2021 IFC® Significant Changes

Based on the 2021 International Fire Code® (IFC®)

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Welcome

- Instructor
- Exits
- Breaks and Schedule
- Cell Phones

Objectives

- Upon completion, participants will be better able to:
  - Identify the differences between the 2018 IFC and the 2021 IFC
  - Explain differences between current and previous code years
  - Identify changes in organization and code requirements
  - Identify revised design, plan review and inspection requirements

Course Icons

Addition

Deletion

Modification

Clarification

Chapter 3

General Requirements

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Additive Manufacturing §320

- Additive manufacturing is a process of joining materials to make objects from 3D model data, usually layer upon layer
- 2 types of additive manufacturing:
  - Industrial additive manufacturing
    - Utilize combustible powders or metals, an inert gas supply, a combustible dust collection system, or creates a hazardous (classified) location area or zone outside of the equipment

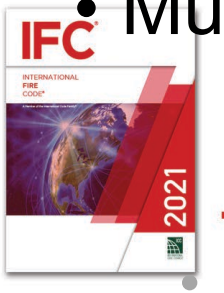
Additive Manufacturing §320

- ***Industrial*** additive manufacturing requirements:
  - Operational permit
  - Listed to UL 2011
  - Use of inert gases must comply with Ch 53
  - FCO can require technical assistance and require an evaluation report
  - Only allowed in manufacturing facilities
  - If the quantities of hazardous materials exceed the maximum allowable quantity per control area, the room or building will become a Group H

Additive Manufacturing §320

- ***Non-industrial*** additive manufacturing
  - 3D printing operations that do ***not*** create a hazardous (classified) location area outside of the equipment, and do ***not*** utilize an inert gas supply or a combustible dust collection system
- Must be listed

- Self-contained unit
- ≤30 L of production material
- Cannot use inert gas or combustible dust



Artificial Combustible Vegetation §321

- Regulates artificial combustible vegetation >6’ in height and permanently installed outdoors ≤5’ of a building or on the roof of a building
  - Exception: Artificial decorative vegetation >30’ from the exterior wall of a building
- Flame retardant and tested to NFPA 701 or NFPA 289

Chapter 4
Emergency Planning & Preparedness

Emergency Drills §405

- Lockdown plans are not required; but if they exist, they must be approved
- §405.1 – lockdown drills cannot substitute for fire and evacuation drills

Emergency Drills §405

- §405.2 – participants must actually exit the facility during fire and evacuation drills
  - Exceptions for severe climate, ambulatory care and Group I

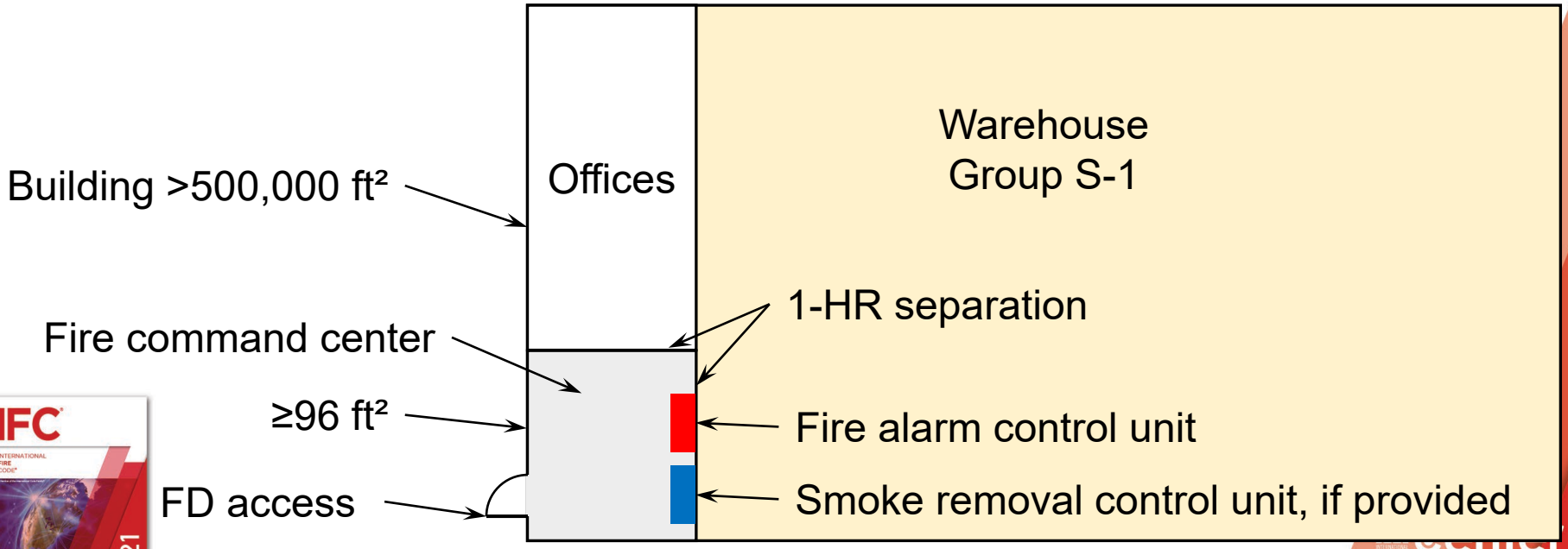
- Table 405.3 requires ‘staff’ to participate, rather than ‘employees’
  - This is intended to include volunteers and other workers who may not be employees

Chapter 5

Fire Service Features

Fire Command Center §508

- Fire command center now required in Group F-1 and S-1 where the building footprint >500,000 ft²
- Fire command center must be a minimum of 96 ft² with the smallest dimension >8’



Fire Command Center §508

- Identified

FIRE COMMAND CENTER

Emergency Responder Communication Coverage – Signals §510.4.1

- Adequate coverage for in-building 2-way emergency responder communication coverage is ≥95% in all areas ***AND*** ≥99% coverage in critical areas

Critical areas – areas designated for the highest level of emergency responder radio coverage including but not limited to areas such as exit stairs, exit passageways, elevator lobbies, fire protection equipment room and control valve locations, fire command centers.

- Criteria is DAQ ≥3.0 ***AND*** ≥-95 dBm

Emergency Responder Communication Coverage – Interference §510.4.2

- Equipment for in-building, 2-way emergency responder communication coverage listed to UL 2524
- Must be provided with oscillation detection
- Signal boosters and RF-emitting devices must have built-in oscillation detection and control capability

Bidirectional Amplifier
Photo courtesy of Radio Solutions, Inc.

Emergency Responder Communication Coverage – Antenna §510.5.1

- Donor antennas on the building must be:
  - Permanently affixed to building, ***OR***
  - Mounted on a movable sled so they can be properly repositioned
- Sign is required

MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT APPROVAL FROM THE FIRE CODE OFFICIAL

Chapter 6

Building Services & Systems

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Electrical Working Space §603.4

- Working space of ≥3’ is increased based on voltage

Voltage	Minimum Depth of Working Space (feet)		
	Condition 1	Condition 2	Condition 3
150 or less	3	3	3
151 – 600	3	3.5	4
601 – 1,000	3	4	5
1,001 – 2,500	3	4	5
2,501 – 9,000	4	5	6
9,001 – 25,000	5	6	9
25,001 – 75,000	6	8	10
Over 75,000	8	10	12

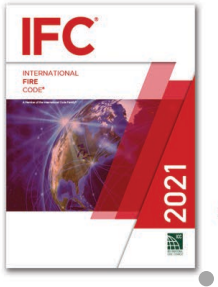
- Condition 1 – exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space, ***OR*** exposed live parts on both sides that are guarded by insulating materials
- Condition 2 – exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space (concrete, brick or tile are to be considered grounded)
- Condition 3 – exposed live parts on both sides

Storage in Elevator Spaces §604.3, §604.7, §315.3.3

- Storage is specifically prohibited in:
  - Elevator lobbies where hoistway opening protection is required
  - Elevator machine rooms
  - Elevator cars

Fuel Oil Storage Tanks §605.4.2.2

≤660 gallons	≤1,320 gallons	≤3,000 gallons
Tank listed to UL 80	Tank listed to UL 142 ***WITH*** 2nd containment ***AND*** building is sprinklered with NFPA 13 system	Tank listed to UL 2085 ***AND*** building is sprinklered with NFPA 13 system



Clothes Dryer Exhaust Ducts §610

- New section dealing with dryer fires
- Clothes dryer vent ducts must be installed in accordance with IMC and manufacturer's instructions
- Clothes dryer components must be maintained to prevent the accumulation of lint and debris
  - Lint trap
  - Heating components
  - Exhaust duct
  - Termination cover

Chapter 7

Fire & Smoke Protection Features

Fire-resistance-rated Construction §701.6

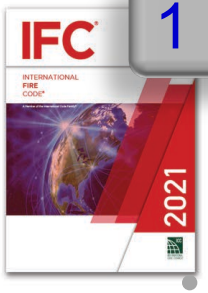
- IFC includes requirements to maintain the fire-resistance rating of Type IVA and IVB construction

Photo courtesy of the American Wood Council

Fire-resistance-rated Construction §701.6

- ***IBC*** now includes
  - Type IVA construction
    - Exterior walls protected with 40-min fire resistance
    - Interior walls protected with 80-min fire resistance
  - Type IVB construction
    - Exterior walls protected with 40-min fire resistance
    - Interior walls protected with 80-min fire resistance
    - ≤40% of walls and ≤40% of ceilings can be exposed

1 layer of 5/8” Type X gypsum wallboard = 40 minutes



Fire-resistance-rated Construction §701.6

- ***IBC*** now includes
  - Type IVC construction
    - No added fire-resistance
    - Limited in height and area, similar to Heavy Timber

Penetrations and Voids §703.2, §704.2

- Through-penetrations and membrane-penetrations of fire-resistance-rated assemblies must be maintained
- The repair must meet or exceed the code requirements applicable at the time of construction

Sprayed Fire-Resistant Materials §708

- Intumescent fire-resistant materials and spray applied fire-resistant materials must be visually inspected and maintained
- §701.6 requires annual inspection

Chapter 8
Interior Finish, Decorative Materials & Furnishings

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Play Structures §808.5

- New play structures >10’ in height ***or*** 150 ft² must comply with IBC §424

IBC §424

- Materials are noncombustible or fire-resistant
- Foam plastics with heat-release rate ≤100 kW
- Plastic structure with maximum heat release ≤400 kW/m²
- Balls with heat-release rate ≤100 kilowatts
- Class I interior floor finish
- Play structures >300 ft² or 10’ in height are limited to flame spread ratings in IBC Table 803.13

Chapter 9
Fire Protection & Life Safety Systems

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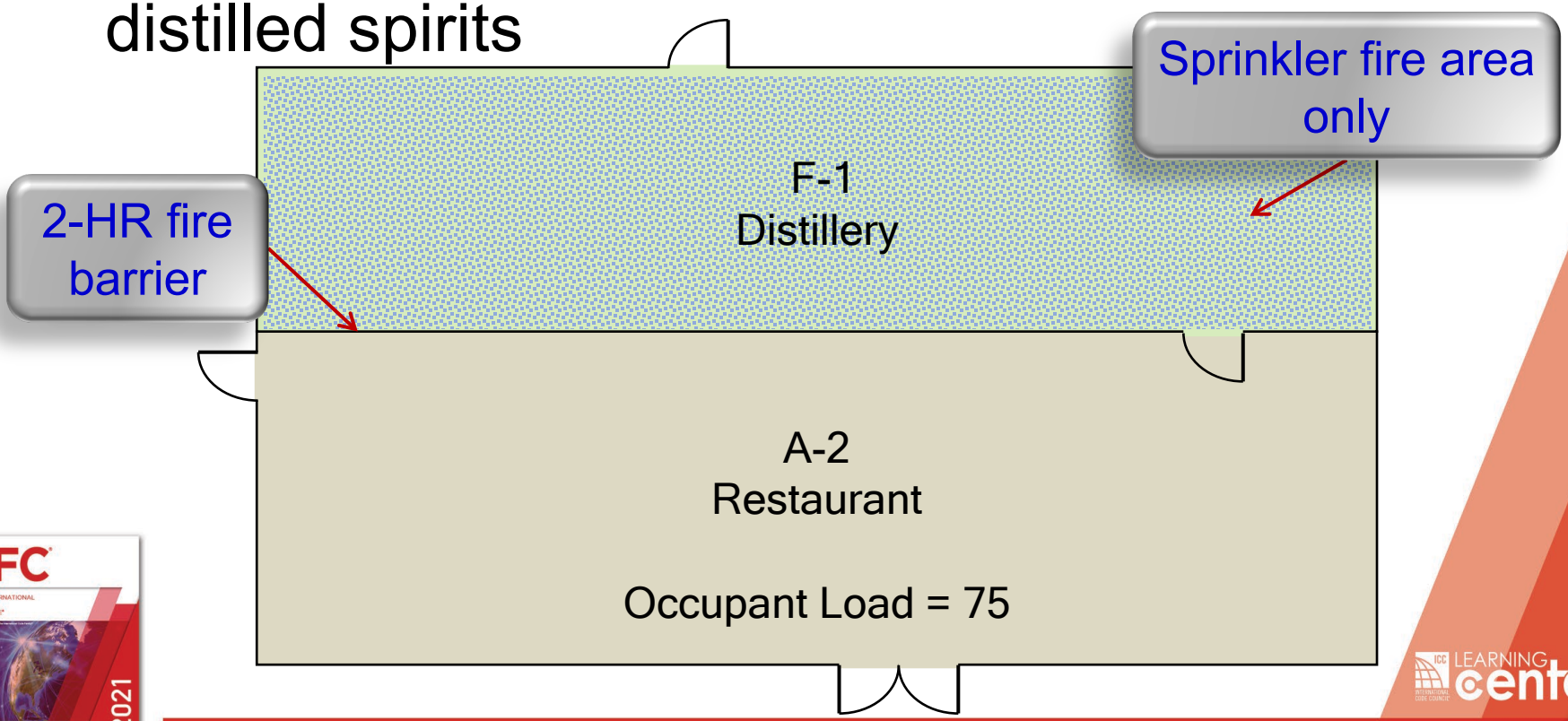
Life Safety Systems
Ch 9

- Revisions have occurred throughout the chapter to acknowledge the life safety systems in addition to the fire protection systems in Ch 9
  - Gas detection
  - Mass notification
  - Carbon monoxide

LIFE SAFETY SYSTEMS – systems, devices and equipment that enhance or facilitate evacuation, smoke control, compartmentation or isolation.

