2015 MSFC Update Training
Module 3: Chapters 6-8

Your Presenter
Forrest Williams
Fire Safety Supervisor
MN State Fire Marshal Division
651-769-7784
forrest.williams@state.mn.us

Acronyms and Abbreviations
• ASTM – American Society for Testing and Materials
• UL – Underwriters Laboratories
• FM – Factory Mutual
• PV – Photovoltaic (solar power systems)
• LPG – Liquefied Petroleum Gas
• CGA – Compressed Gas Association
• NIST – National Institute of Standards and Technology
New, Revised, Review or Caution Tags

Chapter 6
Building Services and Systems

Fuel Oil Storage Systems & MAQ

- Indoor storage of Class II or III combustible liquids serving appliances and generators
  - Storage amounts are not counted towards the MAQ
  - Not required to be located in a control area

MSFC 603.3.2.3
Portable Outdoor Gas-Fired Heating Appliances

Prohibited locations
- Inside any occupancy when connected to its fuel source
- Inside tents, canopies or membrane structures
- On exterior balconies except as allowed in 6.19 of NFPA 58

MSFC 603.4.2
As the code official, would you allow a gas-fired patio heater to be operated in a screened enclosure?

A. Yes  
B. No

Portable Outdoor Gas-Fired Heating Appliances

- Prohibited locations
  - Inside any occupancy when connected to its fuel source
  - Inside tents, canopies or membrane structures
  - On exterior balconies except as allowed in 6.19 of NFPA 58

NFPA 58 (2011) Section 6.19

- Portable heaters on balconies:
  - Auto fuel shutoff in event of combustion failure
  - Self-supporting
  - Pilot light or electric ignition when exceeding 50,000 Btu input
  - Secured to prevent falling over edge
**NFPA 58 (2011) Section 6.19.11.2**

- **Portable heaters on balconies:**
  - Cylinders > 2.7 lbs. (1 lb. LP capacity) prohibited on decks or balconies above the first floor of multi-dwelling-unit buildings
  - **Exception:** Balconies/decks served by an exterior stairway

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**NFPA 58 (2011) Section 6.19**

- **Movement of LPG containers indoors:**
  - 'Public' stairways shall not be used
  - Valve outlets capped with a listed quick closing or quick connect coupling
  - Precautions to prevent cylinders from falling down stairs when stairway provides access to elevators

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**Portable Outdoor Gas-Fired Heating Appliances**

- Not located within 5' of an exit or exit discharge

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MSFC 603.4.2
Portable Outdoor Gas-Fired Heating Appliances

Clearances
- At least 5' from buildings
- Not beneath or within 5' from combustible:
  - Decorations
  - Overhangs
  - Awnings
  - Sunshades and similar attachments

• During operation, this product can be a source of ignition. Keep heater area clear and free from combustible materials, gasoline, paint thinner, cleaning solvents and other flammable vapors and liquids. Do not use heater in areas with high dust content. Minimum heater clearances from combustible materials: three (3) feet from the sides & two (2) feet from the top.
Portable Outdoor Gas-Fired Heating Appliances

Installation & operation

- Listed and approved
- Fuel gas container must be integral

Listing ensures certain safety features:

- Integral tank design
- CGA fitting that:
  - Auto-closes in case of fire
  - Requires positive connection to cylinder before gas will flow
  - Contains an excess flow-valve
Portable Outdoor Gas-Fired Heating Appliances

- **Appliance installation & operation**
  - Installed and maintained per manufacturer’s instructions
  - Auto fuel shutoff when tipped >15°
  - Heating element or combustion chamber guarded against accidental contact

MSFC 603.4.2

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Portable Outdoor Gas-Fired Heating Appliances

- **Fuel gas containers**
  - DOTn or ASME approved only
  - Replacement prohibited when public is present
  - 20 lb. max capacity
  - Storage inside buildings prohibited except as allowed per NFPA 58

MSFC 603.4.2

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Battery Operated Emergency Lighting Units MSFC 604.5

- **Monthly activation test required**
  - 30 second test
- **Annual power test required**
  - 30 minute test
- **Testing records to be maintained**
Emergency Illumination

- Integral/combination emergency light fixtures
  - Identified and tested?

