TEMPORARY CHANGE REQUEST

TCR NO.TCR-ESHD-5008,Sect.9, Ch2, R3-001
(e.g., TCR-ENG-021,R0-001)

The Temporary Change Request (TCR) Form is to be used to process urgent or minor changes for PPPL Policies, Organization/Mission Statements and Procedures. The TCR should be used when changes are:
1) urgent, and can not wait the 2-4 week period for Department Head review/comment, or
2) minor, and do not warrant Department Head review.

Person Requesting Change: Julia Toth **Phone Ext: 2832**

Department Name: ES&H

Document Number: ES&HD 5008 Section 9 Chapter 2_Revision No.: 3

Document Title: Compressed Gas Cylinder Safety

Reason for change:
Clarify requirements for securing cylinders during transport by cart.

Change description: (Summarize and attach changed pages, with changes clearly indicated)
Addition of; **Secured** – Not allowed to be not dropped nor be transported in a way which it could strike a person or other object.
Added statements to 2.6.2.A; Cylinders shall be secured with a retaining strap or chain when transported via a hand truck or cart.
Added to 2.6.2.E; 1. Cylinders shall be secured with a restraining strap or chain to fixed structures, wall bracket; 2. Cylinders shall be secured by the body (above its center of gravity), at two-thirds the height

1. Does this TCR significantly alter the intent or scope of the document? **YES:____** **NO: X____**

2. Does this TCR significantly impact **ES&H**? **YES:____** **NO: X____**

If 1 or 2 is **YES**, Explain why the changes should not be routed for Department Head review:

_____ _____
Department/Division Head Approval **Date**

_____ _____
Head, Quality Assurance/Quality Control/designee **Date**

Release/Effective date of this TCR: _____

Incorporate this TCR into next revision of this document? **YES: X** **NO:_____**

CHAPTER 2 COMPRESSED GAS CYLINDER SAFETY

2.1 INTRODUCTION

The use of compressed gas cylinders is a frequent adjunct to the Laboratory's daily operation. These cylinders contain gases that vary in chemical properties from inert and harmless to toxic and explosive. In addition, the high pressures of these gases constitute a serious hazard in the event that the cylinders are exposed to physical damage and/or high temperatures.

2.2 SCOPE

This chapter provides guidelines concerning the safe use of compressed gas cylinders in the Laboratory. Identification, inspections, transport, storage, installation, use, and disposal of gas cylinders are discussed. This chapter does not provide guidance for the protection of personnel against inhalation hazards associated with the accidental dispersion of gases (for details, refer to Section 8, "Industrial Hygiene," Chapter 7).

2.3 DEFINITIONS

Approved Testing Facility - A facility authorized and approved by the US Department of Transportation for requalification, repair, or rebuilding of cylinders. The facility must have a Requalification Identification Number (RIN) assigned by DOT.

Compressed Gas - A gas, other than in solution, that is in a packaging under charged pressure and is entirely gaseous at a temperature of 20 °C (68 °F).

DOT Cylinder - Cylinder meeting U.S. Department of Transportation Regulation 173.34.

Toxic Gas - A gas having a health rating of three or four, as defined by the National Fire Protection Association (NFPA) 704, "Standard System for the Identification of the Fire Hazards of Materials."

Standard Cylinder Status Tag - A tag attached to a compressed gas cylinder that gives the status of the cylinder as follows: full, in use, or empty.

Secured – Not allowed to be not dropped nor be transported in a way which it could strike a person or other object. TCR-ESHD 5008 Section 9 Chapter 2,R3-001

2.4 RESPONSIBILITIES

2.4.1 Department or Division Heads are responsible for ensuring implementation of this section.

2.4.2 Line Supervisors/Users are responsible for direct implementation of this section. Specifically, Line Supervisors shall provide training in the proper use and handling of cylinders.