Distilled Spirits §903.2.4.2

- Sprinkler system is required throughout the fire area of Group F-1 used for manufacture of distilled spirits



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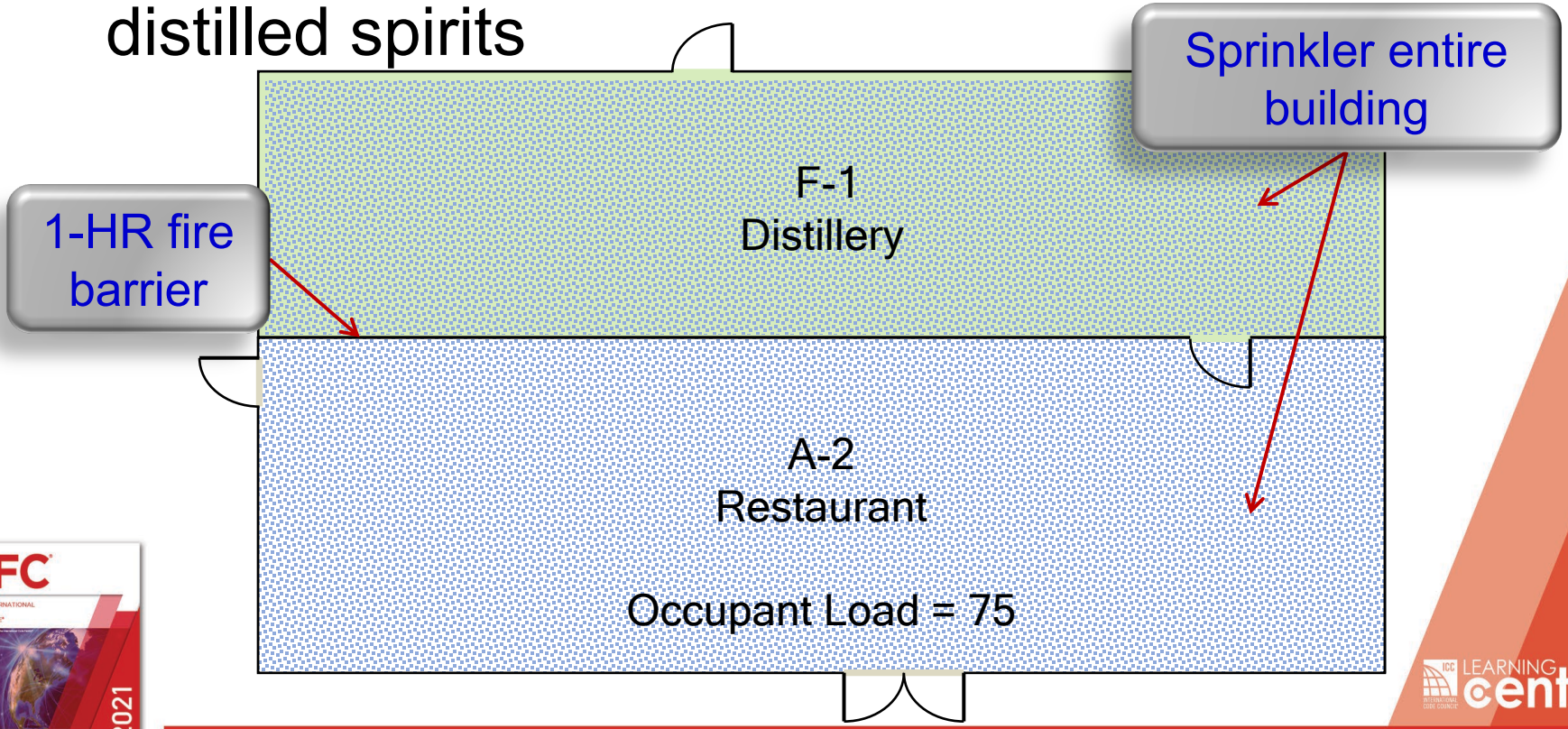

Distilled Spirits §903.2.9.3

- Sprinkler system is required throughout the fire area of Group S-1 used for bulk storage of distilled spirits or wine

Wine storage with alcohol content of ≤16% would be classified as Group S-2

Upholstered Furniture & Mattresses §903.2.4.3

- Manufacturing, storage and retail display of upholstered furniture and mattresses requires a sprinkler system ***IF***:
  - Group F-1: fire area used for manufacturing >2,500 ft²
  - Group M: fire area used for display and sale >5,000 ft²
  - Group S-1: fire area used for storage >2,500 ft²

Exception for 1-story self-service storage facilities with direct access to each unit from the exterior

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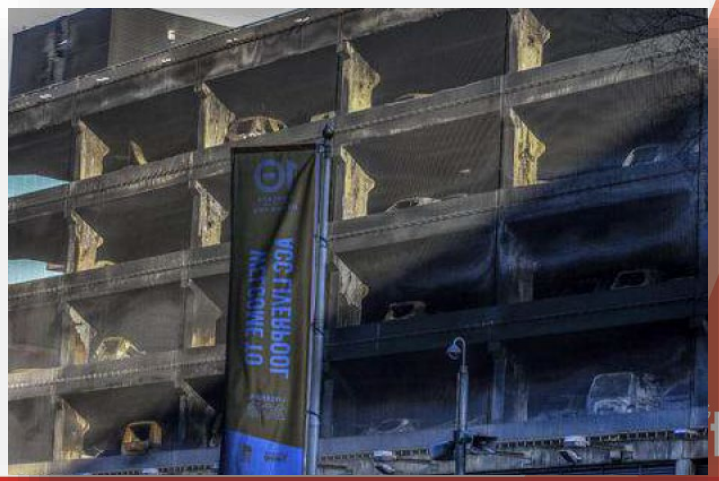
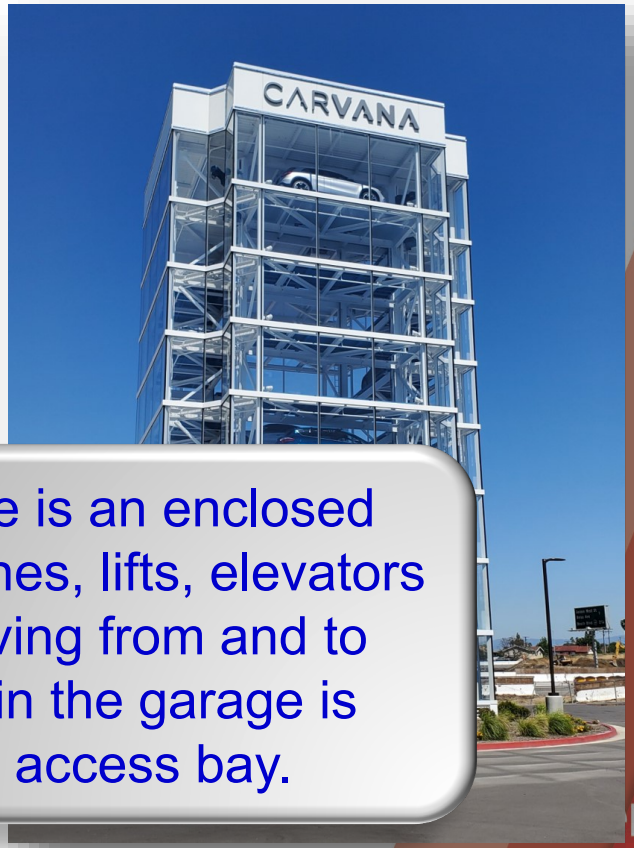
Group S-2 Parking Garage §903.2.10

- Enclosed and open parking garages now have thresholds for the installation of a sprinkler system
  - Enclosed parking garage with a fire area >12,000 ft²
  - Enclosed parking garages located beneath other occupancies except Group R-3
  - Open parking garage with a fire area >48,000 ft²



Mechanical-access Parking Garage §903.2.10.2

- Sprinkler system is required throughout buildings used as a mechanical-access parking garage
- Engineered design is required for the sprinkler system



Mechanical-access enclosed parking garage is an enclosed parking garage which employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.

NFPA 13R Sprinkler Systems §903.3.1.2

- NFPA 13R sprinkler design allowed ***IF***

- 4 stories above grade plane
- No longer count floors above pedestal
- Floor level ≤30’ above LLFDVA
- Floor level ≤30’ below LLFDVA

Means of Egress Balconies §903.3.1.2.2

- Sprinklers required in corridors and balconies in the means of egress in the following conditions:
  - Corridors have combustible floor or walls
  - Corridors with a change of direction >45 degrees
  - Corridors <50% open to the atmosphere at the ends
  - Open-ended corridors and associated exterior stairways and ramps per §1027.6, Exc 3
  - Egress balconies not complying with §1021.2 and §1021.3

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Standpipes in Parking Garages §905.3.1

- Class I standpipe is allowed in all parking garages regardless whether or not it is sprinklered
- The requirement for Class I hose connections to be located as for Class II standpipes has been removed
  - Comply with Class I requirements

Portable Fire Extinguishers §906.1

- Two exceptions added:
  1. Group S storage areas – where approved by FCO, 40A:80B:C extinguishers can be provided on powered industrial equipment in lieu of mounted extinguishers throughout
  2. Extinguishers not required in unoccupied Group U communication equipment structures

Public-storage & Self-storage Facilities – §907.2.10

- Manual fire alarm system required in Group S public- and self-storage facilities ≥3 stories
- Cover interior corridors and interior common areas

Only 1 manual fire alarm boxes required ***IF*** building is sprinklered

Visible notification ***not*** required in storage units

Audible Alarm Sound Pressure §907.5.2.1.2

- The threshold for elimination of audible notification appliances has increased from 95 dBA to 105 dBA
- Where the ambient noise level >105 dBA, audible devices are not required

Low-frequency Alarms §907.5.2.1.3

- Sleeping rooms in Group R-1 and R-2 shall be provided with a notification signal with a 520 Hz low-frequency signal
- This alarm signal frequency is more effective in waking children and adults over 65 or alcohol impaired

Low-frequency signals can be provided by the alarm itself, or by mounting the alarm on a sounder base

Photo courtesy of
Daniel P. Finnegan, Siemens Industry, Inc.

Emergency Voice/Alarm Communication Systems §907.5.2.2.5

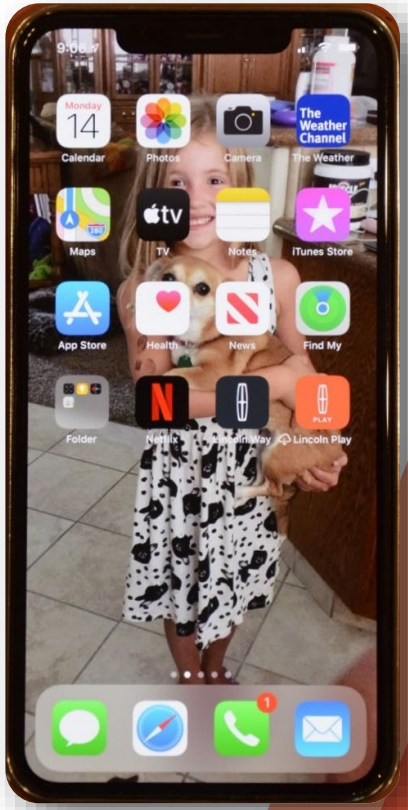
- Emergency voice/alarm communications systems can be powered with standby power
- NFPA 72 still requires secondary power supply within 10 second which can be accomplished with battery until generator starts

Expansion Capability in R-2 §907.5.2.3.3.1

- Fire alarm systems in Group R-2 shall be designed for future visible notification by 1 of the following:
  - Replacement of audible appliances with audible/visible appliances
  - Extension of existing wiring from the unit smoke alarm locations to visible appliances
  - Fire alarm power supply and circuits shall provide ≥5% excess capacity with a single access point to such circuits shall be available on every story

Monitoring §907.6.6.1, §907.6.6.2

- Do It Yourself (DIY) fire alarm devices and Monitor It Yourself (MIY) capabilities are available
- Monitoring of fire alarm systems must be in accordance with NFPA 72
- Monitoring via MIY technology is only allowed where approved by the FCO

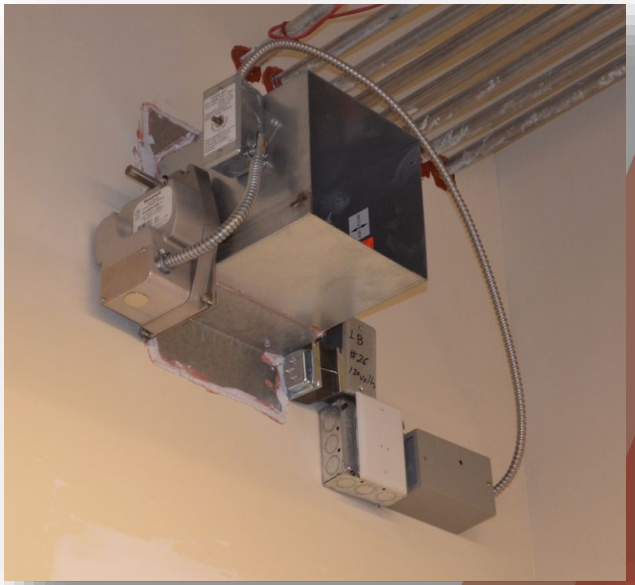


Emergency Alarm & Fire Alarm Interface §908.3

- Emergency alarm signal must be different from the fire alarm signal
- Emergency alarm signal is a local alarm with notification at the emergency control station
- Where interconnected to the FACU, it will produce supervisory notification

Smoke Control System Response §909.17

- Transition from normal ventilation to smoke control mode is not instantaneous
- A maximum time period of 90 seconds is stipulated for full transition to operating conditions and notification at the smoke control panel



Smoke & Heat Vent Operation §909.10.3.4, §909.10.3.5

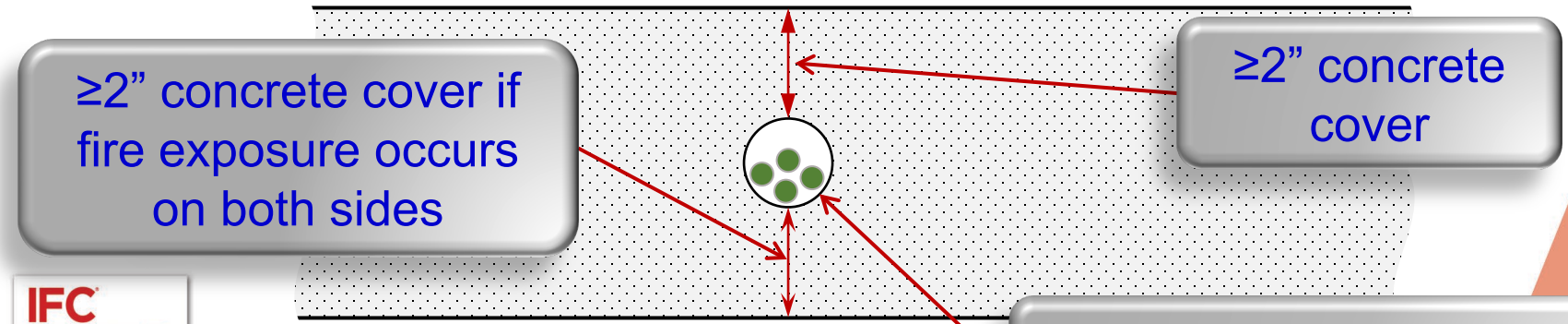
- Smoke/heat vents are required to be operable by an automatic and manual method
- Fusible links shall have a temperature rating of 360°F

Fire Pumps §913.1

- Two revisions to clarify the need for a listed fire pump and compliance with NFPA 20
  - Fire pumps for systems designed under NFPA 13D or IRC §P2904 do not need to comply with NFPA 20
  - Pumps serving a municipal water supply do not need to comply with NFPA 20 – only fire pumps specific for fire protection systems