Integral/Combination Emergency Light Fixtures

Solar Photovoltaic Power Systems (PV)
Solar Photovoltaic Systems for Residential Dwellings

Non-Residential Solar Photovoltaic Systems

Solar Photovoltaic (PV) Power Systems

- Addresses potential hazards to firefighters:
  - Identification of PV systems, circuits and disconnects

MSFC 605.11
Solar Photovoltaic (PV) Power Systems

- Addresses potential hazards to firefighters:
  - Location, protection and labeling for conductors

MSFC 605.11

Solar Photovoltaic Power Systems - MSBC 3113

WARNING
ELECTRIC SHOCK HAZARD
DO NOT TOUCH TERMINALS
TERMINALS ON BOTH LINE AND LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION

2014 NEC 690.16(E)

- Rapid shutdown required for PV systems installed on or in buildings

Solar Photovoltaic (PV) Power Systems

- Addresses potential hazards to firefighters:
  - Roof access and pathways to facilitate manual roof venting operations

Solar Photovoltaic (PV) Power Systems

- DLI-CCLD moved PV language to building code (Section 3113)
- Building official to notify fire official of proposed installations
- 605.11 now reads:
  - PV systems to be installed per the state building code and electrical code
  - PV systems to be maintained per the state building and electrical codes

MSFC 605.11
Solar Photovoltaic (PV) Power Systems

- **Current problem...**
  - Original language in IFC applied to all building, including IRC dwellings
  - Per CCLD interpretation, MSBC language does not apply to IRC dwellings

MSFC 605.11

Solar Photovoltaic (PV) Power Systems

IFC Commentary Re: 102.5

**Application of Residential Code**

“Although the IRC regulates the construction of detached one- and two-family dwellings and townhouse structures, it does not contain provisions to regulate the design and construction of emergency access to and community fire protection for residential developments within which such dwelling structures are constructed.”

Solar Photovoltaic (PV) Power Systems

IFC Commentary Re: 102.5

**Application of Residential Code**

“These specific requirements of the code are applicable because they include design and construction regulations that provide necessary emergency access and community fire protection for residential developments containing structures that are regulated within the scope of the IRC.”
Commercial Kitchen Hoods

- Operations and maintenance moved from Chapter 9 to Chapter 6

MSFC 609

Commercial Kitchen Hoods

- Inspections:
  - Conducted per Table 609.3.3.1, or
  - As approved by the code official
  - Completed by qualified personnel

MSFC 609

Commercial Kitchen Hoods

<table>
<thead>
<tr>
<th>TABLE 609.3.3.1</th>
<th>COMMERCIAL COOKING SYSTEM INSPECTION FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF COOKING OPERATIONS</td>
<td>FREQUENCY OF INSPECTION</td>
</tr>
<tr>
<td>High-volume cooking operations such as 24-hour cooking, charbroiling or wok cooking</td>
<td>3 months</td>
</tr>
<tr>
<td>Low-volume cooking operations such as places of religious worship, seasonal businesses and senior centers</td>
<td>12 months</td>
</tr>
<tr>
<td>Cooking operations utilizing solid fuel-burning cooking appliances</td>
<td>1 month</td>
</tr>
<tr>
<td>All other cooking operations</td>
<td>6 months</td>
</tr>
</tbody>
</table>

MSFC 609.3.3.1
Commercial Kitchen Hoods

Cleaning

- When inspection finds grease accumulation on grease removal devices, fans or ducts, such components shall be cleaned

MSFC 609.3.3.2

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Commercial Kitchen Hoods

- Inspection records to include:
  - Name of individual and company
  - Date and description of inspection
- Cleaning records to include:
  - Name of individual and company
  - Date of cleaning
- Records maintained for 3 years

MSFC 609.3.3.3
(Used) Commercial Kitchen Cooking Oil Storage

Commercial Kitchen Cooking Oil Storage

MSFC 610
Commercial Kitchen Cooking Oil Storage

➢ General
  • Classified as IIIB unless determined otherwise via testing
  • Storage per Chapter 57 (Flammable/Combustible Liquids)

MSFC 610

Commercial Kitchen Cooking Oil Storage

➢ Systems storing over 60 gallons:
  • Tanks listed to UL 142 or UL 80
    • UL 142 – Standard for steel aboveground tanks for flammable & combustible liquids (no size limit)
    • UL 80 – Standard for steel tanks for oil-burner fuels and other combustible liquids (60 to 660 gallons)

MSFC 610
Commercial Kitchen Cooking Oil Storage

- Systems storing over 60 gallons:
  - Tanks to be installed per Section 5704 (flammable/combustible liquid storage) and manufacturer’s instructions
  - Piping systems and components installed per Section 5703.6
  - Normal and emergency venting to terminate outdoors per Sections 5704.2.7.3 and 5704.2.7.4

Commercial Kitchen Cooking Oil Storage

- Systems storing over 60 gallons:
  - Summary of venting requirements per 5704.2.7.3 and 5704.2.7.4
  - Normal venting for IIIB liquids may terminate indoors when vent is normally closed
  - Emergency venting for IIIB liquids may terminate indoors

2015 MSFC Chapter 7
Fire Resistance Rated Construction
Fire Resistance Rated Construction

- Unsafe conditions (701.2) summary:
  - Any damaged or non-functioning components required by Chapter 7 can be deemed an unsafe condition.
  - Repairs or replacements to conform with the code under which the building was constructed.

