Biodiesel

The Code Official's Perspective
- Fire Marshals
- Building Officials

Permitting and Occupancy

Fire Marshals & Building Officials
- Permit Process & Certificate of Occupancy
- NFPA 30 & IBC Chapter 4

Fire Marshals
- Ongoing/Annual Inspections

Statutory Authority

- 2005 State Building Code
  - authorized by CGS 29-252
  - Regulations of CT State Agencies 29-252-1d
  - Permits Required (CSBC 105.3)
  - Construction Documents (CSBC 106)
    - prepared by Design Professional (CSBC 106.1)
      - "Design Professionals" CSGS 29-276c
      - Engineer Required

Statutory Authority

- 2005 State Building Code
  - FM approval required (CSBC 105.3.1.2)
    - References Connecticut Fire Safety Code
      - CFSC Part II, Referenced Publications
        - CT Flammable & Combustible Liquids Code

Statutory Authority

- CT Fire Safety Code
  - Authorized by CGS 29-292
  - Regulations of CT State Agencies 29-292-1e to 29-292-11e
  - CFSC Part II, Referenced Publications
    - CT Flammable & Combustible Liquids Code

Statutory Authority

- CT Flammable & Combustible Liquids Code
  - Authorized by CGS 29-320
  - Regulations of CT State Agencies 29-320-1a to 29-320-4a
  - 29-320-3a adopts NFPA 30 – 1996

NFPA 30 – 1996

Flammable and Combustible Liquids Code Chapters

1. General Provisions
2. Tank Storage
3. Piping
4. Portable Containers
5. Operations

NFPA 30 – 1996

- **1-1 Scope**
  - **1-1.1** This code shall apply to the storage, handling, and use of flammable and combustible liquids, including waste liquids, as herein defined and classified.
  - Exceptions
    - certain special classes of liquids with unique hazards
    - liquids covered by NFPA 395
    - transportation governed by US DOT
    - fuel oil tanks connected with oil burning equipment

NFPA 30 – 1996

- **1-2 Purpose**. The purpose of this code shall be to provide reasonable requirements for the safe storage and handling of flammable and combustible liquids.

NFPA 30 - 1996

- **1-3 Applicability**. Chapters 2 and 3 shall apply to bulk storage of liquids in tanks and similar vessels. Chapter 4 shall apply to storage of liquids in containers and portable tanks in storage and in warehouses. Chapter 5 shall apply to handling of liquids in manufacturing and related operations and processes.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Refinery.** A plant in which flammable or combustible liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Storage Tank Building.** A roofed structure that contains storage tanks and that limits the dissipation of heat or the dispersion of flammable vapors or restricts fire-fighting access and control and that is installed in accordance with the requirements of Section 2-5.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Storage Tank.** Any vessel having a liquid capacity that exceeds 60 gal. (227 L), is intended for fixed installation, and is not used for processing.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Process or Processing.** An integrated sequence of operations. The sequence can be inclusive of both physical and chemical operations, unless the term is modified to restrict it to one or the other. The sequence can involve, but is not limited to, preparation, separation, purification, or change in state, energy content, or composition.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Atmospheric Tank.** A storage tank that has been designed to operate at pressures from atmospheric through 1.0 psig measured at the top of the tank.
  - **Low-Pressure Tank.** A storage tank that has been designed to withstand an internal pressure above 1.0 psig but not more than 15 psig measured at the top of the tank.
  - **Pressure Vessel.** Any fired or unfired vessel within the scope of the applicable section of the ASME *Boiler and Pressure Vessel Code*.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Stable Liquid.** Any liquid not defined as unstable.
  - **Unstable Liquid.** A liquid that, in the pure state or as commercially produced or transported, will vigorously polymerize, decompose, undergo condensation reaction, or become self-reactive under conditions of shock, pressure, or temperature.

NFPA 30 - 1996

- **1-6 Definitions**
  - **Protection for Exposures.** Fire protection for structures on property adjacent to liquid storage. Fire protection for such structures shall be acceptable when located either within the jurisdiction of any public fire department or adjacent to plants having private fire brigades capable of providing cooling water streams on structures on property adjacent to liquid storage.