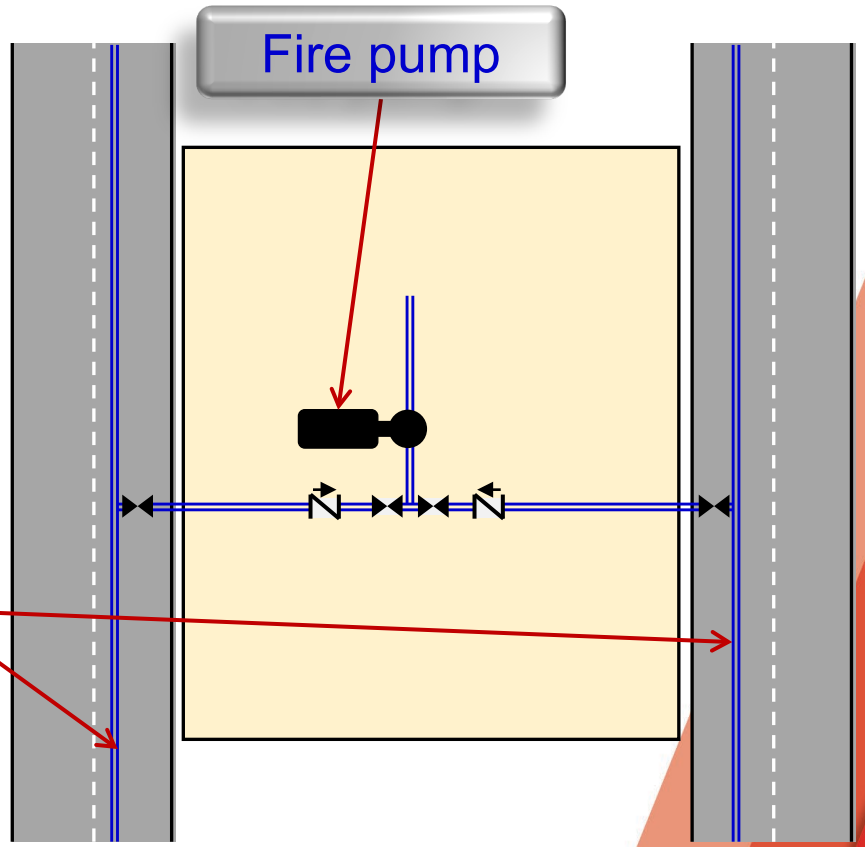
Electric Circuits for Fire Pumps §913.2.2

- Protection of electric conductors serving fire pumps is already specified in the code
- Option of protection with ≥2” of concrete is added
- NFPA 20 also provides this option
- Protection not required inside separated pump room



Water Supply for Fire Pumps §914.3.1.2

- 2 water supply connections are required for fire pumps in buildings >420’ in height
- New requirement adds Type IVA and IVB buildings >120’ in height to this requirement



Puzzle Rooms §914.7

- Revised definition for Special Amusement Areas, and includes puzzle rooms

A special amusement area is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and is arranged in a manner that:

1. Makes the means of egress path not readily apparent due to visual or audio distractions.
2. Intentionally confounds identification of the means of egress path.
3. Otherwise makes the means of egress path not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

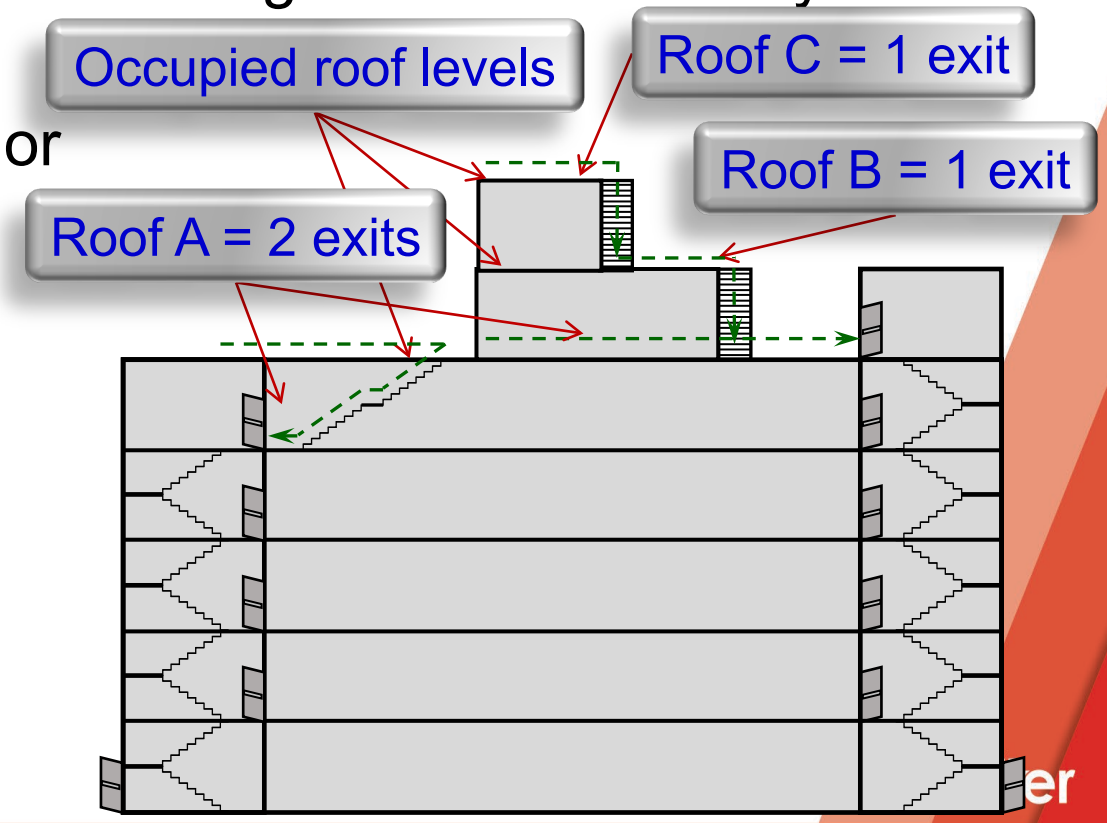
- Sprinkler system and smoke detection system required
  - Sprinklers not required if <1,000 ft²

Chapter 10

Means of Egress

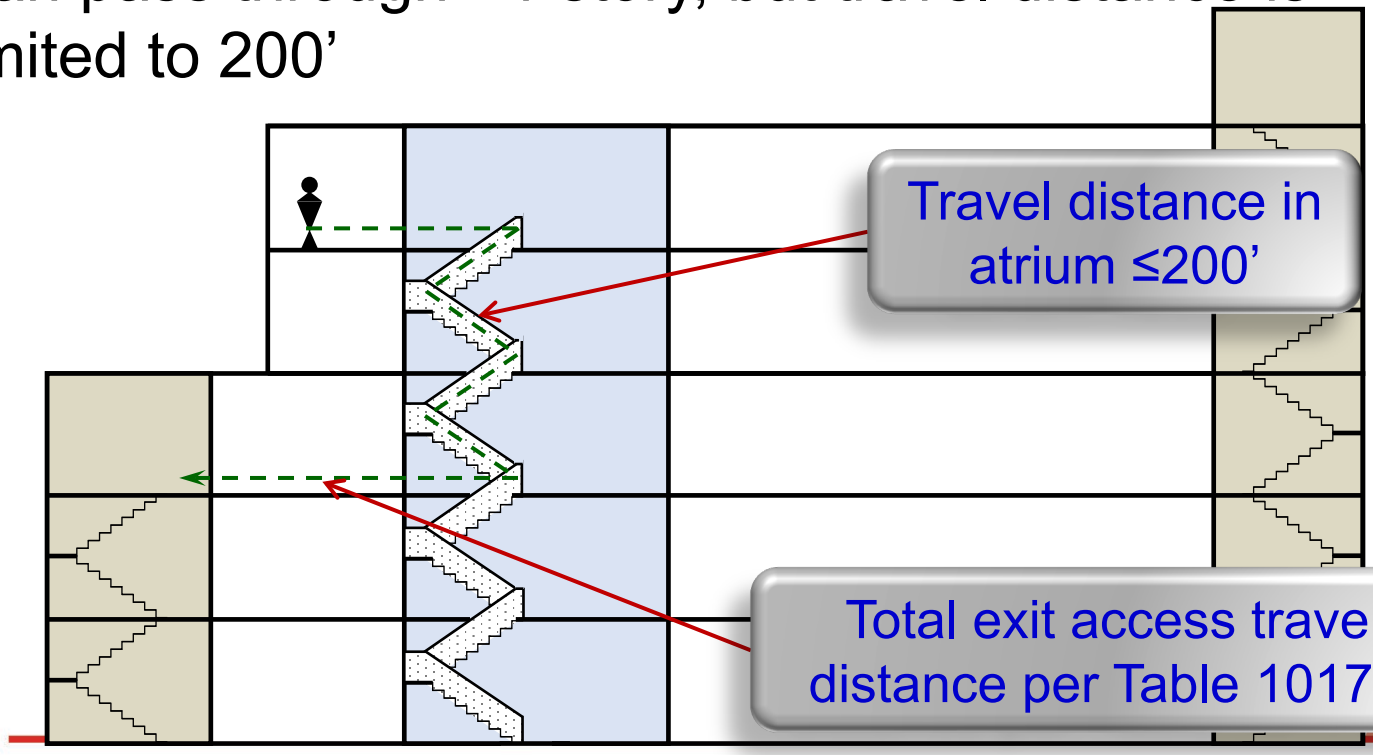
Egress from Occupied Roofs §1006.3

- Only the occupant load of each separate story or roof is considered when determining exits and stairways serving:
  - >1 occupied roof, or
  - >1 story **and** an occupied roof



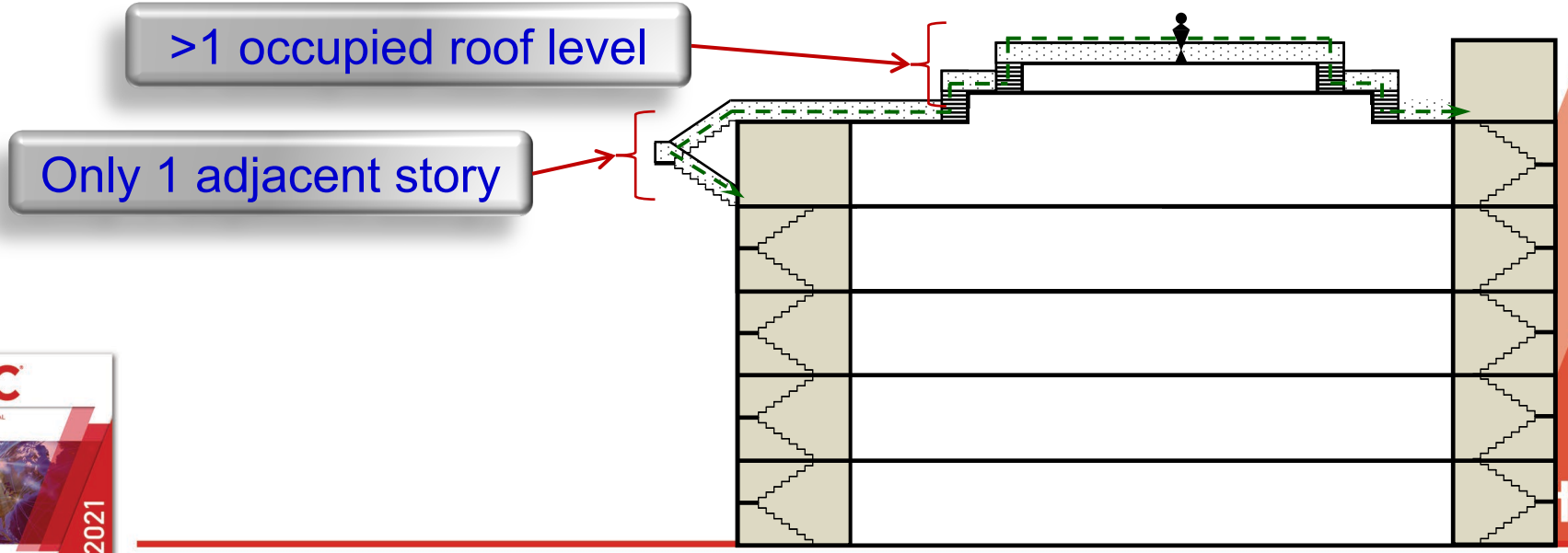
Exit Access Stairs in Atriums §1006.3.2, Exc 3

- Where the egress path is within the atrium, there is no longer a limitation of only traversing 1 story
- Can pass through >1 story, but travel distance is limited to 200’



Egress from Occupied Roofs §1006.3.2, Exc 7

- Path of egress shall not pass through >1 adjacent story
- Exc 7: exit access stairways and ramps between occupied roofs



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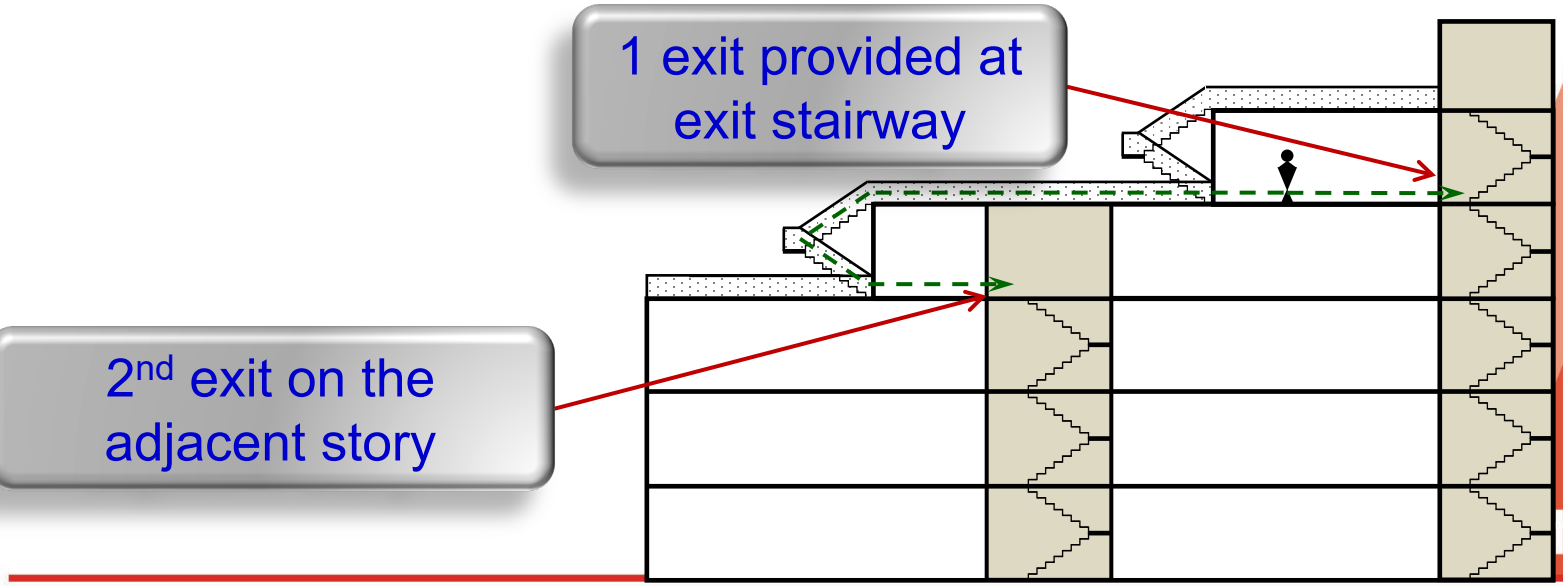
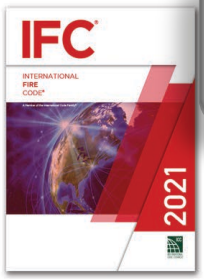




