

Fire Inspector Certification Program

New Jersey Uniform Fire Code Inspector training program

Module 12 Hazardous Materials Part 1



1

Hazardous Materials

In this module we will begin discussing...

- How the NJIFC defines Hazardous Materials,
- Basic hazardous materials chemistry,
- Placard and safety data sheets
- State and federal regulations,

2

Hazardous Materials

We will also discuss...

- Performance requirements
- Emergency Plan (HMMP)
- Control areas and exempt amounts
- Storage, Secondary containment,
- Discharges and local response protocols,
- High-hazard provisions of the UCC,
- Chapters 50 through 67 of the NJIFC, and High Level Alarm Requirements.

3

What is a Hazardous Material?

Hazardous materials:

■ Those chemicals or substances which are physical hazards or health hazards as defined and classified in this chapter, whether the materials are in a usable or waste condition



These fit two broad categories

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Why do we regulate them in a fire code?

?

This is important. Many people fail to understand that the fire code has historically regulated hazardous materials from a health, safety and welfare perspective for occupants, the general public and responding firefighters. The growth of agencies such as NJDEP and USEPA were in response to environmental impacts and that still remains their primary focus. The fire code goes beyond that focus by regulating the safety of individuals. The mere presence of a hazardous material in an otherwise routine fire situation raises the bar on the safety threats to those exposed to the fire scene and firefighters operating at the scene.

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Chapter 50 Hazardous Materials



Video : Danvers port Massachusetts

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Physical Hazard: 5001.2.2.1

Explosive
Flammable & Combustible
Liquids
Flammable Solids & Gases
Organic Peroxides
Oxidizer
Pyrophoric
Unstable (reactive)
Water Reactive
Cryogenic



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Health Hazard: 5001.2.2.2

A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons.

- includes chemicals which are
 - Highly toxic and toxic materials
 - Corrosives materials
 - Radioactive materials



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Highest Volume Chemicals-US

■ Sulfuric acid	88.8 billion lbs...
■ Nitrogen	8.7 billion lbs...
■ Oxygen	42.4 billion lbs...
■ Ethylene	40.4 billion lbs...
■ Ammonia	36 billion lbs...
■ Lime	34.7 billion lbs...
■ Phosphoric Acid	25.4 billion lbs...
■ Sodium Hydroxide	24.0 billion lbs...
■ Propylene	22.6 billion lbs...
■ Chlorine	22.3 billion lbs..
■ Nitric acid	16.1 billion lbs..

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How do you identify their presence?

We use the same clues taught to the First Responder when covering the 'Recognition and Identification of Hazardous Materials.'



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Hazardous Material Information/Clues

■ Location & Occupancy type



■ Placards/Labels



■ Container shapes












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UN / DOT Classification

Hazard Class Name	Hazard Class Number	Color
Explosives	1	Orange
Poisonous Gases	2	White
Compressed Gases	2	Green
Flammable Gas	2	Red
Flammable Liquids	3	Red
Flammable Solids (dangerous when wet)	4	Blue/Red/White
Oxidizers	5	Yellow
Poison Liquids	6	White
Radioactive Substances	7	Yellow/White
Corrosives	8	Black/White
Miscellaneous Hazardous Materials	9	

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UN/DOT Classifications


UN HAZARD CLASSES & WARNING DIAMONDS				
Class 1 	Class 2 	Class 3 	Class 4 	Class 5 
Class 6 	Class 7 	Class 8 	Class 9 	

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Global Harmonization System

GHS Labels		
 Explosives - May explode if exposed to fire, heat, shock, friction.	 Flammable - May ignite if exposed to ignition sources, sparks, heat. Some substances may give off flammable gases.	 Corrosives - May cause skin burns and permanent eye damage.
 Gases under pressure - Gas released may be very cold. Gas container may explode if heated.	 Toxic material which may cause life threatening effects even in small amounts and with short exposure.	 Toxic to aquatic organisms and may cause long lasting effects in the environment.
 Irritant - May cause irritation (redness, rash) or less serious toxicity.	 May cause serious and prolonged health effects on short or long term exposure.	

