

**COMPRESSED GAS STORAGE**

1. Version, Date. 1, 27 January 10 (EMS)

2. Purpose. This Environmental Standard Operating Procedure (ESOP) summarizes the procedures to be followed for the storage and handling of compressed gas cylinders that ensure responsible environmental stewardship and worker safety. This ESOP addresses all tenants and commands aboard MCB Quantico that handle or store compressed gas. Additional procedures for the storage of compressed chlorine gas (Cl<sup>2</sup>) are provided as a separate ESOP.

3. Applicability

a. Audience. This procedure applies to all personnel who use, handle, deliver, and/or store compressed gas cylinders as part of their normal duties.

b. Scope. This procedure applies to material handling and storage of compressed gases at MCB Quantico.

4. Definitions

a. Absolute Pressure - zero referenced against a perfect vacuum, so it is equal to gauge pressure plus atmospheric pressure.

b. Atmospheric Pressure - the force per an area exerted against a surface by the weight of air above that surface at any given point in the earth's atmosphere.

c. Compressed gas. The term compressed gas is defined as follows:

(1) Any mixture or material having, in the container, an absolute pressure exceeding 40 pounds per square inch (PSIA) or 25 pounds per square inch gauge (25 PSIG), at a temperature of 70 degrees Fahrenheit (°F).

(2) The contents of the container will have an absolute pressure exceeding 104 PSIA (or 89 PSIG) at 130°F.

(3) Any flammable material having a vapor pressure exceeding 40 PSIA (25 PSIG) at 100°F as determined by the American Society for Testing Materials (ASTM) D-323, Test for Vapor Pressure of Petroleum Products (Reid Method), latest edition.

d. Cylinder. A compressed gas cylinder is a pressure vessel designed for the storage and transportation of a compressed gas at pressures higher than 40 PSIA (25 PSIG), with a tubular shape and

circular cross section. This does not include a portable tank, a multi-unit car tank, a cargo tank, or tank car (49 CFR 171.8).

e. Gauge Pressure - is zero referenced against ambient air pressure, so it is equal to absolute pressure minus atmospheric pressure.

f. Flammable gas. Flammable gases may be ignited when mixed with air in certain concentrations (i.e. acetylene, methane, hydrogen).

g. Material Safety Data Sheet (MSDS). The MSDS is provided by the manufacturer of a given material. It contains specific information about the health and physical hazards of the material; equipment required when handling the material; describes the material's physical characteristics; and, the procedures that should be followed in the case of an emergency.

h. Pressure Relief Device. Prevents the rupture of a charged compressed gas cylinder under abnormal conditions (e.g., over-filling, over pressurization, engulfed in a fire, etc). It can be activated by either pressure or temperature and will relieve all or partial pressure sufficiently to prevent the rupture of the cylinder. Such a device must be subjected to a fire test as required by 49 CFR 173.34(d). Pressure relief devices are prohibited on cylinders charged with a poisonous gas (Poison A) or liquid and fluorine.

5. Responsible Parties. All tenants and commands aboard MCB Quantico that use, handle, deliver, or store compressed gas cylinders are responsible for ensuring these procedures are implemented, as applicable.

## 6. Procedures

Compressed gas cylinders can be extremely hazardous if handled improperly. Ruptured cylinders can create projectile hazards, or cause chemical exposure, fire, and/or explosions. In addition, gases stored inside these cylinders (e.g., chlorine), can be toxic to humans and require immediate evacuation of the immediate area. Compressed gases stored at MCB Quantico include nitrogen, chlorine, oxygen, propane, carbon dioxide, and acetylene. Aspects associated with this practice include air emissions (greenhouse and ozone depletion gases), the possibility of a chemical or hazardous material release or spill, and the physical presence which can lead to a slip, trip, or fall hazard. The following procedures outline simple requirements that reduce the likelihood of accidents related to compressed gas cylinders. For additional information, refer to the Material Safety Data Sheet (MSDS) for the cylinder contents.