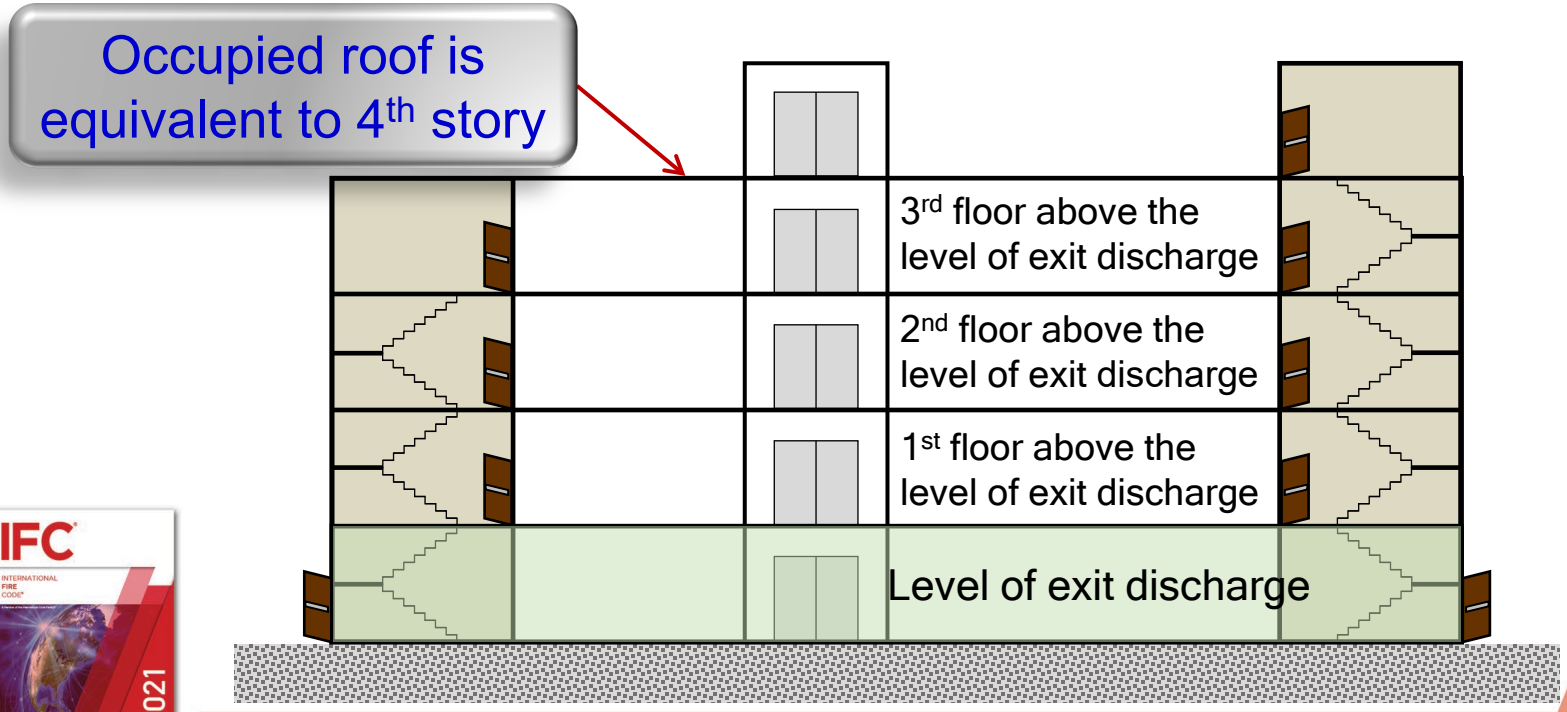
Exit Access vs Common Path §1006.3.4

- When evaluating rooms, stories or buildings for only one exit, common path of travel requirements do not apply

STORY	OCCUPANCY	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM ~~COMMON PATH OF EGRESS~~ EXIT ACCESS TRAVEL DISTANCE (feet)
First story above or below grade plane	A, B [b], E F [b], M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2 [a,c]	10	75
	S [b,d]	29	75
Second story above grade plane	B, F, M, S [d]	29	75
Third story above grade plane and higher	NP	NA	NA

Elevator Serving Occupied Roof §1009.2.1

- An elevator is required where:
  - Accessible floor is ≥4 stories above LED
  - Occupied roof creates ≥4 levels above LED



Size of Doors §1010.1.1

- Doors are no longer limited to 48” in width
- Limitation is based on pressure to open the door
- §1010.1.3 limits the force to unlatch and open doors

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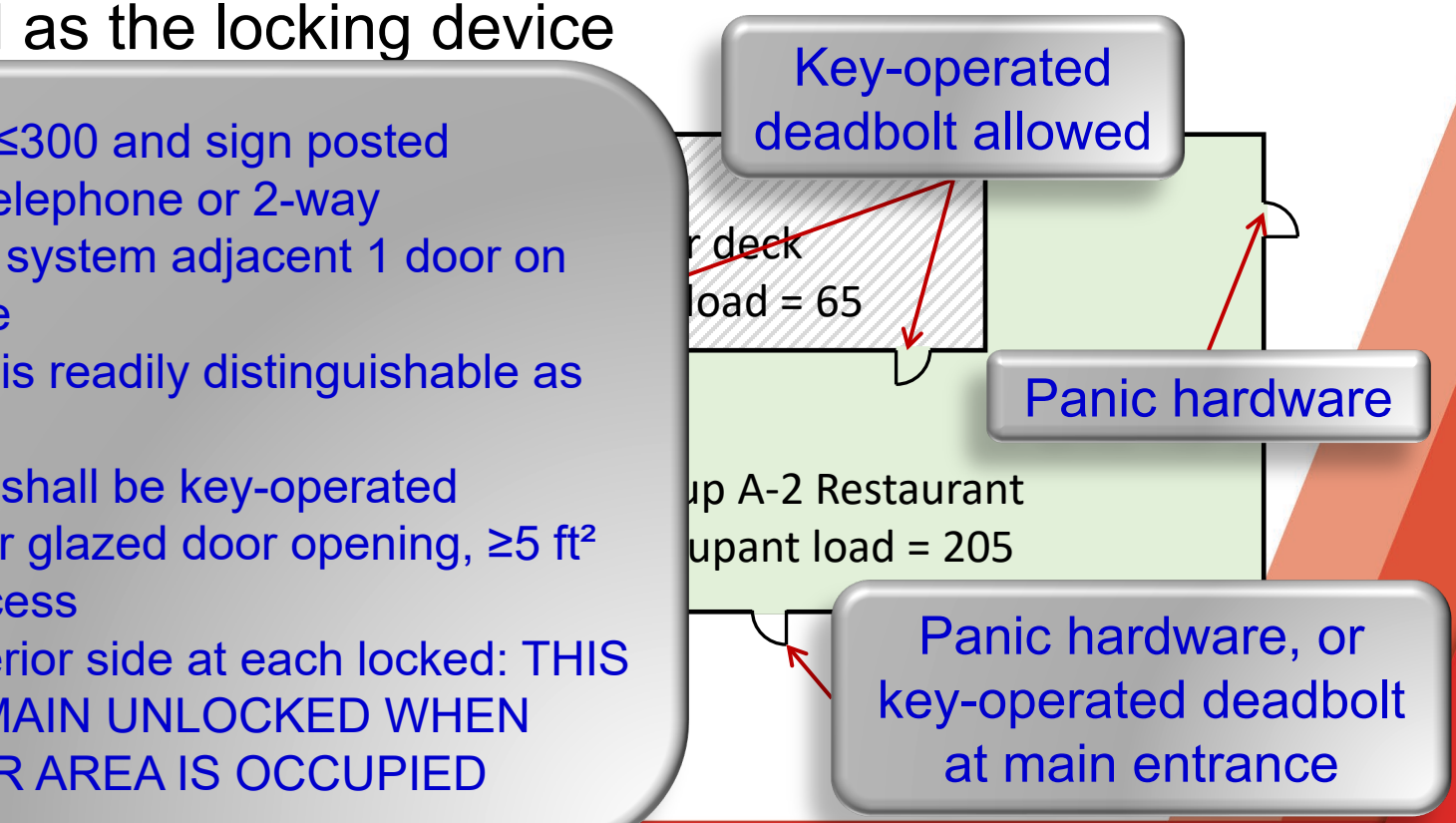
Locks and Latches §1010.2.4

- Except in egress courts, where the egress path travels back into the building, key-operated deabolts are allowed to be used as the locking device

- Occupant load ≤300 and sign posted
- Weatherproof telephone or 2-way communication system adjacent 1 door on the exterior side
- Locking device is readily distinguishable as locked
- Locking device shall be key-operated
- Clear window or glazed door opening, ≥5 ft² at each exit access
- Sign on the interior side at each locked: THIS DOOR TO REMAIN UNLOCKED WHEN THE OUTDOOR AREA IS OCCUPIED



Locks in Educational Occupancies §1010.2.8

- Locks to exclude intruders are located in one section
- Such locks in new construction and locks added to existing buildings must meet the same requirements
- Occupancies affected:
  - Group E
  - Group B educational
  - Group I-4

Photo courtesy of Assa Bloy

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Locks in Educational Occupancies §1010.2.8

- Doors shall be capable of being unlocked from outside the room with a key or approved means
- Doors shall be openable from within the room with single action
- Modifications shall not be made to listed panic hardware, fire door hardware or door closers
- Modifications to fire door assemblies sh

Photo courtesy of Assa Bloy

Remote locking or unlocking of doors from an approved location is permitted ***in addition*** to the unlocking operation in Item 1

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Panic Hardware & Fire Exit Hardware §1010.2.9

- Panic hardware now required in:
  - Mechanical rooms >1,000 ft²
    - These mechanical rooms must have ≥2 exits
  - Electrical rooms with transformer vaults, rooms designated for batteries or energy storage systems or modular data centers
  - Electrical rooms with electrical equipment ≥800 amps

Dead-end Corridors in Group I-2 §1020.5

- Dead-end corridors in portions of Group I-2 Condition 2 allowed up to 30’ in length if ***not*** serving patient rooms or treatment rooms

Dead-end Corridors in Group I-2 §1020.5

- General limitation for length of dead-end corridors — 20’
- Group I-2 Condition 2 not serving patient areas — 30’
- Groups B, E, F, I-1, M, R-1, R-2, S and U with NFPA 13 sprinklers — 50’
- Group I-3 Conditions 2, 3, 4 — 50’

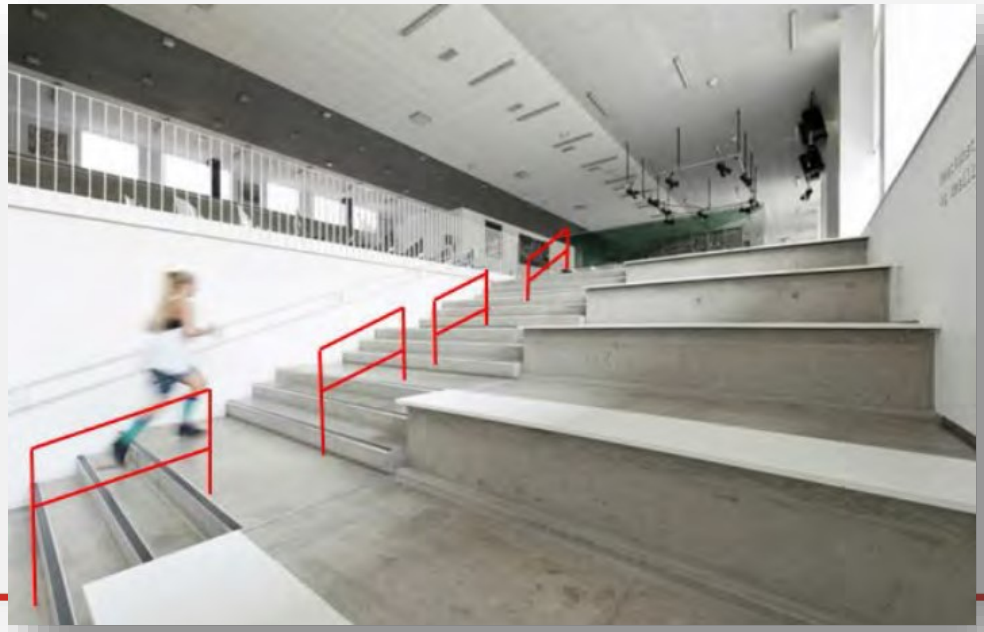
Dead-end corridors are ***not*** limited in length where the length is less than 2.5 times the narrowest width

Handrails at Social Stairs §1030.16

- Where seating occurs on one side of stairs and stairs are <74” wide, only 1 handrail is required
- Where seating occurs on one side of stairs and stairs are ≥74” wide, 2 handrails are required
  - Handrail must be ≤30” of the tiered floor

Handrails at Social Stairs §1030.16

- Handrail on the seating side shall be discontinuous
- Where seating is on both sides of stairs, mid-aisle handrail shall be discontinuous



Chapter 11
Construction Requirements for Existing Buildings

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Sprinklers in High-rise §1103.5.4

- Sprinklers required in existing high-rise ***IF*** any of the following exist:
  - Occupied floor >75’ and ≤120’ and building does not have ≥2 interior exit stairs complying with §1104.10 with 2-HR enclosure

§1104.10
- Tread rise ≤8¼”
- Tread run ≥9”

This section only applies ***IF*** Appendix M is ***NOT*** adopted

Sprinklers in High-rise §1103.5.4

- Sprinklers required in existing high-rise ***IF*** any of the following exist:
  - Occupied floor >75’ and ≤120’ and building does not have a fire alarm system with smoke detection in:
    - Electrical, mechanical, transformer, telephone rooms
    - Corridors
    - Elevator lobbies
    - Doors penetrating interior exit stairway enclosures

This section only applies ***IF*** Appendix M is ***NOT*** adopted

Sprinklers in High-rise §1103.5.4

- Sprinklers required in existing high-rise ***IF*** any of the following exist:
  - Occupied floor >120’ above LLFDVA

Where any of the 3 conditions exist, the owner must:

- File a compliance schedule within 1 year of notification
- Complete the sprinkler installation within 12 years

