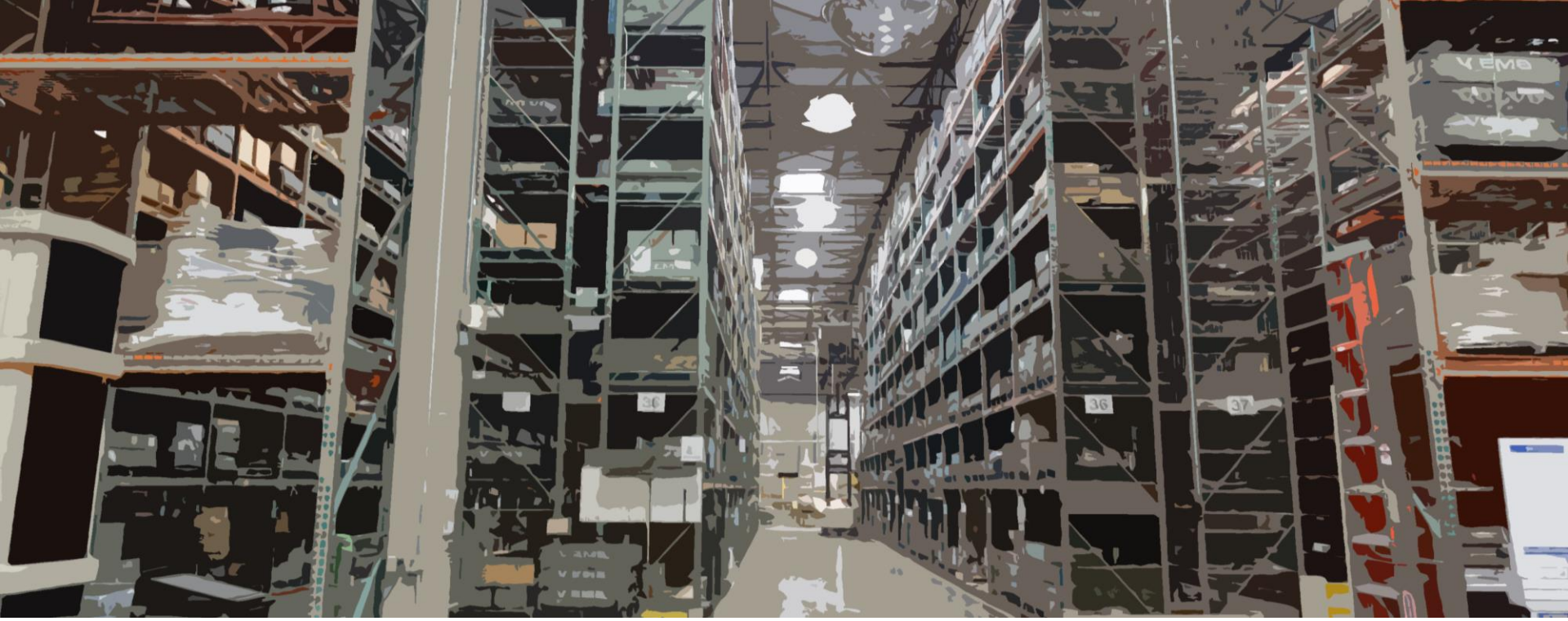


IFC® Chapter 32: High-Piled Combustible Storage

2018 Washington State Fire Prevention Institute

Chelan, Washington

YOUR INSTRUCTOR

Rob Neale, MA, CFPS

Principal

Integra Code Consultants

Former:

Vice President: National Fire Service Activities
International Code Council

Deputy Superintendent: Curriculum and Instruction
US National Fire Academy

Fire Chief
Lynden - Fire District No. 3, Washington

Fire Marshal/Building Services Manager
Bellingham Fire Department, Washington

GOAL

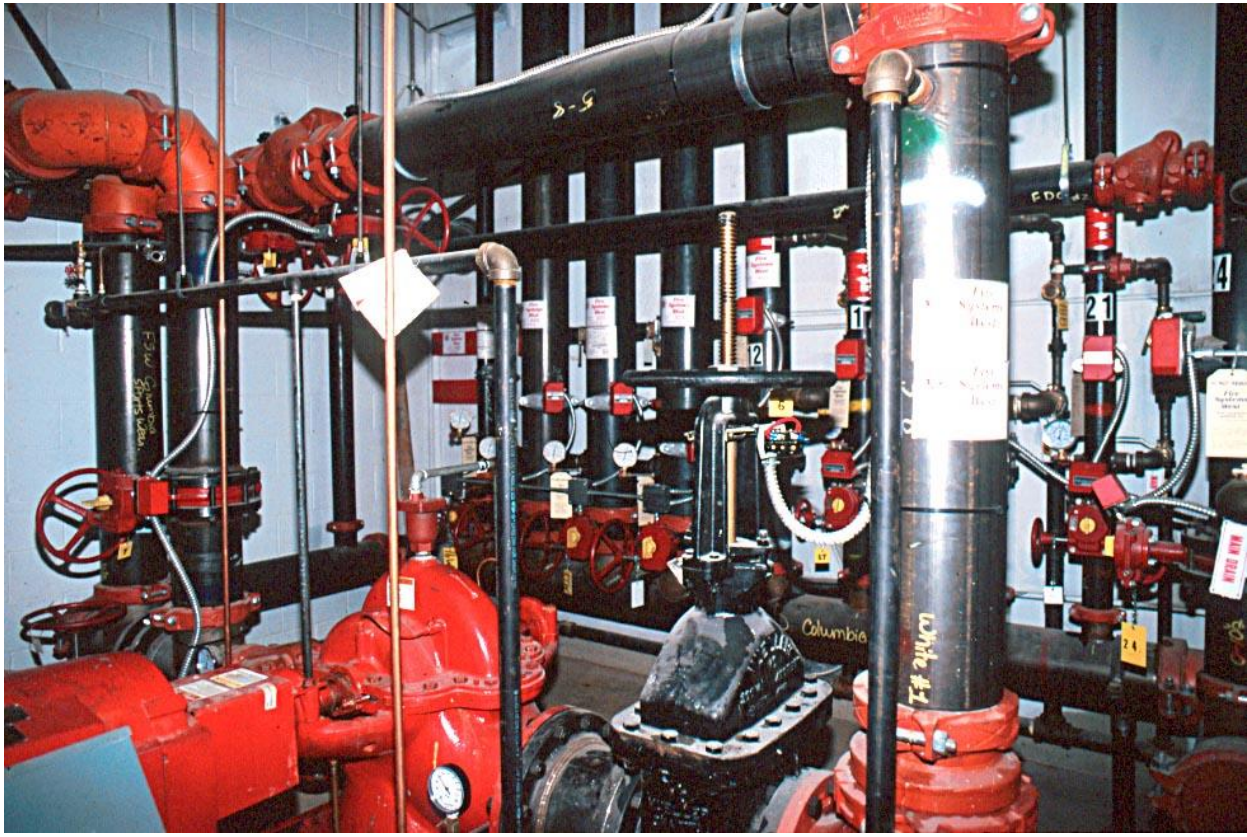
Improve your understanding of the life safety and fire protection requirements in high-piled combustible storage environments.

YOUR QUESTIONS

What specific questions do you have about IFC® high-piled combustible storage requirements?

NOT INCLUDED TODAY

Due to limited time, we *will not* cover the detailed requirements, specifications and design standards for fire detection or suppression systems.



PRESENTATION OBJECTIVES

Upon completion, you will be able to outline the 2018 *International Fire Code*® requirements for high-piled combustible storage.

To accomplish this, you will able to:

1. Describe the scope and application of IFC® Chapter 32.
2. Explain the code definitions applicable to Chapter 32.
3. Explain commodity classification based on Section 3203 criteria and interpret Figures 3203.9.1(1) and (2).
4. Interpret Table 3206.2 to apply the high-piled combustible storage requirements for plan review and inspections.

PREREQUISITE KNOWLEDGE

Familiarity with *International Fire Code*® adoption and use

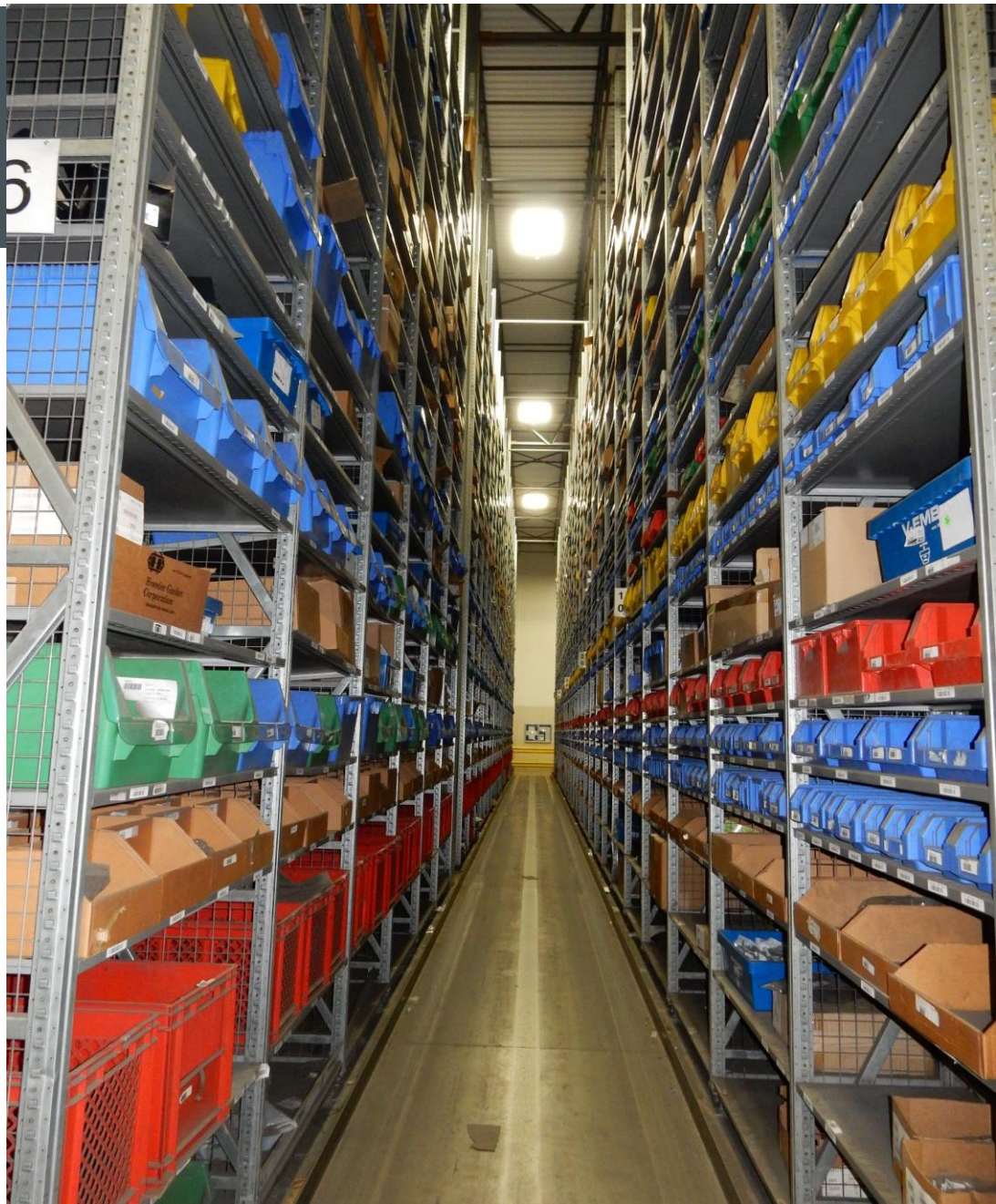
- Mandatory standard references to NFPA 13 and 72
- IFC® Chapters:
  - 315: General Storage

International Building® and *Fire Code*® occupancy classifications

Use of "§" to represent code section numbers

COURSE OUTLINE

- High-Piled Storage Practices
- Commodity Classifications
- Storage Area Requirements
- Fire Protection Requirements
- Case Study: Austin, Texas



IFC® DEFINITION: HIGH-PILED STORAGE

Photo courtesy The Boeing Company

"Storage of combustible materials in closely packed piles or combustible materials on pallets, in racks or on shelves where the top of storage is greater than 12 feet in height".

HIGH-PILED STORAGE (CONT'D)

"When required by the fire code official, high-piled combustible storage also includes certain high-hazard commodities, such as rubber tires, Group A plastics, flammable liquids, idle pallets and similar commodities, where the top of storage is greater than 6 feet in height".

MODULE #1

HIGH-PILED STORAGE PRACTICES

WHY HIGH-PILED?