### a. Storage and Handling Requirements

(1) Place the cap on the cylinder when not in use. Keeping the threaded cap over the discharge valve on a cylinder protects the

weakest part, which is the discharge valve. Anytime a cylinder is not actively connected to piping or a hose, the cap must be secured in place. In addition, a cylinder must never be lifted by the discharge valve or regulator.

(2) Properly secure cylinder(s) with chains or other restraints, or lay them on the ground. A falling cylinder can rupture, shear its nozzle, or damage other items in its path. Securing the cylinder with a chain, strap, or other means can keep it from falling. In addition, laying a cylinder on its side can provide the same protection, as long as the cylinder is secured, so it cannot roll. **However, an acetylene cylinder must never be stored on its side.** Acetylene cylinders contain acetone solvent, which may create operational problems if not kept upright. Acetylene cylinders should always be stored, transported, and used in an upright position to avoid a loss of solvent (acetone) during use and to provide a safe position of the cylinder should a pressure relief valve be activated during a fire. If a cylinder has to be positioned in a horizontal position for any reason, it must then be positioned in an upright position for a minimum of at least 2 hours prior to its use. Generally, it is a good practice to store and transport all cylinders in the upright position.

(3) Keep cylinders away from high traffic areas. Cylinders should never be stored in areas exposed to traffic hazards, such as forklifts and vehicles. They should be clearly visible and secured as listed above. Storage areas for compressed gas cylinders are required to have protection against physical damage, fire hazards, adverse environmental conditions, and tampering by unauthorized personnel. This includes storage at a location that is secured, and does not subject the cylinder(s) to extreme temperatures or ignition sources. In addition, MCO 4450.12A specifies that cylinders must be stored at least 50 feet away from other buildings in a roofed, open-sided shed.

(4) Compressed gases must be segregated by their hazard class or division into three primary groups: flammable gas, nonflammable gas, and poisonous gas. If an additional secondary transportation hazard is present in conjunction with the primary classification, such as poisonous gas and flammable gas or nonflammable gas and oxidizer, the secondary transportation hazard must be considered to determine the compatibility of the gas with other gases and the need for further segregation and separation within the primary group. Follow safe use, storage, and handling requirements for specific gas classifications. MCO 10330.2D, Section 5-10 provides specific cylinder management requirements based on the different gas classifications (flammable, non-flammable, corrosive, poison, cryogenic liquefied). These unique requirements must be followed when storing these specific gas classifications at MCB Quantico.

(5) Return cylinders when they are empty. When a cylinder is no longer in use, it should be returned to the storage area. Empty cylinders may still pose a hazard. Although the pressure may be too

low to be useful, it may have enough pressure to be harmful if mishandled.

(6) Never roll, drag, or slide cylinders. Where practical, the user shall use a suitable hand truck, fork truck, roll platform, or similar device with the cylinders secured for transportation. One cylinder at a time may be tilted and rolled to and from a filling or dispensing manifold and, to and from a staging area within the filling plant or using facility.

(7) Follow the instructions for the management of medical gas cylinders as listed in MCO 10330.2D, enclosure (2). Procedures included in this enclosure address storage and handling procedures, inspections, and shelf life.

#### b. Compressed Gas Cylinder Identification Requirements

(1) Clearly and properly label cylinders. Prior to storage, all compressed gas cylinders must be clearly labeled with the contents and a tag system should be in place to label and segregate full cylinders from empty cylinders. Cylinders not labeled may be accidentally used for the wrong purpose, which can lead to a serious accident. Segregating and labeling empty and full cylinders ensures that useful gas constituents are not discarded. In addition, gas cylinders require a color coding to identify hazards associated with the stored product (See below).