This section only applies ***IF*** Appendix M is ***NOT*** adopted

Fire Alarm in R-1 Hotel/Motel §1103.7.5.1

- Manual fire alarm system required in existing R-1 hotel or motel when >1 story or >20 sleeping rooms
  - Exceptions
    1. Fire alarm system not required if only 1-story with >20 sleeping rooms ***AND*** each room has direct access to public way ***AND*** each sleeping room is separated by 1-HR

Fire Alarm in R-1 Hotel/Motel §1103.7.5.1

- Manual fire alarm system required in existing R-1 hotel or motel when >1 story or >20 sleeping rooms
  - Exceptions
    2. Fire alarm system not required if ≤3 stories with ≤20 sleeping rooms ***AND*** is sprinklered with NFPA 13 or 13R

Fire Alarm in R-1 Hotel/Motel §1103.7.5.1

- Manual fire alarm system required in existing R-1 hotel or motel when >1 story or >20 sleeping rooms
  - Exceptions
    3. Fire alarm system is required but only 1 manual fire alarm box ***IF*** sprinklered with NFPA 13 or 13R

CO Detection in Existing Buildings §1103.9

- CO detection required in existing:
  - Group I-1, I-2, I-4
  - Group R
  - Classrooms in Group E
- Can be battery operated CO alarms if the code in effect at the time of construction did not require CO detection
- Can be CO alarms or CO detection system

Chapter 12

Energy Systems

ICC LEARNING center

Fuel Piping Protection §1203.1.2

- Fuel piping for emergency and standby generators requires fire-resistance-rated protection
  - 2-HR listed pipe-protection system – UL 1489
    - Reduced to 1-HR if sprinklered with NFPA 13
  - An assembly provided 2-HR fire-resistance rating
    - Reduced to 1-HR if sprinklered with NFPA 13
  - Other approved methods

Photo courtesy of 3M

Portable Generators §1204

- Portable generators manufactured after 1/1/2021 must be listed to UL 2201
- Must be grounded
- Portable generators operated:
  - Only outdoors or enclosed areas
  - ≥5’ from building openings or air intakes
  - Separation from tents per Ch 31
- Temporary wiring shall be provided with GFCI

Do not refuel while the generator is operating

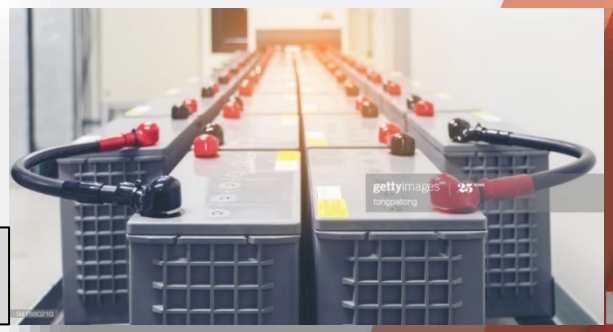
Portable Generators §1204

- Connections to premise wiring system shall ***NOT*** be provided by back-feeding through receptacles
- Connection to a premise served by commercial power must be through a transfer switch
- Connections to buildings not served by commercial power shall comply with NFPA 70

If no transfer switch is available, then the use of relocatable power taps and extension cords to power appliances must comply with §603

Electrical Energy Storage Systems §1207

- Entire content of §1207 has been revised
  - Nickel metal hydride technology now included
  - “Other battery technologies” is listed along with “other electrochemical ESS technologies”
  - Sodium batteries are no longer listed separately
    - Included under “Other electrochemical ESS technologies” and are regulated at 3 kWh
  - Capacitor ESS systems included
    - Regulated at ≥3 kWh



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Electrical Energy Storage Systems §1207

- Construction permit and operational permit required
- Mobile ESS systems addressed
- UL 9540A is used to evaluate thermal runaway
- Amount of stored power can only exceed Table 1207.5.2 if justified by hazard mitigation analysis or large-scale fire testing
  - No longer becomes Group H
  - Mitigation measures provided to address the hazards
- No longer treated as Incidental Use in the IBC

Outdoor ESS Installations Table 1207.8

- Outdoor ESS systems and battery storage

Compliance Required		Remote Installations [a]	Installations Near Exposures [b]
Feature	Section		
All ESS installations	1207.4	Yes	Yes
Clearance to exposures	1207.8.3	Yes	Yes
Fire suppression systems	1207.5.5	Yes [c]	Yes
Maximum allowable quantities	1207.5.2	No	Yes
Maximum enclosure size	1207.5.6	Yes	Yes
Means of egress separation	1207.5.8	Yes	Yes
Size and separation	1207.5.1	No	Yes [d]
Smoke and automatic fire detection	1207.5.4	Yes	Yes
Technology-specific protection	1207.6	Yes	Yes
Vegetation control	1207.5.7	Yes	Yes

Remote outdoor installations are separated by ≥100’ from lot lines, buildings, public ways, stored combustibles, haz mat

Outdoor ESS Installations Table 1207.8

- ESS can be installed outdoors on the exterior wall ***IF***:
  1. Energy capacity of individual ESS units ≤20 kWh
  2. ESS must comply with technology-specific provisions
  3. ESS is installed in accordance with the manufacturer's instructions and listing
  4. Individual ESS units shall be separated ≥3'
  5. ESS separated ≥5' from doors, windows, operable openings into buildings or HVAC inlets

FCO can approve smaller separations in Items 4 and 5 when based on large-scale fire testing

Mobile ESS Systems
Table 1207.10

TABLE 1207.10 – MOBILE ENERGY STORAGE SYSTEMS (ESS)

COMPLIANCE REQUIRED		DEPLOYMENT [a]
Feature	Section	
All ESS installations	1207.4	Yes [b]
Fire suppression systems	1207.5.5	Yes [c]
Maximum allowable quantities	1207.5.2	Yes
Maximum enclosure size	1207.5.6	Yes
Means of egress separation	1207.5.8	Yes
Size and separation	1207.5.1	Yes [d]
Smoke and automatic fire detection	1207.5.4	Yes [e]
Technology-specific protection	1207.6	Yes
Vegetation control	1207.5.7	Yes

a. See §1207.10.2.

b. Mobile operations on wheeled vehicles and trailers shall not be required to comply with §1207.4.4 seismic and structural load requirements.

c. Fire suppression system connections to the water supply shall be permitted to use approved temporary connections.

d. In walk-in units, spacing is not required between ESS units and the walls of the enclosure.

e. Alarm signals are not required to be transmitted to an approved location for mobile ESS deployed ≤30 days.

ESS in Groups R-3 & R-4 §1207.11

- Must be listed for residential installation – UL 9540
- Individual ESS units ≤20 kWh

ESS Location	Maximum Aggregate Rating	Conditions
Detached garages & detached accessory structures	80 kWh	
Attached garages	80 kWh	Separated from the dwelling unit and sleeping units per IBC
Utility closets, storage or utility spaces within dwelling units and sleeping units	40 kWh	
Outdoors on exterior walls	80 kWh	≥3' from doors and windows
Outdoors on the ground	80 kWh	≥3' from doors and windows

Use of electric vehicles to power a dwelling unit shall comply with manufacturer's instructions and NFPA 70

Chapter 22
Combustible Dust-producing Operations

Combustible Dust
Ch 22

- Chapter is revised
- Explosion prevention
- Dust collection
- Control of ignition sources
- Housekeeping
- Emergency response plan
- Employee training

US No. 40 Standard Sieve

Dust Explosion Projection §2203

- Identification of hazard – critical depth layer

Type of Dust	Critical Depth Layer (inches)
Wood Flour	1/8
All Other Dusts	1/32

- Other depths can be used ***IF*** evaluated under specific criteria in NFPA 654

Housekeeping §2203.5

- Accumulation on surfaces inside buildings shall be maintained below the critical depth layer
- Accumulated combustible dust shall be collected by one of the following methods:
  - Portable vacuum cleaners listed for use in Class II, Group G, Division 1
  - Dust collection systems
  - Other approved means

Pressurized air shall not be used to remove dust

Except if it is the only solution ***AND*** only after other cleaning methods have been completed ***AND*** in accordance with NFPA 625, 654 or 664

Dust Collection §2203.3

- Dust collection system designed to collect dust at the point of generation
- Dust collectors must be located outdoors with some limited exceptions
- Listed equipment
- Collection system and ductwork must be grounded
- Openings in system for inspection and maintenance

Chapter 23
Motor Fuel-dispensing Facilities & Repair Garages

ICC LEARNING center

CNG Vehicle Fueling §2308.2

- Vehicle Fueling Appliance (VFA)
  - Listed to CSA/ANSI NGV 5.2
  - Fueling rate ≥10 cfm/min
- Residential Fueling Appliance (RFA)
  - Listed to CSA/ANSI NGV 5.1
  - Fueling rate ≥5 cfm/min

Lighter-than-air Fueled Vehicles §2311.8

- Repair of CNG, LNG & H_2 fueled vehicles where work is performed on the fuel tanks or fuel system must comply with provisions of §2311.8
- Repair work can occur in:
  - Motor vehicle repair room (traditional repair garage)
  - Motor vehicle repair booth
  - Motor vehicle repair space (separated by noncombustible spray curtains)
- Exhaust ventilation
  - Shall operate continuously or upon activation of gas detection

Lighter-than-air Fueled Vehicles §2311.8 Exceptions

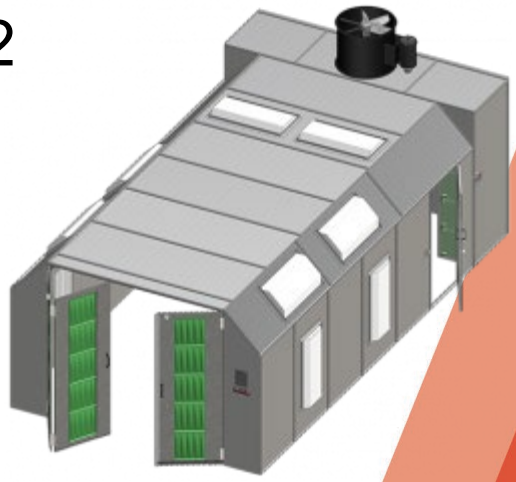
- §2311.8 does not apply to repair of lighter-than-air fueled vehicles apply ***IF***:
  - Fuel tank is purged
  - Fuel tank is mounted on a subassembly that must be removed to access other components
  - Work is not being performed on the fuel tank ***AND*** no open flame or welding ***AND***
    - H_2-fueled vehicles with <400 ft³ in tank
    - CNG-fueled vehicles with <250 PSI in tank

Chapter 24

Flammable Finishes

Size of Spray Booths §2404.3.3.6

- Individual spray booths are no longer limited to 1,500 ft²
- Limited to the smaller of:
  - 10% of the floor area of the building
  - Basic allowable area for Group H-2
- When only a single booth, it can be 500 ft²
  - Even when it exceeds 10%



Size of Spray Booths §2404.3.3.6

- IBC Table 506.2

Basic allowable area

Occupancy Classification	See Footnotes	TYPE I		TYPE II	
		A	B	A	B
F-1	NS	UL	UL	25,000	15,500
	S1	UL	UL	100,000	62,000
	SM	UL	UL	75,000	46,500

Group F-1
Type IIB construction
1-story
Sprinklered
50,000 ft²

10% of floor area → Spray Booth 5,000 ft²

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Chapter 27
Semiconductor Fabrication Facilities

Water Reactives in Semiconductor Fabs Table 2704.2.2.1

- Quantities of Class 3 water reactive solids in a fab area is increased
- Maximum of 0.01 lbs per square foot of fab area
- Also limited to ≤1 lb per tool

Chapter 28

Lumber Yards & Agro-industrial, Solid Biomass & Woodworking Facilities

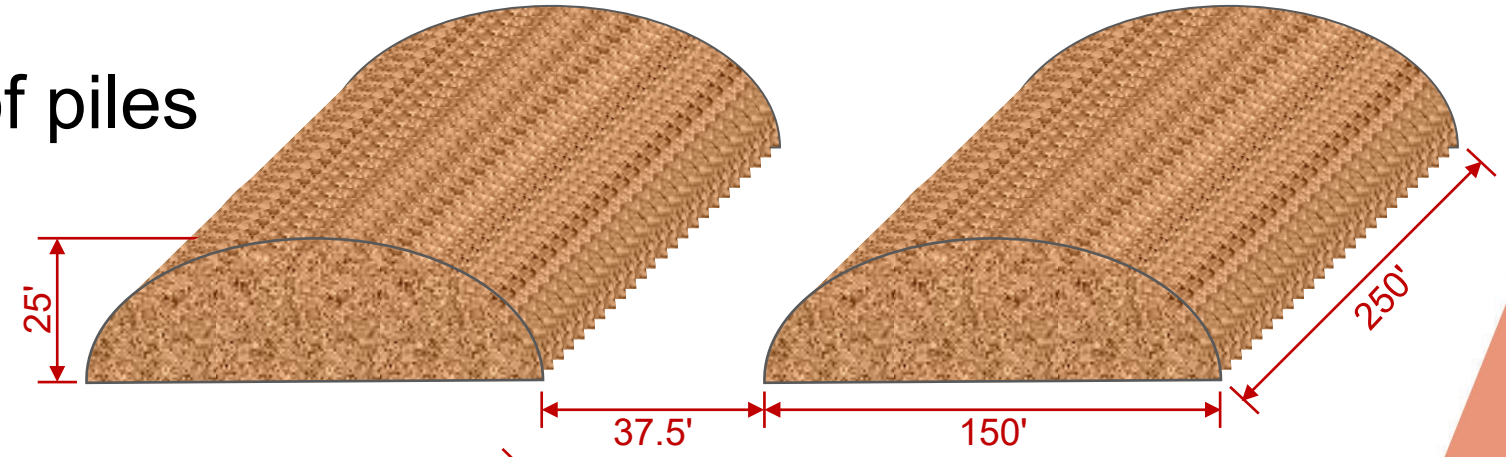
ICC LEARNING center

Size of Piles or Stacks §2808.3

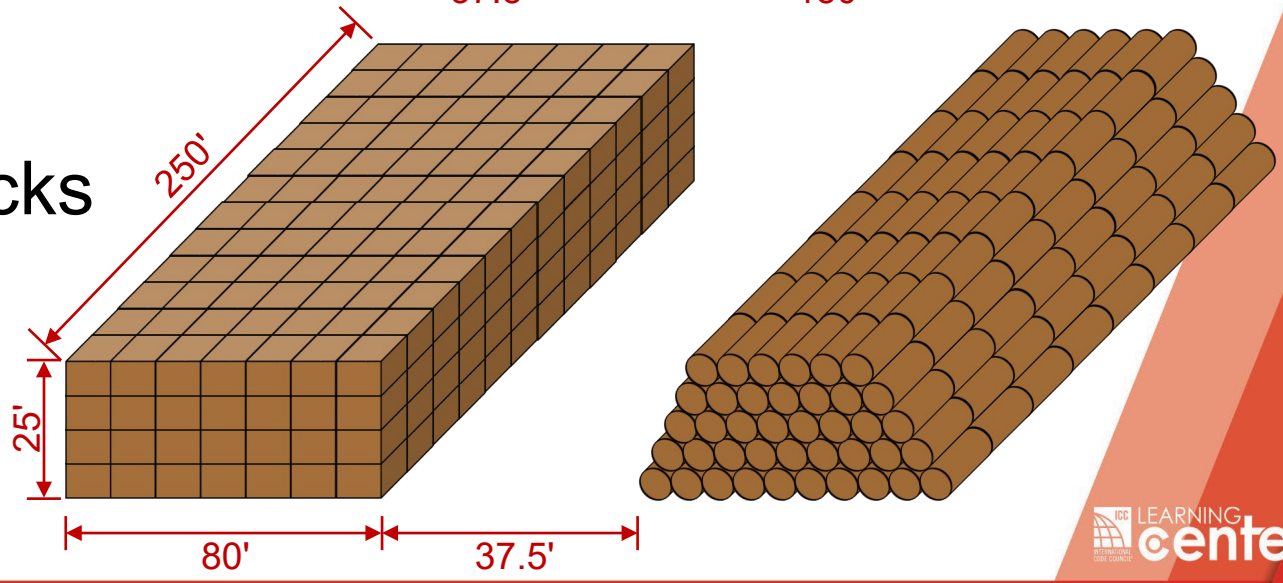
- Storage piles associated with
  - Storage & processing of wood chips, hogged material, fines & compost
  - Solid biomass feedstock
  - Raw products at yard waste, agro-industrial facilities & recycling facilities
- Size of piles can be increased based on fire protection plan

