Marijuana Growing, Processing, and Extraction Facilities

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Fire Protection Engineer
Why Marijuana?

“Aside from cryptocurrency, there is simply no other industry changing as rapidly or as unevenly as the cannabis sector”

- Troy Dayton, CEO of the Arcview Group

Interest in retail marijuana products has surged in recent years.

New topic for many professionals.
New Codes

NFPA 1-2018, Chapter 38: Marijuana Growing, Processing, or Extraction Facilities.

- Primarily contains existing codes applicable to marijuana facilities.
- Does not apply to retail where growing and processing do not occur.
General Building Design

- Use Groups
- Hazardous Materials
- Control Areas
- Mixed vs. Separated Use
- Work Area
General Building Design

- Use Groups
- Hazardous Materials
- Control Areas
- Mixed vs. Separated Use
- Work Area
Use Groups

 Marijuana dispensaries = Mercantile (M).

 Cultivation “Grow” facilities = Factory (F-1).

 Extraction facilities = Factory (F-1).

 Marijuana-infused product kitchens and bakeries = Factory (F-1).
General Building Design

- Use Groups
- Hazardous Materials
- Control Areas
- Mixed vs. Separated Use
- Work Area
Hazardous Materials

- Document hazardous materials.
  - Safety Data Sheet (SDS).
  - Post NFPA 704 Hazard Diamond(s) and no smoking signs on extraction room door.

- Locate in fire cabinet or dedicated storage room.

- Be mindful of MAQ Tables.
  - Reference Tables 307.1(1) and 307.1(2) in IBC-2009.
  - Reference NFPA 1 and NFPA 30.
General Building Design

- Use Groups
- Hazardous Materials
- Control Areas
- Mixed vs. Separated Use
- Work Area
Control Areas

Control Area: Spaces in a building where quantities of hazardous material do not exceed the maximum allowable quantities per control area for storage, closed, and open-use systems.

Maximum allowable quantity (MAQ) of hazardous material per control area.
- Reference Table 307.1(1) in IBC-2009

Implementation:
- Reference Table 414.2.2 in IBC-2009
General Building Design

- Use Groups
- Hazardous Materials
- Control Areas
- Mixed vs. Separated Use
- Work Area
Mixed vs. Separated Use

- Mixed Occupancy: Multiple occupancy, intermingled.
- Separated Occupancy: Multiple occupancy, separated.
- Shared exits = Mixed Use
General Building Design

- Use Groups
- Hazardous Materials
- Control Areas
- Mixed vs. Separated Use
- Work Area
**Work Area**

- **Work Area:** The portion(s) of a building consisting of all reconfigured space as indicated on construction documents.

- **New building:** Comply with new requirements in NFPA 101-2015 and IBC-2009.

- **Existing building:** Comply with IEBC-2009 and Chapter 43 in NFPA 101-2015.
General Building Design

❖ Use Groups
❖ Control Areas
❖ Mixed vs. Separated Use
❖ Work Area
Marijuana Facilities

- What is Cannabis
- Hazards Associated with Cultivation
- The Extraction Process
- Hazards Associated with Extraction
- Extraction Room Design
Cannabis

- Cannabis is a flowering plant.
- Uses carbon dioxide (CO$_2$), light, and water to grow.
- Used for industrial, medical, and recreational purposes.
- Used in raw form or refined through extraction processes to create cannabis oil.
Cultivation Hazards

- Carbon Dioxide
- Fertilizers
- Fuel load
- Fumigation and Pesticides
Cultivation Hazards

- Carbon Dioxide
- Fertilizers
- Fuel load
- Fumigation and Pesticides
Carbon Dioxide (CO$_2$)

- Earth’s atmosphere contains approximately .04% CO$_2$ by volume.

- CO$_2$ dilutes oxygen (O$_2$).

- Used to cultivate plants.

- Can be used in the extraction process.
Carbon Dioxide (CO$_2$)

- CO$_2$ dispersion system.
- Per OSHA, the permissible exposure limit (PEL) for CO$_2$ is 5,000 PPM (0.5% by volume) over an 8-hour work day.
- Interlock CO$_2$ sources.
- Compressed gas.
Cultivation Hazards

- Carbon Dioxide
- Fertilizers
- Fuel load
- Fumigation and Pesticides
Many fertilizers include Ammonium Nitrate (NH₄NO₃).

Ammonium Nitrate explodes when introduced to a high enough activation energy

E.g.: West Fertilizer Company explosion in West, TX, in 2013.
Many fertilizers include Ammonium Nitrate ($\text{NH}_4\text{NO}_3$).

Ammonium Nitrate explodes when introduced to a high enough activation energy

E.g.: West Fertilizer Company explosion in West, TX, in 2013.
Best Practices

❖ Use fertilizers that have limited or no ammonium nitrate.

❖ \( \leq \text{MAQ} \) for reactive materials.

