COMPRESSED GAS / CRYOGENS APPLICATION –

In accordance with the International Fire and Spokane Municipal Codes, no permit-required activity or work is allowed prior to the issuance of proper permits and/or approvals by the Spokane Fire Department (SMC 17F.080.060).

44 W. Riverside Avenue
Spokane, WA 99201-0189
509.625.7000
509.625.7006 Fax
sfdservicereports@spokanefire.org
www.spokanefire.org

Date:

SITE INFORMATION

BUILDING/SITE NAME:	
BUILDING/SITE ADDRESS:	# DIRECTION STREET NAME ZIP

BUSINESS INFORMATION

BUSINESS NAME:	
BUSINESS ADDRESS:	CITY STATE ZIP
MAIL ATTENTION TO:	
MAILING ADDRESS:	CITY STATE ZIP
(MAILING ADDRESS MUST BE INCLUDED IF DIFFERENT FROM BUSINESS ADDRESS)	
BUSINESS PHONE:	**FAX#:** **E-MAIL:**
EMERGENCY PHONE#:	AREA CODE NUMBER

Submittal shall include a drawing of the location and support detail of the cylinders/tanks and one set of manufacturer cut sheets for tanks and accessories including gas detectors and alarms where applicable.
Submittal of plans DO NOT imply project design approval or authorize commencement of work.

PERMIT TYPE	PERMIT FEE	*Please Check*
Compressed Gas Storage, Use and Handling……..	$ 210.00	_____
Carbon Dioxide (CO2) Gas Systems……...	$ 210.00	_____
Cryogens Production, Storage, Transport, Use, Handling or Dispensing……..	$ 210.00	_____

PURPOSE: Installation ☐ Alteration/Repair ☐

Permitees are subject to additional inspections fees, which shall apply in a minimum of one hour increments for each permit fee category, for additional time spent on inspection services to include code research and return site visits.

PROJECT NARRATIVE: **(Including *specific* location of work and tank(s)** _____

_____

_____

Describe Physical Securing of Containers: _____

_____

Describe Product Handling Safety Precautions: _____

_____

Location of Compressed Gas or Cryogens: _____

_____

Number and Capacity of Containers for each Product: _____

_____

_____

VENTILATION: Not Required ☐ Passive ☐ Mechanical – automatic ☐ Mechanical - manual ☐

STORAGE: Room ☐ Containment Area ☐

Indicate What the Surface Material is Under the Container (Cryogens only): _____

May 3, 2023
Spokane Fire Department

Informational Bulletin 23-03

Compressed Gases

Compressed gas storage and use systems pose a hazard to building occupants. These gases can be flammable (fire and explosions), corrosive, toxic, cryogenic (extreme cold) and can cause oxygen displacement, as well as the physical hazards associated with high pressure systems. Precautions are necessary when storing, using, and/or handling compressed gases to control these hazards.

These gases are used in a number of ways including medical or dental procedures, beverages, industrial processes including cutting and welding, sports facilities, agricultural growing, science and engineering labs, schools, vehicle fueling, higher education facilities, and even fire suppression.

Most locations store and use compressed gases from cylinders that are replaced on an as-needed basis by suppliers. Other locations use larger tanks that can be filled onsite.

The Fire Code requires permits for installation, alteration, addition, or repair of compressed gas systems as well as an annual operating permit.

Attached is a summary of the requirements for a complete submittal for a permit including the requirements from the International Fire Code (IFC) and National Fire Protection Association (NFPA).