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NFPA-704

- Firefighter warning placards designed to be used on fixed facilities, storage, warehousing, laboratories.
- System is designed to provide firefighters with information to protect themselves.
- The NFPA-704 "Diamond" provides a hazard assessment of "Flammability", "Reactivity" and "Health" hazards & Special Information

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NFPA-704

Five degrees of fire hazard:

- **4 = Fire too dangerous to approach with standard fire fighting equipment and procedures; obtain expert advice**
- **3 = Fire can be fought using methods intended for extremely hazardous situations, such as remote monitors & PPE that prevents bodily contact.**
- **2 = Fire can be fought with standard procedures but hazards are present and can only be handled with certain special equipment.**
- **1 = Nuisance hazards are present and require some care**
- **0 = No special hazards are present**

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Placards & Labels in use



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Placards & Labels in use



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Placards & Labels in use



Labels on Cabinet

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Placards & Labels in use



Labels on containers

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Container Types



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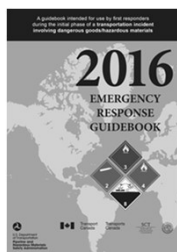
How do we identify the hazards?

- Safety Data Sheet -SDS
- RTK Hazardous Substance Fact Sheets
- NIOSH pocket guide
- NAERG-Emergency Response Guide
- Wireless Info Sys for Emerg. Resp. (WISER)
- Amer. Conf. Gov.Inds Hygienist (ACGIH)
- NFPA Hazardous Materials Guide
- Others.....

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NAERG

- Placard information
- DOT Identification number
- Alphabetical listing by shipping names
- Isolation tables
- Water reactive materials



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Safety Data Sheets (SDS)

New 16-section standardized SDS format required (ANSI Z400.1)

- | | |
|--|---|
| Section 1 – Identification | Section 10 – Stability and Reactivity |
| Section 2 – Hazard(s) identification | Section 11 – Toxicological Information |
| Section 3 – Composition / Information on Ingredients | Section 12 – Ecological Information* |
| Section 4 – First-aid Measures | Section 13 – Disposal Consideration* |
| Section 5 – Fire-fighting Measures | Section 14 – Transport Information* |
| Section 6 – Accidental Release Measures | Section 15 – Regulatory Information* |
| Section 7 – Handling and Storage | Section 16 – Other information including date of preparation of last revision |
| Section 8 – Exposure Controls / Personal Protection | |
| Section 9 – Physical and Chemical Properties | |

Inspector must make sure they are available and current

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NJ-DEP, US-EPA, US-DOT?

- US-EPA – Enforces regulations intended to protect the environment.
- US-DOT – Enforces regulations intended to provide for the safe transport of hazardous materials.
- NJ-DEP – Enforces US-EPA and NJ regulations intended to protect the environment. Provides emergency response assistance for spills.

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Hazardous Materials Chemistry

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Hazardous Materials Chemistry

- ***The Fire Inspector should understand the following chemical properties:***
 - *Flash point*
 - *Boiling point*
 - *Flammable range*
 - *Vapor density*
 - *Specific gravity*
 - *Auto ignition temperature*

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Hazardous Materials Chemistry

Flash Point

- *The minimum temperature in degrees Fahrenheit at which a flammable liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion.*
- *The flash point of a liquid shall be determined by ASTM D56 and D93.*

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Hazardous Materials Chemistry

Boiling Point

- *The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch or 760 mm of mercury.*



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Hazardous Materials Chemistry

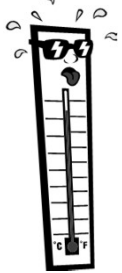
Flammable limits

- *Lower Flammable Limit - Minimum percent of vapor to air needed to cause an ignition or explosion.*
 - *Below LFL vapor is too lean to burn*
- *Upper Flammable Limit - Maximum percent of vapor to air needed to cause an ignition or explosion.*
 - *Above UFL vapor is too rich to burn*
- *Flammable Range LFL to UFL*

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Hazardous Materials Chemistry

Vapor Pressure



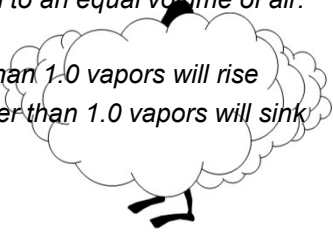
- Pressure exerted by escaping molecules from the surface of a liquid against the sides of a container at equilibrium
- Vapor pressure is temperature dependent

