Indoor Cannabis

Cultivation Facilities

Flower & Nursery Facilities
System Designs and Code Requirements
Environmental Note:
In consideration of the environment, this handout has been designed to conserve printing costs.

Contact:
IAPMO Training and Certification Department at:
Chicago Regional Office
18927 Hickory Creek Dr., Suite 220
Mokena, IL 60448-8399
Email: seminars@iapmo.org
Toll free: 1-877-427-6601

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Indoor Cannabis Cultivation Facilities

Who Would Benefit from this Presentations?

Codes and Standards

- Uniform Mechanical Code – 2018 edition

❖ Electrical is not covered in this presentation

California Building Standards Codes

- Fire Code
- Energy Code
- Building Code
- Plumbing Code
- Electrical Code
- Mechanical Code
- Historical Building Code
- Residential Building Code
- Green Building Standards Code (CalGreen)

❖ For on-line copies, go to [www.dgs.ca.gov/BSC/Codes](http://www.dgs.ca.gov/BSC/Codes)

What California State Agency has Jurisdiction Over Cannabis Cultivation?
What California Agency has Jurisdiction over Plant Extraction Facilities?

How long has indoor agriculture been employed?

Is there a difference between floriculture and Cannabis?

Where is Cannabis Legal?

What is an Occupancy?

What are Cannabis Occupancies?

Why are Use and Activity Useful?
What is a Change of Occupancy?

Occupancy Classification - Colorado

Fire Protection

Signage for Rooms

• Certain equipment rooms contained within a building may require identifying signage to aid firefighters.
  1. Rooms containing fire protection equipment (fire alarm panels, fire sprinkler valves, etc.)
  2. Rooms containing controls for air-conditioning equipment
  3. Rooms containing utility equipment for gas or electrical service
  4. Rooms containing hazardous materials
Fire Code

Hazardous Occupancy

Combustible Liquids Classification
Occupant Load - IBC Table 1004.1.2 Maximum Floor Area Allowances per Occupant

California Fire Code

Remainder of page Intentionally left blank for notes
Cannabis Remodeling – Fire Sprinklers

Regulatory Do's and Don’ts

• Always confirm answers in writing, which often means you send the email.
• Policies can never be more stringent than Code.
• If the answer isn’t logical, the answer isn’t Code.
• Regulators customarily avoid volunteering design and Code alternatives. You have to ask.
• While jurisdictions are immune from not enforcing Code, you’re not immune from not following Code.
Building Code and Fire Code

Storage of Chemicals and Compressed Gases

- There are many regulations regarding control rooms, compressed gases.

What about Greenhouses?
• Control room wiring shall be (class 1 Division 1)
• General Regulations for control rooms are in chapter 50 in 2016 California Fire Code (CFC)
• Compressed gas shall be stored in accordance with CFC 2016 sec. 5304
• Maximum Allowable Quantities per Control Area shall be established 2016 CFC sec. 5003.1
• CFC 2016 chapters 58 (Flammable Gases)
• CFC 2016 chapter 60 (Highly Toxic and Toxic Materials)
• An application for a building permit shall include a Hazardous Materials Inventory Statement (HMIS) per 2013 CFC 5001.5.2

Standby Power

608.0 Automatic Shutoffs. - 2019 California Mechanical Code

• 608.1 Air-Moving Systems and Smoke Detectors. Air moving systems supplying air in excess of 2000 cubic feet per minute (ft³/min) (0.9439 m³/s) to enclosed spaces within buildings shall be equipped with an automatic shutoff. Automatic shutoff shall be accomplished by interrupting the power source of the air-moving equipment upon detection of smoke in the main supply-air duct served by such equipment.

• Duct smoke detectors shall comply with UL 268A, shall be labeled by an approved agency, approved and listed by California State Fire Marshal, and shall be installed in accordance with the manufacturer’s installation instructions. Such devices shall be compatible with the operating velocities, pressures, temperatures, and humidities of the system.

• Where fire-detection or alarm systems are provided for the building, the smoke detectors shall be supervised by such systems in an approved manner and installed in accordance with NFPA 72 and the "California Building and Fire Codes."

• Exceptions:
(1) Where the space supplied by the air-moving equipment is served by a total coverage smoke-detection system in accordance with the California Fire Code, interconnection to such system shall be permitted to be used to accomplish the required shutoff.

(2) Automatic shutoff is not required where occupied rooms served by the air-handling equipment have direct exit to the exterior and the travel distance does not exceed 100 feet (30 480 mm).

(3) Automatic shutoff is not required for Group R, Division 3 and Group U Occupancies.

(4) Automatic shutoff is not required for approved smoke control systems or where analysis demonstrates shutoff would create a greater hazard, such as shall be permitted to be encountered in air-moving equipment supplying specialized portions of Group H Occupancies. Such equipment shall be required to have smoke detection with remote indication and manual shutoff capability at an approved location.