2.4.3 Industrial Hygiene (IH) is responsible for assisting in the interpretation and implementation of this section.

2.4.4 M&ES is responsible for administering the basic ordering agreement for the supply of industrial and specialty gases, and ensuring that the selected supplier:

A. Assures that cylinders are within specified hydrostatic test date before filling,
B. Assures that the condition of compressed gas cylinders is as specified in this chapter prior to issuance,
C. Attaches a standard cylinder status tag to each cylinder at the time of delivery to the user, and
D. Delivers cylinders properly secured.

2.5 REQUIREMENTS

2.5.1 DOT 173.34
2.5.2 NFPA 55
2.5.3 Compressed Gas Association Pamphlet P-1;
2.5.4 OSHA Regulations 29 CFR 1910
2.5.5 PPPL ESHD 5008, Section 8,
2.5.6 NFPA 704
2.5.7 49 CFR, Parts 171-179
2.5.8 ANSI Z48.1-1954

2.6 PRACTICES/PROCEDURES

2.6.1 General

A. Identification - Compressed gas cylinders shall be legibly marked, with either the chemical or trade name of the gas, for the purpose of identifying gas content. Cylinders shall be marked with stencil, stamp, or securely attached label. Whenever practical, the marking shall be on the shoulder of the cylinder. Markings, labels, decals, tags, or stencil marks used for the identification of contents shall not be defaced. No marks or numbers stamped into a cylinder shall be changed or obliterated.

B. Repairs and Alterations - Cylinders, valves, or safety-relief devices shall not be repaired or altered except by an approved testing facility. Cylinders shall be repainted only with the concurrence of IH.

C. Connections - Compressed gas cylinders shall be equipped with a connection as required by Pamphlet CGAV-1 of the Compressed Gas Association, Inc. or American National Standards Institute (ANSI) B57.1 as appropriate.

D. Inspections - Compressed gas cylinders shall be inspected by the user prior to and during use to determine that cylinders are in a safe condition for use. Inspect for corrosion, valve damage or leaks, evidence of tampering, etc. Never use a flame to detect flammable gas leaks.

E. Periodic Testing - Most compressed gas cylinders are required to be retested periodically. All portable cylinders used for the storage and shipment of compressed gases shall be constructed and maintained in accordance with the regulations of the U.S. Department of Transportation, 49 CFR, Parts 171-179. Compressed gas cylinders shall be legibly marked for the purpose of identifying cylinder contents in accordance with ANSI Z48.1-1954.

F. All cylinders with a water weight capacity of over 30 pounds shall be equipped with means of connecting a valve protection cap, or with a collar or recess to protect the valve.

G. Cylinders shall not be used for any other purpose other than for storing and dispensing gases.

H. Cylinders shall not be refilled by anyone other than the owner of the cylinder.

2.6.2 Cylinder Use

A. Moving and Handling

1. Caps shall be kept on at all times except when cylinders are physically connected to a regulator, manifold, or distribution apparatus.

2. Cylinders shall not be lifted by the cap.

3. Cylinders shall not be dropped or permitted to strike against each other or other surfaces violently.

4. Cylinders shall not be lifted with a lifting magnet. Slings, ropes, or chains should not be used unless provisions have been made on the cylinder by the manufacturer for appropriate lifting attachments, such as lugs. A crane may be used only when a safe cradle or platform is provided to hold the cylinders.

5. Cylinders shall be transported by suitable hand trucks, or rolled on the bottom edge. Rolling compressed gas cylinders on the bottom edge is an acceptable practice for short distances only, for example, moving the cylinder from a cart to it's final resting place. Cylinder carts shall be the primary means of transporting compressed gas cylinders. Cylinders cannot be rolled when conditions are unsafe, such as when surfaces are icy or wet.

6. Cylinders shall be secured with a retaining strap or chain when transported via a hand truck or cart. TCR-ESHD 5008 Section 9 Chapter 2,R3-001

7. Before returning cylinders to the supplier, the valve shall be closed and the protective cap reattached.

B. Storing Cylinders

1. Compressed and liquefied gases in portable cylinders shall be stored in accordance with NFPA 55.

2. Cylinder storage areas shall be posted prominently with the types of gases to be stored.

3. Where gases of different types are stored at the same location, cylinders should be grouped by types of gas, and the groups arranged to take into account the types of gas contained, e.g., flammable gases shall not be stored next to oxidizing gases.