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Hazardous Materials Chemistry

Vapor Density

- The density of a volume of a vapor as compared to an equal volume of air.
- Air = 1.0
- VD less than 1.0 vapors will rise
- VD Greater than 1.0 vapors will sink



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Hazardous Materials Chemistry

Specific Gravity

- Weight of a liquid as compared to an equal volume of water
- Water = 1.0
- SG less than 1.0 material floats
- SG greater than 1.0 material sinks

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Permit Requirements

NJAC 5:70-2.7

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Type – 1 permits

■ Class-I flammable liquids:

- More than 10 gallons but less than 660 gallons inside
- More than 60 gallons but less than 660 gallons outside.

■ Class –II & IIIA combustible liquids:

- More than 25 gallons but less than 660 gallons inside
- More than 60 gallons but less than 660 gallons outside.

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Type – 4 Permits

- Portable tanks and containers with capacity more than 660 gallons of flammable or combustible liquids
- More than 2,000 cubic feet of flammable compressed gases or 6,000 cubic feet of non flammable compressed gases
- Production or sale of cryogenic liquids
- Use or storage of 10 gallons or more flammable cryogenic liquids, liquid oxygen or organic peroxides or more than 500 gallons of non-flammable or non-toxic cryogenic liquids.

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Type – 4 Permits

- *Storage or handling of:*
 - *More than 55 gal. Corrosives*
 - *More than 500 lbs. oxidizers*
 - *More than 10 lbs. organic peroxides*
 - *More than 500 lbs. of nitromethane*
 - *More than 1,000 lbs. of ammonium nitrate*
 - *More than 10 lbs. of flammable solids*
 - *More than 10 lbs. of magnesium used per working day*

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Type – 4 Permits

- *More than 1 micro curie of radium not contained in a sealed source*
- *More than 1 micro curie of radium contained in a sealed source.*
- *Any amount of radioactive materials regulated by the NRC.*



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Hazardous Materials

2015 IFC NJ
Chapter Over View

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Chapter 50

- 5001 General
- 5002 Definitions
- 5003 General Requirements
- 5004 Storage
- 5005 Use, Dispensing and Handling
- 5006 Hazardous Material Tank Vehicles
- 5007 Radioactive Materials

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Chapter 50

- 5001 General
 - Defines scope and exceptions
 - Categorizes hazard classes
 - Performance based alternatives
 - Hazardous Materials Management Plan
 - Hazardous Material Inventory Statement
 - Facility closure process

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Chapter 50

5001.3.3 Performance requirements

- *The Fire Code Official may permit a design alternative to requirements established in Chapters 51 to 67 if the owner provides the following for approval*
- 5001.3.1 thru 5001.3.18



Chapter 50

5001.5 Facilities documentation

- HMMP – Hazardous material management plan
 - Liaison to fire department
 - Hazard classes for each area
- HMIS
 - SARA Tier I or II report
 - Inventory
 - MSDS sheets
- Lock box locations – fire prevention code

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NJ –ESIS Report – March 1st

- Tier-II (ESIS-NJ)
 - Chemical name and common synonym
 - Estimated maximum amounts
 - Estimated Average daily amounts
 - Manner of storage
 - Location within facility
 - Public disclosure

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Chapter 50

- 5003 General Requirements.
 - Quantity allowed in control areas
 - Systems, equipment processes
 - Tables for calculating allowable storage
 - Tank requirements (above and below ground)
 - Testing requirements
 - Procedures to limit unauthorized release
 - SDS Sheets
 - Signage

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Control Areas & Exempt Amounts Section 5003.8.3 H- Use Group Alternatives

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CHAPTER 50

5003.8.3 Control Areas

- *Control areas are established under the Uniform Construction Code*
- *They are an alternative to High Hazard use, but must be followed properly*
- *Building, rooms or spaces exceeding the exempt amount tables must be classified H-1, H-2, H-3, H-4, or H-5 based upon the hazardous materials used.*