Basic Size of Piles or Stacks §2808.3

- Size of piles

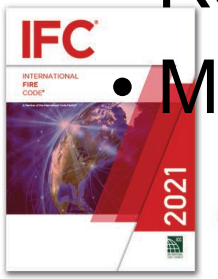


- Size of stacks



Fire Protection Plan §2808.3.1

- Contact information for after-hours personnel
- Storage yard areas and material-handling equipment selection, pile design and arrangement
- Access roads around the piles or stacks and access roads to the top of piles
- Evaluation and control of spontaneous heating
- Routine yard inspections
- Method of early fire detection and reporting



Fire Protection Plan §2808.3.1

- Facilities and equipment needed by the FD
  - Water
  - Heavy equipment
- De-inventory plan
- Increased pile size based on the capabilities of fire protection systems and features
- Controlled burn area

Chapter 32

High-piled Combustible Storage

Lithium-ion Batteries
Table 3203.8

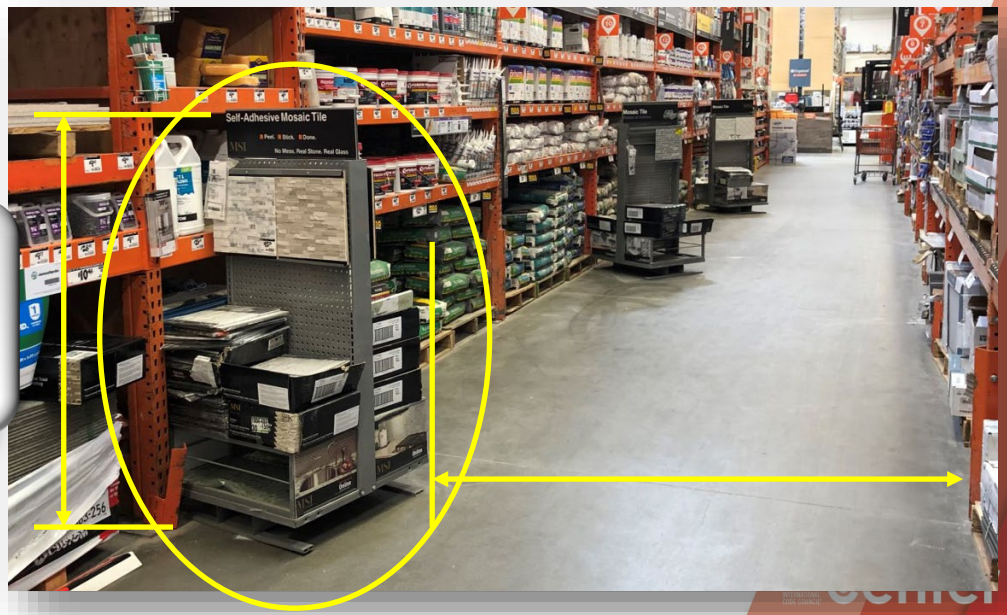
- Listed as high-hazard commodity
- Can be classified as high-piled storage >6’

Product Category	Product	Classification
Batteries	Dry cells (excludes lithium, lithium-ion and other similar exotic metals or combustible electrolyte); without blister packing (if blister packed, refer to the commodity classification definitions)	Class I
	Dry cells (nonlithium or similar exotic metals); in blister packing; cartoned	Class II
	Vehicle; any size (for example, automobile or truck); empty plastic casing	High-hazard (Group A unexpanded)
	Vehicle; large (in other words, truck or larger); dry or wet cells (excludes lithium-ion and other cells containing combustible electrolytes)	High-hazard (Group A unexpanded)
	Vehicle; small (for example, automobile); wet cells (excludes lithium-ion and other cells containing combustible electrolytes)	Class I
	Lithium-ion	High-hazard

Maintenance of Aisle Width §3205.5

- Displays are allowed to encroach into the required aisle width ***IF***:
  - Sprinklers have K-factor of 25.2 and comply with NFPA 13 §21.9.1
  - Height ≤48”
  - Clear aisle ≥48”

2 hydraulic design points
1. 0.60 gpm/ft² over 2,000 ft²
2. 0.70 gpm/ft² from 4 sprinklers



Automatic Rack Storage Shutdown §3209.4

- Automated rack storage systems are required to be provided with shutdown ***IF*** high-piled storage area >500 ft²
  - Manual shutdown switch
  - Automatic shutdown activated by either of the following:
    - Sprinkler water flow
    - Activation of fire detection system

Chapter 33
Fire Safety during Construction & Demolition

ICC LEARNING center
INTERNATIONAL CODE COUNCIL

Site Safety Plan §3303.1

- Site safety plan shall include:
  - Name & contact info for site safety director
  - Training documentation
  - Procedures for reporting emergencies
  - Fire department vehicle access routes
  - Location of fire protection equipment
  - Smoking and cooking policies
  - Temporary heating equipment
  - Hot work permit plan

Site Safety Plan §3303.1

- Site safety plan shall include:
  - Control of combustible waste material
  - Storage and use of flammable and combustible liquids and other hazardous materials
  - Site security
  - Changes that affect the site safety plan
  - Other site-specific information required by the FCO

Daily Fire Safety Inspection §3303.3

- Owner shall designate a Site Safety Director for construction and remodel
- Daily inspection of building and site where construction is occurring
  - Contractors entering to perform hot work have been instructed in the hot work safety requirements
  - Temporary heating equipment is properly used
  - Combustible debris, rubbish and waste material is removed
  - Temporary wiring does not have exposed conductors

Daily Fire Safety Inspection §3303.3

- Flammable liquids and other hazardous materials are stored in locations approved by the site safety director
- Access roads are maintained clear of obstructions
- Fire hydrants are clearly visible and not obstructed
- FDCs are clearly identified and not obstructed
- Standpipe systems are in service and continuous to the highest work floor
- Portable fire extinguishers are available in required locations

Daily Fire Safety Inspection §3303.3.1

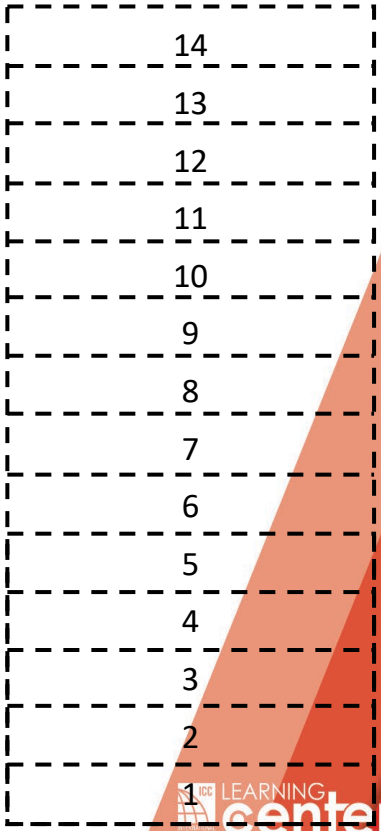
- Failure to properly conduct, document and maintain daily inspection records and documentation
  - Is an unlawful act
  - Shall result in the issuance of a notice of violation
  - On the 3rd offense, FCO is authorized to issue a stop work order
  - Work cannot resume until assurances of future compliance have been presented and approved by the FCO

Fire Safety for Type IV-A, IV-B & IV-C §3303.5

- Type IV construction is now subdivided to include mass timber construction
  - Type IV-A – mass timber with interior structural members provided with protection
  - Type IV-B – mass timber with limited portions of interior members unprotected
  - Type IV-C – mass timber with exposed interior elements
  - Type IV-HT – traditional heavy timber construction

Fire Safety for Type IV-A, IV-B & IV-C §3303.5

- For buildings >6 stories in height that require noncombustible protection
  - Type IV-A & IV-B
- Water supply required during construction
- Standpipe required when construction >40’ above LLFDVA
  - Connections provided to within 1 floor of active construction with a floor or deck



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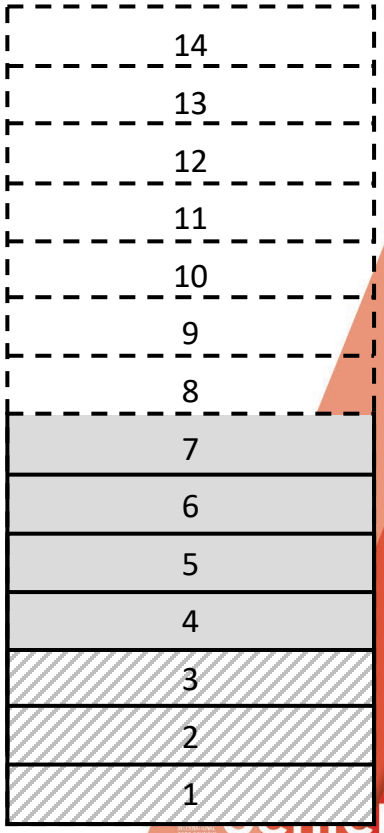
Fire Safety for Type IV-A, IV-B & IV-C §3303.5

- When construction extends >6 stories:
  - 1 layer of noncombustible protection to be applied on all ***interior*** levels >4 levels below active mass timber construction
  - 1 layer of noncombustible protection to be applied on all ***exterior*** levels >4 levels below active mass timber construction



Fire Watch – Demolition §3305.5

- Fire safety plan is required
- Fire watch provided for demolition ***IF***:
  - Required by fire safety plan, or
  - Required by FCO

Fire Watch – New Construction §3305.5.1

- Fire safety plan is required
- Fire watch provided for new construction ***IF***:
  - >40’ above lowest adjacent grade,
  - New multi-story construction >50,000 ft² per story,
  - Required by fire safety plan, or
  - Required by FCO

Fire Watch §3305.5.1

- ***IF*** fire watch is required, it must be provided:
  - During nonworking hours
  - When construction >40’ above lowest adjacent grade
- Fire watch personnel
  - Must be trained
  - Keep written log
- Fire watch for hot work is still required

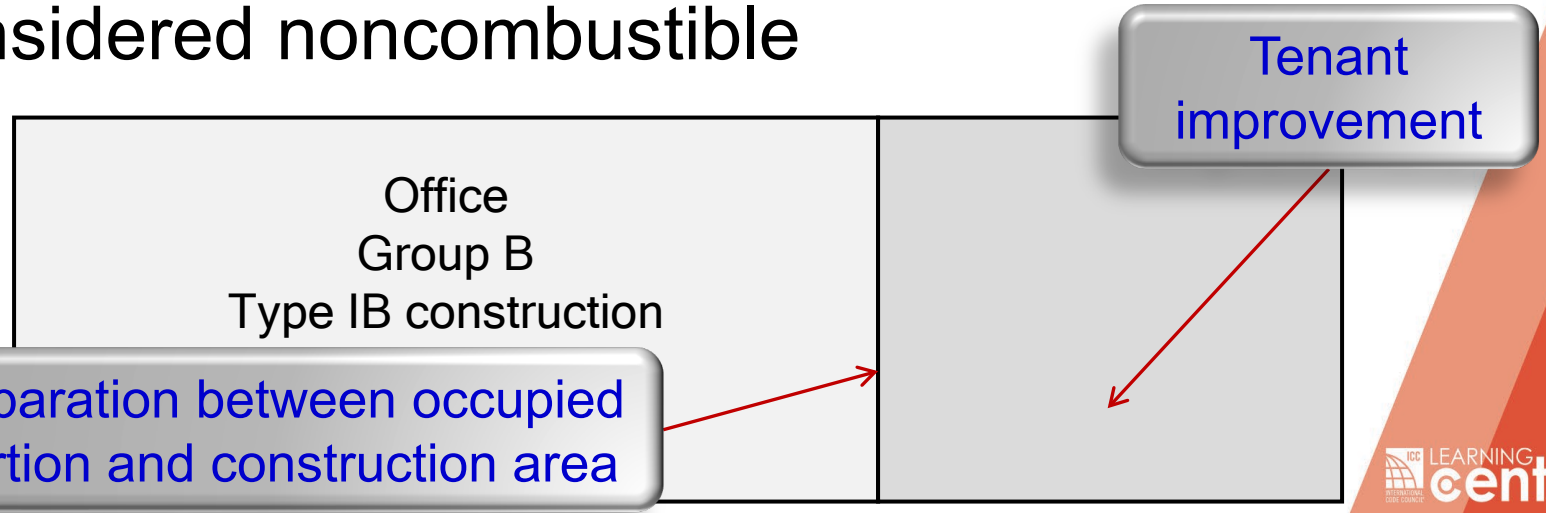
This fire watch is different than fire watch for hot work

Separation of Construction Areas §3305.9

- In Type I or II construction, separations between construction areas and occupied areas must comply with one of the following:
  - Noncombustible
  - Class A flame spread rating
  - Peak heat release ≤300 kW/m²

Separation of Construction Areas §3305.9

- Can exposed sheetrock be used to separate the construction area from the work area in this Type IB building?
- Even though sheetrock is covered with paper, flame spread rating is <25 and is considered noncombustible



Water Supply during Construction §3313

- Water supply required when combustible building materials arrive on site
  - Minimum 500 GPM
  - Fire hydrant ≤500’ of the combustible materials
- Water supply required when standpipe is available
  - Minimum 500 GPM
  - Fire hydrant ≤100’ of FDC

Water Supply during Construction §3313

- Minimum fire flow of 500 GPM is increased for Type III, IV or V buildings before vertical construction commences
  - Full fire flow if building ≤30’ of property line that can be built on
  - 50% of full fire flow if building >30’ and ≤60’ of property line that can be built on
  - Minimum of 500 GPM is acceptable during construction if building >60’ of property line that can be built on

Chapter 38

Higher Education Laboratories

ICC LEARNING center

Restricted Materials in College Labs §3805.2

- Class 4 oxidizer and pyrophoric materials are allowed in nonsprinklered higher education labs, but the quantity is limited
  - ≤25% of quantity in Table 5003.1.1(1) based on sprinklered MAQ
  - 25% limitation is applied to allowed percentage in Table 3805.4