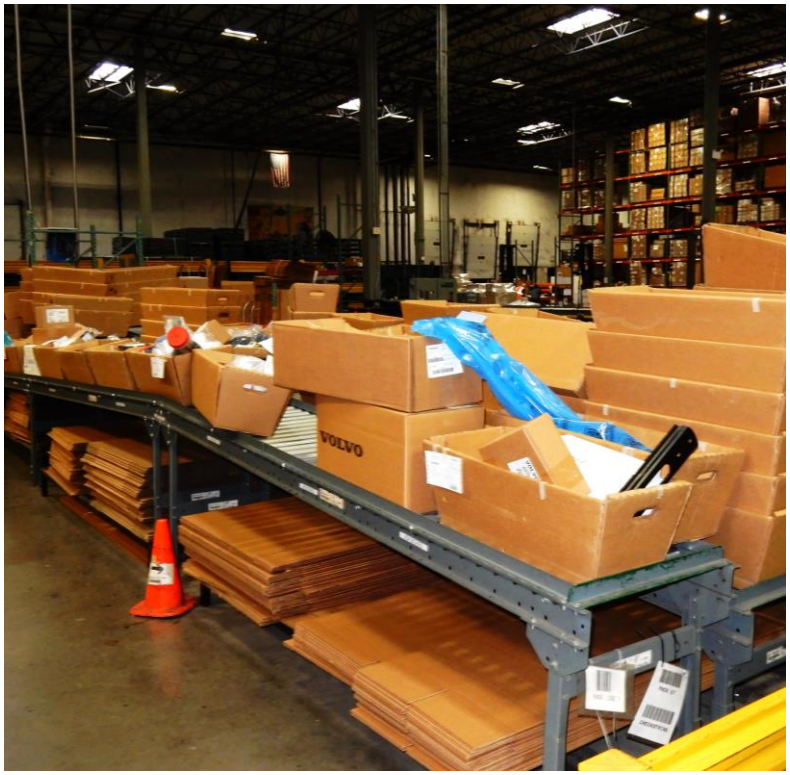
- High-piled storage arrays:
  - allow the owner or tenant to maximize amount of goods stored in a smaller footprint,
  - enable rapid construction of large, low-cost warehouses near shifting population and transportation nodes, and,
  - increase efficiency in product handling within the storage configuration.

FIRE CHALLENGES

- Increased fuel loads per square foot
  - Undeclared commodity changes
- Increased potential fire loss per square foot
  - Smoke damage to unburned products
- Rapid structural failure
  - Building, racks, storage piles
  - First responder endangerment
- Losses can surpass the building construction value

Courtesy: The Boeing Company

HIDDEN "WATCH-OUTS"



- "Undeclared" high-piled storage areas
- Storage areas within manufacturing plants
- Shipping and receiving areas of any business
- Speculation warehouses or general storage facilities renting space to individuals
- Consumer retail sales areas

CODE OFFICIAL CHALLENGES

- Determining fire protection adequacy
  - Sprinkler types and designs have improved protection options
  - Sprinkler designs can be more complicated
  - Fire detection systems may not be suitable for the environment
  - Commodity classes may change over time
- Retailers may have special designs for specific merchandising plans
- When in doubt, seek technical assistance

Source: *Building Safety Journal Online*, August 2016

Technical And Research Re

A Guide

Editor's note: The June edition of Building Safety Journal Online included an article approaches and technical reports.

As modern construction projects become more complex, owners, architects and engineers may address their unique design challenges by seeking alternatives to prescriptive code requirements.

The code official is responsible for reviewing and approving those proposals. To assure life safety, fire protection and structural demands are met, the code official must have full confidence the designs are somehow equivalent or better than the requirements outlined in the codes. One way to achieve that confidence is to obtain, review and approve a technical or research report as authorized in the model codes.

The technical report must be prepared by an individual or organization acceptable to the code official. The code official must approve its contents and conclusions; the code official is not obligated accept the report. The *International Building Code®* (IBC) authorizes the code official to ask for research and test reports from approved agencies. The *International Fire Code®* (IBC) allows the code official to rely on technical protection engineer, testing labo organization to support alternati proposals.

Effective in the 2015 *I-Code* not approve the alternative mate construction, he or she must res writing and explain why. This ass due process in code enforcemen

TECHNICAL AND RESEARC

The technical report submitte must be sufficiently detailed and date any conclusions or recomm checklist provides the code offic lish the minimum requirements alternative methods and material circumstance when the code offi mation is needed to make an inf

SCOPE/APPLICATION

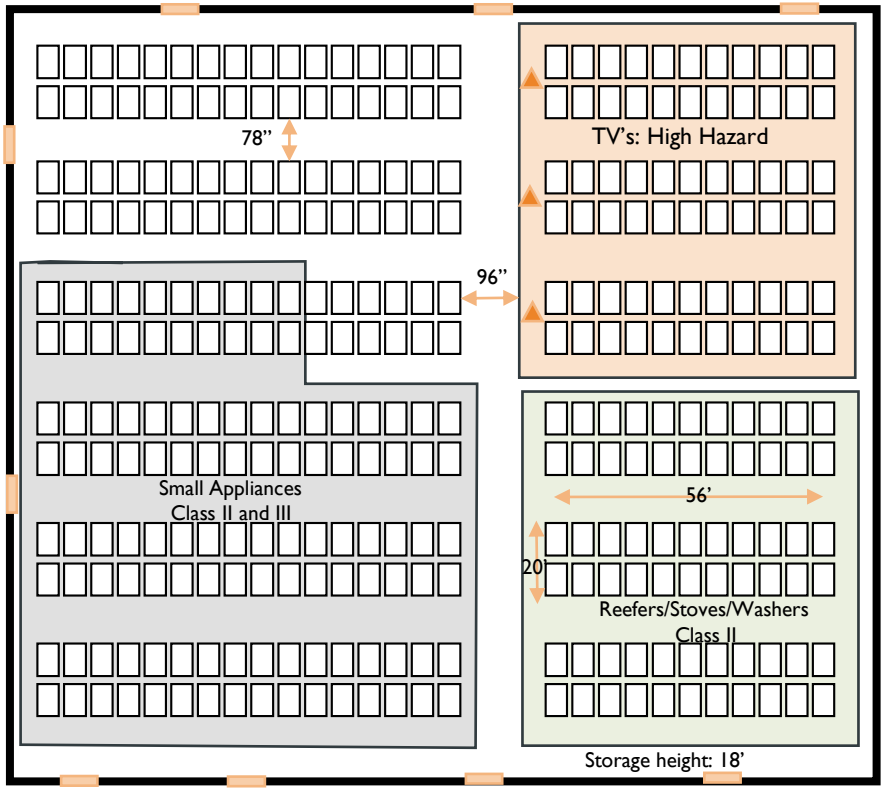
- Chapter 32 references:
  - Aerosols – Chapter 51
  - Flammable & combustible liquids – Chapter 57
  - Hazardous materials – Chapter 50
  - Combustible paper, fibers and miscellaneous storage – Chapter 37
  - General storage – Chapter 3

CONSTRUCTION/OPERATING PERMITS

- §105.6.22 Operational permit for buildings containing more than 500 ft² of high-piled storage.
- §105.7 Fire protection system installation.
- §3201.3 Additional details that must be illustrated in the design drawings.

STORAGE PLAN

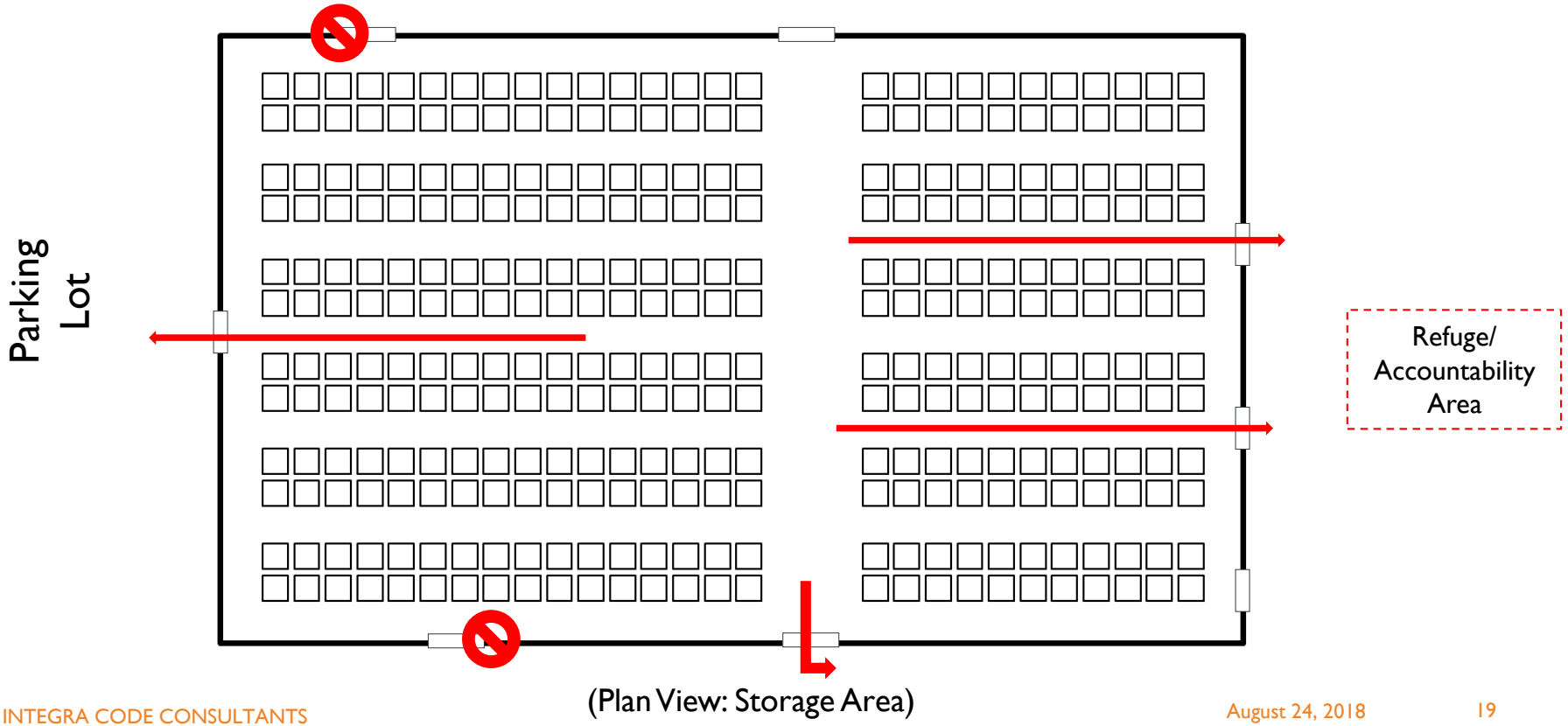
- § 3201.3.2



- Location/dimensions
- Design height
- Commodity types/classifications
- Clearance beneath sprinklers
- Aisle dimensions
- Pile volumes
- Fire department access doors
- Ceiling and in-rack sprinkler control valves

EVACUATION PLAN

- § 3201.4 Fire code official may require evacuation plans for publicly accessible areas



(Plan View: Storage Area)

MODULE #2

COMMODITY CLASSIFICATION

COMMODITY CLASSIFICATION

Fire protection requirements' foundation

"COMMODITY"

- "A combination of *products*, *packing materials* and *containers*."

Product: item being stored	Coffee mugs, engine blocks, plywood panels, wristwatches, toilet paper . . . .
Packing materials around the item	Cardboard boxes with dividers, steel containers, shrink wrap, boxes with foam "peanuts" . . . .
Containers: pallets, bins or product storage method	Wood or plastic pallets, plastic, cardboard or paper bin boxes, crates, wooden spools . . .

COMMODITY CLASSIFICATION

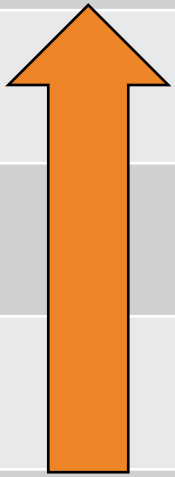
Class based on typical products or goods' estimated/compared heat release rate (HRR)

- Heat of Combustion (Btu/Lb.) * Burning Rate (Lbs./Minute)
  - Expressed in Btu/Minute (KW)
- Influenced by:
  - Material characteristics
  - Material quantity in a given pile, pallet load or rack
  - Surface area/density
  - Ventilation

A higher heat release rate (HRR) results in a higher commodity classification

RELATIVE FIRE HAZARD

Commodity Class	Fire Hazard Ranking
High-hazard Commodity	Highest Fire Hazard
Class IV Commodity	
Class III Commodity	
Class II Commodity	
Class I Commodity	Lowest Fire Hazard



COMMODITY MODIFICATION

"Materials listed within each commodity classification are assumed to be unmodified for improved combustibility characteristics.

"Use of flame-retarding modifiers or the physical form of the material could change the classification.

"See Section 3203.7 for classification of Group A, B and C plastics."