(2) Gas cylinders must meet color coding requirements. DoD MIL-STD-101B, Color Codes for Pipelines and Compressed Gas Cylinders, requires specific gas cylinders to be color coded to provide hazard warnings for personnel. MCO 10330.2D requires that all personnel who handle or use compressed gas cylinders must be familiar with the color coding cylinder requirements of DoD MIL-STD-101B. The appearance of any of the following six colors on the body or top or as a band(s) on compressed gas cylinders shall serve as a hazard warning:

- (a) yellow (flammable)
- (b) brown (toxic and poisonous)
- (c) blue (anesthetic and harmful)
- (d) green (oxidizers)
- (e) gray (dangerously high pressure and an asphyxiant)
- (f) red (fire protection)

#### c. Use of Compressed Gas Cylinders

(1) Personnel managing compressed gas cylinders must have working knowledge of the material. MCO 10330.2D requires all

personnel having the responsibility of storing, handling, and/or using compressed gases and gas cylinders to have a working knowledge of the characteristics and hazards associated with each individual gas. Specific and detailed information on the properties and/or hazards of any gas is best obtained from the manufacturer or supplier of the product through MSDSs or brochures. For additional training requirements, refer to paragraph 9.

(2) If venting (discharging) the contents of a compressed gas cylinder, follow proper procedures. MCO 10330.2D, Section 7 (Disposal of Compressed Gases or Liquids in Cylinders) provides venting requirements for specific types of gases and outlines the following basic requirements when emptying compressed gas cylinders:

(a) Do not release Class I or II ozone depleting substances (ODS) into the environment. Section 608 of the Clean Air Act prohibits knowingly venting or releasing Class I or II ODS to the environment. A listing of Class I and II ODS is provided in 40 CFR 82. The user may also refer to the applicable MSDS.

(b) The contents of the tank should be released slowly, so that the released energy does not cause the tank to rocket. The cylinder must be secured in an upright position, with the discharge outlet pointed away from personnel at all times.

7. Inspection and Corrective Action. Periodic inspections of compressed gas cylinders and compressed gas storage areas are required to mitigate the potential of an accident or release. MCO 10330.2D outlines inspection program requirements for facilities managing compressed gas cylinders. The inspection system outlined in MCO 10330.2D has been divided into five separate inspections. The applicable inspections are identified as: Receiving Inspection (Contractor Receipts), Receiving Inspection (Customer Returns), Receiving Inspection (Redistribution), Periodic Inspection, and Shipping Inspection.. Section 4 of the MCO outlines the program, but note inspection requirements are based upon the type of gas, amount, purpose of usage, and storage and handling activities of the cylinder(s). Refer to Section 4 of the MCO for further information. Whereas specific compressed gas cylinder checklist requirements are outlined in MCO 10330.2D, a basic inspection checklist (Attachment 21-1) is provided at the end of this ESOP. The frequency of any inspections should be determined by the Unit Environmental Coordinator or NREA. Any problems identified during inspections should be corrected immediately. Notify your Unit Environmental Coordinator or NREA.

## 8. Internal Communication

a. Unit Environmental Coordinators will complete the compressed gas cylinder inspection checklist included with this ESOP. It is recommended that copies of previous inspections be maintained on file for a period of 3 years.

b. Unit Environmental Coordinators will review the inspection requirements outlined in MCO 10330.2D Section 4 to determine which inspections are required and document completion of the inspections.

#### 9. Training/Awareness

a. Hazard Communication (HAZCOM) training provides workers training and awareness of the properties and potential health and safety hazards associated with materials to which they are exposed to in the workplace. All individuals working with compressed gas cylinders as part of their normal duties should receive appropriate HAZCOM training.

b. As listed in Paragraph 6.b.(2) of this ESOP, MCO 10330.2D requires personnel managing compressed gas cylinders to have a working knowledge of the gases used in their workplace. The Unit Environmental Coordinator will provide Material Safety Data Sheets (MSDS) in addition to the manufacturer/supplier provided information related to characteristics and hazards associated with all gases in the workplace to meet the MCO requirement.

c. As needed, the Unit Environmental Coordinator provides on-the-job training through use of this ESOP and the MCO to ensure safe and compliant storage and handling of compressed gas cylinders.

d. Practice owners are responsible for maintaining training records of personnel as required and applicable. Additionally, per Marine Corps Order 5090.2A, Table 2-1, the practice owners will maintain this ESOP and ensure it is addressed in new and annual employee training.