NFPA 30 - 1996

- 1-7.3.1 Flammable Liquid
  - **Class I**
    - Flash Point < 100° F
    - Vapor Pressure <= 40psia @ 100° F
    - **Class 1A**
      - Flash Point < 73° F & Boiling Point < 100° F
    - **Class 1B**
      - Flash Point < 73° F & Boiling Point => 100° F
    - **Class 1C**
      - 73° F <= Flash Point < 100° F

NFPA 30 - 1996

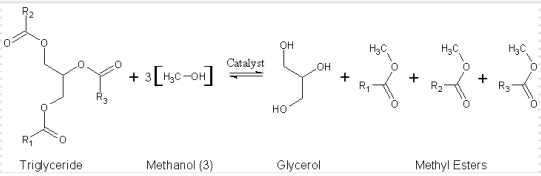
- 1-7.3.2 Combustible Liquid
  - **Class II**
    - 100° F < Flash Point <= 140° F
  - **Class IIIA**
    - 140° F <= Flash Point < 200° F
  - **Class IIIB**
    - Flash Point > 200° F

NFPA 30 - 1996

- **1-9.3 Exits.** Egress from buildings and areas covered by this code shall meet the requirements of NFPA *101®, Life Safety Code®.*

Applying NFPA 30

Ask the right questions!

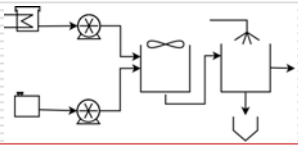


Facility Specific Data

- Construction Documents
  - Provide Detailed Physical Layout
    - plot plan
      - property lines
      - other important buildings
      - public ways
    - show every tank & process vessel
      - contents, capacities, purpose
    - determine required separations

Facility Specific Data

- Construction Documents
  - Provide Schematic Piping Plan
    - identify tanks and process vessels
    - identify valves and related appurtenances
    - identify product flow through entire system



Facility Specific Data

- Construction Documents
  - Provide MSDS for each chemical
    - determine hazard classes
      - Flammable
      - Combustible
    - determine occupancy group
      - Group I
      - Group H

Facility Specific Data

- Exactly what will the facility do?
  - Refining raw feed stock into Biodiesel?
    - Feed Stock & Alcohol ➔ B100
  - Blending Biodiesel with petrodiesel?
    - B100 & petrodiesel ➔ B20, B5, B2
    - fuel additives
      - anti-gel / pour-point depressants; may contain toluene
      - anti-contaminants; biocides & fungicides
      - stabilizers / antioxidants; may contain phenols

Facility Specific Data

- Exactly what will the facility do?
  - Dispensing Biodiesel fuels?
    - public service stations
    - fleet service stations
  - Using Biodiesel on the premises?
    - building heating
    - feed stock heating
    - farm equipment fueling

Common Chemicals

- "Biodiesel"
  - Fatty Acid Methyl Ester (FAME); Alkyl C_{14} – C_{24} methyl esters
    - "cetane" in petrodiesel is $C_{16}H_{34}$
  - Stable, Class IIIB Combustible
  - Non-toxic, environmentally friendly

Common Chemicals

- "Feed Stock"
  - Raw materials that will be processed into Biodiesel
    - most often vegetable oil, raw or recycled, but a wide variety of sources may be used
  - Stable, usually Class IIIB
  - "triglyceride"

Common Chemicals

- Methanol
  - Commonly known as "Wood Alcohol"; CH_3OH
  - Stable, Class 1B Flammable
  - Toxic (Poison B)
  - NFPA 704 1-3-0
  - Main ingredient in "Dry Gas" for automobiles
- Other alcohols may also be used
  - ethanol; "grain alcohol"; C_2H_5OH
  - propanol; C_3H_7OH
  - butanol; C_4H_9OH

Common Chemicals

- Sodium Hydroxide
  - commonly know as "Lye"; NaOH
  - alkaline catalyst
  - "Corrosive" (Caustic)
  - NFPA 704 3-0-1
- Potassium Hydroxide
  - also known as "Potash Lye"; KOH
  - alkaline catalyst
  - "Corrosive" (Caustic)
  - NFPA 704 3-0-1
- Sodium Methoxide
  - $Na(CH_3O)$
  - alkaline catalyst
  - "Corrosive" (Caustic)
  - NFPA 704 3-4-3