4. When oxygen and a fuel gas such as acetylene are to be stored, they shall be separated by a distance of twenty feet or by a non-combustible barrier at least five-feet high having a fire-resistance rating of one-half hour.

5. Cylinders shall not be stored near highly flammable or combustible substances, shall not be exposed to sparks or flames, and shall not be located where they could become part of an electrical circuit.

6. Charged and empty cylinders shall be stored separately. Old stock should be stored in an accessible area so as to be removed first. Empty cylinders shall have their valves closed.

7. The gas cylinder storage area shall be dry, cool, well ventilated, and fire resistant, where practical.

8. Heated storage areas shall be arranged so that stored cylinders or other containers cannot be spot-heated or heated above 125 °F (51.7 °C).

9. Cylinders should not be stored in the open; but in such cases where required, they shall be protected against extremes of weather. In summer certain gases when stored in the open should be protected from the continuous rays of the sun (refer to the supplier for specific recommendations). If ice or snow accumulates on a cylinder, it should be thawed at room temperature or with water at a temperature not exceeding 51 °C (125 °F).

10. Cylinders shall be protected from any object that will produce a cut or other abrasion in the surface of the metal. Do not store near elevators, stairs or gangways, or in locations where cylinders will be knocked over or damaged by passing or falling objects. Do not store cylinders in unventilated enclosures.

11. Cylinders shall not be exposed to continuous dampness and shall not be stored near salt or other corrosive chemicals or gases. Corrosion may damage the cylinders and may cause the valve-protective caps to stick.

12. Fuel gas storage inside a building shall be kept to no more than 2,000 cubic feet or 300 pounds of liquefied petroleum gas.

13. Cylinders shall not be stored on two or three wheeled carts. Four wheeled carts may be used for storage of cylinders if the cart is in a stable position with all wheels on the ground.

C. Installation

1. Compressed gas cylinders should be handled only by personnel who have attended the PPPL Training course, “Compressed Gas and Cryogenics Safety”.

2. The user responsible for the cylinder and for its installation shall check the identity of the gas before use. The cylinder shall be returned to the supplier, unused, if the cylinder content is not identified, if hydrostatic test date is past due, or if the cylinder is in any way damaged.

3. Cylinders shall be secured properly (see paragraph E of this section).

4. Valve-protective caps shall be kept in place until the cylinder is connected to a regulator or manifold.

5. Suitable pressure regulating devices must be used in all cases where gas is admitted to systems designed for pressure less than cylinder pressure. Only regulators approved by the manufacturer for the gas being used and in good condition shall be installed.

6. Before connecting a cylinder to a regulator, the valve should be opened slightly and closed immediately. Stand to the side of the outlet, never in front of it. Never crack a flammable or oxygen cylinder near sparks, flame, or other sources of ignition.

D. Withdrawing Cylinder Content

1. Cylinder valves should be opened slowly. Never direct high-pressure gas streams toward the body as embolisms can result from gas forced under the skin or entering a wounded area.

2. Do not use wrenches or tools to open a cylinder valve except those provided or approved by the gas manufacturer. Never hammer the valve wheel in attempting to close the valve.

3. Do not attempt to open valves or caps that are hard to open or frozen because of corrosion. Return these cylinders to Materiel and Environmental Services or to the vendor.

4. Never use compressed gas, unless protected by suitable traps or check valves, where the cylinder or its contents is apt to be contaminated by the feedback of process material.

5. Connections to piping, regulators, and other equipment always should be kept tight to prevent leakage. Where hoses or metal coils are used, they should be maintained in good condition. Use Leak-tek or a similar material to check for leaks. A flame shall not be used for leak detection.

6. Before a cylinder is removed from service, determine that the cylinder valve is closed securely and all pressure is released from the connected system.