MSFC 701.2

Fire Resistance Rated Construction

- Smoke barriers & smoke partitions
  - Required smoke barriers and smoke partitions must be maintained per NFPA 105.

MSFC 703.1.2

Fire Resistance Rated Construction

- Fire walls, fire barriers and fire partitions
  - All openings protected with approved fire doors or fire dampers shall be maintained per NFPA 80 (2010).

MSFC 703.1.3
## Fire Resistance Rated Construction

### NFPA 80 fire damper maintenance requirements
- Changes of airflow or noise shall be investigated to ensure it is not related to damper operation
- Inoperable dampers repaired without delay and tested
- Exposed moving parts dry lubricated per manufacturer
- All maintenance documented
- Combo fire/smoke dampers maintained per NFPA 105

NFPA 80 (2010) 19.5

### Opening Protectives (703.2)
- Requires opening protectives to be maintained in operative condition per NFPA 80 (2010)
- Language expanded to include:
  - Allowance for 3rd party certification of non-labeled fire-rated doors

MSFC 703.2

### Examples of maintenance and operation provisions for opening protectives from NFPA 80
- Operable at all times
- Kept closed and latched or auto-closing
- Repairs and defects corrected without delay
- Replacement glazing shall be labeled and properly rated per the assembly/construction
- Field modification requirements and limitations, etc.
Fire Resistance Rated Construction

- **Testing requirements for opening protectives:**
  - Located in the MSFC (703.4)
  - Requires annual testing of:
    - Horizontal and vertical sliding and rolling fire doors only
    - Not swinging

Fire Resistance Rated Construction

- Interpretation available on our website: fire.state.mn.us

Proscenium Fire Curtain Maintenance
Proscenium Fire Curtain Maintenance

Proscenium Fire Curtain Maintenance

Proscenium Fire Curtain Maintenance

Proscenium Fire Curtain Maintenance

- Annual inspection of fire curtains (NFPA 80 via MSFC 703)
  - Performed by qualified personnel
  - Inspection of all system components and rigging
  - Mandatory retraining of owner & staff
  - Detailed inspection records signed and maintained

MSFC 703.2 & NFPA 80 (10) 20.9
Proscenium Fire Curtain Maintenance

- Annual inspection of fire curtains (NFPA 80 via MSFC 703)
  - Repairs required for emergency operation must be made prior to event occupancy
  - Repairs not affecting emergency operation to be made within 30 days

MSFC 703.2 & NFPA 80 (10) 20.9

Fire Resistance Rated Construction

- Floor Openings and Shafts in Existing Buildings:
  - Moved to Chapter 11 – Construction Requirements for Existing Buildings

- Separation of Occupancies and Hazardous Areas
  - Moved to Chapter 11

Chapter 8: Interior Finish & Decorative Materials
ASTM E84 (NFPA 255) “Steiner Tunnel” Comparative test using a flame spread index:
- Cement board: 0
- Red Oak: 100
- Gypsum board: 10-15

Flame Spread & Smoke Development Testing

- ASTM E84 “Steiner Tunnel Test”

ASTM E84: Steiner Tunnel

- What’s being tested?
  - Lateral surface flame propagation as a function of time
  - Smoke development (via obscuration)
  - Materials tested are rated in comparison with cement board (0) and red oak flooring (100)
Plastics as Interior Finish

- Foam plastics
- Polypropylene
- High density polyethylene

Large Scale Fire Testing Options for Foam Plastic Interior Finish

- NFPA 286
- UL 1715
- UL 1040
- FM 4880
- MSFC 803.7 & MSBC 2603.10
Large Scale Room Fire Tests

What’s being tested?
- The contribution of interior finish materials to room fire growth (e.g. NFPA 286)
- Extent of fire growth
- Rate of heat release
- Total heat released
- Time to flame extension
- Time to flashover
- Upper level gas temps
- Smoke obscuration
- Carbon monoxide emissions
- Emissions of other combustion gases

