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		Effective Date: 1 January 2010
	Compressed Gas Handling	Reviewed/ Revised: January 1, 2013

1.0 PURPOSE

This procedure has been established to provide employees with a uniform directive for the use and storage of compressed gas cylinders. This procedure covers the handling and storage of compressed gas cylinders as delineated by the Compressed Gas Association Pamphlet P-1 (as revised and dated) incorporated by reference by the Occupational Safety and Health Administration (OSHA) as specified in 1910.6

2.0 SCOPE

This procedure will apply to all employees within the City of Tucson who are required to handle and utilize compressed gas cylinders in order to perform of their duties. It describes the functions that Directors, Managers, Supervisors and employees shall perform in compliance with this directive.

The policies and procedures contained in this section are intended to assist in identifying and complying with OSHA Safety Standards. In all cases where there is a difference between specific OSHA standards and the compressed gas use and handling policies set forth in this procedure, the stricter of the two shall apply.

3.0 DEFINITIONS

Color Coding: Gas cylinders are often color coded, but the codes are not standard across different jurisdictions, and sometimes are not regulated. Cylinder color should not be used for positive product identification. Compressed gas cylinders have labels which identify the gas they contain and the label alone should be used for positive identification.

Compressed Gas:

A compressed gas is any gas which when enclosed in a container gives:

- an absolute pressure reading greater than 276 kPa (40 psi) at 21°C (70°F) or;
- an absolute pressure greater than 717 kPa (104 psi) at 54°C (129.2°F) or;
- any flammable liquid having a vapor pressure greater than 276 kPa (40 psi) at 38°C (100.4°F).

Compressed Gas Cylinder: A compressed gas cylinder is any metal cylinder of the type approved by the U.S. Department of Transportation (DOT) for storage and transportation of gases under pressure, including liquefied gases. Metal cylinders are the only approved DOT packaging for compressed gases.

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Flammable Gas: A gas that is flammable in a mixture of 13 percent or less (by volume) with air, or the flammable range with air is wider than 12 percent regardless of the lower limit, at atmospheric temperature and pressure.

Nested: A cylinder is “nested” when the cylinder is placed within a device that includes a stable base that prevents cylinder tipping and extends up from the floor to encase the cylinder to approximately 40% of the cylinder height. Examples of vertical nesting include a cylinder cart or cylinder box. Breathable Air (SCBA-type) for Tucson Fire Department cylinders may be nested in horizontal cubicles.

Nonflammable Gas: A gas that does not meet the definition of a flammable gas.

Oxidizing Gas: A gas that can support and accelerate combustion of other materials.

Pressure Regulator: A mechanical device used to safely control the discharge pressure of a compressed gas from a container.

Toxic Gas: A gas having a health hazard rating of 3 or 4 defined in NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*.

Valve Protection Device: A device attached to the neck ring or body of the cylinder for the purpose of protecting the cylinder valve from being struck or damaged from impact resulting from a fall or an object striking the cylinder.

Valve Protective Cap: A rigid, removable cover provided for compressed gas container valve protection.

4.0 RESPONSIBILITIES

A. Department/Division Managers

1. The user Department or Division shall ensure that compressed gases are handled and stored in a safe and appropriate manner as per the policies and procedures contained herein and that appropriate warning labels identifying compressed gases are posted in the workplace.

B. Supervisor

1. Supervisors shall ensure that employees are trained in the safe and appropriate manner of utilization, handling, transport and storage of compressed gases and that an employee(s) perform pre-use safety inspections of gas cylinders, pressure regulating and pressure/relief devices.
2. Supervisors shall ensure that where required, compressed gas cylinders are segregated according to type or class and that empty (MT) cylinders are marked and isolated from filled cylinders.

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C. Employees

1. Employees shall follow the inspection, handling, use and transport procedures outlined in this policy and shall not smoke in the vicinity of compressed gas while in use or storage.