Compressed Gases Permit Amounts

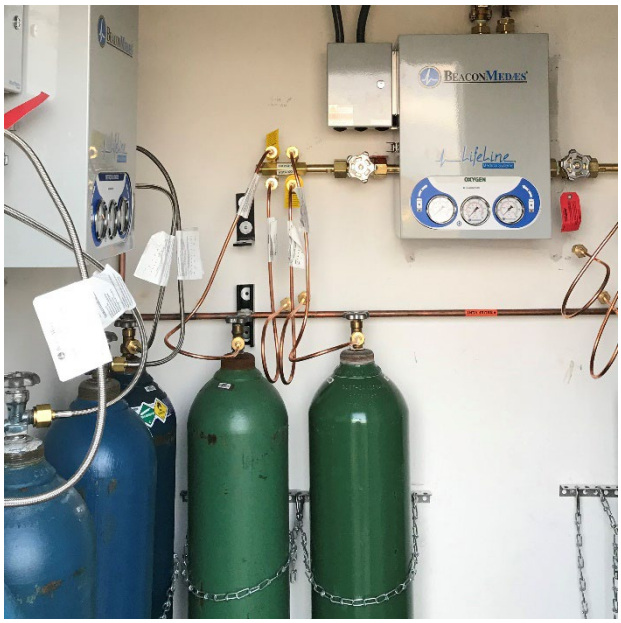

TABLE 105.6.8
PERMIT AMOUNTS FOR COMPRESSED GASES

TYPE OF GAS	AMOUNT (cubic feet at NTP)
Carbon dioxide used in carbon dioxide enrichment systems	875 (100 lbs.)
Carbon dioxide used in insulated liquid carbon dioxide beverage dispensing applications	875 (100 lbs.)
Corrosive	200
Flammable (except cryogenic fluids and liquefied petroleum gases)	200
Highly toxic	Any Amount
Inert and simple asphyxiant	6,000
Oxidizing (including oxygen)	504
Pyrophoric	Any Amount
Toxic	Any Amount

For SI: 1 cubic foot = 0.02832 m^3.

Compressed Gases Permit Submittal Checklist

Electronic Plan Standards (WHEN ELECTRONIC PLAN SUBMITTAL IS AVAILABLE)

File Naming Standards:
Electronic plans and documents shall be named as specified in **bold typ** ts". For example, the site plan must be named **"Site Plan"**.

Acceptable File Types:
Plans, calculations, specificatio me.

Plan Sheet Standards:
All plans shall be drawn t st, and each sheet shall state the scale.

Document Orientation:
All **plans** must be uploaded in **"Landscape"** format in the horizontal position. All other documents can be in "Portrait" format.

Electronic plan submittal is not available at this time

Plans

Complete the **Plans** and **Compressed Gases Submittal Checklist**s. Do **not** submit the checklists with the submittal.

The following information is required at time of application for the fire permit:

- ☐ Completed **Fire Permit Application— compressed Gases**
- ☐ **Site Plan**
- ☐ **Product Cut Sheets for tank(s), piping, shut-off valves, pressure relief devices**
- ☐ **Floor plans showing piping, cylinder location, details, piping, etc.**
- ☐ **CO2 Enrichment – see item 4a, Page 7.**

Compressed Gases Submittal Checklist

The following is a list of information required on all plan submittals for review of a **Compressed Gas** permit. The plan shall be drawn to 1/8"= 1'-0" minimum scale. The applicant is required to submit all of this information so an accurate and timely review may be done:

General Requirements:

- ☐ Site plan indicating the location and size of the proposed tank(s) and piping system
- ☐ Type and use of container, equipment or device
- ☐ Material to be stored, used or transported
- ☐ Description showing dimensions and materials used in construction
- ☐ Design pressure, maximum operating pressure and test pressure of vessels and associated piping
- ☐ Type, size, setting and location of pressure relief devices, vents and emergency shutoff locations
- ☐ Details to show proper construction of the foundation supporting stationary tanks
- ☐ Pressure relief devices shall be arranged to discharge upward and unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the container, adjacent structures or personnel.

  Exception: DOTn specification containers having an internal volume of 30 cubic feet or less. (IFC 5303.3.4)

- ☐ Pressure relief devices or vent piping shall be designed or located so that the moisture cannot collect and freeze in a manner that would interfere with the operation of the device.
- ☐ Stationary compressed gas containers, cylinders, and tanks shall be marked with the name of the gas and in accordance with IFC Sections 5003.5 and 5003.6. Markings shall be viable from any direction of approach.
- ☐ Piping systems shall be marked in accordance with (American Society of Mechanical Engineers) ASME A13.1, Markings used for piping systems shall consist of the content's name and include a direction-of-flow arrow. Markings shall be provided at each valve; at wall, floor, or ceiling penetrations; at each change of direction; and at not less than every 20 feet (6096 mm) or fraction thereof throughout the piping run.