Physical form also must be evaluated when classifying commodities

GEOMETRY INFLUENCES

- HRR may evolve differently based on product geometry

Dimensional wood lumber: Class III

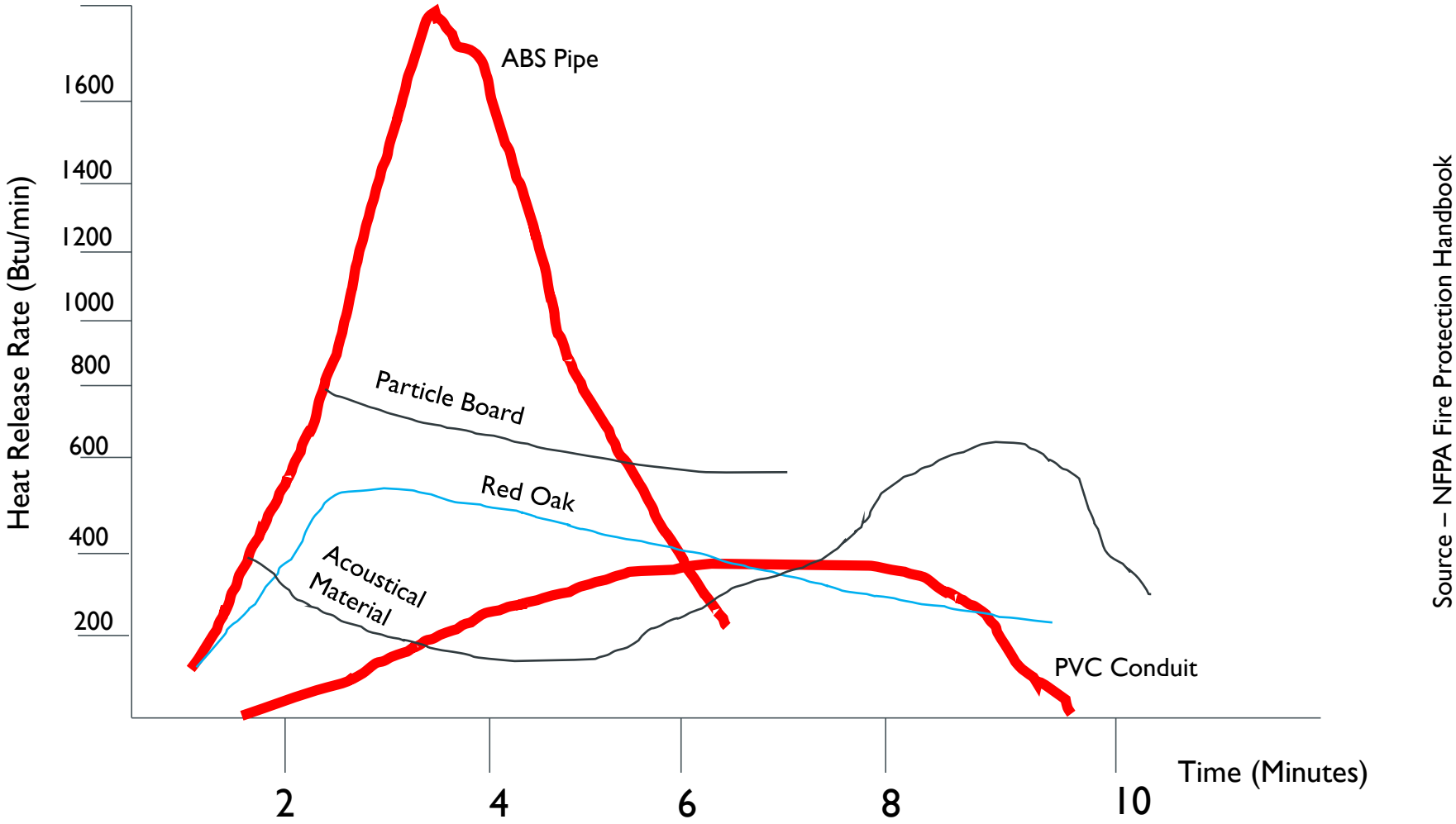
Cutting and assembling into uniform shapes for fence sections: High Hazard

PLASTICS (PRODUCT OR PACKAGE)

- Plastics are ranked into Groups A, B and C based on their:
  - Heat of combustion
    - Potential heat released upon full combustion (Btu/lb.)
  - Heat Release Rate

- Group A plastics represent the most severe hazard while Group C represent the least severe

SAMPLE HEAT RELEASE RATES

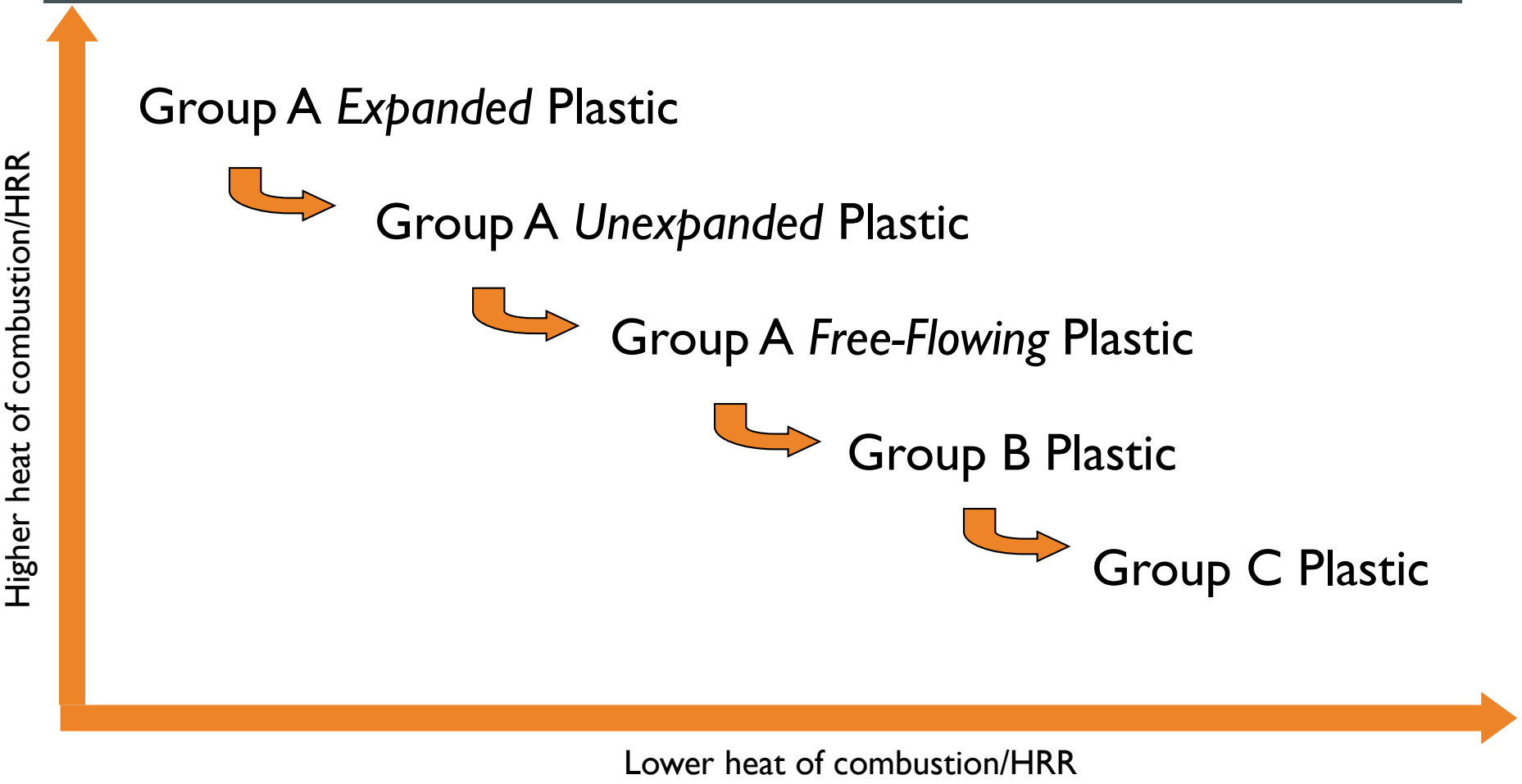


Source – NFPA Fire Protection Handbook

PLASTIC HAZARDS

- Some plastics may exhibit faster burning rates compared to ordinary combustibles
  - Plastics can produce 1½ - 3 times as much heat per unit of weight as wood or paper
    - Group A or B
- Some plastics behave similarly to ordinary combustibles
  - Group B or C

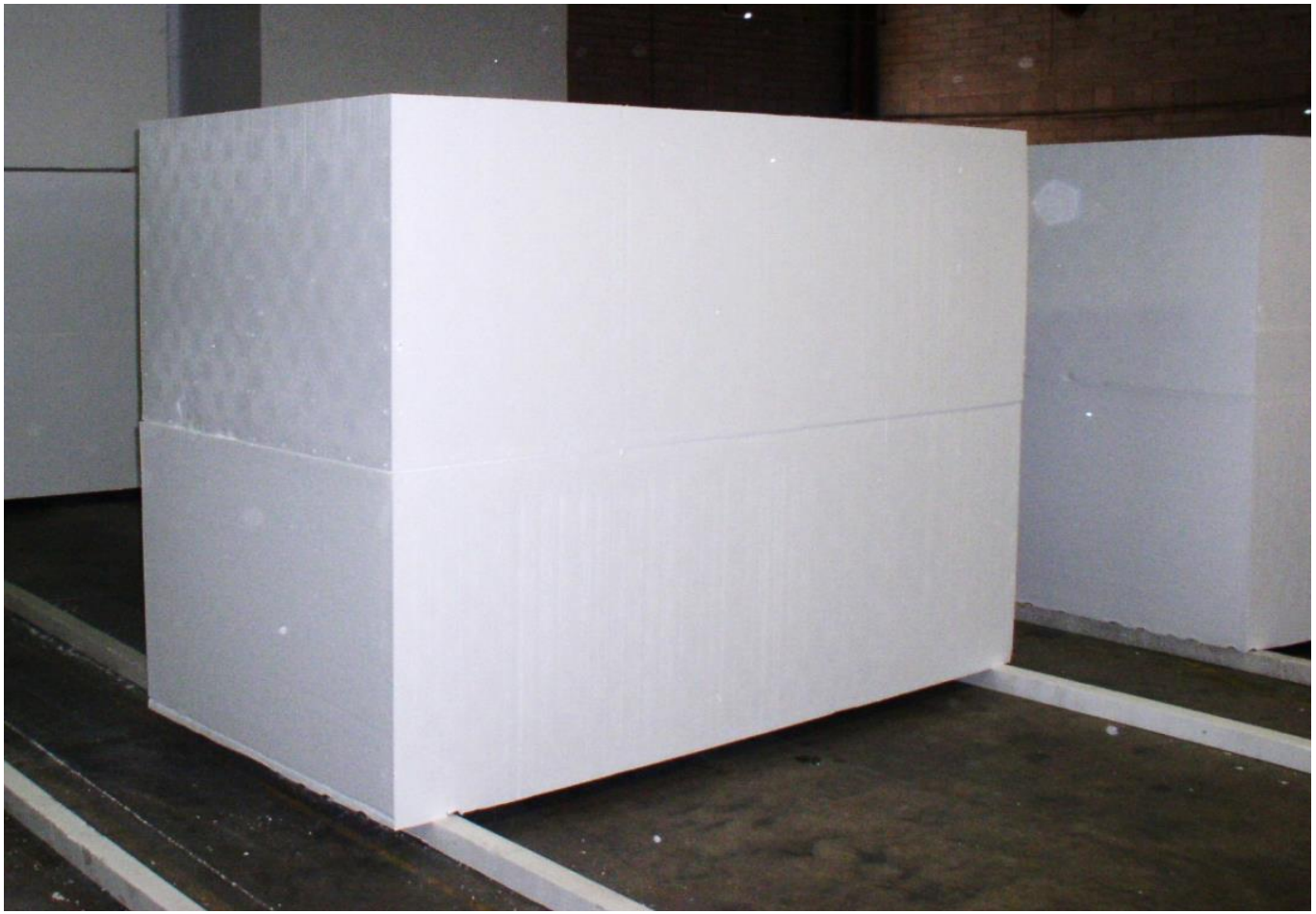
PLASTICS CLASSIFICATION (EXAMPLES)



PLASTIC GEOMETRY

- Geometry influences ease of ignition and heat release rate
- Plastics have three basic geometric forms:
  - Expanded (foam coffee cups)
  - Unexpanded (rigid, dense sheets or molds)
  - Free-flowing (pellets or prill)
- Expanded plastics represent the greatest fire hazard while free-flowing plastics represent least

EXPANDED GROUP A PLASTIC



UNEXPANDED GROUP A PLASTIC

FREE-FLOWING GROUP A PLASTIC

CLASS I AND II COMMODITIES

- Essentially *non-combustible* commodities
  - Limited amount of Group C plastics
  - No Group A or B plastics
- Difference between Class I and II is amount of combustible packaging

CLASS III COMMODITIES

- "Ordinary combustibles"
  - Allows more plastics than Class I or II
    - Limited Group A or B plastic
  - Group C plastic is Class III commodity

CLASS IV COMMODITIES

- Can contain **Group A plastics**
  - 3 - 7% by weight, or
  - 15 - 24% by volume
- Also includes:
  - Group B plastic and
  - Group A free flowing plastic
- Many commodities fall into Class IV classification because of the amount of plastics

HIGH-HAZARD COMMODITIES

- Not defined: *High-Hazard* commodities represent a significant fire threat and require specialized fire protection

- Includes:
  - Flammable and combustible liquids
  - Group A plastics
    - Unexpanded and expanded
  - Rubber tires
  - Idle pallets

HIGH-HAZARD COMMODITIES

- IFC® - unique category for fire protection strategies and operational limitations
  - Neither FM Global nor NFPA use this commodity designation
  - NFPA 13 uses "commodity-specific" sprinkler designs
    - Rolled paper
    - Plastic motor vehicle components
    - Rubber tires
    - Baled cotton
    - Records storage with catwalk access

LIMITED AMOUNT: GROUP A PLASTICS

Presence of Group A plastics alone does not result in high-hazard commodity classification

Some amounts allowed in a package or carton or on a pallet without increasing the commodity classification

Figures 3203.9 (1) and (2) provide a qualified person guidance to assess Group A plastic content

Key Point

Compare both: assign higher commodity classification

LIMITED GROUP A (EXAMPLE)

- Product
  - Light fixture in cardboard box
    - Wt. 3.17 lbs
    - 32 per pallet
  - Table 3203.8
    - "Housing materials and appliances"
    - "Light fixtures; non-plastic; cartoned"
- Class II