Common Chemicals

- "Methoxide"
  - as used in Biodiesel production, more properly termed a "metal hydroxide solution in methanol"
  - NaOH or KOH dissolved in methanol
  - Stable, Class IB flammable

Common Chemicals

- Glycerin/glycerol
  - Stable, Class IIIB Combustible
  - $HOCH_2CH(OH)CH_2OH$
  - used in soap making
  - sugar alcohol used in foods and beverages
  - also used to make nitroglycerin

Tank Storage

- 2-2 Fabrication
  - 2-2.3 Atmospheric Tanks
    - Constructed to Recognized Standards
      - UL, API, ASTM
  - 2-2.4 Low-Pressure Tanks
    - Constructed to Recognized Standards
      - UL, API, ASME
  - 2-2.5 Pressure Vessels
    - "not exceed the design pressure"

Tank Storage

- 2-3 Outside Aboveground Tanks
  - With Respect To Property Lines, Public Ways, and Important Buildings
  - Look up in Tables
    - Type & Size of Tank
    - Stable versus Unstable Liquids
    - Relief Venting Pressures
    - Protection of Exposures

Tank Storage

- 2-3.5 Tank Venting
  - Normal venting to account for day to day changes in pressure
- 2-3.6 Emergency Venting
  - emergency venting to prevent catastrophic tank failure during a fire exposure or other thermal insult

Tank Storage

- 2-5 Storage Tank Buildings
  - *Buildings with Storage Tanks in Them*
  - Class IIIB tanks only are exempt
- 2-5.1 Location & Exposure Hazards
- 2-5.2 Construction Integrity for 2 Hours
- 2-5.3 Ventilation (accumulation of vapors)

Tank Storage

- 2-5.4 Drainage (minimize fire exposure)
- 2-5.5 Vents (tanks vent outdoors)
- 2-5.6 Other Openings (properly secured)
- 2-5.7 Electrical Equipment (ignition sources)
- 2-5.8 Fire Prevention & Control

Tank Storage

- 2-6 Support, Foundations, & Anchorage
  - Are tank foundations adequate?
  - Aboveground / Underground
  - Building Official
- 2-7 Sources of Ignition
  - Safety Plan needed for CO
- 2-8 Testing & Maintenance
  - Tests needed for CO

Tank Storage

- 2-9 Fire Protection & Identification
  - Where required
  - NFPA 704
    - if Health or Reactivity => 2
    - or if Flammability = 4
- 2-10 Overfill Prevention
- 2-11 Leakage Detection
  - Underground Tanks

Piping Systems

- 3-1 Scope
  - piping, valves, fittings, etc.
  - devices for mixing, separating, distributing, metering, controlling flow, secondary containment of liquids and associated vapors, etc.
- 3-2 General
  - "suitable for the expected working pressures and stresses"
    - Conformance with ANSI B31 acceptable
    - Engineered alternatives
- 3-3 Materials for Piping, Valves, and Fittings

Piping Systems

- 3-4 Pipe Joints
  - acceptable joining methods
- 3-5 Pipe Supports
  - protection against physical damage
- 3-6 Protection against Corrosion
  - all piping systems subject to external corrosion
- 3-7 Underground Piping
  - vehicle traffic
  - separation in common trenches

Piping Systems

- 3-8 Valves
  - "a sufficient number of valves"
  - schematic plan showing entire process
    - show all tanks, process vessels, valves, pressure relief valves, check valves, etc.

Piping Systems

- 3-9 Testing
  - acceptable Criteria
    - applicable sections of ANSI B31
    - hydrostatic test at 150% maximum anticipated pressure
    - pneumatic test at 110% maximum anticipated pressure
      - test pressure not less than 5psi
  - test long enough for complete visual inspection
    - not less than 10 minutes
- 3-10 Identification
  - loading and unloading risers
    - color code or marking

Container & Portable Tank Storage

– Chapter 4 applies to storage of liquids in:

drums or other containers that don't exceed 60 gallons and

portable tanks that don't exceed 660 gallons

Chapter 4

- Design, Construction and capacity of:
  - Containers
  - Storage Cabinets
  - Operations of Inside Liquid Storage Areas
- Allowable Quantities and Storage Heights
- Operations – Dispensing
- Occupancies specific to incidental storage

Chapter 4

- Storage Lockers
- Spill or Leakage Control
- Storage Practices
- Outdoor Storage
- Fire Protection and Control

Chapter 5 Operations

Applies to operations involving the use or handling of F&C liquids as a principal or incidental activity except as covered elsewhere in this code or other NFPA standards.