D. Central Safety Services

1. The Central Safety Services Section, in cooperation with all affected Departments/Divisions within the City of Tucson, shall provide information and training on the use, handling, transportation and storage of compressed gases.

5.0 EDUCATION AND TRAINING

- A.** All departments/divisions will provide training to each employee who is required by this procedure to use compressed gases. Such employees shall be trained to know at least the following procedures for:

1. Identification and Labeling.
2. Inspection.
3. Transport and Placards.
4. Storage.
5. Leaking Cylinders.

- B.** Supervisors are responsible for validating that an employee has demonstrated an understanding of the training specified above and the ability to use compressed gases properly before being allowed to perform work requiring the use of compressed gases.

- C.** When the supervisor has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by the employer to utilize compressed gases, the employer shall retrain these employees. Circumstances where retraining is required include, but are not limited to, situations where:

1. Changes in the workplace render previous training obsolete.
2. Changes in the types of compressed gases to be used to render previous training obsolete.
3. An affected employee's knowledge or use of compressed gas storage or transport of compressed gases is inadequate.

- D.** Departments/divisions will verify that each affected employee has received and understands the required training through a written certification that contains the name of each employee trained, the date(s) of training, and the subject of certification.

6.0 GENERAL

A. Classification

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1. Compressed gases are classified according to hazard and shall be labeled by title and shall have a pictograph (as delineated in Appendix B) describing the hazard:
 - Flammable or Combustible
 - Corrosive
 - Explosive
 - Poisonous (Toxic)
 - Inert
 - Acidic
 - Reactive
 - Combination of Hazards

B. Identification

1. The contents of any compressed gas cylinder shall be clearly identified. Identification shall be stamped or stenciled on the cylinder or label. In the event a label becomes illegible, the cylinder shall be removed from service and the cylinder shall be labeled "contents unknown" and shall be segregated and secured away from other compressed gas cylinders.
 - a. Do not rely on the color of the cylinder for identification. Color-coding is not reliable as cylinder coding may vary by supplier. Color-coded caps shall be matched with the color of the cylinder.
 - b. Signs shall be posted in areas where flammable compressed gases are utilized and stored identifying the gas type, the hazard and appropriate precaution. Flammable and Toxic gases are referenced in Appendix A and Pictograph labels are referenced in Appendix B.

C. Inspection, Handling and Use

1. Compressed gas cylinders shall be equipped with the appropriate regulator. Valves shall be "cracked" open, then closed prior to affixing the regulator, to purge dirt or debris from the valve opening. Regulators shall be inspected for the presence of grease, oil, dirt or solvents prior to operation. Damaged valves, regulators, hoses or connecting hardware shall be immediately replaced.
 - a. Cylinders (other than breathing oxygen intended for use in SCBA) shall be utilized in the upright position. Toxic and irritating gases (refer to MSDS) shall only be utilized while the cylinder is operated within a working fume hood.
 - b. Only cylinder wrenches provided by the supplier shall be utilized to open or close a cylinder valve. Pliers, vice-grips or similar shall not be utilized to open/close valves. Valves and pressure regulators shall be checked for the presence of any required washer or similar leak prevention device prior to use.

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- c. Piping, distribution lines and outlets utilized for the transport of compressed gases within a facility shall be labeled with appropriate contents.
- d. In areas where corrosive gas cylinders are present, an eye wash/shower station is required within the work area for immediate emergency use by the affected employees. Installation and water flow rates for Emergency eye wash/shower stations shall conform to OSHM SD-008 – Emergency Eyewash and Shower Stations.
- e. Employees utilizing compressed gases for welding, cutting or brazing shall be trained in the operation and use of a portable fire extinguisher and shall have a portable fire extinguisher readily available when combustible materials may be exposed to welding, cutting or brazing operations.
- f. Employees utilizing compressed gases for welding, cutting and brazing shall assess the work practice to determine whether a Hot Works Permit (S-010) shall be completed prior to initiating any welding, cutting or brazing activity.
- g. Unless with the expressed permission of the Fire Marshall or their designee, only one (1) liquefied-propane gas (LPG) cylinder for the expressed purpose of connection to a portable (wheeled or similar) barbeque unit shall be allowed inside of a city facility where an ignition source is present. Extra and empty cylinders shall be secured and stored upright away from the building or secured and stored upright in another adjacent building where no ignition source is present.