Foam Plastic Interior Finish

- Newly installed and existing foam plastic materials used as interior finish must be documented to have passed an approved large-scale fire test

Foam Plastic Interior Finish

Newly installed and existing foam plastic materials used as interior finish must be documented to have passed an approved large-scale fire test

MSFC 803.7; 804; 807.1; MSBC 2603.10

Interior Finish

Remember!
- Paneling
- Movable partitions
- Wall and crash pads
- Acoustical or decorative panels
...are considered interior finish when exceeding 10% of wall or ceiling area

MSFC 807.1
Foam Plastic Interior Finish

- Even when allowed based on large-scale fire testing, minimum flame spread and smoke development requirements apply per 803.3

  • **NOTE:** Meeting the performance criteria of 803.1.2.1 when tested per NFPA 286 is considered equivalent to Class A

MSFC 803.7 & MSBC 2603.10

Foam Plastic Interior Finish

- Approved large-scale fire tests for foam plastic interior finish

  • **NFPA 286** – Fire Tests for Evaluating Contribution of Wall and Ceiling Finish to Room Fire Growth
    • With acceptance criteria of MSFC 803.1.2.1
Foam Plastic Interior Finish

- Approved large-scale fire tests for foam plastic interior finish
  - UL 1715 – Fire Test of Interior Finish Materials
  - UL 1040 – Fire Test of Insulated Wall Construction

Foam Plastic Interior Finish

- Approved large-scale fire tests for foam plastic interior finish
  - FM 4880 – Fire Tests for Evaluating
    - Insulated Wall & Roof/Ceiling Assemblies
    - Plastic Interior Finish Materials
    - Wall/Ceiling Coating Systems
    - Interior/Exterior Finish Systems
  – Note: NFPA 286 is a test option in FM 4880

NFPA 286 “Room Corner Test”
NFPA 286 Acceptance Criteria

803.1.2.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:
1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m³.
Based on Govmark's NFPA 286 testing report, do these foam wall panels comply with the MSFC for use as interior finish?

A. Yes  
B. No
Why are the wall panels non-compliant?
A. Flames spread to ceiling or outer extremity of test samples
B. Flashover occurred
C. Exceeded maximum peak heat release rate
D. Exceeded maximum smoke release rate

NFPA 286 Acceptance Criteria

803.1.2.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:
1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m³.

High-Density Polyethylene (HDPE) & Polypropylene (PP)
High-Density Polyethylene (HDPE) & Polypropylene (PP)

- **Common uses**
  - 3D decorative wall & ceiling panels
  - Restroom partitions
  - Lockers
- **When used as interior finish in existing buildings**
  - Meet performance criteria of 803.1.2.1 when tested per NFPA 286

Site-Fabricated Stretch Systems

- **Three Components**
  - Fabric (or vinyl), frame and core
**Newly Installed Site-Fabricated Stretch Systems**

- Tested in the manner intended for use per:
  - [NFPA 286](803.1.2), or
  - [ASTM E84](803.1.1) with specimen preparation and mounting per [ASTM E2573](834.1.1)

**Newly Installed Textile Wall & Ceiling Coverings**

- **Option 1**
  - Class A flame spread & smoke development + sprinkler protection

- **Option 2**
  - Meet criteria of 803.5.1.2 (Method B) when tested per [NFPA 265](803.5.1.2) with end-use mounting system
  - [NFPA 265 – Fire Tests for Evaluating Room Fire Growth of Textile or Expanded Vinyl Wall Coverings](803.5.1.2)
Newly Installed Textile Wall & Ceiling Coverings

- Acceptance criteria for NFPA 265

  According to NFPA 265, the textile wall covering or expanded vinyl wall covering shall comply with the following:
  1. During the 40-kW exposure, flames shall not spread to the ceiling.
  2. The flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (2.4 by 3.7 m) walls.
  3. Flashover, as defined in NFPA 265, shall not occur.
  4. For newly introduced wall and ceiling coverings, the total smoke released throughout the test shall not exceed 1,000 m².