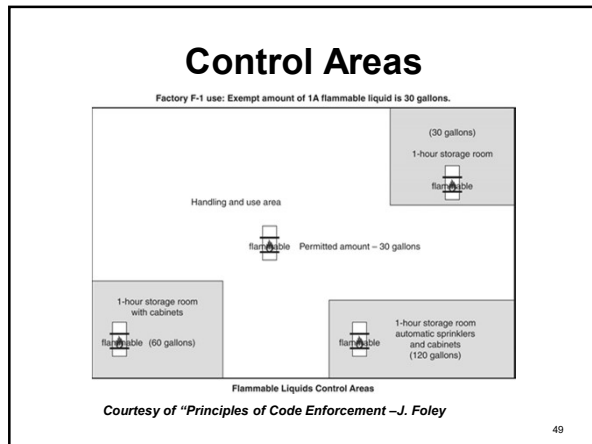
IFSTA Chapter 10 p 434

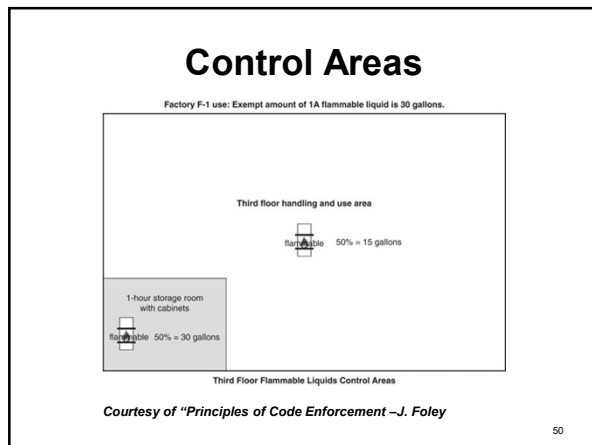
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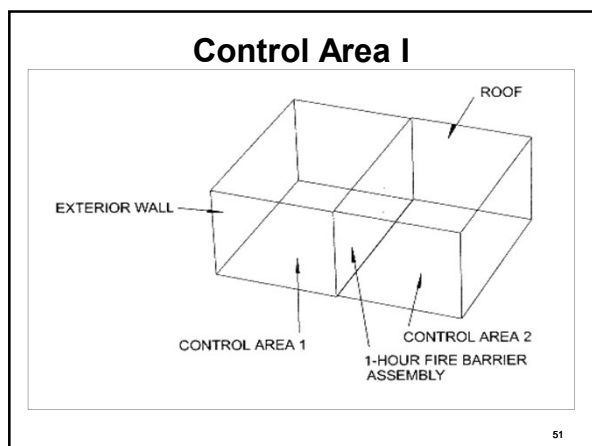
Table 5003.8.3.2 IFC 2015 NJ

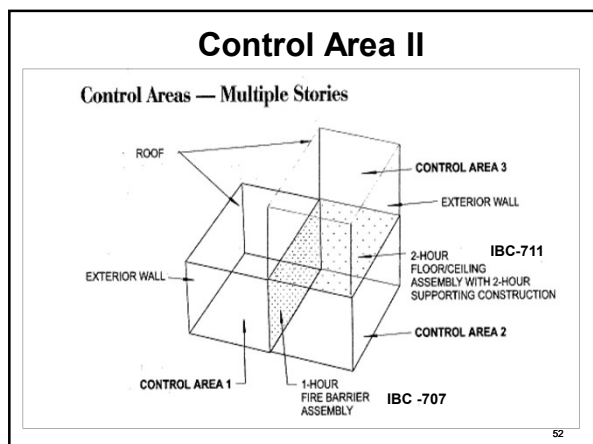
Floor level	% of exempt Amt.	# of control areas	Fire Resistance
Over 9 story	5%	1	2 hour
7-9	5%	2	2 hour
6	12.5%	2	2 hour
5	12.5%	2	2 hour
4	12.5%	2	2 hour
3	50%	2	1 hour
2	75%	3	1 hour
1	100%	4	1 hour
1 below	75%	3	1 hour
2 below	50%	2	1 hour

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Sample Problem

- *How much flammable compressed gas may be stored in a second floor control area in a sprinklered S-1 warehouse ?*
- *What is the fire resistance rating?*
- *How many control areas are permitted ?*
- *What is the maximum amount permitted before a change of use occurs?*

