Laboratory Standard Operating Procedure: Compressed Gases

I.	CONTACT INFORMATION
Procedure Title	
Procedure Author	
Date of Creation/Revision:	**April 12, 2013**
Name of Responsible Person	*(The PI, Lab Supervisor, or Autonomous Researcher)*
Location of Procedure	*(Building and room number)*
Approval Signature	*(If required. See section XI of this template)*

II. THIS STANDARD OPERATING PROCEDURE (SOP) IS FOR A:

☐ **Specific laboratory procedure or experiment**
Examples: synthesis of chemiluminescent esters, folate functionalization of polymeric micelles, etc.

☐ **Generic laboratory procedure that covers several chemicals**
Examples: distillation, chromatography, etc.

☒ **Generic use of specific chemical or class of chemicals with similar hazards**
Examples: organic azides, mineral acids, etc.

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with compressed gases. This general use SOP only addresses safety issues specific to compressed gases. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., for flammable gases, both this general use SOP and the general use SOP for flammables would apply). If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or the Chemical Environmental Health and Safety Coordinator [CEHSC] at (813) 842-3528.

III. CLASS OF HAZARDOUS CHEMICALS

Compressed gases have inherent pressure hazards and can also create health hazardous and/ or flammable atmospheres. Common hazard characteristics of gases include flammability, toxicity, and corrosivity. A few gases will ignite spontaneously in air (i.e.,

silane, diborane, phosphine) and are considered pyrophoric.

One additional hazard property common to all compressed gases is the substantial volume expansion when released to air. Gas release in an inadequately ventilated room can create an oxygen-deficient environment.

IV. GENERAL HAZARD CONTROL

1) Check connections and hoses regularly for leaks using a specific monitoring instrument or soapy water (or equivalent).
2) When using highly flammable or toxic gas, check the delivery system using an inert gas prior to introducing the hazardous gas.
3) When using compressed acetylene:
   a) do not exceed a working pressure of 15 psig, and
   b) do not use vessels, piping, or other materials that contain a significant amount of copper (usually considered to be more than 50% copper
4) Replace valve caps when cylinders are not in use or before moving.
5) Remove damaged or defective cylinders from service (contact the cylinder vendor for assistance).

V. ENGINEERING & VENTILATION CONTROLS

Use a properly functioning lab fume hood when handling mists, fumes, gases or vapors. Lab ventilation should have a minimum of 6 air changes per hour. If the process does not permit the handing of such materials in a fume hood, contact the CEHSC at (813) 842-3528 for reviewing the adequacy of room ventilation standards.

Contact the CEHSC at (813) 842-3528 for reviewing the adequacy of room ventilation standards or to determine if an oxygen-deficiency monitor or other alarm devices is necessary.

VI. PERSONAL PROTECTIVE EQUIPMENT

☒ Lab Coat ☒Long pants ☒Close-toed shoes ☒Safety goggles

The above listed personal protective equipment should be worn when handling

compressed gases. Additional protection may be required based upon each chemical agent.

Check all personal protective equipment [PPE] prior to use to ensure good undamaged condition. At a minimum:

1. When handling chemicals or contacting potentially contaminated surfaces, protective gloves are to be worn. For proper selection of glove material, review **chemical Safety Data Sheet [SDS]** and **glove selection guidance**.
2. Goggles (not safety glasses) are appropriate for general processes, but where a splash or spray potential exists a face shield is also recommended.
3. Additional protective clothing (i.e., face shield, apron, and oversleeves) is appropriate for chemicals that are toxic via skin contact and the potential for contact is possible.

VII. SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

Ensure secondary containment and segregation of incompatible chemicals per guidance within the **UT Chemical Hygiene Plan**. Also, follow any substance-specific storage guidance provided in SDS documentation**.**

Safe Handling	**1. NEVER TRANSPORT UNSECURED COMPRESSED GAS CYLINDERS!** **2. Compressed gas cylinders must be transported using hand-trucks or other appropriate means.** **3. Cylinders should be transported upright whenever possible (always transport acetylene in an upright (vertical) position).** **Elevators can be a confined space – NEVER ride in an elevator with compressed gas cylinders. Have one person send the elevator and another person receives the elevator.**
Safe Storage	**1. Secure compressed gas cylinders (>26" tall) to an anchored rack using two metal chains (at 1/3 and 2/3 cylinder height).** **2. No more than two cylinders may be secured with one pair of chains.** **3. Segregate and clearly mark full and empty ("MT") cylinders.** **4. Store compressed gas cylinders away from heat sources, and flammable and highly combustible materials (such as oil and greases).** **5. Segregate according to hazard class and chemical compatibility. Ensure to separate flammable and oxidizing gases.**