❖ \( \leq \text{MAQ} \) for oxidizers.
Cultivation Hazards

❖ Carbon Dioxide
❖ Fertilizers
❖ Fuel load
❖ Fumigation and Pesticides
Fuel Load

- Plants are susceptible to fire.
- Rack storage = unique problem.
Cultivation Hazards

- Carbon Dioxide
- Fertilizers
- Fuel load
- Fumigation and Pesticides
Fumigation and Pesticides

Toxic

Marijuana is illegal under federal law, so EPA can’t regulate pesticides for use on marijuana.

Extraction vs. concentration of pesticides?
Cultivation Hazards

- Carbon Dioxide
- Fertilizers
- Fuel load
- Fumigation and Pesticides
Disclaimer

疡 This presentation details how to conduct extractions.

疡 Extractions should always be done in professional settings.

疡 Extractions should never be done in residential occupancies.
Simulation of Butane Explosion

Credit: USA Today
The Extraction Process

- Multiple methods exist to extract cannabinoids (water, butters/food oils, CO$_2$, or solvents).

- Goal is to extract tetrahydrocannabinol (THC) from marijuana plants.
Extraction Hazards

- Flammable Liquids
- Liquid Petroleum Gas (LPG, LP-Gas)
- Compressed Gas (CO₂)
  - Reference previous slides.
Extraction Hazards

❖ Flammable Liquids

❖ Liquid Petroleum Gas (LPG, LP-Gas)
Flammable Liquids

Flammable liquids don’t burn.

Classification based on boiling temperatures and flashpoints.

Flammable vs. combustible liquids.
Flammable Liquids

- Extractions must be performed in a ventilated area.
- Electrical components shall comply w/ NEC.
- Proper storage and handling is required.
- Sprinkler protection is likely required.
Extraction Hazards

- Flammable Liquids
- Liquid Petroleum Gas (LPG, LP-Gas)
Liquid Petroleum Gas (LPG)

- Gas at normal room temperature and atmospheric pressure.
- Liquefies under moderate pressure and readily vaporizes upon release of pressure.
  - Transported and stored in liquid form.
- Mainly composed of propane, propylene, butane, and/or butylene.
Liquid Petroleum Gas (LPG)

- Extractions must be performed in a ventilated area.
- Electrical components shall comply w/ NEC.
- Proper storage and handling is required.
- Sprinkler protection is likely required.
- Automatic emergency power required for lighting, exhaust, and gas detection.
Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems
Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems
Construction & Location

- Noncombustible, fire-rated construction.
- Extraction room must be dedicated to the extraction process.
- Industrial buildings only.
- Many important details…
  Contact a Fire Protection Engineer.
Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems
Means of Egress

- Specific MOE for extraction rooms using hazardous materials.
  - Outward door swing.
  - Automatic closing device.
  - Panic or fire exit hardware.

- Similar precautions for electrical rooms.
Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems

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Electrical Classifications

Class I
Vapor-Air Mixture

Division I
Normal operations
Material Groups A, B, C, D

Division II
Unusual conditions
Material Groups A, B, C, D

Class II
Dust-Air Mixture

Division I
Normal operations
Material Groups E, F, G

Division II
Unusual conditions
Material Groups E, F, G

Class III
Fibers

Division I
Manufacturing
No material group

Division II
Non-manufacturing
No material group
Electrical Classifications

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Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems
Ventilation

Crucial for safe extractions.

Maintain vapors below lower flammability limit.

Perform extractions in **fume hood** or **exhausted enclosure**.

Interlock electrical components with fume hood or exhausted enclosure.
Fume Hood

❖ Not all are suitable for extractions.

❖ Ducted vs. Ductless.

❖ Use an indicator with filters.

Exhausted Enclosure

**Construction:**
- Locate air intake at ground level.
- Non-combustible ducts.
- Non-ferrous (no iron) propellers.
- Clearance and penetration requirements.

**Protect ducts with sprinklers.**

**Reference the Standard for Exhaust Systems for Air Conveying Vapors, Gases, Mists, and Particulate Solids (NFPA 91).**
Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems
Gas Detection System

 мн Sensor failure
- Activate/ transmit trouble signal.

 мн Pre-alarm (25% to <100% Lower Flammability Limit)
- Activate/ transmit supervisory signal.
- Alert extraction operator.

 мн Alarm condition (100% or higher LFL)
- Activate/ transmit alarm signal.
- Activate exhaust system (if not already done)
- Initiate notification devices.
Extraction Room Design

- Construction and location
- Means of Egress (MOE)
- Electrical classifications
- Ventilation
- Gas detection systems
Summary

- Extractions should always be done in professional settings.
- Important to understand quantity and location of hazardous materials.
- All preventative techniques are important, but ventilation is crucial.
- When in doubt... Contact a Fire Protection Engineer!

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Questions?

Thank you for your attendance!

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