581-6590

THE UNIVERSITY OF UTAH

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Standard Operating Procedures

Laboratory Specific
Chemical: **Hydrogen Gas (H2)**

Please fill out the form completely.
Print a copy and insert into your *Chemical Hygiene Plan*.
Refer to instructions for assistance.

NOTE: ***All users of this chemical must carefully read and sign this SOP.***

Department:_____ Date when SOP was written:_____

Date when SOP was approved by the lab supervisor: _____

Principal Investigator:_____

Internal Laboratory Safety Coordinator/Lab Manager:_____

Laboratory Phone:_____ Office Phone:_____

Emergency Contact:_____
(Name and Phone Number)

Location(s) covered by this SOP:_____
(Building/Room Number)

Type of SOP: ☐ Process ☐ Hazardous Gas ☐ Flammable Gas

Purpose

Hydrogen (H2) is a highly flammable gas. Hydrogen gas forms explosive mixtures with air if it is 4–74% concentrated and forms explosive mixtures with chlorine if it is 5–95% concentrated. The mixtures spontaneously explode by spark, heat or sunlight. Auto-ignition temperature of Hydrogen: The temperature of spontaneous ignition in air, is 500 °C (932 °F). The detection of a burning hydrogen leak may require a flame detector; such leaks can be very dangerous. Hydrogen reacts with every oxidizing element.

Hydrogen poses a number of hazards to human safety, from potential detonations and fires when mixed with air to being an asphyxiant in its pure, oxygen-free form. Hydrogen dissolves in many metals. In addition to leaking out, may have adverse effects on metals, such as hydrogen embrittlement, leading to cracks and explosions. Hydrogen gas leaking into external air may spontaneously ignite. Moreover, hydrogen fire, while being extremely hot, is almost invisible, and thus can lead to accidental burns.

Even interpreting the hydrogen data (including safety data) is confounded by a number of phenomena. Hydrogen detonation parameters such as critical detonation pressure and temperature, strongly depend on the container geometry.

If not handled and stored properly, Hydrogen gas can pose a serious threat to the health and safety of laboratory personnel & emergency responders and also to the property. This SOP helps to understand how to properly store & handle hydrogen.

Uses not limited to;

- Used to process ('upgrade') fossil fuels.
- Used to produce ammonia- used in common household cleaning products.
- Hydrogen is used as a hydrogenating agent to produce methanol and convert unhealthy unsaturated fats and oils to saturated fats and oils.
- The triple point of hydrogen (the temperature where all 3 phases- gas, solid and liquid- are in equilibrium) can be used to calibrate some thermometers.
- Tritium, a radioactive isotope of hydrogen, is produced in nuclear reactions. It can be used to make hydrogen bombs and acts as a radiation source in luminous paints. In the biosciences, tritium is sometimes used as an isotopic label.
- Hydrogen (either used on its own or combined with nitrogen) is used in many manufacturing plants to determine whether there are any leaks. It is also used to detect leaks in food packages.
- Hydrogen is used as a rotor coolant in electrical generators.
- Hydrogen gas is used as a shielding gas in atomic hydrogen welding (AHW).
- Used in the production of hydrochloric acid- used widely in chemical industries.
- Hydrogen gas is used to reduce many metallic ores.
- Can be used to make water

Physical & Chemical Properties/Definition of Chemical Group

Class: Highly flammable gas

Color	colorless
Phase	Gas
Density	(0 °C, 101.325 kPa) 0.08988 g/L
Liquid density at m.p.	0.07 (0.0763 solid) $g \cdot cm^{-3}$

Liquid density at b.p.	0.07099 $g \cdot cm^{-3}$
Melting Point	14.01 K, -259.14 °C, -434.45 °F
Boiling Point	20.28 K, -252.87 °C, -423.17 °F
Triple Point	13.8033 K (-259°C), 7.042 kPa
Critical Point	32.97 K, 1.293 MPa
Heat of Fusion	(H_2) 0.117 kJ.mol -1
Heat of Vaporization	(H_2) 0.904 $kJ \cdot mol^{-1}$
Molar Heat Capacity	(H_2) 28.836 $J \cdot mol^{-1} \cdot K^{-1}$

Potential Hazards/Toxicity

Hydrogen (H2) is a highly flammable gas. Hydrogen gas (dihydrogen or molecular hydrogen) is highly flammable and will burn in air at a very wide range of concentrations between 4% and 75% by volume.

Personal Protective Equipment (PPE)

Eye protection
Safety goggles.
Skin and body protection
Fire/flame resistant lab coat (100% cotton based)
Cotton based clothing/attire.
Full length pants or equivalent
Close toed shoes

Storage Requirements

Oxygen cylinders in storage must be separated from hydrogen or other fuel-gas cylinders or combustible materials (especially oil or grease) by a minimum distance of 20 feet or by a non-combustible barrier at least five feet high and with a fire resistance rating of least one-half hour.