SHIPPING PROBLEMS/SOLUTIONS

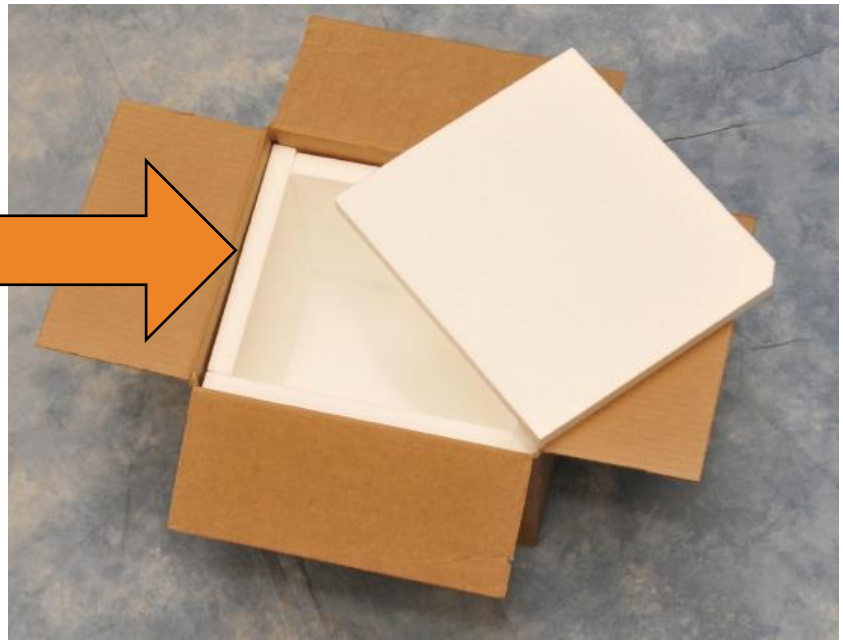


Figure 3203.9(1) Mixed Commodities Group A by *Volume*

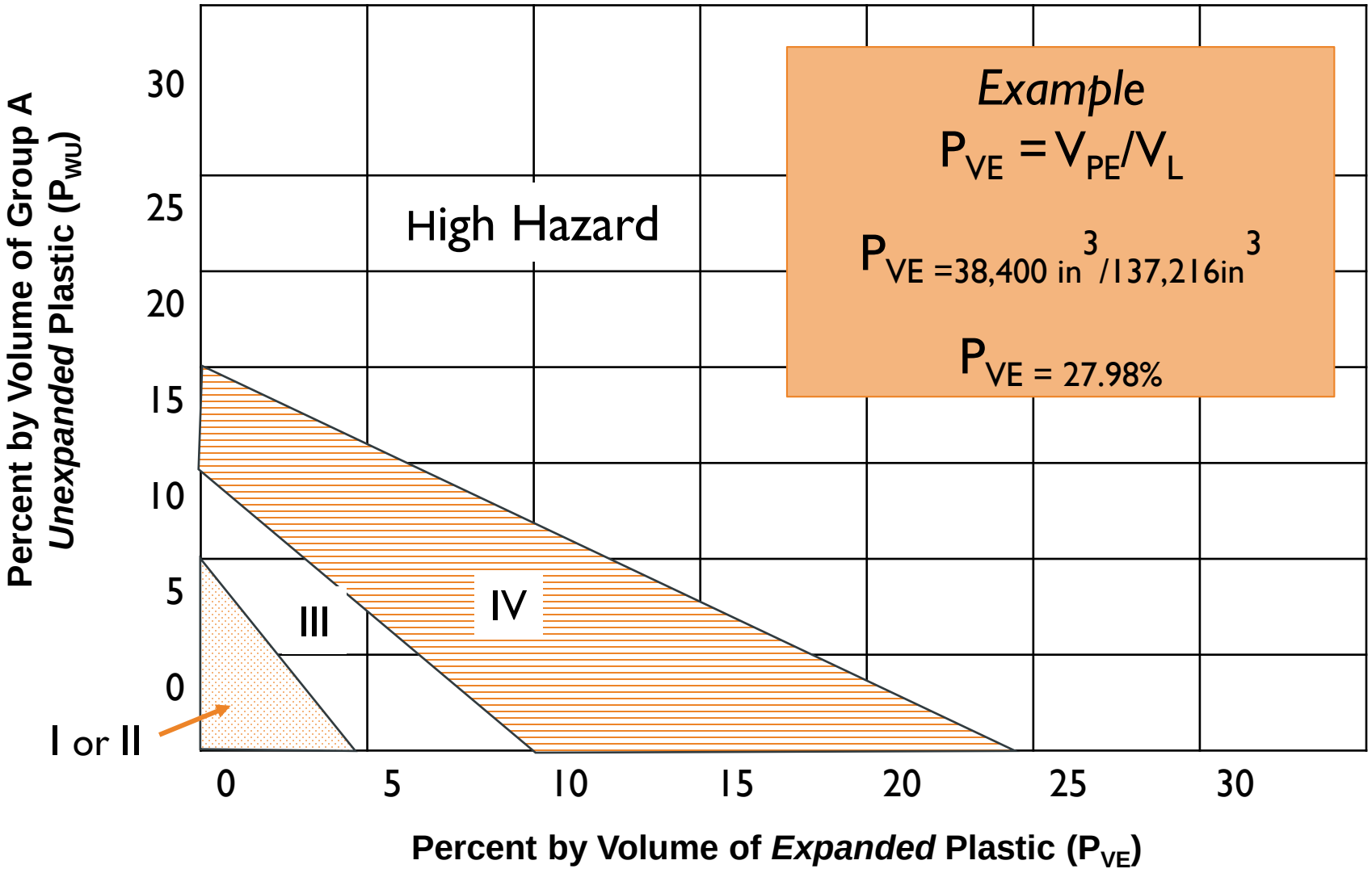
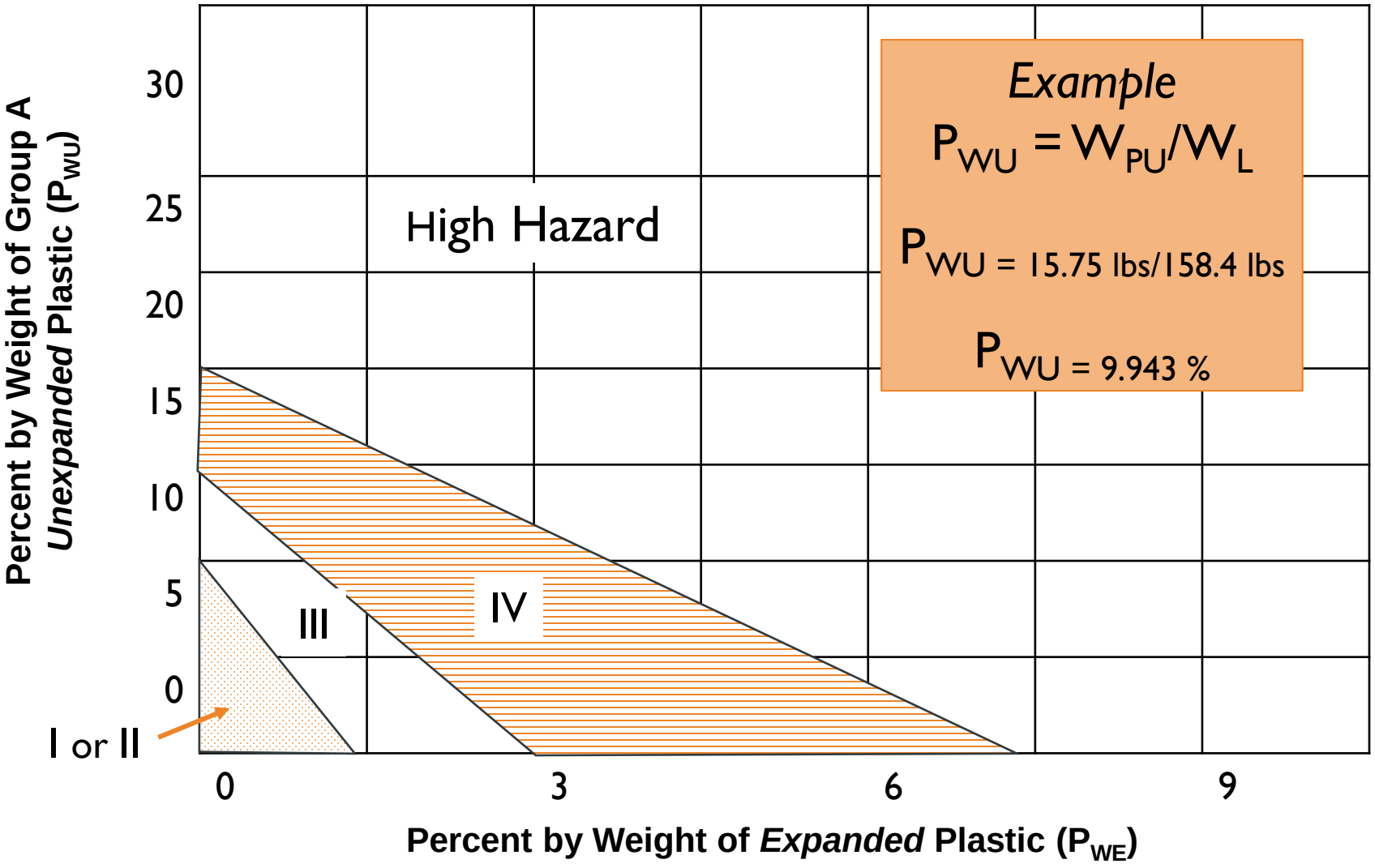


Figure 3203.9(2) Mixed Commodities Group A by *Weight*



Activity

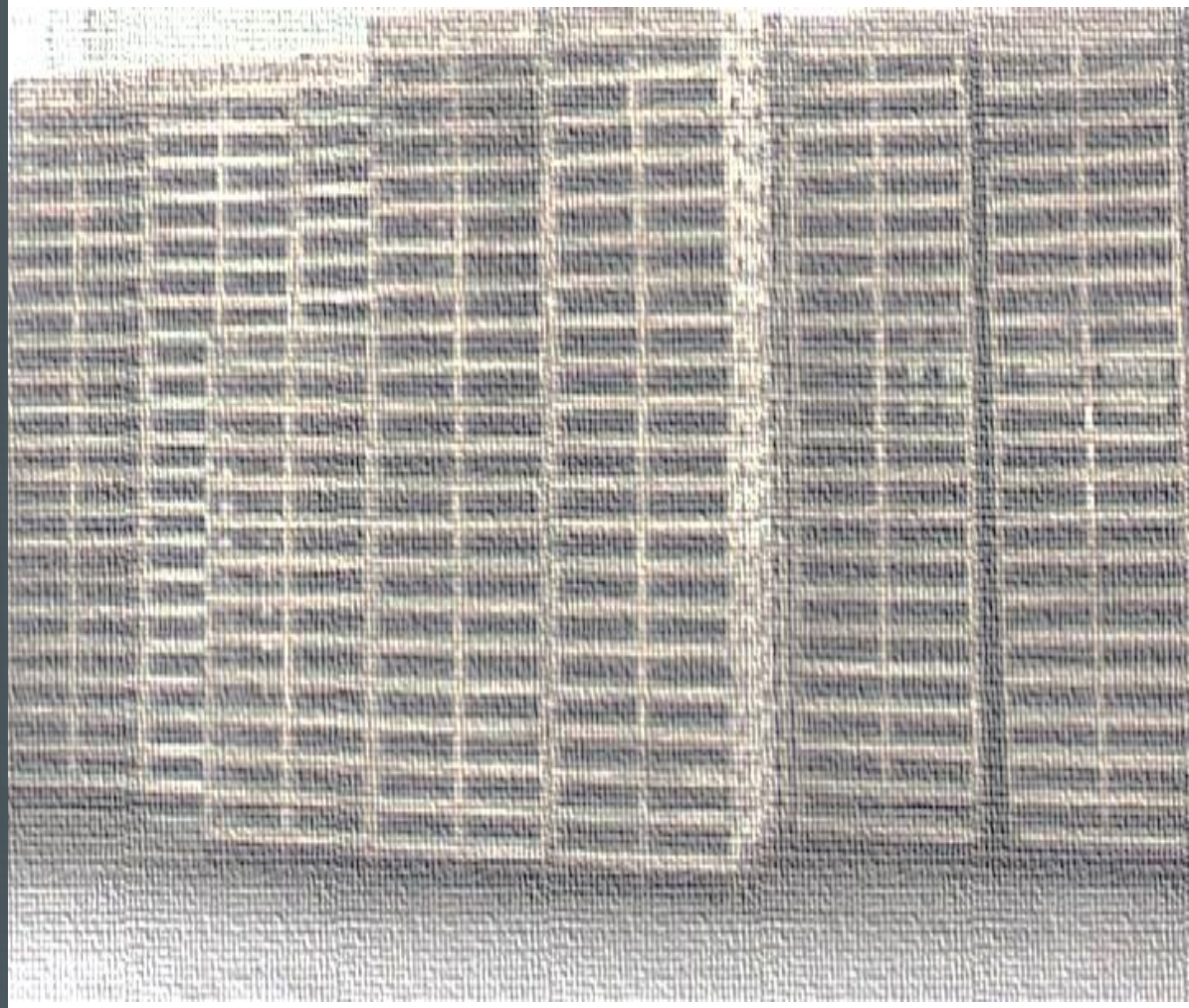
LIMITED GROUP A OUTCOME (EXAMPLE)

- Product
  - Originally Class II
  - Now
    - 27.98% Group A by *volume*
    - 9.43% Group A by *weight*

- What is the commodity classification?