Option 3

- Meet criteria of 803.1.2.1 when tested per NFPA 286 with end-use mounting system

Note: The only difference between new installations vs. existing is new does not have the option of using Method A testing criteria when tested per NFPA 265:

- Method A is less restrictive with no smoke development limitations

New Interior Floor Finish and Floor Coverings

- No additional information provided.
New Interior Floor Finish and Floor Coverings

- Must comply with the “pill test”
  - CPSC 16 CFR Part 1630 or ASTM D2859

MSFC 804.3

New Interior Floor Finish and Floor Coverings

- Must meet minimum critical radiant flux per NFPA 253 in:
  - Exit enclosures
  - Corridors
  - Rooms/areas not separated from corridors by full-height partitions

MSFC 804.3

New Interior Floor Finish and Floor Coverings

  - Critical radiant flux
    - The minimum radiant energy needed to sustain flame propagation (watts/cm²)
      - Class I: 0.45 watts/cm² or greater
      - Class II: 0.22 watts/cm² or greater

MSFC 804.3
Class I minimum critical radiant flux required in:
- Groups I-1, I-2, and I-3

Class II minimum critical radiant flux required in:
- Groups A, B, E, H, I-4, M, R-1, R-2, S

New Interior Floor Finish and Floor Coverings

- In fully sprinklered buildings per NFPA 13 or 13R
  - Class II materials permitted where Class I required
  - "Pill Test" permitted where Class II required

MSFC 804.3
New Interior Floor-Wall Base

- Floor-wall base 6” or less in height:
- Shall comply with Class I or II MCRF per NFPA 253 - OR- 804.1 (Class C per ASTM E84)

Mohawk NFPA 253 Test Report
Carpet Floor Covering

Based on the Mohawk Industries testing report, could this carpet be installed as an interior wall finish in a non-sprinklered community center?

A. Yes
B. No
Why can't this carpet be approved as an interior wall finish?

A. No sprinkler protection
B. Wrong testing report provided
C. Class I minimum critical radiant flux is required
D. Textiles cannot be installed on walls

Which testing report could apply when evaluating textile materials used as wall or ceiling finishes?

A. NFPA 286
B. NFPA 265
C. ASTM E84
D. All of the above

Would the MSFC allow this carpet to be installed as a floor finish in a community center?

A. No
B. Yes, but not in exit enclosures or corridors
C. Yes, can be installed in all rooms/areas
D. Unknown: wrong testing report provided
Decorative Natural Vegetation

- Decorative vegetation permitted in all occupancies except Group I when:
  - Adequate safeguards are provided per the code official based on type, quantities, location, etc.
  - For Group M, the use and display of decorative vegetation is permitted for resale purposes

Decorative Natural Vegetation

- Location of materials shall not:
  - Obstruct the means of egress
  - Obstruct access to fire protection systems or equipment
  - Accumulate inside a building
Artwork & Teaching Materials on Corridor Walls

- **Groups E and I-4**
  - Limited to 20% of the wall area
  - **Exception:** 50% coverage allowed in fully sprinklered buildings

MSFC 807.4.3.2 & 807.4.4.2
Combustible Decorations in Group I-2

- 807.5 lists criteria where combustible decorations are permitted in I-2 (consistent with NFPA 101)
  - Flame retardant treatments
  - Compliance with NFPA 701
  - Heat release rates per NFPA 289
  - Limited amounts based on percentage of total wall area

Wastebaskets & Linen Containers in Groups I-1, I-2 & I-3

- Changes to 808.1:
  - Added I-1 & I-2 to the scope
  - Now regulates linen containers
  - Requirements for containers > 32 gal.
Wastebaskets & Linen Containers in Groups I-1, I-2 & I-3

➤ Changes to 808.1
➤ Waste and linen containers (including lids) to be noncombustible or made of materials having a peak heat release rate of 300 kW/m² when tested per ASTM E1354

Wastebaskets & Linen Containers in Groups I-1, I-2 & I-3

➤ Summary of Section 808.1
▪ Portable containers exceeding 32 gallons to be stored in a waste/linen collection room constructed per Table 509 of the MSBC
  ▪ One-hour rated fire separation or sprinkler protection

Waste Containers in Group R-2 College & University Dorms

➤ Containers of 20 gallons or more:
▪ Noncombustible (including lids), or
▪ Materials having a peak heat release rate of 300 kW/m² when tested per ASTM E1354

➤ Metal waste containers 20 gallons or more:
▪ Listed to UL 1315
▪ Noncombustible lids
**Waste Containers in Group R-2 College & University Dorms**

- Portable containers exceeding 32 gallons to be stored in a waste/linen collection room constructed per Table 509 of the MSBC
  - One-hour rated fire separation or sprinkler protection

MSFC 808.2

**Combustible Lockers & Interior Finish**

- Combustible lockers shall be considered as interior finish and comply with Section 803
  - Exception: Lockers made entirely of wood allowed in areas where a Class C flame-spread rating is required per 803.1.1

MSFC 808.4