



Riverside County Fire Department

Office of the Fire Marshal

2300 Market St., Ste. 150, Riverside, CA 92501 Ph. (951) 955-4777 Fax (951) 955-4886

Technical Policy

Title: Carbon Dioxide (CO ₂) Gas Enrichment Systems in Plant Growing (Husbandry) Applications		
Technical Policy: # TP 16-004	Effective Date: 10/07/2016	Revised Date: 05/30/2017
Code References: 2016 California Fire Code, Sec. 102.9, 104.1, and Ch. 53; NFPA 55		

Purpose:

Riverside County Fire Department (RCFD) Office of the Fire Marshal (OFM) has prepared this policy to provide guidance to building officials, contractors, engineers, consultants and the general public on local interpretations and practices that are considered to be in compliance with the 2016 California Fire Code (CFC). This policy is intended to provide information on the use of carbon dioxide gas enrichment systems in plant growing (husbandry) applications. The requirements of this policy shall not be construed as altering any existing code, law or regulation which may require fire protection features not covered or alluded to in these requirements, nor shall they waive any requirements of any code, law or regulation. The reader is cautioned that the guidance detailed in this policy may or may not apply to their specific situation, and that the OFM retains final authority to determine compliance.

Scope:

This policy covers the installation, maintenance, operation and permitting requirements as they pertain to Carbon Dioxide (CO₂) gas enrichment systems in plant growing (husbandry) applications in new and existing facilities under the jurisdiction of the RCFD. This policy applies to the following:

- The use and storage of Carbon Dioxide (CO₂) compressed gas systems with more than 100 pounds (45.4 kg) of Carbon Dioxide (CO₂) or any system using any amount of Carbon Dioxide (CO₂) below grade.

Other methods of Carbon Dioxide (CO₂) gas enrichment are not permitted unless specifically approved by the Fire Code Official. The use of heaters to generate CO₂ is prohibited.

Existing buildings or facilities where Carbon Dioxide (CO₂) gas enrichment systems are introduced or changed shall comply with this Technical Policy.

Design and installation shall comply with the applicable provisions of the California Construction Codes, as amended, and this policy. The most restrictive requirements shall govern.

Codes and Standards

This policy is based on the 2016 California Fire Code (CFC), Chapter 1, Section 102.9, Matters not provided for; Chapter 53, Compressed Gases; 2016 NFPA 55, Compressed Gases and Cryogenic Fluids Code.

Specifically, CFC Section 102.9 permits the Fire Code Official to determine requirements that are essential for the public safety of an existing or proposed activity, building or structure, or for the safety of the occupants thereof, which are not specifically provided for by the CFC.

The State and County adopted 2016 CFC does not currently provide regulatory provisions for gas enrichment systems in plant growing (husbandry) applications. This Technical Policy is based upon the recently incorporated provisions to the 2018 International Fire Code including, but not limited to, a new Section 916 Gas Detection Systems and a new Section 5308 for Gas Enrichment Systems. The California State Fire Marshal is supplementing the 2016 California Building Standards Code with these 2018 International Fire Code provisions which should be effective statewide July 2018.

Definitions

Carbon Dioxide (CO₂) Enrichment System. A system where carbon dioxide gas is intentionally introduced into an indoor environment, typically for the purpose of stimulating plant growth.

Permits and Inspections

A. CONSTRUCTION PERMITS

1. Carbon Dioxide (CO₂) gas enrichment systems. A construction permit is required for installation of or modification of Carbon Dioxide (CO₂) systems with more than 100 pounds (45.4 kg) of Carbon Dioxide (CO₂) and any system using any amount of Carbon Dioxide (CO₂) below grade used in plant growing (husbandry) applications. Maintenance performed in accordance with the CFC is not considered to be modification and does not require a construction permit.

2. Gas detection systems. A construction permit is required for installation of or modification to gas detection systems. Maintenance performed in accordance with the CFC is not considered a modification and shall not require a permit.

3. Requirements.

Riverside County Fire Department, OFM must review all Carbon Dioxide (CO₂) systems permit applications.

Comply with any additional permit applications and review requirements of the Building and Safety Dept/Division with jurisdiction.

Applicable plan review and permit fees shall apply.

Construction permits shall be issued to licensed contractors unless otherwise approved by the Fire Code Official.

Construction drawings and specifications shall bear the seal and signature of a licensed California professional engineer/architect who prepared the drawings/specifications and shall be complete and of sufficient clarity to indicate the entire work proposed and show in detail that the Carbon Dioxide (CO₂) system conforms to the provisions of this policy, the California Fire and Building Codes and relevant laws, ordinances, rules and regulations. Each set of drawings and specifications shall, at a minimum, contain the following information, architectural, structural, mechanical, electrical drawings, specifications and analysis:

1. Exact address, legal description and location of the work performed.
2. Name and address of the owner.
3. Name and address of the person or firm responsible for the preparation of the drawings and specifications. The seal and signature of the California licensed architect and/or engineer responsible for the preparation of the drawings and specifications.
4. Two complete sets of construction documents showing the construction of architectural, structural, mechanical, plumbing and electrical arrangements.
5. One copy of specifications or notes that clearly describe the type, quality and finish of materials and the method of assembly, erection and installation of equipment to be installed with proper reference to accepted standards.
6. Except for entirely interior installations, a plot plan showing the location of the proposed construction (i.e., tanks) and the location of every adjacent existing building on the property, roads, walks, utilities and other site improvements, all property lines, streets, alleys, easements and other public areas.
7. Bulk tank installations may require an engineered structural foundation with a separate tank installation permit. Contact the Building and Safety Dept/Division with jurisdiction to determine requirements.
8. Total aggregate quantity of liquid CO₂ in pounds or cubic feet at normal temperature and pressure.
9. 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.
10. Location of containers relative to equipment, building openings and means of egress.