  Exceptions:
  1. Piping that is designed or intended to carry more than one gas at various times shall have appropriate signs or markings posted at the manifold, along the piping, and at each point of use to provide clear identification and warning.
  2. Piping within gas manufacturing plants, gas processing plants, refineries and similar occupancies shall be marked in an approved manner.

- ☐ **Physical Protection -** Compressed gas containers, cylinders, tanks and systems that could be exposed to physical damage shall be protected. Guard posts or other approved means shall be provided to protect compressed gas containers, cylinders, tanks and systems indoors and outdoors from vehicular damage and shall comply with IFC Section 312.

- ☐ **Securing Compressed Gas Containers, Cylinders, and Tanks -** Compressed gas containers, cylinders, and tanks shall be secured to prevent falling caused by contact, vibration, or seismic activity. Securing of compressed gas containers, cylinders, and tanks shall be by one of the following:

  1. Securing containers, cylinders, and tanks to a fixed object with one of more restraints.
  2. Securing containers, cylinders, and tanks on a cart or other mobile device designed for the movement of compressed gas containers, cylinders, or tanks.
  3. Nesting of compressed gas containers, cylinders, and tanks at container filling or servicing facilities or in seller' warehouses not open to the public. Nesting shall be allowed provided that the nested containers, cylinders, or tanks, if dislodged, do not obstruct the required means of egress.
  4. Securing of compressed gas containers, cylinders, and tanks to or within a rack, framework, cabinet, or similar assembly designed for such use.

  Exception: Compressed gas containers, cylinders, and tanks in the process of examination, filling, or servicing.

International Fire Code Sections

Storage (IFC 5304)

1. **Upright Storage -** Compressed gas containers, cylinders, and tanks, except those designed for use in a horizontal position, and all Compressed gas containers, cylinders, and tanks containing non-liquefied gases, shall be stored in an upright position with the valve end up. An upright position shall include conditions where the container, cylinder, or tank axis is inclined as much as 45 degrees (.80 rad) from the vertical.

   Exceptions:
   1. Compressed gas containers with a water volume less than 1.3 gallons (5 L) are allowed to be stored horizontally.
   2. Cylinders, Containers, and tanks containing non-flammable gases, or cylinders, containers, or tanks containing non-liquefied flammable gases that have been secured to a pallet for transportation purposes.

2. **Material-specific Regulations** - In addition to the requirements of this section, indoor and outdoor storage of compressed gases shall comply with the material-specific provisions of IFC Chapters 54, 58, and 60 through 67.

Use and Handling (IFC 5305)

1. **Compressed gas systems.** *Compressed gas* systems shall be suitable for the use intended and shall be designed by persons competent in such design. *Compressed gas* equipment, machinery and processes shall be *listed* or *approved*.
2. **Controls.** *Compressed gas* system controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls shall be designed to be fail safe.
3. **Piping Systems** - Piping, including tubing, valves, fittings, and pressure regulators, shall comply with this section and IFC Chapter 50. Piping, tubing, pressure regulators, valves, and other apparatus shall be kept gas tight to prevent leakage.
4. **Valves** - Valves utilized on compressed gas systems shall be suitable for the use intended. Access to such valves shall be provided and maintained. Valve handles or operators for required shutoff valves shall not be removed or otherwise altered to prevent access.
5. **Venting** - Venting of gases shall be directed to an approved location. Venting shall comply with the International Mechanical Code.
6. **Upright Use** - Compressed gas containers, cylinders, and tanks, except those designed for use in a horizontal position, and all compressed gas containers, cylinders, and tanks containing non-liquefied gases, shall be used in an upright position with the valve end up. An upright position shall include conditions where the container, cylinder, or tank axis is included as much as 45 degrees (.80 rad) from the vertical. Use of nonflammable liquefied gases in the inverted position where the liquefied phase is used shall not be prohibited provided that the container, cylinder, or tank is properly secured and the dispensing apparatus is design for liquefied gas use.