E. Securing Cylinders

1. Cylinders shall be secured with a restraining strap or chain to fixed structures, wall bracket, or to movable carts in the case of gas, welding, or cutting apparatus. TCR-ESHD 5008 Section 9 Chapter 2,R3-001

2. Cylinders shall be secured by the body (above its center of gravity), at two-thirds the height of the cylinder, and not by the valve. TCR-ESHD 5008 Section 9 Chapter 2,R3-001

3. Cylinders shall be secured by one of the following methods, depending on size and use:

a. Safety chain provided with a positive locking device such as a nylon strap with a locking buckle or self-locking hook to prevent accidental release of cylinder.

b. Nylon strap and buckle assembly with attachment fixture. This item is specially designed to restrain portable gas cylinders.

c. A cradle with indentations designed to accommodate gas cylinders in a horizontal position.

d. An upright storage box with individual cells designed to hold several cylinders at one time.

F. Tagging Procedure

1. At the time of delivery, a Standard Cylinder Status Tag should be placed on all cylinders by the supplier. M&ES should be contacted if a cylinder does not have a status tag.

2. When the cylinder is placed in use, the bottom of the tag with the word "Full" should be removed.

3. When the cylinder is no longer required, the "IN USE" section of the tag should be removed and M&ES shall be called for pick-up. All cylinders shall be treated as though residual gas remains.

G. Removal

When cylinders are empty or are no longer needed, remove from the installation and request pick-up by M&ES.

H. Cylinder Defects and Disposal

1. If a cylinder leak cannot be stopped by tightening a valve gland or packing nut, close the valve; and if possible, detach the cylinder from the installation. Remove the leaking cylinder from the building and allow it to empty safely.

2. When cylinders, valves, contents, etc., are in such a condition that the only safe or practical solution is disposal, request removal through M&ES. If an unsafe condition exists, the pick-up request will be expedited by M&ES.

2.7 SPECIAL GASES

2.7.1 Toxic Gases

A. Persons handling and using toxic gases shall have procedures for handling, storage and emergency response in place and approved by Industrial Hygiene (IH).

B. Toxic gases shall be used only with the approval of IH. Additional review and approval may be necessary.

C. Chlorine - As indicated above, compressed gas cylinders shall not be stored or used at temperatures exceeding 51 °C (124 °F). This is particularly important in the case of chlorine cylinders as metal plugs of these cylinders fuse at 74 °C (165 °F). Care must be exercised to ensure cylinders are not exposed to steam, hot water, etc., which would produce temperatures in excess of 74 °C (165 °F).

2.7.2 Other Gases

A. Acetylene

1. Acetylene shall be used only with a pressure-regulating valve and gauge with pressures not exceeding 15 PSIG.

2. An acetylene valve shall not be turned more than one and one-half turns on the spindle.

3. If a wrench is required to open an acetylene valve, it shall be left on the cylinder-valve stem during use.

4. Acetylene cylinders shall be stored and used only in an upright position.

B. Liquid Oxygen, Nitrogen, and Argon

DOT cylinders containing these gases must be transported, stored, and used in an upright position to permit venting of the vapor to maintain safe internal pressure (for details, see Section 9, Chapter 7, "Cryogenic Safety").

C. Oxygen - Oxygen cylinders shall not be stored within 20 feet of flammable gases or highly combustible materials, particularly oil or grease, as oil and grease in the presence of oxygen may ignite violently. Alternatively, oxygen may be separated from flammable and combustible materials by a fire rated wall at least five feet high.

1. Oil, grease, or other combustible material shall not come into contact with valves, regulators, gauges, or any fittings used with oxygen.

2. Such cylinders should never be handled with oily hands or gloves.

3. Oxygen shall never be used as a substitute for compressed air.

2.8 REFERENCES

DOT Regulation 49 CFR 178.

OSHA Regulation 29 CFR 1910.

CGA Pamphlet P-1, "Safe Handling of Compressed Gases."

NFPA 55, "Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Container."

NFPA 704, "Standard System for the Identification of the Fire Hazards of Materials."

DOT Regulation 49 CFR, Parts 171-179.

ANSI Z48.1-1954.