10. Emergency Preparedness and Response. For compressed gas releases, the response and emergency preparedness procedures will vary depending upon the amount and type of gas being released. Specific response procedures for a chlorine gas release are provided in a separate ESOP. Please reference the Chlorination ESOP (ESOP #22) for emergency preparedness and response procedures.

a. A small compressed gas release is considered to be a slow, controllable release of gas that poses no risk of personal injury or exposure. Any release of hazardous, flammable, or combustible gas will be considered a large release (see paragraph 10.b). In the event of a small release, perform the following steps:

(1) Notify everyone in the immediate area of the release.

(2) If the leak is in the gas supply system, close cylinder valve and tighten leaking connections.

(3) If the leak is at other areas on the cylinder (e.g., valve seal, valve threads, pressure safety device), move the cylinder to a

fume hood, under a local exhaust canopy, or to an isolated, well-ventilated area to vent cylinder contents.

(4) As appropriate, evacuate the immediate area and post warning signs to prevent unauthorized access.

(5) Notify Unit Environmental Coordinator and/or NREA Officers as necessary to provide details of incident.

(6) Return failed cylinder to supplier for repair/replacement.

b. In the event of a large, uncontrolled release of a compressed gas cylinder which cannot be quickly and safely repaired, immediately notify personnel in the immediate area, and evacuate, then dial 911 (specify the location as MCB Quantico). Inform the fire department dispatcher of the gas being released and potential amount.

11. References and Related Documents. The following references are relevant to this procedure:

a. 29 CFR 1910.101, Occupational Safety and Health Standards, Compressed Gases.

b. 40 CFR 82, Protection of Stratospheric Ozone

c. MCO 10330.2D, Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders.

d. MCO 4450.12, Storage and Handling of Hazardous Materials.

e. MCO P5090.2A, Environmental Compliance and Protection Manual.

f. MCBO 6280.1B, Handling, Transfer, and Disposal of Hazardous Materials and Hazardous Waste. September 2007.

g. MCBO 6280.4, Hazardous Material Management Program. September 2007.

h. DoD MIL-STD-101B, Color Code for Pipelines and for Compressed Gas Cylinders

12. Document Revision History. The following provides a history of revisions of this SOP:

Revision Number	Date	Revision Made By	Section	Page	Summary of Change and Reason	Signature

13. Document Owner. This document has been reviewed and approved by the document owner. Any revisions or future updates to the procedure will be completed by the document owner in coordination with the NREA Branch, EMS Section at 703-432-0536.

a. Document Owner. MCB Quantico EMS Section

b. Document Approval. Chair, EMS Core Team

<b>Material Handling and Storage (Compressed Gas) Inspection Checklist</b>	
Date:	Time:
Unit/Bldg #:	Work Center:
Inspector's Rank/Name:	Signature:

<b>Inspection Items</b>	<b>Yes</b>	<b>No</b>	<b>Comments</b>
1. Is cap placed on cylinder when not in use?			
2. Are full cylinders separated from empty ones?			
3. Are cylinders secured with chains or other restraints?			
4. Are cylinders in an upright (vertical) position?			
5. Are cylinders kept away from high traffic areas?			
6. Are cylinders kept away from heat or direct sunlight?			
7. Are cylinders returned when empty?			
8. Are cylinders clearly labeled with contents?			
9. Are cylinders stored 50 feet from buildings?			
10. Are cylinders not subjected to freezing temperatures?			
11. Are cylinders kept in an approved storage area?			
12. Are cylinders kept away from heat sources such as furnaces, radiators, and flames?			

Attachment 21-1