Restricted Materials in College Labs §3805.2

- Example – storage of solid Class 4 Oxidizer

Table 5003.1.1(1)
Maximum Allowable Quantity per Control Area of Hazardous Materials Posing a Physical Hazard

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE [b]			USE-CLOSED SYSTEMS [b]			USE-OPEN SYSTEMS [b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Oxidizer	4	H-1	1 [g]	(1) [e,g]	NA	0.25 [g]	(0.25) [g]	NA	0.25 [g]	(0.25) [g]
Pyrophoric	NA	H-2	4 [e,g]	(4) [e,g]	50 [e,g]	1 [g]	(1) [g]	10 [e,g]	0	0

  - 1 lbs + (0% increase for sprinklers) = 1 lbs
  - 25% x 1 lb = ¼ lbs

Solid Class 4 Oxidizer = ¼ lbs

- Example – storage of liquid pyrophoric
  - 4 lbs + (100% increase for sprinklers) = 8 lbs
  - 25% x 8 lbs = 2 lbs

Liquid Pyrophoric = 2 lbs

Restricted Materials in College Labs §3805.2

- Example – storage of solid Class 4 Oxidizer

Table 3805.4
Design and Number of Control Areas in Existing Nonsprinklered Laboratories

Floor Level		Percentage of the Maximum Allowable Quantity per Lab Suite [a]	Number of Control Areas per Floor	Fire-resistance Rating for Fire Barriers in Hours [b,c,d]
Above grade plane	Higher than	5	1	2 [c]
	7-9	10	2	2 [c]
	4-6	25	2	2 [c]
	3	75	2	1
	1-2	100	4	1
Below grade plane	1	100	3	1
	2	75	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

  - 3rd floor = 75%
  - 75% x ¼ lbs = $^{3}/_{16}$ lbs or 4 oz

Solid Class 4 Oxidizer = ¼ lbs

- Example – storage of liquid pyrophoric
  - 75% x 2 lbs = 1½ lbs

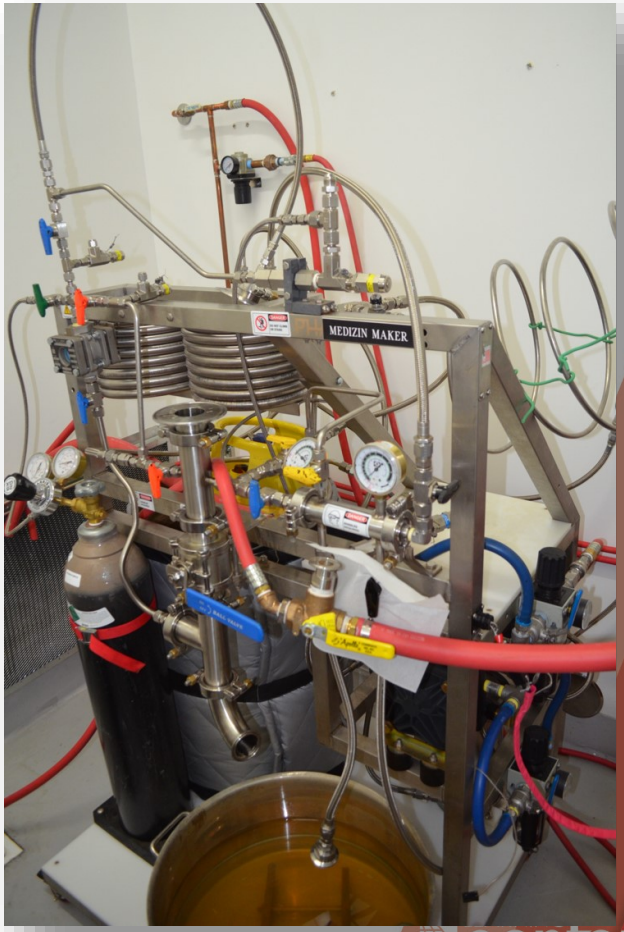
Liquid Pyrophoric = 2 lbs

Chapter 39

Processing & Extraction Facilities

Extraction Equipment §3904.2

- Extraction equipment can be listed under UL 1389
- Unlisted equipment must be approved by the FCO based on a technical report prepared by a registered design professional



Chapter 40
Storage of Distilled Spirits & Wines

ICC LEARNING center

Distilled Spirits & Wines Ch 40

- New chapter for storage of distilled spirits and wines
- Not classified as Group H
  - Group F-1 and S-1 for beverages >16% alcohol
  - Group F-2 and S-2 for beverages ≤16% alcohol
- Ch 50 & 57 do not apply to storage when in compliance with Ch 40

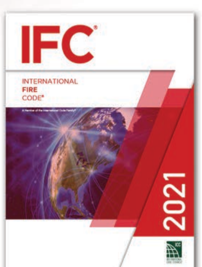
Distilled Spirits & Wines §4003

- Protection of storage areas
  - Spill control
    - 2nd containment not required
  - Ventilation
    - 1 cfm/ft², ***OR***
    - Monitored and ventilated to maintain ≤25% LFL
  - Control of ignition sources
    - No smoking
    - Listed equipment for hazardous (classified) areas
  - Lightning protection

Storage
§4004, §4005

- Fire sprinklers required if stored in basement and:
  - Class I cannot exceed MAQ for open-use systems
  - Class II or IIIA are not limited
- Fire sprinklers
  - Sprinklers required throughout Group F-1 fire areas used for manufacture of distilled spirits
  - Sprinklers required throughout Group S-1 fire areas used for bulk storage of distilled spirits or wine

Chapter 50
Hazardous Materials — General Provisions



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Haz Mat Exceptions §5001.1

- Correlation of Ch 50 exceptions with other portions of the code
  - Flammable liquids in motor fuel-dispensing facilities – Ch 23
  - Fuel oil in tanks and containers connected to oil-burning equipment – §603
  - Aerosol products – Ch 51
  - Flammable or combustible liquids with a flash point >95°F in a water-miscible solution – Ch 57
  - Commercial cooking oil storage tank – §607

Beer, Distilled Spirits & Wine §5001.1, Exc 10

- Storage of beer, distilled spirits and wine is not classified as a hazardous material
- Exc 10 is revised to:
  - Added beer to the list of distilled spirits and wine
  - Removed the specification of wooden barrels

- Note this exception is only for storage
- It does exempt brewing, distilling or processing

Flammable/Combustible Liquids §5001.1, Exc 15

- Definitions of flammable liquid and combustible liquid are revised
  - If flash point but no fire point, then it is not classified as a flammable or combustible liquid
- Consistent with §5701.2 Exc 7

Flash Point is the minimum temperature at which a 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.

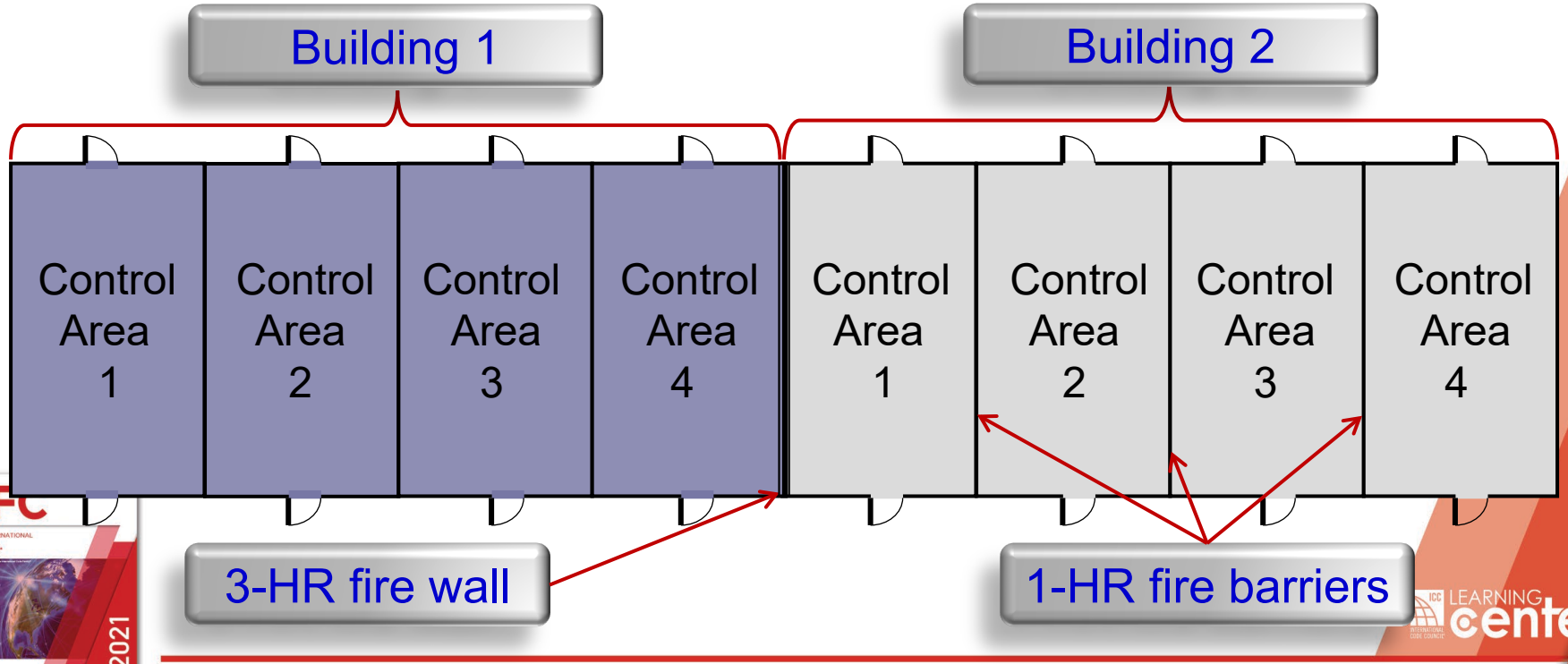
Ch 57

must be addressed

Fire Point is the lowest temperature at which a liquid will ignite and achieve sustained burning when exposed to a test flame.

Number of Control Areas §5003.8.3.3

- For the purposes of determining the number of control areas, each portion of a building separated by ≥1 fire walls shall be considered a separate building



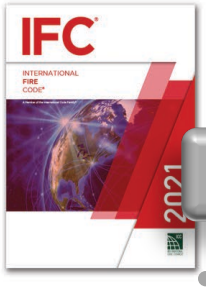
Toxic Solids in Retail Table 5003.11.1

- MAQ for solid toxic materials increased to 10,000 lbs ***IF***:
  - Toxic is the only hazard classification for the material, ***and***
  - Product is in original sealed containers, ***and***
  - Toxic classification is based solely on LC_{50}

LC_{50} = Lethal Concentration where 50% of subjects perish, based on inhalation

For testing of solid materials, the solids are crushed into a fine powder which can become airborne

Pulverized, airborne powder does not occur in retail settings

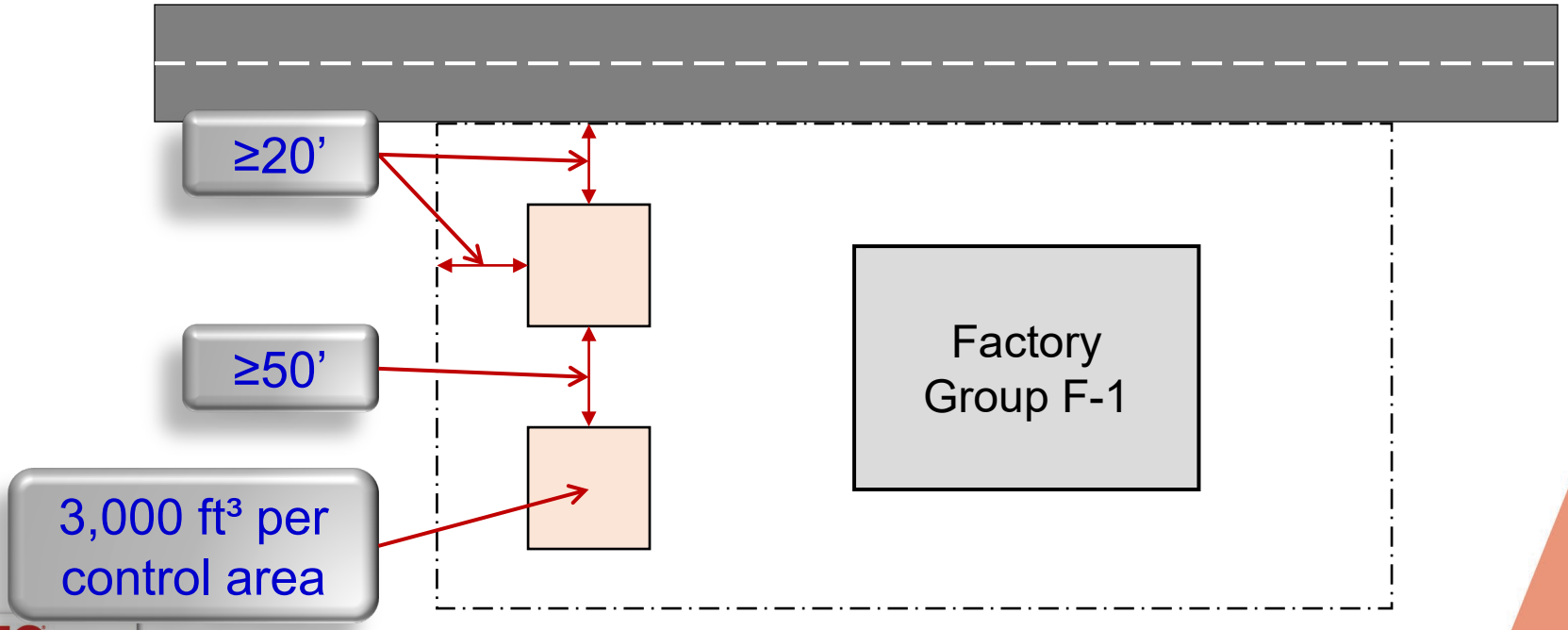


Outdoor Control Areas §5003.12

- §5003.12 is specified as “general requirements”
- §5004.14, §5005.3.3 & §5005.4.3 are revised to state outdoor storage must comply with outdoor control area requirements, except where material specific requirements are found in the code or referenced standard