D. Cylinder Leaks

- 1. Cylinder leaks at the valve junction line shall be immediately reported to the supplier for replacement. Leak detection is only to be performed with a soapy water solution.
 - a. Leaking cylinders containing flammable, inert or oxidizing gases shall be moved to a well-ventilated (outdoor) location away from ignition source and isolated by appropriate warning until the cylinder is completely discharged. Flammable, inert or oxidizing gases where the leak is uncontrollable (cannot move or isolate in a well ventilated area) shall require a 911 notification to emergency services.
 - b. Leaking cylinders containing corrosive gases shall be isolated in a well-ventilated area. The area surrounding the leak shall be immediately evacuated. If it can be safely accomplished, the corrosive gas should be directed into appropriate neutralizing equipment and when warranted, a 911 notification to emergency services should be immediately initiated.

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- c. Leaking cylinders containing toxic gases shall require immediate sounding of the building evacuation alarm system and immediate full evacuation of the facility. Alarm shall be immediately followed by 911 notifications to emergency services.

E. Storage

1. All Compressed Gas Cylinders, including those with valve protection devices (hard plastic collars) to protect the valve stem, excepting those for designed to dispense breathable air (Self-contained Breathing Apparatus (SCBA) bottles), shall be stored upright and shall be secured or “nested” to prevent fall.
 - a. Material appropriate for the size and weight of the compressed gas cylinder (chain, plastic coated wire or commercial straps) shall be utilized to secure cylinders, including CO2 cylinders utilized to provide carbonation for soda dispensing. Cylinders shall be secured to a supporting wall, or sturdy, immovable object by eye-bolt and chain or other similar manner; or cylinders may be “nested” in containers to prevent accidental fall.
 - b. SCBA bottles may be stored upright or horizontally but shall be secured or nested at all times to guard against fall.
 - c. Compressed Gas Cylinders shall be segregated in hazard class while in storage. Oxidizers shall be separated from flammable gases by a wall five feet (5') in height with a thirty (30) minute fire rating or by a minimum distance of twenty feet (20'). Cylinders that are not in use shall have the valve closed and the valve cap secured in place.
 - d. Compressed Gas Cylinders shall not be stored in direct sunlight and shall not be subject to temperatures greater than 125°F.
 - e. Empty cylinders shall be isolated from filled cylinders. Valve caps shall be secured to all empty cylinders. Empty cylinders shall be stored in a designated area, marked with signage, or shall be tagged (MT) or marked “MT” with chalk.

F. Transport

1. Compressed Gas Cylinders shall always be transported in the upright position, with the exception of SCBA bottles, with the valve turned off and the valve cap in place. Vehicle-mounted welding units shall utilize a valve cap with a regulator protective device. The cylinders shall be secured with commercial strap and buckle during travel.
 - a. SCBA bottles shall be secured against movement and shall not be allowed to strike each other when transported in a vehicle.

7.0 ADVICE AND COUNSEL

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OSHA 1926.350 Gas Welding and Cutting – Transporting, Moving and Storing Compressed Gas Cylinders

Hazardous materials Regulations of the Department of Transportation (49CFR Parts 171-179 and 14CFR Part 103)

National Fire Protection Association (NFPA) 55, Standard for the Storage, Use and Handling of Compressed and Liquefied Gases in Portable Cylinders

Compressed Gas Association Pamphlet P-1, (current edition)

Compressed Gas Association Pamphlet C-6-1968 and C-9-1962

Appendix A

COMMON COMPRESSED AND LIQUEFIED GASES WHICH ARE FLAMMABLE OR TOXIC (HEALTH 3 OR 4)