(5) Smoke detectors that are factory installed in listed air moving equipment shall be permitted to be used in lieu of smoke detectors installed in the main supply-air duct served by such equipment.

Dampers

- Building codes specify where fire dampers are required.
  - International Building Code
  - Some States modify the IBC for adoption within the State.
  - Generically,
  - Openings are windows, doors, escalators, and stairs.
  - Penetrations are electrical and plumbing pipes, tubes, conduit and vents
  - Duct and Air Transfer Openings may need fire dampers

Building Code for Smoke and Fire Dampers
Fire Barriers, Partitions, and Walls

Fire Barrier

Fire Partition

Fire Wall

Opening Protection

Openings at Horizontal Assemblies
Trough Penetration

Membrane Penetration

Key Firestop Terms and Definitions

Wall or Floor Assembly

Penetrant

Annular space
Code Requirements for accessing and exiting occupancies.

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What are We Trying to Accomplish?

• Prevent mold and mildew
• Prevent pests (such as spider mites, aphids, white flies and mealy bugs, leaf minors and fungus gnats)
• Prevent harmful organisms (powdery mildew, botrytis and downy mildew)
• Grow Cannabis without having to destroy entire crop when subjected to required testing protocols

Insecticides and Miticides

• Azadirachtin
• *Bacillus thuringiensis* sub. *kurstaki*
• *Bacillus thuringiensis* sub. *israeensis*
• *Beauveria bassiana*
• *Burkholderia* spp. strain A396
• Capsaicin
• Cinnamon and cinnamon oil
• Citric acid
• Garlic and garlic oil
• Geraniol
• Horticultural oils (petroleum oil)
• Insecticidal soaps (potassium salts of fatty acids)
• Iron phosphate
• *Isaria fumosorosea*
• Neem oil
• Potassium bicarbonate
• Potassium sorbate
• Rosemary oil
• Sesame and sesame oil
• Sodium bicarbonate
• Soybean oil
• Sulfur
• Thyme oil

Fungicides and Antimicrobials

• *Bacillus amyloliquefaciens* strain D747
• Cloves and clove oil
• Corn oil
• Cottonseed oil
• *Gliocladium virens*
• Neem oil
• Peppermint and peppermint oil
• Potassium bicarbonate
• Potassium silicate
• Rosemary and rosemary oil
• Sodium bicarbonate
• Reynoutria sachalinensis extract
• Trichoderma harzianum
Eye Wash Requirements

Nutrient Water Tanks

- Control PH according to local treatment plant regulations (typically 6-8)
- Control odors from leaving permitted premises.
- Provide acceptable IAQ when grow rooms are occupied
- Control CO\textsubscript{2} levels
- Prevent mixing class 2 air into class 1 air areas
- Nutrient tanks are chemical tanks—Do not use clear or translucent tanks for water storage outside. (algae)

Water Storage

- Control temperature about 75 degrees
- Control Humidity levels to 50% or below
- Maintain 1200-1500 ppm of CO\textsubscript{2} during daylight hrs.
  - Cultivators typically mimic both Day and Night conditions in grow rooms

Vapor Pressure Deficit

- Vapor-pressure deficit, or VPD, is the difference (deficit) between the amount of moisture in the air and how much moisture the air can hold when it is saturated. Once air becomes saturated, water will condense out to form clouds, dew or films of water over leaves.
<table>
<thead>
<tr>
<th>Clones Humidity Level</th>
<th>Seedlings Humidity Level</th>
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<tbody>
<tr>
<td>Growth Week 1: 70%</td>
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<td>Flowering Week 1: 65%</td>
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<tr>
<td>Flowering Week 9: 40%</td>
<td>Flowering Week 9: 40%</td>
</tr>
</tbody>
</table>

What are Typical Components

- Grow lights
- Dehumidifier
- Carbon filters or scrubbers
- UV lights in air handler
- CO₂ tank or burner
- Air handler
- Condenser/compressor
- Monitoring/Sample box for nutrient water testing
- Absorption chiller and cooling tower
- Air cooled chiller
- Water cooled chiller

Reheat Heat Recovery
Variable Refrigerant Flow (VRF) System types

- Cooling only systems (less popular) – those systems can only cool. Heating is not available. Fan and Dry modes are available for each indoor unit independently.

- Heat Pump systems (most popular) – all the indoor units can either heat, or cool (not at the same time). Fan and Dry modes are available for each indoor unit independently.

- The term variable refrigerant flow, or VRF, refers to the system’s ability to control the amount of refrigerant flowing to each of these small air handlers.

- Heat Recovery systems (less popular) – those systems are the most sophisticated ones, where cooling and heating may be available by each indoor unit, independently, at the same time.

Direct Expansion Units (DX)

- A packaged DX system also contains all components of the system in a single unit, but in some packaged systems, the evaporator, compressor and condenser are located outside the building, and the unit pumps cooled air into the building through ducts.