   Exception: Compressed gas containers, cylinders, or tanks with a water volume less than 1.3 gallons (5 L) are allowed to be used in a horizontal position.
7. **Transfe**r. Transfer of gases between containers, cylinders and tanks shall be performed by qualified personnel using equipment and operating procedures in accordance with (Compressed Gas Association) CGA P-1.

   Exception: The fueling of vehicles with CNG or CH2, conducted in accordance with IFC Chapter 23.
8. **Use of compressed gas for inflation**. Inflatable equipment, devices or balloons shall only be pressurized or filled with compressed air or inert gases.
9. **Material-specific Regulations** - In addition to the requirements of this section, indoor and outdoor storage of compressed gases shall comply with the material-specific provisions of IFC Chapters 54, 58, and 60 through 67.
10. **Handling**. The handling of compressed gas containers, cylinders and tanks shall comply with IFC Sections 5305.10.1 and 5305.10.2.
    1. **Carts and trucks.** Containers, cylinders and tanks shall be moved using an approved method. Where containers, cylinders or tanks are moved by hand cart, hand truck or other mobile device, such carts, trucks or devices shall be designed for the secure movement of containers, cylinders or tanks. Carts and trucks utilized for transport of compressed gas containers, cylinders and tanks within buildings shall comply with IFC Section 5003.10. Carts and

trucks utilized for transport of compressed gas containers, cylinders and tanks exterior to buildings shall be designed so that the containers, cylinders and tanks will be secured against dropping or otherwise striking against each other or other surfaces.

2 **Lifting devices.** Ropes, chains or slings shall not be used to suspend *compressed gas* containers, cylinders and tanks unless provisions at time of manufacture have been made on the container, cylinder or tank for appropriate lifting attachments, such as lugs.

Medical Gases (IFC 5306)

General - Compressed gases at hospitals and similar facilities intended for inhalation and sedation including, but not limited to, analgesia systems for dentistry, podiatry, veterinary, and similar uses shall comply with IFC Sections 5306.2 through 5306.4 in addition to other requirements in this section.

Exception: All new distribution piping, supply manifolds, connections, regulators, valves, alarms, sensors, and associated equipment shall be in accordance to the Plumbing Code.

1. **Interior Supply Location** - Medical gases shall be located in areas dedicated to the storage of such gases without other storage or uses. Where containers of gases in quantities greater than the permit amount are located inside buildings, they shall be in a 1-hour exterior room, a 1-hour interior room or a gas cabinet in accordance with IFC Section 5306.2.1, 5306.2.2, or 5306.2.3, respectively. Rooms or areas where medical gases are stored or used in quantities exceeding the maximum allowable quantity per control area as set forth in IFC Section 5003.1 shall be in accordance with the International Building Code for high-hazard Group H occupancies.

   2a. **One-Hour Exterior Rooms** - A 1-hour exterior room shall be a room or enclosure separated from the remainder of the building by fire barriers constructed in accordance with Section 707 of the International Building Code or horizontal assemblies constructed in accordance with Section 711 of the International Building Code, or both, with a fire-resistance rating of not less than 1 hour. Rooms shall have not less than one exterior wall that is provided with not less than two vents. Each vent shall have a minimum free opening area of 36 square inches (232 cm^2) for each 1,000 cubic feet (28 m^3) at normal temperature and pressure (NTP) of gas stored in the room and shall be not less than 72 square inches (465 cm^2) in aggregate free opening area. One vent shall be within 6 inches (152 mm) of the floor and one vent shall be within 6 inches (152 mm) of the ceiling. Rooms shall be provided with not less than one automatic sprinkler to provide container cooling in case of fire.

   2b. **One-Hour Interior Room** - Where an exterior wall cannot be provided for the room, a 1-hour interior room shall be provided and shall be a room or enclosure separated from the remainder of the building by fire barriers constructed in accordance with Section 707 of the International Building Code or horizontal assemblies constructed in accordance with section 711 of the International Building Code, or both, with a fire resistance rating of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be self-closing, smoke and draft-control assemblies having a fire protection rating of not less than 1 hour. An automatic sprinkler system shall be installed within the room. The room shall be exhausted through a duct to the exterior. Supply and exhaust ducts shall be enclosed in a 1-hour-rated shaft enclosure from the room to the exterior. Approved mechanical ventilation shall comply with the International Mechanical Code and be provided at a minimum rate of 1 cfm per square foot of the area of room.