<u>Gas</u>	<u>State</u>	<u>Flammable</u>	<u>Health</u>	<u>Gas</u>	<u>State</u>	<u>Flammable</u>	<u>Health</u>
Acetylene	gas	y		Hydrogen Selenide	liquid	y	3
Allene (propadiene)	liquid	y		Hydrogen Sulfide	liquid	y	4
Ammonia	liquid	y	3	Ketene	gas	y	
Arsine	liquid	y	4	Methane	gas	y	
Boron Trichloride	gas	n	3	Methylacetylene (propyne)	liquid	y	
Boron Trifluoride	gas	n	3	Methylamine	liquid	y	3
1,3-Butadiene	liquid	y		Methylbromide	liquid	y	3
n-Butane	liquid	y		3-Methyl-1-butene	liquid	y	
iso-Butane	liquid	y		Methyl Chloride	liquid	y	
1-Butene	liquid	y		Methyl Ether	gas	y	
2-Butene	liquid	y		Methyl Fluoride	liquid	y	
Carbon Monoxide	gas	y	3	Methyl Mercaptan	liquid	y	4
Carbonyl Chloride (phosgene)	gas	n	4	2-Methylpropene	gas	y	
Carbonyl Fluoride	gas	n	4	Natural Gas	gas	y	
Carbonyl Sulfide	liquid	y	3	Nitric Oxide	gas	n	3
Chlorine	gas	n	3	Nitrogen Dioxide	gas	n	3
Chlorine Dioxide	gas	n	4	Nitrogen Trioxide	gas	n	3
Chlorine Monoxide	gas	y	3	Nitrogen Trifluoride	gas	n	3
Chlorine Trifluoride	gas	n	4	Nitrosyl Chloride	gas	n	3
1-Chloro-1,1-difluoroethane	liquid	y		Oxygen Difluoride	gas	n	4
Chlorotrifluoroethylene	liquid	y		Ozone	gas	n	4
Cyanogen	liquid	n	4	Pentaborane	liquid	spontaneously ignitable	4
Cyanogen Chloride	liquid	n	4	iso-Pentane	liquid	y	
Cyclobutane	gas	y		Phosphine	gas	spontaneously flammable	4
Cyclopropane	liquid	y		Propane	liquid	y	
Deuterium	gas	y		Propylene	liquid	y	
Diazomethane	gas	y	4	Selenium Hexafluoride	gas	n	3
Diborane	gas	spontaneously ignitable	3	Silane	gas	spontaneously flammable	
1,1-Difluoroethane	liquid	y		Silicon Tetrafluoride	gas	n	4
1,1-Difluoroethylene	liquid	y	3	Stibine	gas	y	4
Dimethylamine	gas	y	3	Sulfur Tetrafluoride	gas	n	4
Dimethyl Ether	liquid	y		Sulfuryl Fluoride	gas	n	
2,2-Dimethylpropane	liquid	y		Tetrafluoroethylene, monomer	liquid	y	
Ethane	gas	y		Tetrafluorohydrazine	liquid	y	
Ethylacetylene	liquid	y		Trimethylamine	liquid	y	3
Ethylamine	liquid	y	3	Vinyl Bromide	liquid	y	
Ethyl Chloride	liquid	y		Vinyl Chloride	liquid	y	
Ethylene	gas	y		Vinyl Fluoride	liquid	y	
Ethylene Oxide	liquid	y	3	Vinyl Methyl Ether	liquid	y	
Fluorine	gas	n	4				
Formaldehyde	gas	y	3				
Germane	gas	y					
Hexafluoroacetone	gas	n	3				
Hydrogen	gas	y					
Hydrogen Bromide	gas	n	3				
Hydrogen Chloride	gas	n	3				
Hydrogen Cyanide	liquid	y	4				
Hydrogen Fluoride	gas	n	4				

Appendix B