5-3 Facility Design

- Where operations are a principal activity
- Liquid processing vessels and equipment location
- Table 5-3.2.1 for distances or
  - engineering evaluation and sound FP and process engineering practices.
  - Exception

5-3.3 Construction

- Processing Buildings or structures shall be of FR or noncombustible construction except combustible const. is permitted where AS or equivalent protection approved by AHJ

Chapter 5

- 5-3.4 Ventilation where liquids are heated above their flash points
- 5-3.5 deals with emergency drainage of liquids and FP water
- 5-3.6 Electrical Equipment

5-3.7 Liquid Handling, Transfer and Use

- Safely and promptly dispose of spills or leaks
- Positive displacement pumps shall be used
- Piping, valves and fittings Chapter 3
- Flexible connectors ok.

5-6 Loading and Unloading OPS.

- Specific Operational issues, i.e. Bonding
- Switch Loading from one type of liquid to another in tank vehicles.
- Section on loading and unloading of tank vehicles

5-9 Control Of Ignition Sources

- Open flames,
- Smoking
- Static electricity
- Stray currents etc.

5-10 Vapor Recovery/Processing

- Overpressure/Vacuum Protection
- Vent Location
- Vapor Collection Systems
- Overfill Protection
- Sources of Ignition
- Emergency System Shutdown

5-11 Management of Fire Hazards

- Applies to the management methodology used to identify, evaluate, and control the hazards…. Processing and handling of F&C liquids
- Extent of FP and control …determined by means of an engineering evaluation of sound FP and process engineering principals.

5-11 Management of Fire Hazards

- Written Emergency action plan
  - Procedures to follow for fires and emergencies
  - Appointment and training of personnel
  - Maintenance of FP equipment
  - Shut down/isolation of equipment to reduce the release of liquids
  - Alternate measures for the safety of occupants

5-12 FP and Fire Suppression

- General info
- Portable Fire Control Equipment
  - listed portable fire extinguishers
  - NFPA 14 systems (Standpipe and Hose)
  - NFPA 13 hose connections from sprinkler systems

5-12 FP and Fire Suppression

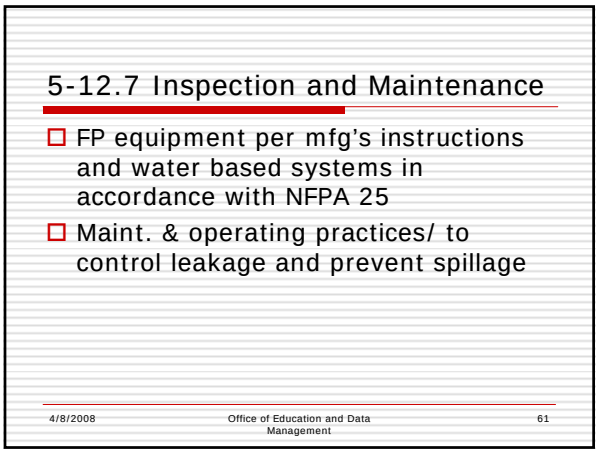
- Fixed Fire Control Equipment
  - Reliable water supplies
  - Hydrants
  - AS, Water spray systems, deluge systems, fire resistive materials or a combination of these.
  - Where provided systems maintained in accordance with respected NFPA standards.

5-12.5 Detection and Alarm

- Approved means shall be provided for prompt notification of fire or emergency within the plant and FD

5-12.6 Emergency Planning and Training

- Persons trained in use and operation of FP equipment Refresher annually
- Planning be coordinated with local emergency response folks
- Safe shut down of operations
- Plan be readily avail.
- If premises unattended, posted located strategically


5-12.7 Inspection and Maintenance
FP equipment per mfg's instructions and water based systems in accordance with NFPA 25
Maint. & operating practices/ to control leakage and prevent spillage
4/8/2008
Office of Education and Data Management
61