	6. **Store flammable gases away from flammable solvents, combustible material, ignition sources (including unprotected electrical connections), and oxygen gas cylinders and liquid oxygen (at least 20 feet if possible).** 7. **Consult MSDS for compressed gas specific storage requirements.**

VIII. DESIGNATED AREA

Establish a designated area if working with a particularly hazardous compressed gas where limited access, special procedures, knowledge, and work skills are required. A designated area can be the entire laboratory, a specific laboratory workbench, or a laboratory hood. Designated areas must be clearly marked with signs that identify the chemical hazard and include an appropriate warning; for example: **WARNING! COMPRESSED GAS WORK AREA –TOXIC.**

IX. EMERGENCY SPILL AND ACCIDENT PROCEDURES

Health-Threatening Emergencies Examples: Fire, explosion, health-threatening hazardous material spill or other Immediate Danger.	1. **Call 911** 2. Alert people in the vicinity to evacuate 3. Activate the local alarm systems 4. Call Campus Security at 813-257-7777 or xtn. 7777 5. Remain nearby to provide arriving emergency responders information about chemicals 6. Once personal safety is established, call the CEHSC at (813) 842-3528
Personnel Injury or Exposure	1. Remove the injured/exposed individual from the area if it is safe to do so because of the medical condition of the victim or the potential hazard to rescuers. 2. **Call 911** 3. Administer first aid as appropriate. 4. Flush contamination from eyes/skin using the nearest emergency eyewash/shower for a minimum of 15 minutes. 5. Remove any contaminated clothing to prevent contaminants from continuing to absorb onto skin. 6. Give medical responders copies of SDSs for all chemicals the victim was exposed to. 7. Report the exposure to the CESHC
Non-Health Threatening Emergencies	Call Security at 813-257-7777 or xtn. 7777 to report incident

Small Spill Clean-Up	**Note: Only minor spills or releases can be cleaned up by knowledgeable personnel using readily available equipment:** 1. Notify personnel in the area and restrict access. Eliminate all sources of ignition. 2. Review the SDS for the spilled material, or use your knowledge of the hazards of the material to determine the appropriate level of protection. 3. Wear gloves and protective eyewear. Clean up using absorbent. Put the contaminated absorbent in a labeled hazardous waste container. 4. If greater than 30 ml, or if it will take longer than 15 minutes for you to clean-up, immediately call Security (813) 257-7777 or xtn. 7777 to report the spill, and notify your supervisor. 5. Submit waste pickup request to the CEHSC.
Incident Reporting	1. Report all occupational injuries or illness to laboratory supervisor as soon as practical. 2. Laboratory personnel are encouraged to report "near misses" as they are considered a precursor to actual incidents. 3. Laboratory supervisor is to conduct (or coordinate) an investigation of all incidents and "near misses." The goal of the investigation is to identify and address any deficiencies that may have contributed to the incident.
Medical Consultation	Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when: 1. A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure). 2. Symptoms or signs of exposure to a hazardous chemical develop.

X.	WASTE DISPOSAL

Unused compressed gas cylinders substances intended for disposal may be considered hazardous waste. Please call the CEHSC at (813) 842-3528 to Describe the quantities of waste you anticipate generating and appropriate waste disposal procedures. Include any special handling or storage requirements for your waste.

XI.	DECONTAMINATION PROCEDURES
PERSONNEL	If immediate medical attention is required, call 911. Remove any contaminated clothing, and IMMEDIATELY flush contaminated skin with water for at least 15 minutes following any skin contact. For eye exposures, IMMEDIATELY flush eyes with water for at least 15 minutes. Consult SDS for guidance on appropriate first aid. Where medical attention is required, ensure to bring along SDS(s) of chemical(s) to aid medical staff in proper diagnosis and treatment.
AREA	1. Decontamination procedures vary depending on the material being handled; consult the SDS. 2. Some materials can be neutralized with other reagents. 3. All surfaces should be wiped with the appropriate cleaning agent following dispensing or handling. *Note: Waste materials generated should be treated as a hazardous waste.*
EQUIPMENT	Decontaminate laboratory apparatus or other contaminated equipment (glassware) before removing them from the designated area.

XII.	TRAINING REQUIREMENTS

General Training *(check all that apply):*

- ☑ General Safety & Emergency Preparedness – Annual Orientation Training
- ☑ Review of MSDS for other chemicals involved in process/experiment
- ☑ Compressed gas safety
- ☑ Review of this SOP
- ☑ Other: _____

The University may require additional safety training depending on the hazardous materials and laboratory-specific processes – consult the PI for more information.