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Answer

1. *Table 5003.1.1(1) –storage allows 1,000 cu ft at NTP*
2. *Fire sprinklers allow 100% increase to 2,000 cu ft at NTP*
3. *Second floor control area decreases to 75% of 2,000 cu ft at NTP = 1,500 cu ft at NTP*
4. *The fire resistance rating is 1 hour*
5. *They may have 3 control areas*
6. *The maximum permitted in three sprinklered control areas would be 4,500 cu ft at NTP*
7. *Above this amount area is classified H-2*

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Fire Inspection Points

■ Control Areas:

- Determine quantities and types of hazardous materials
- Identify floor level
- Identify fire protection requirements
- Identify minimum fire resistance of walls and floor ceiling assemblies
- Determine proper storage arrangements, storage height, aisle space, fire extinguishers, spill control, ventilation.

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General Storage



- Store chemicals according to DOT hazard class
- Store away from sunlight & localized heat
- Do not mix acids, bases, and flammables
- Segregate water reactive from flammable
- Keep peroxide forming chemicals in a cool dry place
- Keep oxidizers away from flammables, and reducing agents
- Keep toxic separated from other chemicals
- Don't store liquid and solid chemicals together

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CHAPTER 50

Material Safety Data Sheets 5003.4

- **MSDS or SDS shall be readily available for all hazardous materials present at a facility.**

– Exception : designated hazardous waste



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CHAPTER 50

5003.8.6 Gas Cabinets

- When used to increase maximum quantities shall comply with Chapter 60
- Self closing doors
- Limited access ports and control access
- Compatible with materials used
- May not exceed three cylinders to a cabinet



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CHAPTER 50

Hazardous Materials Storage Cabinets

- Inside cabinet materials must be treated or coated to be non-reactive with HM being stored or listed to UL-1275
 - Construction 18 gage steel
 - Double walled 1-1/2 " air space
 - Doors self closing and latching
 - 2 inch liquid tight well at bottom for storage of liquids

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Hazardous Materials Storage Cabinets



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Chapter 50

5003.9 General Safety Precautions

- Personnel working with HM shall be trained
- Fire department liaison shall be designated under HMMP
- Security shall be provided as approved by the Fire Code Official
- Tanks shall be protected from vehicle impact (section 312)
- Electrical wiring shall conform to UCC
- UV and/or shock sensitive shall be protected
- Incompatible materials shall be separated as specified

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CHAPTER 50

5003.9.10 Safety Cans

- Listed to UL-30
 - Used to Increase maximum allowable quantity 5003.1.1(1)
- Listed to UL-1313
 - when not used to increase maximum allowable quantity in control area



UL-30



UL-1330

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CHAPTER 50

5003.10.2 Carts

- Liquids in containers exceeding 5 gallons shall be transported on carts in corridors
- Four exceptions as noted in Code

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5004 Storage

- *Storage exceeding exempt amounts must comply with 5001, 5003 & 5004*
- *Storage not exceeding exempt amounts must comply with 5001 & 5003 only*



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Chapter 50

- *5004.2 Spill Control Spill control shall be provided when individual vessels exceed 55 gallons or multiple vessels exceed 1,000 gallons of liquid.*
- *5004.2.2 Secondary Containment As Required by Table 5004.2.2*
- *5004.2.2.5 Monitoring An approved method must be in place*

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Example: Floor Spill Containment



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Chapter 50

5005 Use, Dispensing, & Handling

- *Use, dispensing and handling hazardous materials over the exempt amounts shall be in accordance with 5001, 5003, 5005*
- *Use dispensing and handling hazardous materials under the exempt amounts shall be in accordance with 5001 & 5003*



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CHAPTER 50

5005 Use, Dispensing, & Handling

■ **Requirements:**

- *Separation of incompatible materials*
- *Open systems shall be on non combustible floor that are liquid tight*
- *Spill control and secondary containment shall be provided*
- *Limit controls shall be provided*