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In simple words, DO NOT store Hydrogen & Oxygen/other oxidizing gases, oxidizing materials together.

Hydrogen Safety

Safety can be achieved while handling hydrogen gas by adhering to the below mentioned protocols, *but not limited to the following*;

- University of Utah policy requires that compressed gas cylinders be secured to a stable structure such as a wall. The first chain must be one third from the bottom of the cylinder and the second chain should be one third from the top of the cylinder. Do not use Nylon straps to secure compressed gas cylinders. Do not use table/bench clamps for securing the cylinders. Replace the straps with chains. Secure cylinders of equal sizes together to avoid chaining problems.
- If compressed gas cylinder holding metal rack is used to restrain the cylinders, the rack must be bolted to the floor and the chains or rods must be at 1/3rd from the bottom and 1/3rd from the top of the cylinders. Clam shell (a cylindrical metal casing bolted to the floor) can be used to secure cylinders that need to be stored and used next to the experimental set-up.
- Always use Stainless Steel (SS) tubing to convey hydrogen gas. Teflon tubing is okay *if* specified by the manufacturer.
- Remove the regulator and place the safety cap on, when the cylinder is not in constant use.
- Hydrogen gas leak detector installation is recommended.
- Prevent hydrogen leaks by meticulously connecting gas regulator and tubing.
- Keep constant vigilance to immediately detect accidental leaks.
- Prevent accumulations of leaked hydrogen using plentiful ventilation.
- Eliminate likely ignition sources, and suspect unknown ignition sources.
- Store hydrogen gas cylinders away from electrical panels and emergency eyewash & safety shower.
- Always assume hydrogen is present, and verify the system has been purged to less than 1 percent when performing system maintenance on a hydrogen system. Inert gases such as Nitrogen & Argon can be used for purging.
- Always assume oxygen is present, and verify the system has been purged to the appropriate level when reintroducing hydrogen into a system.
- Have lab buddy system when working with highly flammable gases such as Hydrogen, Ethane, Methane, Acetylene etc.
- All users must have had hands-on training to work with highly flammable gases. The training must be documented.
- Lab personnel handling highly flammable gases must have easy access to an Emergency Eyewash & Safety Shower within 10 seconds (i.e., travel distance no greater than 100 feet).

Repair operations

- The system shall be verified safe according to proper procedures before any type of maintenance is attempted
- Includes all repairs, alterations, cleaning, or other operations performed in confined spaces in which hydrogen vapors or gases are likely to exist.
- The personnel engaged in the operations shall be advised of the hazards that may be encountered, and an attendant (lab buddy) shall be immediately available for emergency rescue if necessary

Types of Emergencies

- The principal danger from a leak is the potential burns and fires
- When a leak occurs, the area shall be completely roped off and caution signs shall be posted
- Leaks can occur near the valve/regulator/tubing/tubing bends or joints or a pumping system.
- Catastrophic fires can occur
- High-pressure gas leaks can occur

Controllable leaks

- Controllable leaks are relatively small leaks that would not result in significant release before shut-off and relief valves can be made operational.

Uncontrollable leaks

- Uncontrollable leaks may be large and involve major release.
- Large fire and explosions may occur.

Procedures to be followed during uncontrollable leaks

- The supply source shall be shut-off immediately *if possible*
- The area shall be evacuated to 152 m (500ft) from the release point
- Call 911 from campus phone or call UPD at 801-585-2677 from cell phone immediately. UPD will immediately notify OEHS.
- Adjacent equipment shall be cooled down in case of fire.

Handling Gas Leaks from Cylinders

- Only an acceptable, approved solution shall be used when testing for leaks.
- If a cylinder safety device leaks, personnel shall not attempt to correct the leak by tightening the safety device cap while the cylinder is under pressure. The contents of the cylinder shall be emptied in a safe location. The cap shall be removed to examine the condition of the threads, correct the damage, pressurize and leak test.
- Leaking commercial cylinders should be safely vented, tagged as defective, and returned to the supplier ASAP.

Accidental release/fire

Dial 911 (or 801-585-2677 from cell phone) immediately for assistance.

Medical Emergency Dial 911

Life Threatening Emergency, After Hours, Weekends And Holidays – Dial **911** (or 801-585-2677 from cell phone)

Material Safety Data Sheet (MSDS) Location
(State the location of MSDS)

Protocol/Procedure
(Add specific description of procedure)

Any deviation from this SOP requires approval from PI.

Documentation of Training *(signature of all users is required)*

- ✓ Prior to conducting any work with hydrogen gas, designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
- ✓ The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the hydrogen gas MSDS provided by the manufacturer.
- ✓ The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate trainings or refresher trainings, and that accurate training records are kept in the laboratory chemical hygiene plan.

I have read and understood the contents of this SOP:

Name	Signature