PALLETS

- Influence fire behavior of "unit load"
  - Wood, metal or plastic
  - Solid or open
  - High density, low density plastic



COMMODITY CLASS IMPACT

Pallet Composition	Commodity Class	Impact
Unreinforced polypropylene (PPE) or unreinforced high-density polyethylene (HDPE)	I-IV	Increase one class
Reinforced polypropylene or reinforced high-density polyethylene	I-III	Increase two classes
Reinforced polypropylene or reinforced high-density polyethylene	I-IV	Increase to High Hazard
Others	I-IV	Unless tests prove otherwise, increase two classes

Discussion

IMPACT

What is the purpose of accurate commodity classification?

What is the consequence of inaccuracy?

Module #3

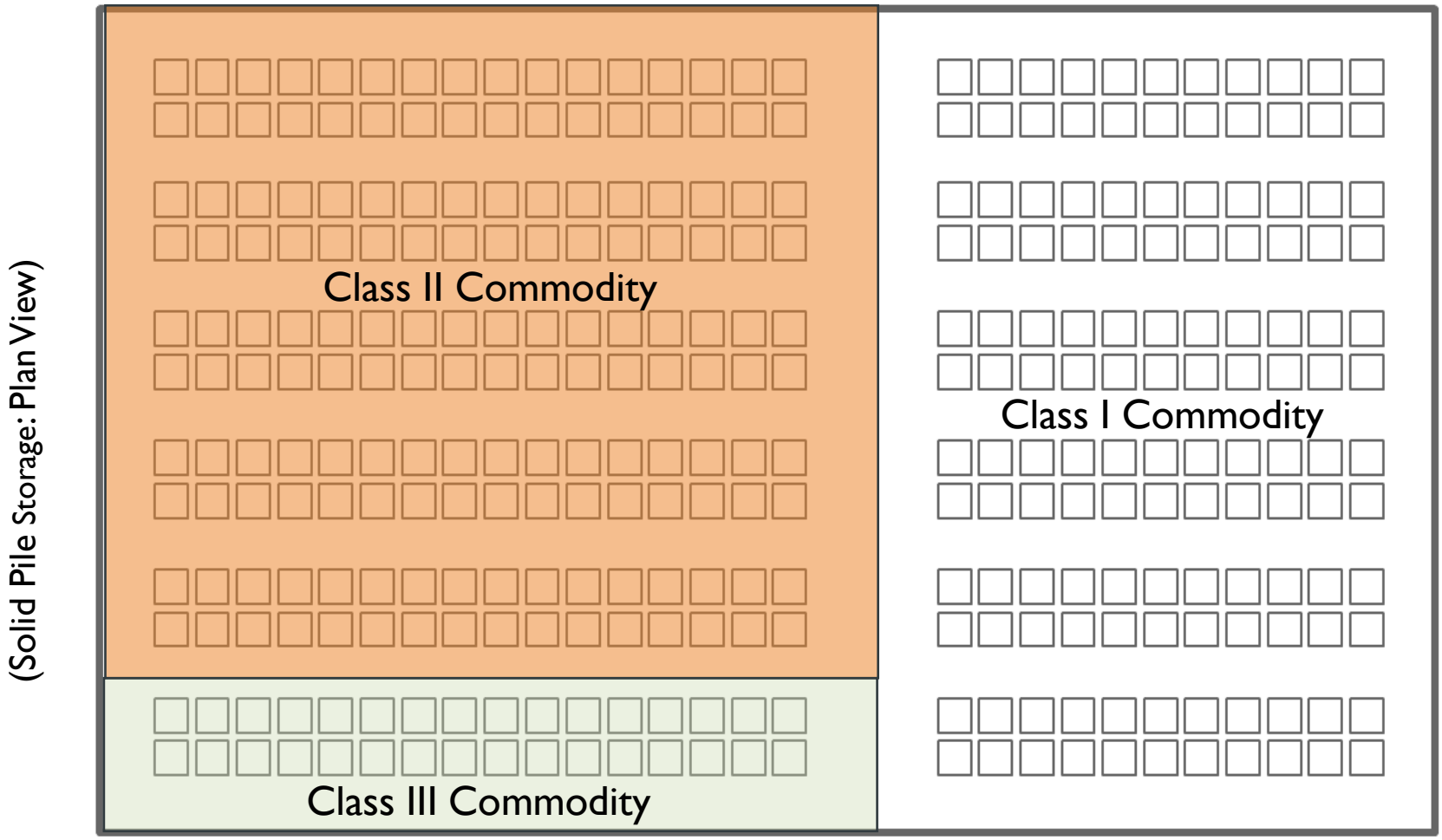
HIGH-PILED COMBUSTIBLE STORAGE AREAS

HIGH-PILED STORAGE AREAS

- §3204.1
- Storage areas must be assigned a *designation based on commodity class*
  - Class I, II, III, IV or High-Hazard
- Designation based on highest hazard class in storage
  - Exception for "engineered analysis option"
- Hazard class establishes fire protection requirements
  - Directly correlates to development and maintenance costs

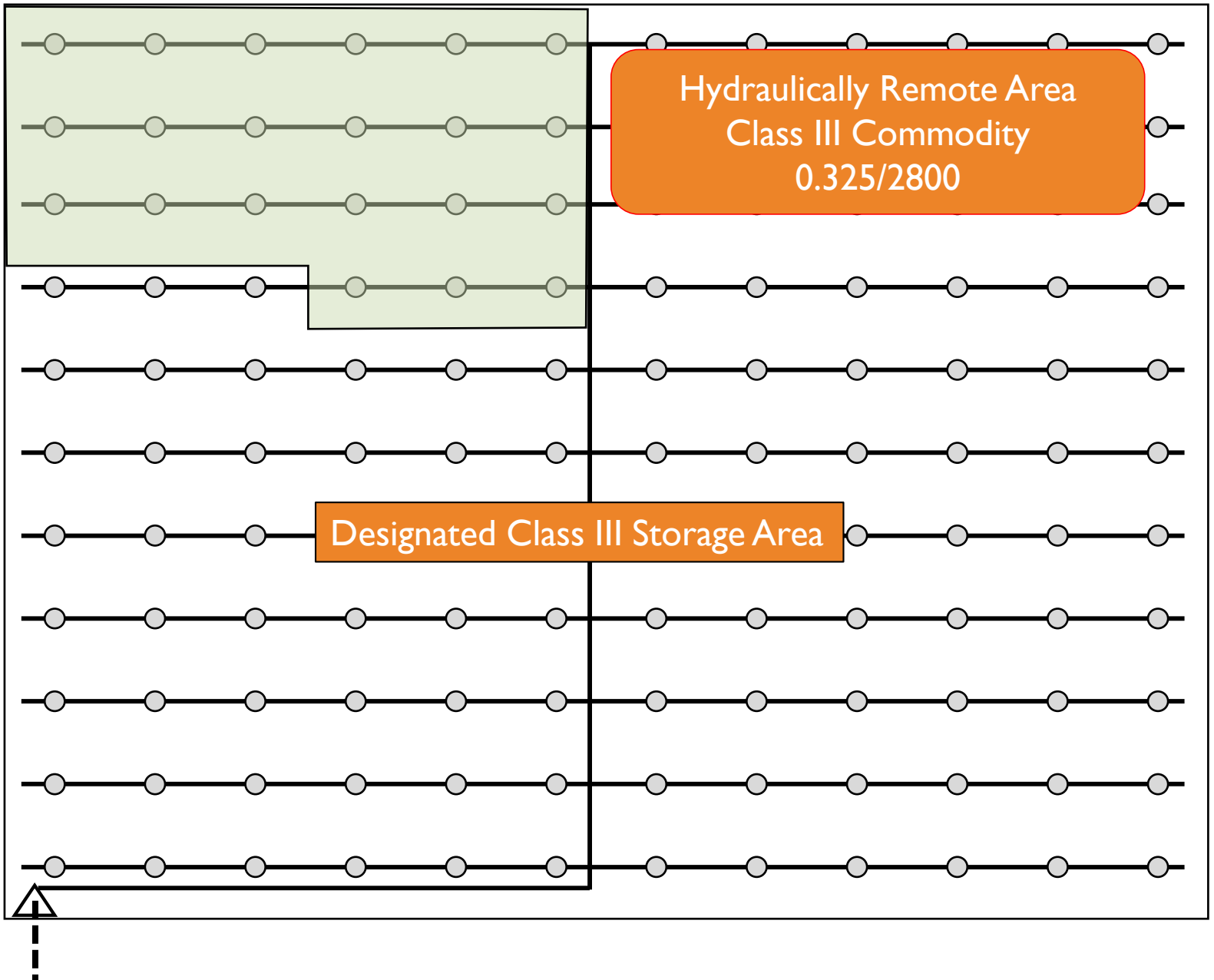
Activity

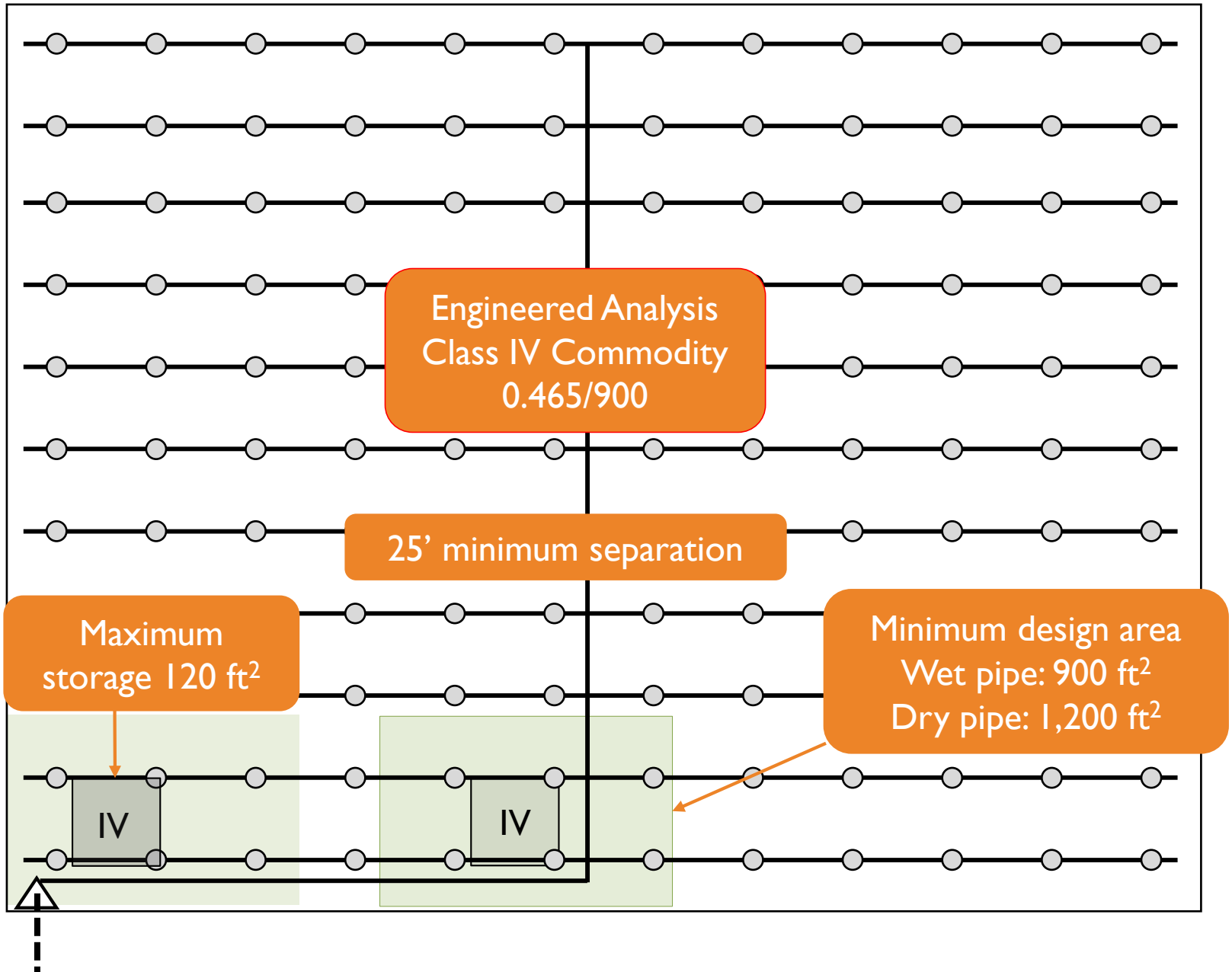
WHAT CLASS IS THIS AREA? WHY?