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CHAPTER 50

5005 Use, Dispensing, & Handling

■ **Requirements:**

- *Standby & emergency power*
 - *Ventilation, temperature controls, alarms, detection and other electrically controlled systems*
- *Supervision & monitoring*
 - *Audible and visual signals – constantly attended location*
- *Lighting – natural or artificial*
- *Fire suppression system*
 - *Ordinary hazard group II over 3,000 sq ft.*
- *Ventilation*
 - *Mechanical exhaust system or natural ventilation if approved*

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CHAPTER 50

5005.1.10 Liquid Transfers



Transfer by approved pumps



Transfer by Gravity

Gravity not approved for flammable liquids

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CHAPTER 50

5006 Tank Truck Vehicles

- *Vehicles shall not be left unattended*
- *Operator shall be present during loading and unloading*
- *Motor shall be shut off during loading and unloading operations and when breaking connections*

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CHAPTER 50

5006 Tank Truck Vehicles



Operator must be present during loading and unloading

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CHAPTER 50

5007 Radioactive Materials

- *Maximum in 1 control area – 25 REM (1 hour or less) whole body from unsealed source*
- *Maximum 100 REM (1 hour or less) whole body from sealed source*
- *Warning signs required*
- *When not in use must be shielded as follows:*
 - *200 milli-roentgen at any point on container*

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CHAPTER 50

5007 Radioactive Materials

- *Outside storage – 25 feet from property line, public way, street or exit discharges*
 - *Exception separated by 2 hour fire separation wall extending 30 inches above and on sides of storage*



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Chapter 51- Aerosols



Chapter 51

- 5101 General
- 5102 Definitions
- 5103 Classification of Aerosol Products
- 5104 Inside Storage of Aerosol Products
- 5105 Outside Storage
- 5106 Retail Display
- 5107 Manufacturing Facilities

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Kmart Warehouse –Falls Twp PA



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CHAPTER 51

5103 Classification of Aerosols

TABLE 5103.1
CLASSIFICATION OF AEROSOL PRODUCTS

CHEMICAL HEAT OF COMBUSTION		AEROSOL CLASSIFICATION
Greater than (Btu/lb)	Less than or equal to (Btu/lb)	
0	8,600	1
8,600	13,000	2
13,000	—	3

For SI: 1 British thermal unit per pound = 0.002326 kJ/g.

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CHAPTER 51

5104 Inside Storage

- **Use: A,B,E,F,I & R Level 2&3 shall be limited:**
 - 1,000 pounds –Level II
 - 500 pounds – Level III
 - Combined 1,000 pounds Level II & III
 - 100% increase for storage cabinets
- Additional requirements as noted in the chapter

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CHAPTER 51

5106 Retail Display

- **Storage limits based on Level**
- **Specific details for height and shelving**
- **Restrictions for basement and upper floors display**
- **Quantity displayed must be outside combustible cartons**
- **Separation between Level 2 and 3 as stated**

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Chapter 53



Compressed Gases

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Chapter 53

- 5301 General
- 5302 Definitions
- 5303 General Requirements
- 5304 Storage of Compressed Gases
- 5305 Use and Handling of Compressed Gases
- 5306 Medical Gases
- 5307 Carbon Dioxide(CO2) systems in Beverage dispensing applications
- 5308 Compressed Gases Not Otherwise Regulated
- 5309 Storage of Potable compressed gas cpmtainers awaiting use or resale

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CHAPTER 53

5301 General

- *Storage, use and handling of compressed gas cylinders shall be in compliance with this chapter and NFPA 55*
- *Empty or partial full compressed gas cylinders shall be considered full for the purpose of controls required.*