   2c. **Gas Cabinets** - Gas cabinets shall be constructed in accordance with IFC Section 5003.8.6 and shall comply with the following:

      1. Exhausted to the exterior through dedicated exhaust duct system installed in accordance with Chapter 5 of the International Mechanical Code.

      2. Supply and exhaust ducts shall be enclosed in a 1-hour fire-resistance-rated shaft enclosure from the cabinet to the exterior. The average velocity of ventilation at the face of access ports or windows shall be not less than 200 feet per minute (1.02m/ s) with not less than 150 feet per minute (0.76 m/s) at any point of the access point or window.

      3. Provided with an automatic sprinkler system internal to the cabinet.

2. **Exterior Supply Locations** - Oxidizer medical gas systems located on the exterior of a building with quantities greater than the permit amount shall be located in accordance with IFC Section 6304.2.1.

3. **Transfilling** - Transfilling areas and operations including, but not limited to, ventilation and separation, shall comply with NFPA 99.

4. **Medical Gas Systems** - The maintenance and testing of medical gas systems including, but not limited to, distribution piping, supply manifolds, connections, pressure regulators and relief devices and valves, shall comply with the maintenance and

testing requirements of NFPA 99 and the general provisions of this chapter.

Compressed Gases not otherwise regulated (IFC 5307)

1. **General** - Compressed gases in storage or use not regulated by the material-specific provisions of IFC Chapters 6, 54, 55, and 60 through 67, including asphyxiants, irritants and radioactive gases, shall comply with this section in addition to other requirements of this chapter.

2. **Ventilation** - Indoor storage and use areas and storage buildings shall be provided with ventilation in accordance with IFC Section 5004.3. Where mechanical ventilation is provided, the systems shall be operational during such time as the building or space is occupied.

   Exceptions:

   1. A gas detection system complying with IFC Section 5307.2.1 shall be permitted in lieu of mechanical ventilation.
   2. Areas containing insulated liquid carbon dioxide systems used in beverage dispensing applications shall comply with IFC Section 5307.3

   2a. ***Gas Detection System*** - In rooms or areas not provided with ventilation in accordance with IFC Section 5307.2, a gas detection system complying with Section 916 or, where approved, an oxygen depletion alarm system, either of which initiates audible and visible alarm signals in the room or area where sensors are installed, shall be provided.

3. **Insulated Liquid Carbon Dioxide Systems Used in Beverage Dispensing Applications** - Insulated liquid carbon dioxide systems with more than 100 pounds (45.4 kg) of carbon dioxide used in beverage dispensing applications shall comply with IFC Section 5307.3.1.

   3a. ***Ventilation*** - Where insulated liquid carbon dioxide storage tanks, cylinders, piping and equipment are located indoors, rooms or areas containing storage tanks, cylinders, piping and equipment, and other areas where a leak of carbon dioxide is expected to accumulate, shall be provided with mechanical ventilation in accordance with IFC Section 5004.3 and designed to maintain the room containing carbon dioxide at a negative pressure in relation to the surrounding area.

   Exception: A gas detection system complying with IFC Section 5307.3.2 shall be permitted in lieu of mechanical ventilation.

   3b. **Gas Detection System -** Where ventilation is not provided in accordance with IFC Section 5307.3.1, a gas detection system shall be provided in rooms or indoor areas and in below-grade outdoor locations with insulated carbon dioxide systems. Carbon dioxide sensors shall be provided within 12 inches (305 mm) of the floor in the area where the gas is expected to accumulate or other approved locations. The system shall be designed as follows:

   1. Activates an audible and visible supervisory alarm at a normally attended location upon detection of a carbon dioxide concentration of 5,000 ppm (9000 mg/m3).
   2. Activates an audible and visible alarm within the room or immediate area where the system is installed upon detection of a carbon dioxide concentration of 30,000 ppm (54 000 mg/m3).