Split Systems

- A split air conditioning system puts the compressor and condenser outside the building and the evaporator and fans inside the building. In a central air conditioning system, fans push cooled air from a centrally located evaporator through ducts to the entire building. In a ductless split system, fans in a wall-
mounted unit move the air from the evaporator into the room in much the same way that a window unit does. Because the split unit's noisy compressor is outside, however, a split ductless system is much quieter than a window unit.

Multi-Zone Split System

Chilled Water Cooling

- A chilled water air conditioning unit uses liquid water, rather than condensed refrigerant, as a cooling medium. A chiller unit outside the building cools the water, then the unit pumps the water to heat exchangers inside the building. These units are well suited to cooling large buildings, but they are generally less efficient than DX systems and are not commonly used in homes.

Water Cooled Chillers

- Water-cooled water chillers are refrigeration systems that cool fluids to support industrial processes.
- Plant water (tower water, city water or well water) is used to dissipate the process heat removed by the refrigerant system.
- These units are designed for indoor installations.
- For process fluid temperatures between 20° - 70°F.
- Water Cooled Chillers are accompanied by Cooling Towers to reject heat
Air Cooled Chillers

- Air-cooled water chillers are refrigeration systems that cool fluids to support industrial processes.
- Ambient air is used to dissipate the process heat removed by the refrigeration system.
- For process fluid temperatures between 20° - 70°F.
- These units are outdoor units and reject waste heat to the air.

Heat Pump in Cooling Mode

PVC - Irrigation Piping

- While table 604.1 2019 CPC only allows PVC for exterior supply piping, there is no standard for underground or under slab irrigation piping materials for indoor irrigation.
- Distribution piping does not apply because it only references potable water distribution piping

Recover condensate from AC coils and dehumidifiers

1506.9.2 Minimum Water Quality.
- On-site treated uses in which it is sprayed or exposed shall be disinfected.
- Acceptable disinfection methods shall include chlorination ultraviolet sterilization, ozone, or other methods

Minimum Water Quality

- As approved by the Authority Having Jurisdiction. The minimum water quality for on-site treated non-potable water systems shall meet the applicable water quality
requirements for the intended applications as determined by the public health Authority Having Jurisdiction.

Distribution Piping - California Plumbing Code (CPC)

• Water piping for facility shall be sized per 2019 CPC sec 610.1
• Nutrient Water should be designed by GPM required by number of emitters and growers' requirements
• Irrigation piping with pumps that can create backpressure shall be protected with an RZP located upstream from the source of backpressure 2019 CPC sec 603.5.6.1
• Also see 2019 CPC sec 603.5.6.2 & 603.5.6.3

Minimum Plumbing Facilities etc…

• Table 422.1, 2019 CPC should be used.
• Sec 602.3 2019 CPC provides Backflow protection and requirements. California requires an air gap between potable and non potable waters.
• All piping shall be labeled per 601.3.1-601.3.5, 2018 CPC
• Drainage sizing shall be designed by the requirements in Chapter 7 of 2019 CPC

Code Compliant Labeling of Piping
Backflow for Condensate or RWH systems (CPC)

- 1503.3 Connections to Potable and Reclaimed (Recycled) Water Systems.

- Gray water systems shall have no direct connection to a potable water supply, on-site treated non-potable water supply, or reclaimed (recycled) water supply systems.

- Exceptions:
  - (1) Potable water, on-site treated nonpotable water, reclaimed (recycled) water, or rainwater is permitted to be used as makeup water for a non-pressurized storage tank provided the connection is protected by an air gap in accordance with this code.
  
  - (2) A potable water supply may be connected temporarily for initial testing of the untreated graywater system as required in Section 1501.11.2.2.

CO₂ Systems CFC 2016
California Fire Code
Mechanical Ventilation

Photocatalytic Oxidation (PCO)

• Photocatalytic Oxidation (PCO) is an advanced process by which volatile organic compounds (VOCs), bacteria, mold and fungus is destroyed by incorporating photon and ultraviolet (UV) energy activating a catalyst creating photo catalytic oxidation (PCO). PCO is produced by the air being exposed to photon light and passing through a catalyst comprised of specific nano-sized mineral compounds. After exposure and upon entering an area, three specific free radicals are released which destroys the bioaerosols (bacteria, molds, and fungus).
Photo-hydro Ionization (PHI)

- When the HVAC system is in operation the HVAC-PHI Cell creates an Advanced Oxidation Process consisting of, Hydro-Peroxides, super oxide ions and hydroxide ions. All are friendly oxidizers. By friendly oxidizers we mean the oxidizers revert back to oxygen and hydrogen after the oxidation of the pollutant.

Air Locks/Cleanroom Designations

Drainage
Grow House Equipment

## Cannabis Lighting Schedule

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<tr>
<th>Grow Stage</th>
<th>Hours of Daylight</th>
<th>Hours of Darkness</th>
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<td>Flowering</td>
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<td>12</td>
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