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CHAPTER 53

5303 General Requirements

- *Cylinders shall comply with DOT 49 CFR 100-185*

Government Agency
Supervision/Approval

Working Pressure

Metal Type

DOT/CTC 3AA 2250

Serial Number

Manufacturer

Hydrostatic Test Date

Hydrostatic Tester's Mark

10% Overfill Allowed

12345 PST 6096X

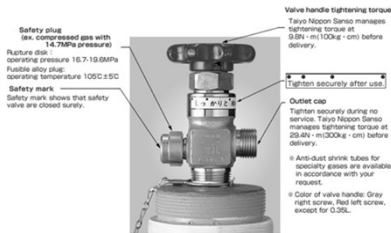


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CHAPTER 53

5303.3 Relief Valves

- *Cylinders must have a pressure relief device*



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CHAPTER 53

5303.5 Security

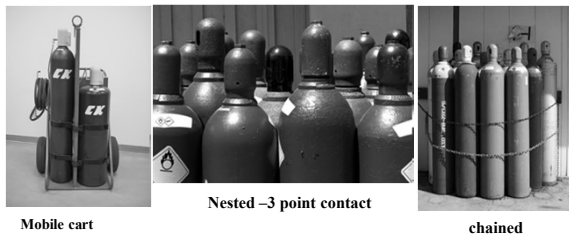
- *Cylinders must be secure or restrained*
- *Storage areas must be secure*
- *Cylinders must be protected from vehicle impact (312)*



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CHAPTER 53

5303.5.3 Securing Cylinders



Mobile cart

Nested -3 point contact

chained

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CHAPTER 53

5303.6 Valve Protection

- Caps and valve protection devices shall be on cylinder when not in use.
- Cylinders designed to be in place during operation shall have them in place



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CHAPTER 53

5303.7 Separation from Hazardous Conditions

- Incompatible gases must be separated
- Storage must be clear of combustible vegetation 10 feet
- Must be protected from extreme temperatures
- Proper storage containers or vaults shall be used

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CHAPTER 53

5306-Medical Gases

- Dedicated interior storage area
- over the exempt amount 1 hour fire resistance
 - Room shall be mechanically vented to exterior
- Medical gas systems (LOX) comply with NFPA 99



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CHAPTER 53

5309 Containers Awaiting Use of Sale

- Must have proper security
- Only trained personnel may remove or replace cylinders
- Storage shall be protected from extreme temperature
- 25 feet from a building opening
- Signs "Compressed Gas – Flammable"
- Fire extinguisher
- ventilation

New Jersey only insertion



Chapter 54



Corrosive Materials

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CHAPTER 54

5403 General Requirements

- **Storage shall comply with requirements of Chapter 50**
 - Under exempt amounts per control area: 5001, 5003, & 5004.1
 - Over the exempt amounts per control area: 5003.1
 - Outdoor storage shall comply with Chapter 50 Table 5003.1.1 (4)
 - Tanks exceeding 1,000 gallons shall have secondary containment
 - Storage shall be 20 feet from buildings and lot lines or protected by a 2 hour fire resistant wall 30 inches above the height of the storage

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CHAPTER 54

Corrosive Storage



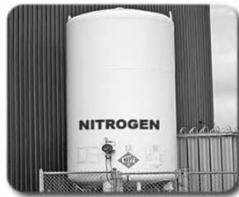
Indoor storage cabinet



Outdoor storage vault

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Chapter 55 - Cryogenic Liquids



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Chapter 55

- 5501 General
- 5502 Definitions
- 5503 General Requirements
- 5504 Storage
- 5505 Use and Handling

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CHAPTER 55

5503-General Requirements

- Containers shall be approved for use of cryogenic materials
- Barriers and tank foundations shall be compatible materials for cryogenic storage –150F
- Pressure relief devices shall be provided
- Tanks shall be marked and placarded to NFPA 704
- Tanks shall have area security including vaporizers and shall be separated from other hazardous materials

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CHAPTER 55

5504 - Storage

- Indoor: Constructed to UCC with ventilation as required
- Outdoor: proper separation and drainage
- Tanks shall be of proper construction
- Tanks must be properly vented and have overfill protection
- Remote point of fill connections shall be positioned the same distance to exposures as stationary tanks
- Areas shall have proper drainage if subject to flooding

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Cryogenic Systems



Stationary Tanks

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Cryogenic Storage



Small containers



Wheeled containers

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CHAPTER 55

5505- USE AND HANDLING

- Cryogenic systems shall be designed by competent engineering.
- Piping shall be physically protected and protected from corrosion
- Piping shall be tested to 150% of working pressure
- Manual and automatic shut off valves shall be provided
- Dispensing and filling shall occur in an approved area with proper ventilation
- Vehicle loading and unloading shall have limit controls

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CHAPTER 55

5505-Cryogenic Transport

Cryogenic truck



Cryogenic cart



Cryogenic trailer



- Containers shall be moved by approved methods on proper hand trucks or carts

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End Module –Part -1



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