ENGINEERING ANALYSIS OPTION

- §3204.2
- Classify to lower commodity classification when:
  - Higher hazard commodity area is limited,
  - Automatic sprinkler protection design is adequate, and,
  - Storage height restrictions can be maintained


Hydraulically Remote Area
Class III Commodity
0.325/2800
Designated Class III Storage Area


Engineered Analysis
Class IV Commodity
0.465/900
25’ minimum separation
Maximum
storage 120 ft²
Minimum design area
Wet pipe: 900 ft²
Dry pipe: 1,200 ft²
IV
IV

MODULE # 4

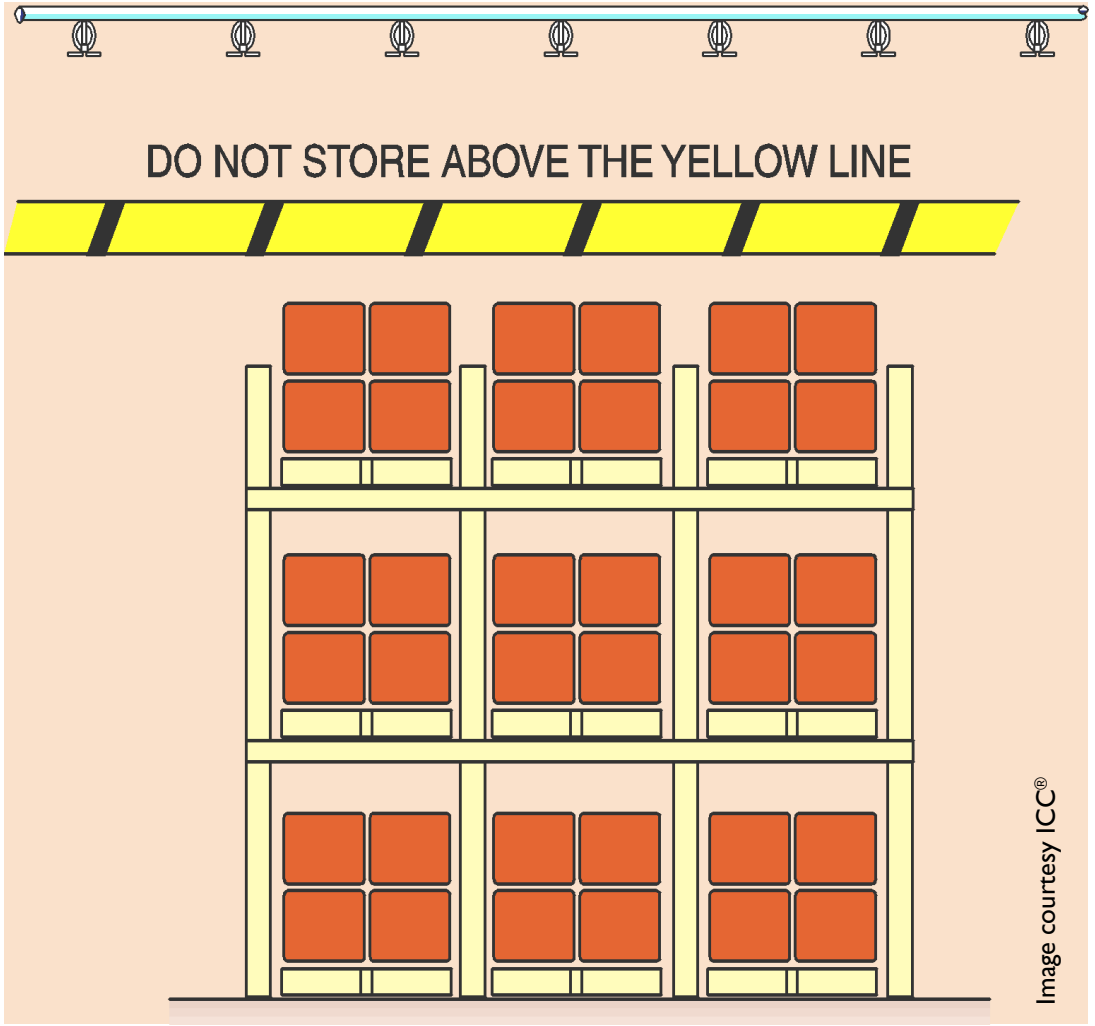
HOUSEKEEPING/MAINTENANCE

HOUSEKEEPING/MAINTENANCE

- Rack integrity
- Ignition sources
  - Smoking
- Aisle maintenance
  - Unobstructed access doors
  - Manual stocking:
    - 24 in. when 48 in. aisle
    - 1/2 width when > 48 in.
  - Mechanical
    - 44 inches

STORAGE HEIGHT DESIGNATION

- § 3205.6
- Fire code official can require maximum allowable storage height identification
  - Visual marker type is not specified



MODULE # 5

FIRE PROTECTION REQUIREMENTS

FIRE PROTECTION & LIFE SAFETY REQUIREMENTS

- Commodity classification
- High-piled storage area size
- Storage volume
  - Solid-piled storage
  - Shelf storage
  - Palletized storage
- Storage height

ARRAYS

SHELF STORAGE

- Shelves
  - < 30-in deep,
  - < 36 in. shelf-to-shelf

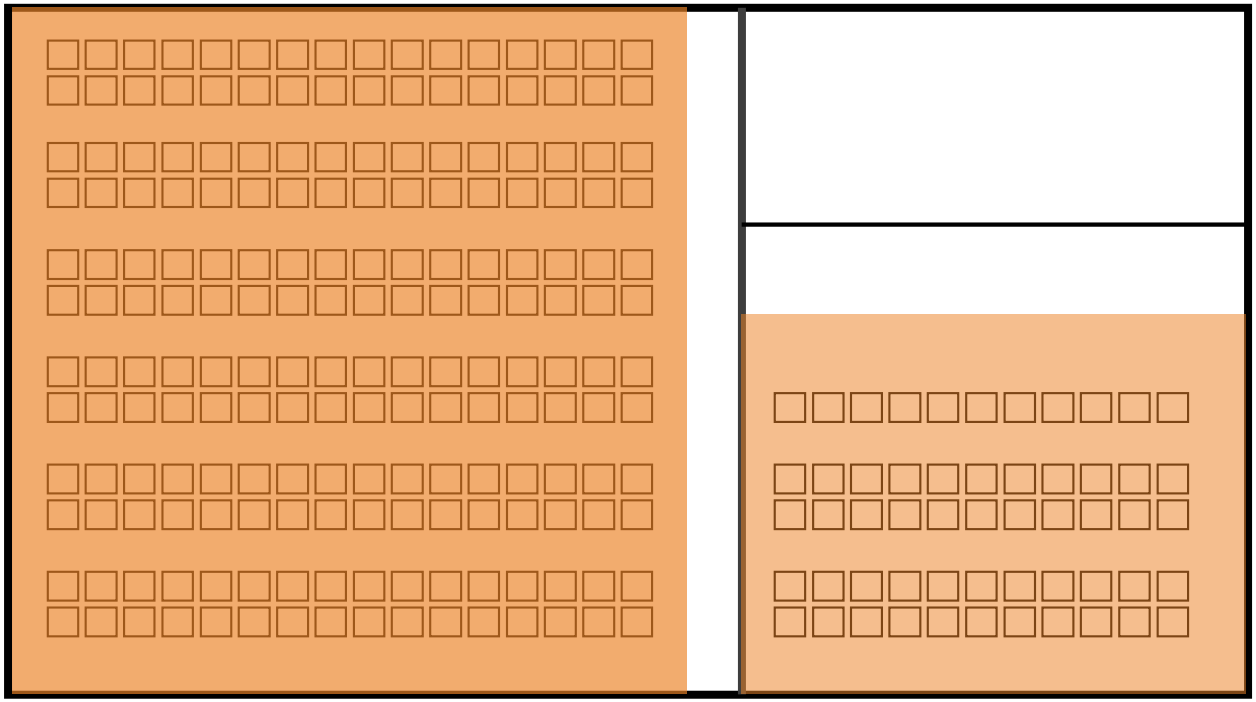
RACK STORAGE

- Typically 48 in. deep
- Structurally - limited height

SOLID PILE

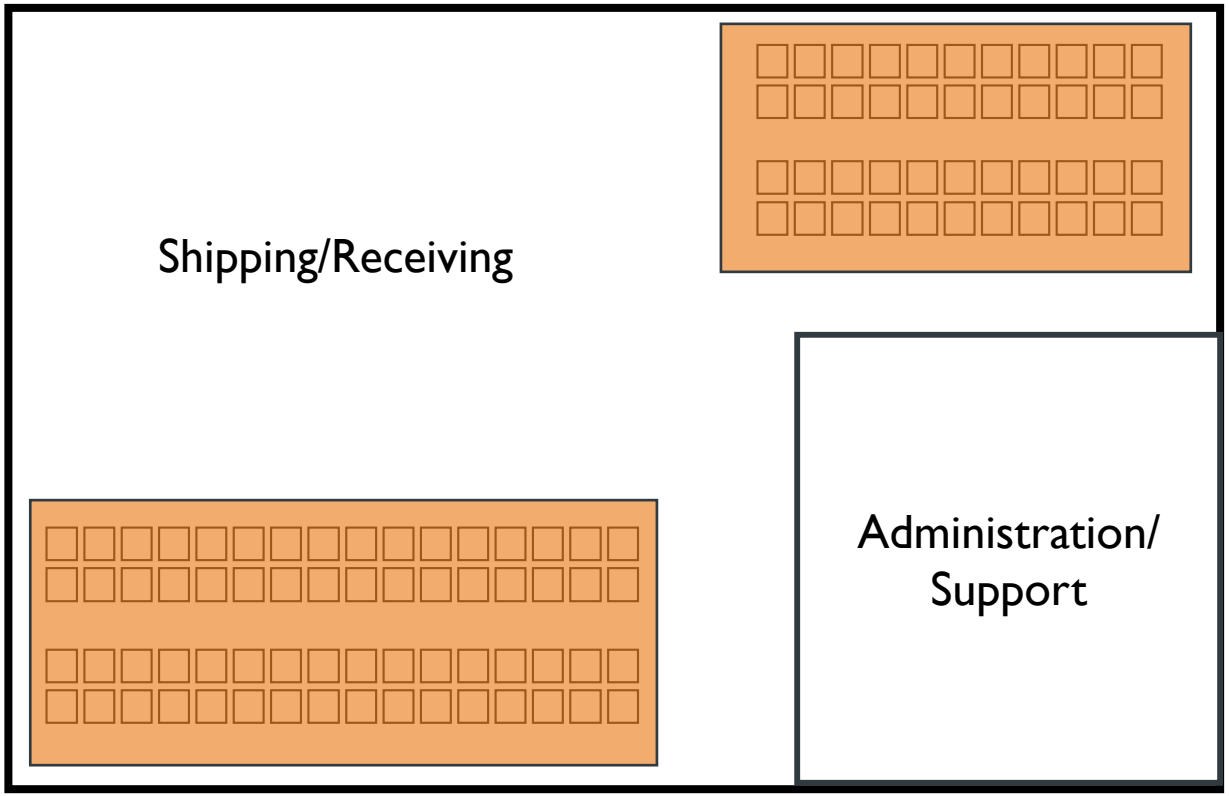
FIRE PROTECTION COVERAGE

- § 3206. 2.1 Protection extent for Table 3206.2
  - "Lesser of" 15 ft *or* full-height wall



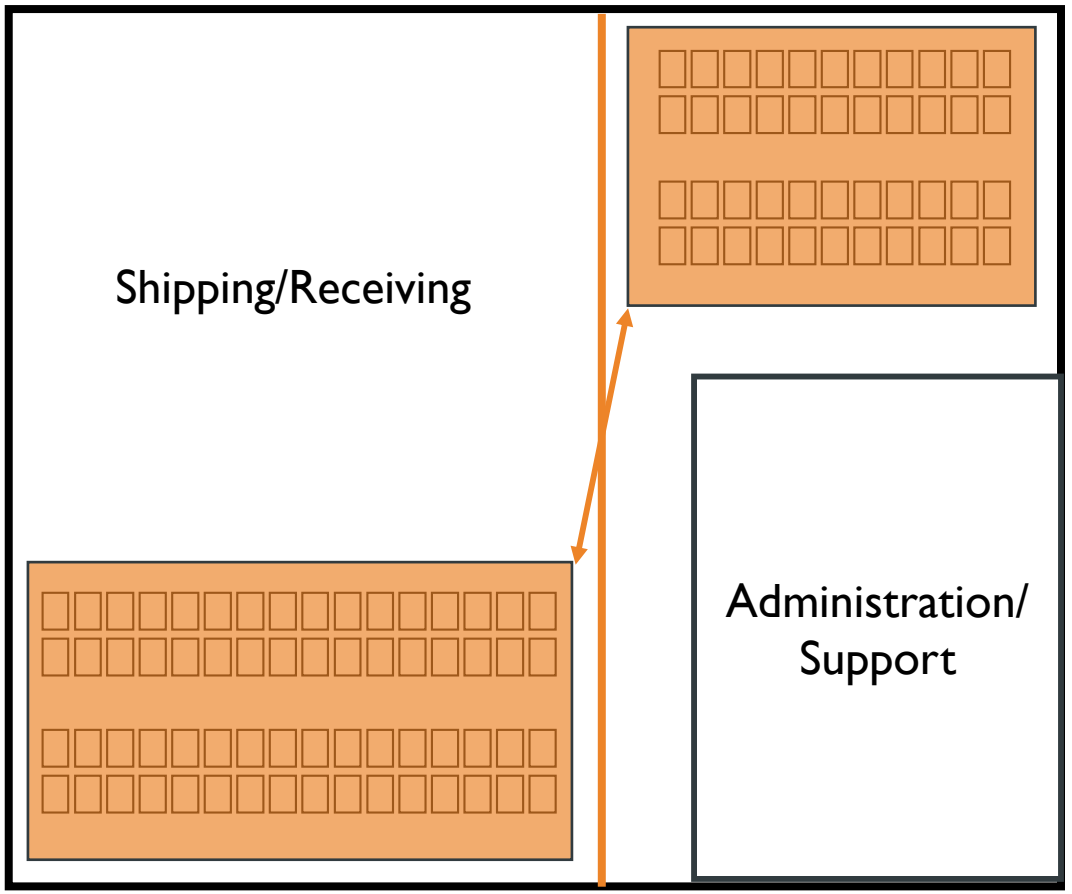
FIRE PROTECTION COVERAGE

- § 3206.3.1 High-piled storage area size – Same commodity class
  - Footprint of storage, racks, shelves or piles
  - Interior aisles
  - Perimeter aisles
    - 44 or 96 in.