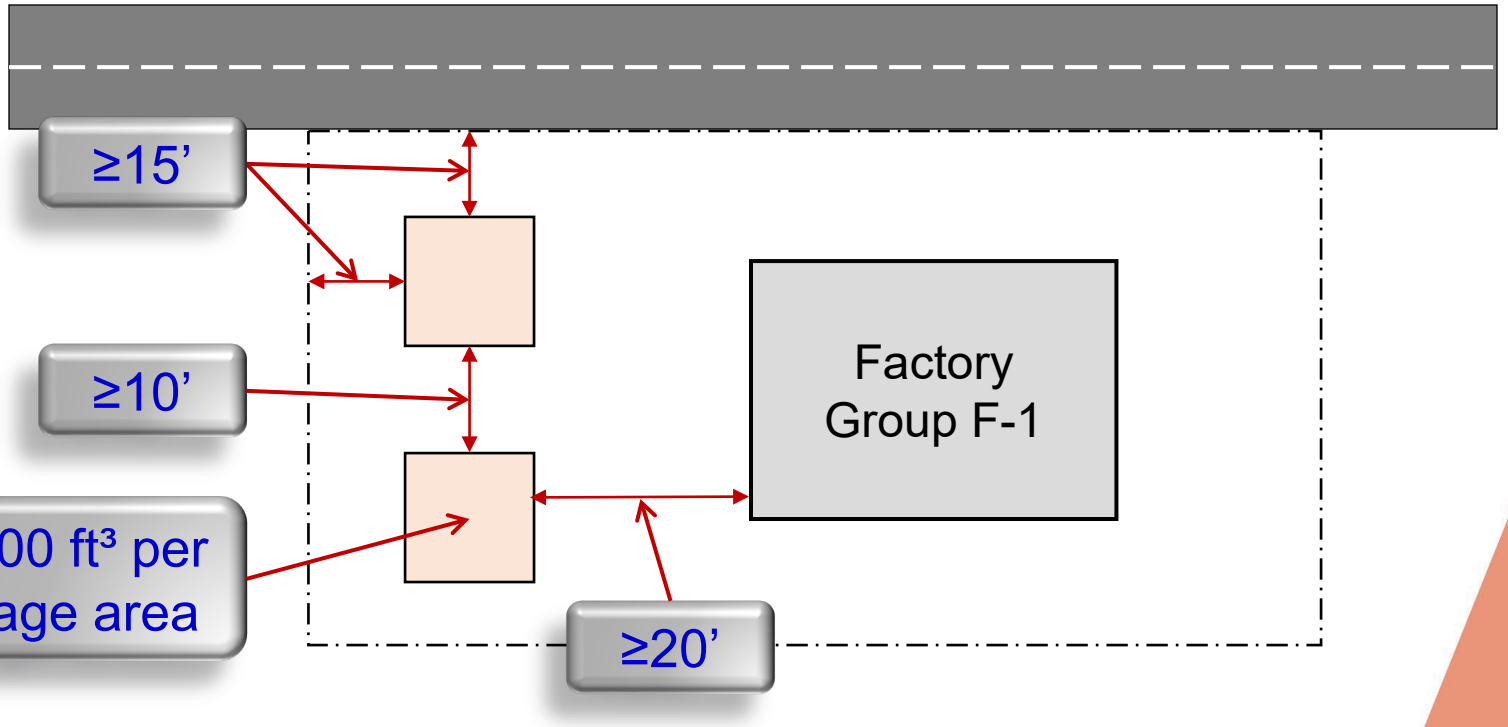
Outdoor Control Areas §5003.12

- Outdoor control area for flammable gas



Outdoor Control Areas §5003.12

- Outdoor control area for gaseous H_2 – NFPA 2



Chapter 56

Explosives & Fireworks

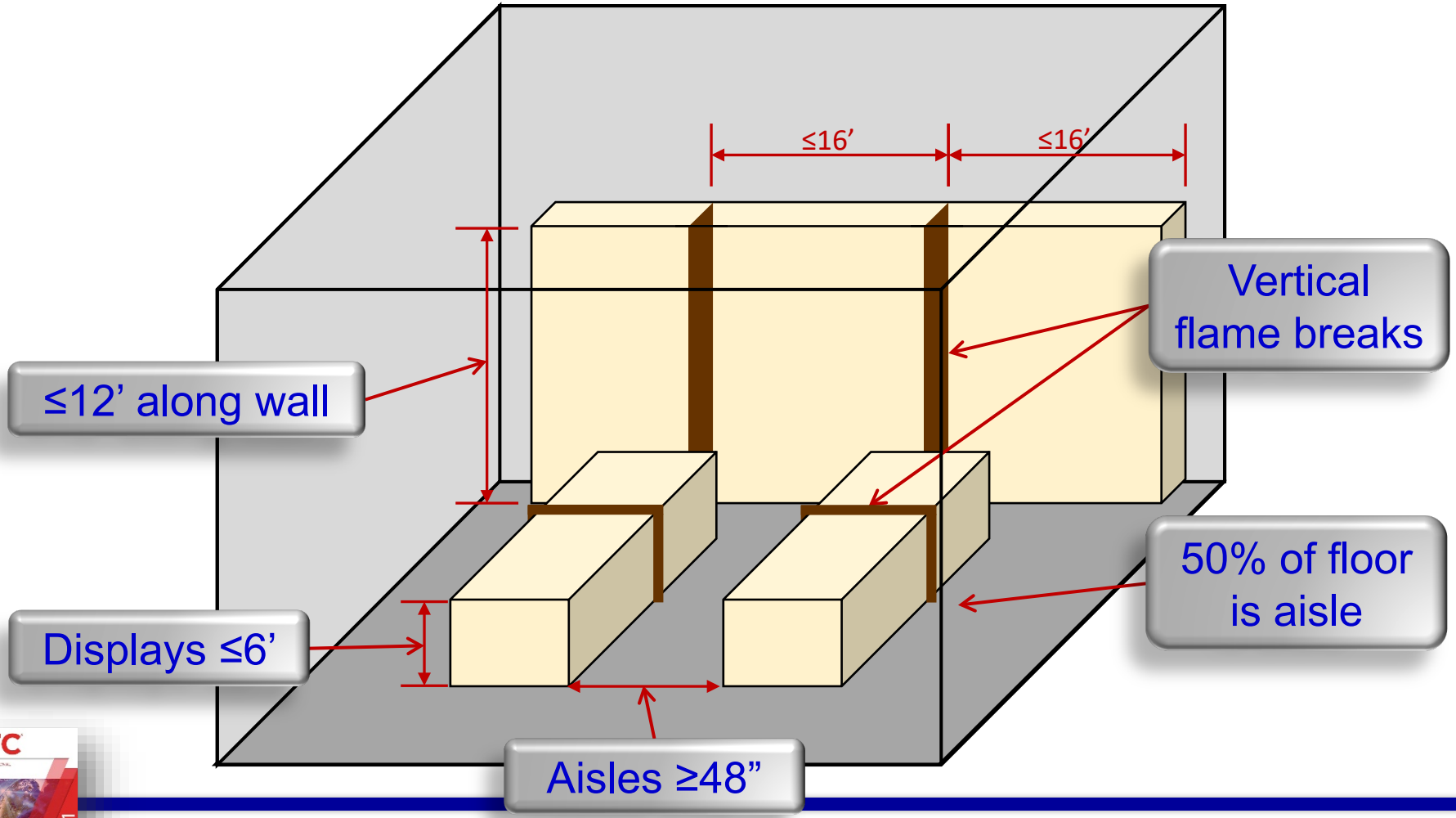
Consumer Use Fireworks §5601.1.3

- Where allowed, the storage, use and handling of Division 1.4G fireworks shall comply with 2006 NFPA 1124
  - Display height ≤6’
  - Display height along wall ≤12’
  - Vertical flame breaks provided every 16’ horizontally
  - ≥50% of floor area shall be aisles

Flame breaks constructed of:

- Sheet steel
- Sheet aluminum ≥0.010” thick
- Hardboard ≥1⁄8” thick
- Gypsum board ≥3⁄8” thick
- Wood panels ≥1⁄8” thick
- Plywood ≥1⁄4” thick
- Particleboard ≥1⁄4” thick
- Cement fiberboard
- Plastic laminate ≥1⁄8” thick
- Safety glass ≥1⁄8” thick
- Other approved material

Consumer Use Fireworks
NFPA 1124



Consumer Use Fireworks NFPA 1124

- Dead-end aisles are prohibited
- Exit access travel distance ≤75’
- Sprinklers required if new building >6,000 ft²
- Sprinklers required if existing building >7,500 ft²
- Smoke/heat vents required in new permanent buildings with ceiling height <10’ and exit access travel distance >25’
- Temporary stands >800 ft² must meet all requirements of a permanent structure

Commercial Ammunition Reloading §5606.6

- Control of ignition sources
  - Classified electrical ≤3’ of equipment
  - Static control and grounding
  - Approved containers for storage
    - Smokeless powder in original containers only
  - Approved containers with lid for waste disposal
    - Empty at least each day or end of shift
- Storage of powder and primers in §5606.5

Chapter 57
Flammable & Combustible Liquids

ICC LEARNING center

On-demand Mobile Fueling §5707.2

- Mobile fueling vehicle
  - Tier 1 – Tank vehicle complying with NFPA 385 with ≥1 chassis-mounted tanks with aggregate capacity ≤1,600 gallons
  - Tier 2 – Vehicle with ≥1 chassis-mounted tanks ≤110 gallons with an aggregate capacity ≤800 gallons or the weight capacity of the vehicle
  - Tier 3 – Vehicle that carries metal containers, each ≤5 gallons with an aggregate capacity ≤60 gallons
    - Metal safety cans listed in accordance with UL 30 or other approved containers

On-demand Mobile Fueling §5707.2.2

- Vehicles with tanks >110 gallons must also comply with NFPA 385
- Vehicle must be maintained in good repair
- Listed safety cans and approved containers must be secured
- Fueling from a trailer connected to a mobile fueling vehicle is prohibited

Photo courtesy of Booster Fuels, Inc.

Mobile Fueling Locations §5707.4

- Language was clarified to indicate that the separation distances apply the point of connection to the vehicle being fueled, rather than the mobile-fueling vehicle
- ≥25’ separation from:
  - Buildings
  - Lot lines
  - Combustible storage

Photo courtesy of Booster Fuels, Inc.

Separation can be reduced to 10’ ***IF*** the fueling process is provided with a vapor recovery system

Chapter 63
Oxidizers, Oxidizing Gases & Oxidizing Cryogenic Fluids

ICC LEARNING center

Storage of Oxidizers §6303.1.4

TABLE 6303.1.4
STORAGE OF CLASS 1, 2 AND 3 OXIDIZER LIQUIDS AND SOLIDS

STORAGE CONFIGURATION	LIMITS (feet)		
	Class 1	Class 2	Class 3
Piles			
Maximum width	24	16	12
Maximum height	20	Note c	Note c
Maximum distance to aisle	12	8	8
Maximum distance to next pile	4 [a]	Note a	Note a
Maximum distance to walls	2 [b]	2	4
Maximum quantity per pile	200 tons	MAQ	NA
Maximum quantity per building	No limit	Note d	Note d

a. The minimum aisle width shall be equal to the pile height, but ≥4' and ≤8'.

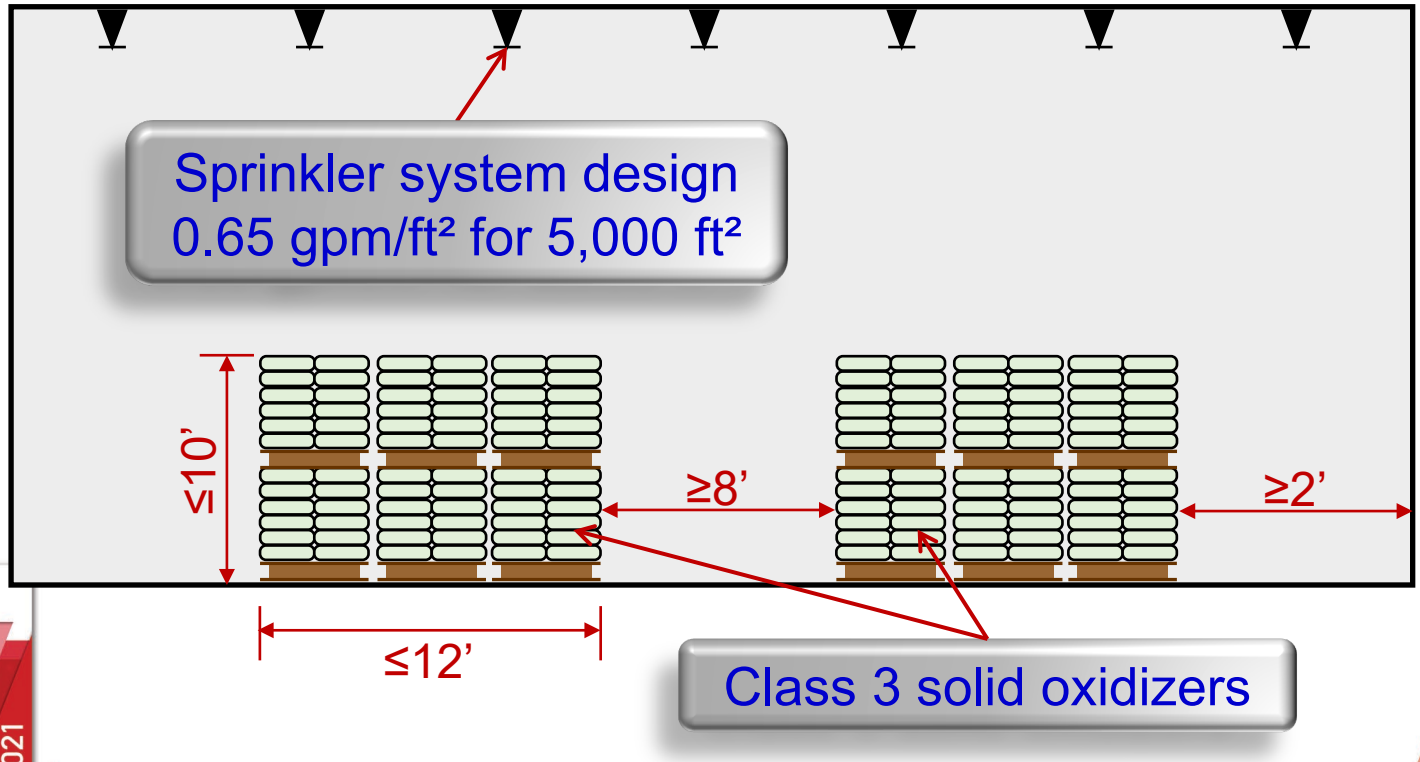
b. There shall not be a minimum distance from the pile to a wall for amounts less than 9,000 lbs.

c. Maximum storage height in nonsprinklered buildings is limited to 6'. In sprinklered buildings see NFPA 400 for storage heights based on ceiling sprinkler protection.

d. Maximum quantity per building varies. See Chapter 50 for control areas and MAQs.

Storage of Oxidizers §6303.1.4

- Footnote c requires storage height to be based on the sprinkler design per NFPA 40



Appendix H
Haz Mat Management Plan & Haz Mat Inventory Statement

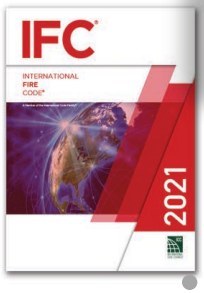
ICC LEARNING center

Chemical Facility Security §H104.2

- Haz mat storage, dispensing and use areas shall be secured against unauthorized entry
- Requires additional security of facilities utilizing a Chemical of Interest with a quantity exceeding the Screening Threshold Quantity

Chemical Facility Anti-Terrorism Standards (CFATS) from DHS

CFATS Appendix A lists >300 specific chemicals of interest



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