11. Manufacturer's specifications and pressure rating, including cut sheets, of all piping and tubing to be used.
12. A piping and instrumentation diagram that shows piping support and remote fill connections.
13. Details of container venting, including but not limited to vent line size, material and termination location.
14. Alarm and detection system and equipment.
15. Seismic support for containers.

B. OPERATIONAL PERMITS

Where required by the Fire Code Official, operational permits shall be issued upon approval, issuance, and final inspections of required construction permits.

A separate annual compressed gas storage/use permit may be required for 6,000 cubic feet or more of Carbon Dioxide (CO₂) as an "Inert Gas." (1 pound of CO₂ = 8.74 cu/ft).

Operational permits shall be posted on site.

To obtain required operational permit(s), the Business owner or Company Representative must complete and sign the Carbon Dioxide (CO₂) Gas Enrichment Systems in Plant Growing (Husbandry) Applications Operational Permit Application.

C. SITE INSPECTION

Riverside County Fire Department OFM, and the Building and Safety Dept/Division shall inspect and witness acceptance testing of the installation. Contact OFM and the Building and Safety Dept/Division with jurisdiction to confirm type and frequency of inspections required. Compliance with all California Fire Code requirements shall be maintained at all times.

Requirements

A. CARBON DIOXIDE (CO₂) GAS ENRICHMENT SYSTEMS REQUIREMENTS

1. 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 CFC Chapter 53 and NFPA 55.

2. Gas detection system. A gas detection system complying with Section B of this Technical Policy 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. Activate a low-level alarm upon detection of a carbon dioxide concentration of 5,000 ppm (9000 mg/m³).
2. Activate a high-level alarm upon detection of a carbon dioxide concentration of 30,000 ppm (54 000 mg/m³).

2.1. 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.

3. 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 California 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 cubic foot per minute per square foot [0.00508 m³/(S × m²)].
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.

4. 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) wide and 6 inches (150 mm) high and indicate:

CAUTION – CARBON DIOXIDE GAS

Ventilate the area before entering.
A high carbon dioxide (CO₂) gas concentration
in this area can cause asphyxiation.

5. Seismic and structural design. Carbon dioxide system containers and piping shall comply with the seismic design requirements in Chapter 16 of the California Building Code and shall not exceed the floor loading limitation of the building.

6. Container refilling. Carbon dioxide containers located indoors shall not be refilled unless filled from a remote connection located outdoors.

B. GAS DETECTION SYSTEMS

1. Gas detection systems. Gas detection systems shall comply with this Technical Policy and the CFC.

2. Permits. Permits shall be required as set forth in this Technical Policy and the CFC.

2.1. Construction documents. Documentation of the gas detection system design and equipment to be used that is adequate to demonstrate compliance with the requirements of this Technical Policy and the CFC shall be provided with the application for permit.

3. Equipment. Gas detection system equipment shall be designed for use with the gases being detected and shall be installed in accordance with manufacturers' instructions.

4. Power connections. Gas detection systems shall be permanently connected to the building electrical power supply or shall be permitted to be cord connected to an unswitched receptacle using an approved restraining means that secures the plug to the receptacle.

5. Emergency and standby power. Standby or emergency power shall be provided or the gas detection system shall initiate a trouble signal at an approved location if the power supply is interrupted.

6. Sensor locations. Sensors shall be installed in approved locations where leaking gases are expected to accumulate.

7. Gas sampling. Gas sampling shall be performed continuously. Sample analysis shall be processed immediately after sampling, except where a less frequent or delayed sampling interval is approved.

8. System activation. A gas detection alarm shall be initiated where any sensor detects a concentration of gas exceeding the thresholds identified in Section A.2 of this Technical Policy.

Upon activation of a gas detection alarm, alarm signals or other required responses shall be as specified by the CFC or this Technical Policy requiring a gas detection system. Audible and visible alarm signals associated with a gas detection alarm shall be distinct from fire alarm and carbon monoxide alarm signals.

9. Signage. Signs shall be provided adjacent to gas detection system alarm signaling devices that advise occupants of the nature of the signals and actions to take in response to the signal.

10. Fire alarm system connections. Gas sensors and gas detection systems shall not be connected to fire alarm systems unless approved and connected in accordance with the fire alarm equipment manufacturers' instructions.

11. Inspection, testing and sensor calibration. Inspection and testing of gas detection systems shall be conducted not less than annually. Sensor calibration shall be confirmed at the time of sensor installation and calibration shall be performed at the frequency specified by the sensor manufacturer.