FIRE PROTECTION COVERAGE

- § 3206.3.2 Multiple high-piled areas
- Aggregate area unless:
  - One-hour fire barriers, *or,*
  - 100 feet if sprinklered



FIRE PROTECTION COVERAGE

- § 3206.2.3 Storage area size – Mixed commodity classes with High Hazard
  - Unless separated: all treated as high hazard
  - Aggregate area

Treat as 7,920 ft^2 High Hazard

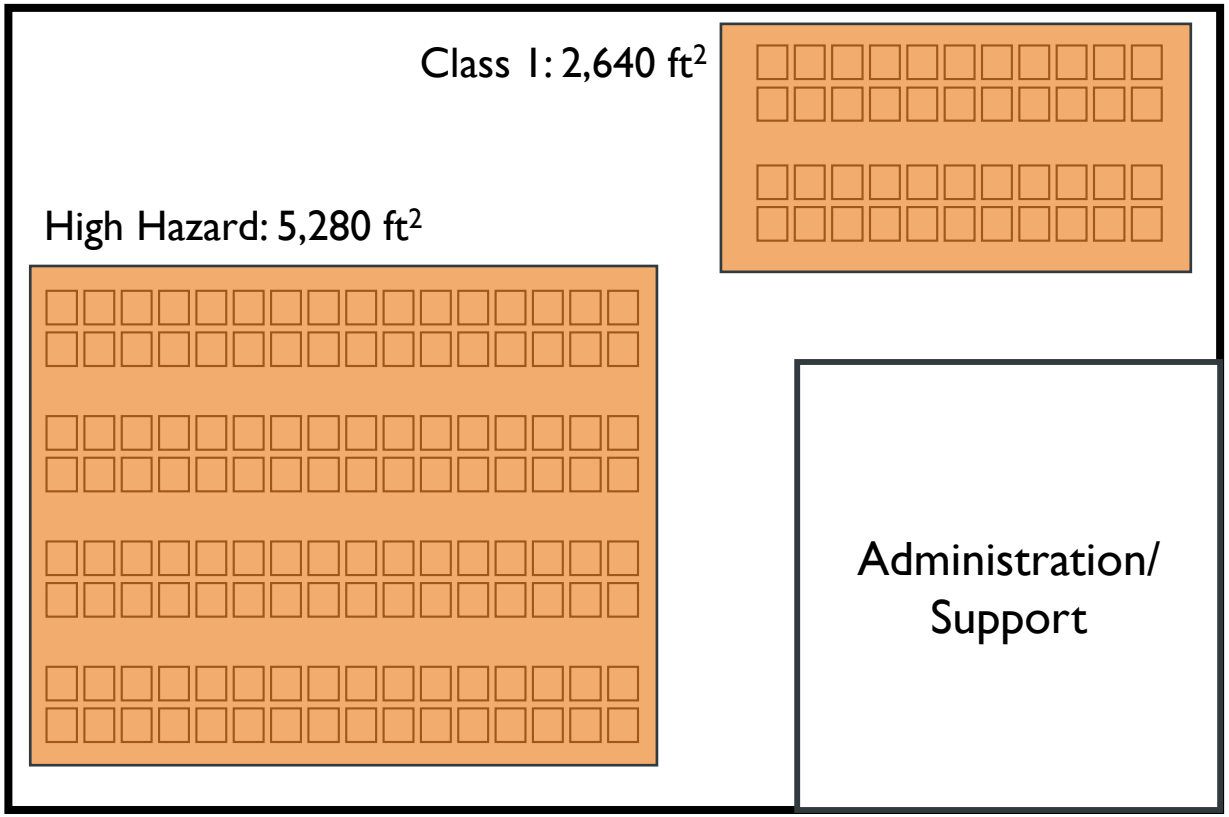


TABLE 3206 (EXTRACT)

Commodity Class	Size of High Piled Storage Area[a] (square feet)	All Storage Areas[b]					Solid-Piled Storage, Shelf Storage and Palletized Storage		
		Automatic Fire Extinguishing System	Automatic Fire Detection System	Building Access	Smoke and Heat Removal	Draft Curtains	Maximum Pile Dimension[c]	Maximum Permissible Storage Height[d]	Maximum Pile Volume
I-IV	2501 – 12,000 Non-public Accessible Option 1	Yes	NR	NR[e]	NR	NR	100	40	400,000
	2501 – 12,000 Non-public Accessible Option 2	NR[a]	Yes	Yes	Yes[j]	Yes[j]	100	30[f]	200,000

Discussion

TABLE 3206.2 – FOOTNOTES

a. When automatic sprinklers are required for reasons other than those in Chapter 32, the portion of the sprinkler system protecting the high-piled storage area shall be designed and installed in accordance with Sections 3207 and 3208.

For what other reasons might a sprinkler system be required?

Discussion

TABLE 3206.2 – FOOTNOTES

e. Section 503 shall apply for fire apparatus access.

Allows fire apparatus access road modifications for sprinklered buildings.

What road modifications would you accept for high-piled storage and why?

Discussion

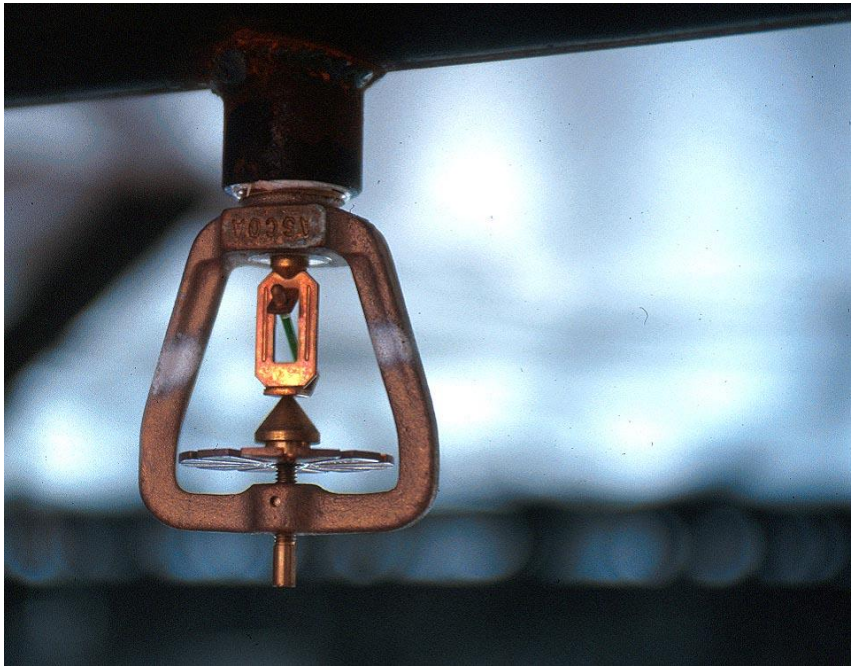
TABLE 3206.2 – FOOTNOTES

- For *High Hazard* commodity warehouses from 300,001 to 500,000 sq. ft. fire code official can require special fire protection provisions including, but not limited to:
  - fire protection of exposed steel columns;
  - increased sprinkler density;
  - additional in-rack sprinklers, without associated reductions in ceiling sprinkler density; or,
  - additional fire department hose connections.

What additional fire protection features might you require and why?

AUTOMATIC SPRINKLERS

Sprinkler system design and installation must meet NFPA 13 except as provided in Section 903.3.1.1.1 [*Normally exempt locations*]."



FIRE SPRINKLER DESIGN

- NFPA 13, *Standard for the Installation of Sprinkler Systems*
  - Design and installation guidance
    - Solid-pile and shelf
    - Racks
    - Automated
  - Commodity identification and classification
  - Rack configurations, height and aisle spacing
- Owner/insurance underwriter may require greater protection

FIRE DETECTION SYSTEMS

- Fire detection system required for non-sprinklered storage areas

Hazard Class	Area (ft^2)	Publicly Accessible
Class I-IV	501-2,500	No
Class I-IV	2,501-12,000	Yes
High Hazard	501-2,500	Yes

FIRE DETECTION SYSTEMS

- Although smoke detectors are IFC §907.2.15 recommendation, heat detection may be more appropriate.

Discussion

Where might heat detection be more appropriate?

- Heat detectors are limited to smooth, beam or sloped ceilings in a building ≤30' in height
  - Ceilings >30' in height require a performance design for spot-type heat detectors, or,
  - Linear cable or pneumatic rate-of-rise heat detection system.

BUILDING ACCESS

- Components of building access:
  - Fire apparatus access roads
  - Fire department access doors
- §503 requires fire apparatus access roads to all buildings
- Table 3207 requires fire department access doors for manual suppression

ACCESS DOOR EXCEPTION

- If wall does not face fire apparatus access road, *and*,
  - Opposite wall has access doors
  - Entire interior <150 ft from access door
  - Sprinklered building

BUILDING ACCESS

- Doors accessible without a ladder.
- One access door in each 125 lineal feet or fraction of exterior walls facing required fire apparatus access roads.
- Access doors at least 3’ wide by 6’ 8” high.
- Roll-up doors not to be used unless approved.
- Only approved locking devices.

BUILDING ACCESS

- Fire department access door threshold:

Commodity Classification	Unsprinklered	Sprinklered
Class I – IV	2,501 ft^2	12,001 ft^2
High-hazard	501 ft^2	2,501 ft^2

SMOKE/HEAT REMOVAL

- Provides aid in salvage and overhaul operations by providing post-extinguishment ventilation

- Significant IFC® 2015 changes
  - Draft curtains eliminated
  - Smoke and heat vents only in non-sprinklered storage areas
  - Smoke and heat vents *or* mechanical ventilation in sprinklered areas

SMOKE/HEAT REMOVAL §910.2.2

When required by Tale 3206, with exceptions

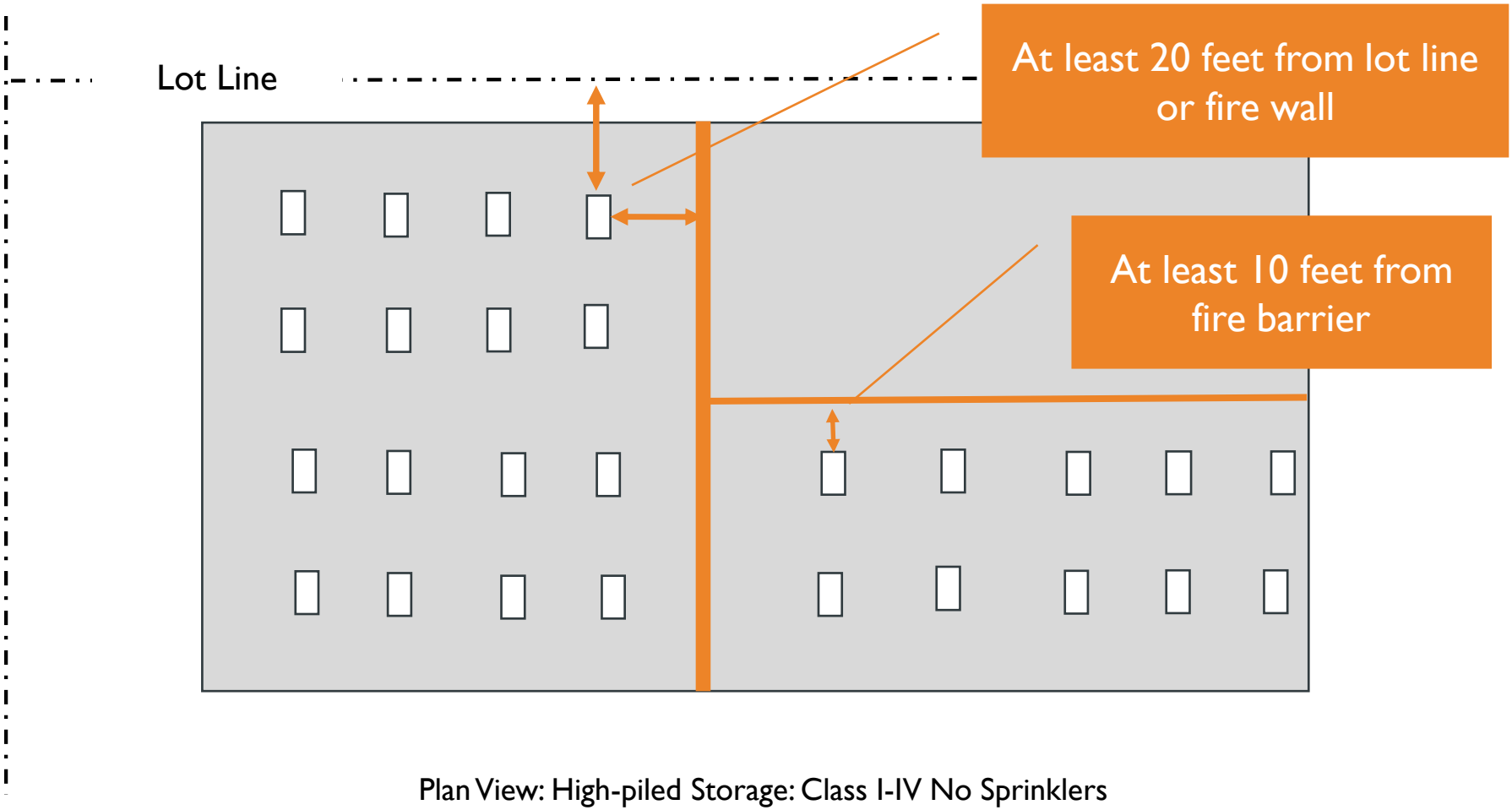
1. Sprinklered frozen food warehouses used solely for storage of Class I and II commodities.