4. **Carbon Dioxide Enrichment System** - The design, installation and maintenance of carbon dioxide enrichment systems with more than 100 pounds (45.4 kg) of carbon dioxide, and carbon dioxide enrichment systems with any quantity of carbon dioxide having a remote fill connection, shall comply with IFC Sections 5307.4.1 through 5307.4.7.

   4a. **Documentation** - The following information shall be provided with the application for permit:

   1. Total aggregate quantity of liquid carbon dioxide in pounds or cubic feet at normal temperature and pressure.
   2. Location and total volume of the room where the carbon dioxide enrichment operation will be conducted. Identify whether the room is at grade or below grade.
   3. Location of containers relative to equipment, building openings and means of egress.
   4. Manufacturer's specifications and pressure rating, including cut sheets, of all piping and tubing to be used.
   5. A piping and instrumentation diagram that shows piping support and remote fill connections.
   6. Details of container venting, including but not limited to vent line size, material and termination location.

7. Alarm and detection system and equipment, if applicable.
8. Seismic support for containers.

4b. **Equipment** - Pressure relief, vent piping, fill indicators, fill connections, vent terminations, piping systems and the storage, use and handling of the carbon dioxide shall be in accordance with IFC Chapter 53 and NFPA 55 and IFC 5307.4.3.

4c. **Gas Detection System** - A gas detection system complying with IFC Section 916 shall be provided in rooms or indoor areas in which the carbon dioxide enrichment process is located, in rooms or indoor areas in which container systems are located, and in other areas where carbon dioxide is expected to accumulate. Carbon dioxide sensors shall be provided within 12 inches (305 mm) of the floor in the area where the gas is expected to accumulate or leaks are most likely to occur. The system shall be designed as follows:

1. Activates a low-level alarm upon detection of a carbon dioxide concentration of 5,000 ppm (9000 mg/m3).
2. Activates a high-level alarm upon detection of a carbon dioxide concentration of 30,000 ppm (54,000 mg/m3).

4d. **System Activation** - Activation of the low level gas detection system alarm shall automatically:

1. Stop the flow of carbon dioxide to the piping system.
2. Activate the mechanical exhaust ventilation system.
3. Activate an audible and visible supervisory alarm signal at an approved location within the building.

Activation of the high-level gas detection system alarm shall automatically:

1. Stop the flow of carbon dioxide to the piping system.
2. Activate the mechanical exhaust ventilation system.
3. Activate an audible and visible evacuation alarm both inside and outside of the carbon dioxide enrichment area, and the area in which the carbon dioxide containers are located.

5. **Pressurization and Ventilation** - Rooms or indoor areas in which carbon dioxide enrichment is provided shall be maintained at a negative pressure in relation to the surrounding areas in the building. A mechanical ventilation system shall be provided in accordance with the International Mechanical Code that complies with all of the following:
   1. Mechanical ventilation in the room or area shall be at a rate of not less than 1 cfm per square foot .
   2. When activated by the gas detection system, the mechanical ventilation system shall remain on until manually reset.
   3. The exhaust system intakes shall be taken from points within 12 inches (305 mm) of the floor.
   4. The ventilation system shall discharge to the outdoors in an approved location per IFC 5307.4.5.
6. **Signage** - Hazard identification signs shall be posted at the entrance to the room and indoor areas where the carbon dioxide enrichment process is located, and at the entrance to the room or indoor area where the carbon dioxide containers are located. The sign shall be not less than 8 inches (200 mm) in width and 6 inches (150 mm) in height and indicate:

CAUTION – CARBON DIOXIDE GAS - VENTILATE THE AREA BEFORE ENTERING. A HIGH CARBON DIOXIDE (CO_2) GAS CONCENTRATION IN THIS AREA CAN CAUSE ASPHYXIATION

7. **Seismic and Structural Design** - Carbon dioxide system containers and piping shall comply with the seismic design requirements in Chapter 16 of the International Building Code and shall not exceed the floor loading limitation of the building.
8. **Container Refilling** - Carbon dioxide containers located indoors shall not be refilled unless filled from a remote connection located outdoors.