2. Buildings protected by ESFR or fast response Control Mode Specific Application (CMSA) sprinklers.

SMOKE AND HEAT VENTS

- Vents must be listed and labeled to demonstrate compliance with:
  - UL 793, *Automatically Operated Roof Vents for Smoke and Heat,* or,
  - FM 4430, *Approval Standard for Heat and Smoke Vents.*

VENT SPACING



Plan View: High-piled Storage: Class I-IV No Sprinklers

MECHANICAL SMOKE REMOVAL

- Mechanical smoke exhaust systems offer firefighters greater control of the smoke removal process
- Building must be sprinklered

MECHANICAL SMOKE EXHAUST

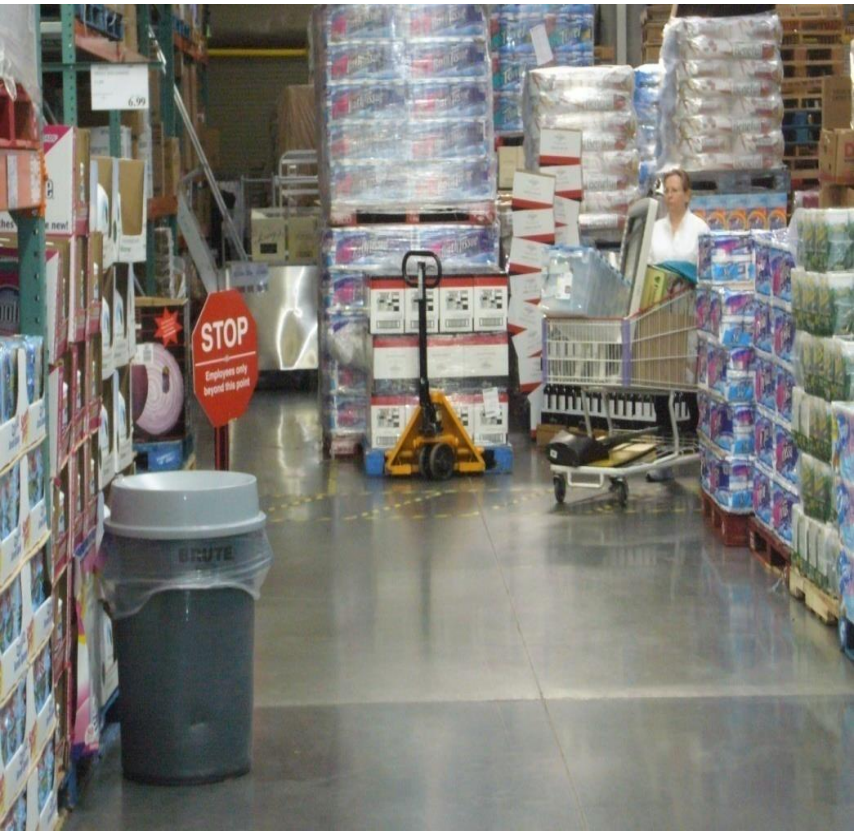
- Mechanical smoke exhaust design for two air changes per hour based on volume.
  - Maximum 30,000 CFM per exhaust fan
  - Automatic or manual make-up air
    - Openings within six feet of floor
    - Min. gross area 8 ft^2/1000 ft^3 of exhaust

AISLES

- Limit fire spread
- Provide egress routes
- Provide firefighter access

- Width dependent on:
  - Sprinkler system design
  - Commodity classification
  - Storage method
  - Publicly accessible

AISLES §3206.9.1.2



- For non-sprinklered buildings: 96”
- Sprinklered buildings:
  - 44 in. min.
  - 96-in. > 2,500 ft^2 and high-hazard open to public

AISLE MAINTENANCE §3205.4

- Aisles not to be obstructed
- Minimum aisle widths must be maintained
  - Mechanical stocking: minimum 44-in aisles
  - Manual stocking: 50% of aisle width

FLUE SPACES

FLUE SPACES IN RACKS

- Flue spaces provided and maintained
  - Table may conflict with NFPA 13, adopted by reference
  - Table 3208.3 takes preference

TABLE 3208.3 (EXTRACT)

Rack Configuration	Flue Design		Sprinklers at the Ceiling With or Without Minimum In-Rack Sprinklers		In-Rack Sprinklers at Every Tier
			≤ 25 feet	> 25 feet	Any Height
Double-row Rack (Option 1)	Transverse Flue space	Size	6 inches	3 inches	Not Required
		Vertically aligned	Not Required	Yes	Not Applicable
	Longitudinal Flue space		Not Required	6 inches	Not Required
Double-row Rack (Option 2)	Transverse Flue space	Size	3 inches	6 inches	Not Required
		Vertically aligned	Not Required	Yes	Not Applicable
	Longitudinal Flue space		6 inches	Not Required	Not Required

EXTRA-HIGH-RACK STORAGE

- Class I-IV > 40 ft
- High Hazard > 30 ft
  - Buildings with extra-high-rack combustible storage to be protected with a *specially engineered* automatic sprinkler system.
  - When required by code official, extra-high-rack combustible storage shall be provided with additional special fire protection:
    - separation from other buildings,
    - additional built-in fire protection features, and,
    - additional fire department access

AUTOMATED STORAGE

- Carousel storage > 500 ft^2
  - Option 1: Smoke detection system 15 feet beyond perimeter
  - Option 2: Smoke detection in enclosed area
  - Option 3: Single dead-man switch
  - All:
    - Provide local alarm
    - Stop carousel

Photo courtesy: The Boeing Company

CASE STUDY: AUSTIN, TEXAS

MODULE # 5

RETAIL OCCUPANCY

- July 2000
- "Big box" Group M home improvement store
- Constructed 1990
  - 1988 *Uniform Building* and *Fire Codes* (Group B-2)
- Fire protection features
  - Wet-pipe ceiling sprinklers
  - In-rack sprinklers in high-hazard commodity areas
    - Class I, II and III A flammable and combustible liquids
    - Level 2 and 3 aerosols

FIRE PROTECTION SYSTEM

- Fire sprinkler design
  - Ceiling: 0.60 gpm/ft² over 2,000 ft²
    - Nearly three times normal mercantile density
    - ESFR not yet invented
  - Two levels of in-rack sprinklers in Class I, II & III A storage areas
  - Two levels of in-rack & face sprinklers at aerosols
  - Supplied by a 1,000 gpm @ 75 psi electric fire pump

HAZARDOUS MATERIALS

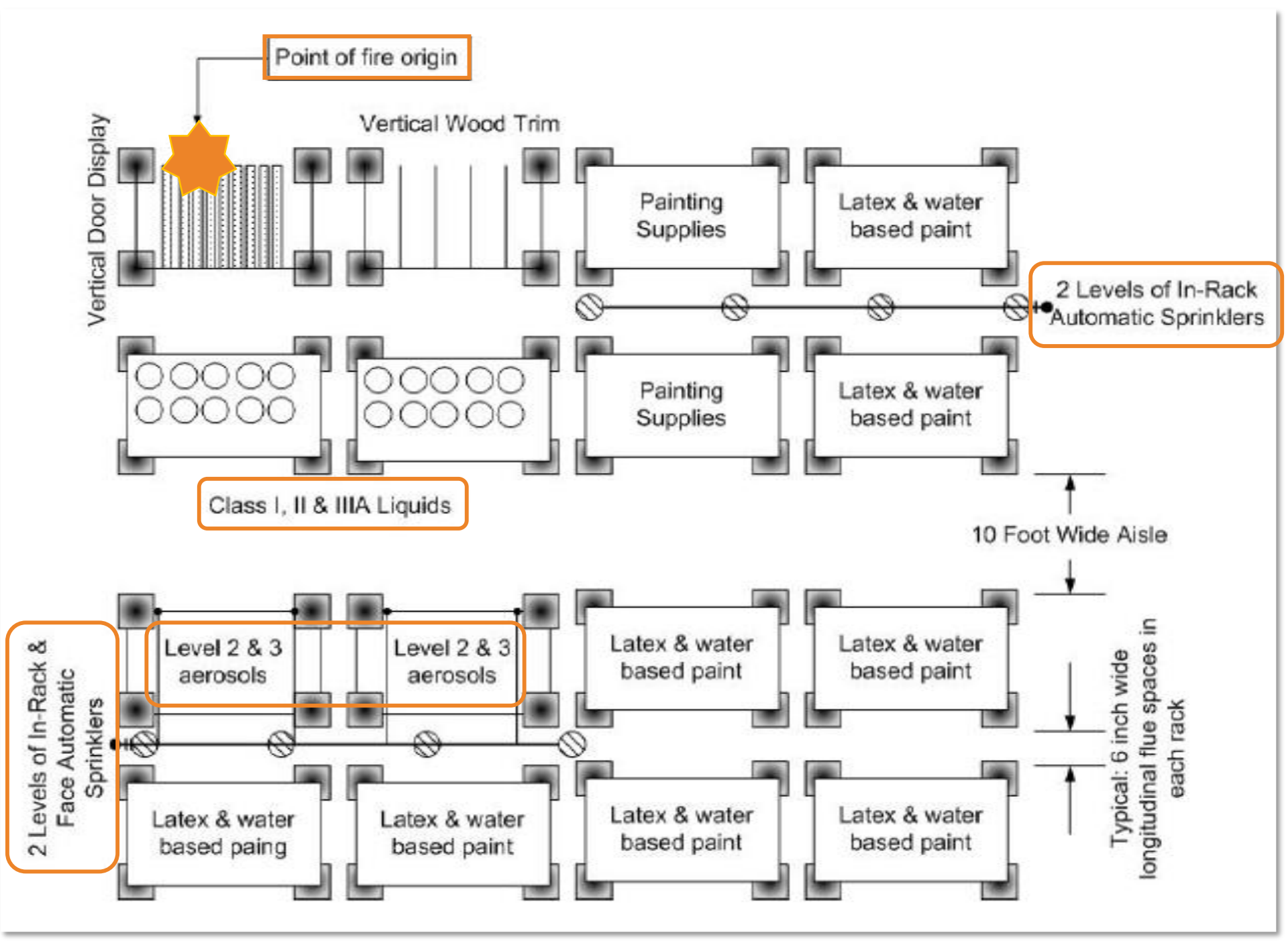
- Wholesale/retail exempt amounts* applied

Hazardous Material Classification	Quantity
Class IB & IC flammable liquids	1,850 gallons
Class II & III-A combustible liquids	5,500 gallons
Level 2 & 3 aerosol products	5,000 pounds
Class III solid oxidizers	2,250 pounds
Class II solid oxidizers	4,500 pounds
Corrosive liquids	1,950 gallons
Toxic solids	1,900 pounds

*Now "Maximum Allowable Quantities (MAQ)"

EVENTS PRIOR TO IGNITION

- Approximately four months before the fire, employees "reset" the liquid storage area racks
  - When reset occurred, in-rack sprinkler protection was not extended into the new locations
- At 12:30 a.m., disgruntled employee poured and ignited one gallon of paint thinner (I-C) in adjacent door storage aisle


Point of fire origin
Vertical Wood Trim
Vertical Door Display
Painting Supplies
Latex & water based paint
2 Levels of In-Rack Automatic Sprinklers
Painting Supplies
Latex & water based paint
Class I, II & IIIA Liquids
10 Foot Wide Aisle
2 Levels of In-Rack & Face Automatic Sprinklers
Level 2 & 3 aerosols
Level 2 & 3 aerosols
Latex & water based paint
Latex & water based paint
Latex & water based paing
Latex & water based paint
Latex & water based paint
Latex & water based paint
Typical: 6 inch wide longitudinal flue spaces in each rack

EMERGENCY RESPONSE

- First alarm: 12:39 am
- First arriving engine reported heavy smoke and sprinkler operation
- Another engine pumped two 3" supply lines to the FDC

POST-FIRE OBSERVATIONS

- Rack collapse produced larger spill area
- Non-polar solvents flowed under aerosol rack, causing cans to BLEVE
  - Aerosol can bottom rim found 52’ from collapse area
- 24 ceiling sprinklers and four in-rack sprinklers operated

CONTRIBUTING FACTORS

- No in-rack sprinklers in flammable and combustible liquid tiers
- "Target" aisle contained more challenging commodities than those used in original fire test to establish sprinkler criteria
- Several containers lacked pressure-relieving features
  - BLEVEs increased the burning rate and fire area
- Initial fire pump failure
  - Fire department unable to determine if this contributed to the number of sprinklers that operated

OTHER LESSONS LEARNED

- When in-rack sprinkler protection is specified, provide protection for the entire rack length
- Aisle plans should be prepared and used by design professionals, regulatory officials, building owners and employees

SUMMARY

1. Describe the scope and application of IFC® Chapter 32.
2. Explain the code definitions applicable to Chapter 32.
3. Explain commodity classification based on Section 3203 criteria and interpret Figures 3203.9.1(1) and (2).
4. Interpret Table 3206.2 to apply the high-piled combustible storage requirements for plan review and inspections.

QUESTIONS/COMMENTS?

THANK YOU FOR YOUR PARTICIPATION

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