FCIA Webinar Series

Fire & Fire-Resistance: What Should and Shouldn't Happen

Bill McHugh, Executive Director of FCIA
Rich Walke, CTI, Consultant to FCIA

FCIA
Firestop Contractors International Association

December 13, 2023

FCIA – Firestop Contractors International Association

- **Fire Exits??**

- **Thanks to FCIA Members**
  - Firestop Contractors
  - Manufacturers, Consultants
  - Firestop Distributors, Reps, Friends

Welcome, Thanks, From FCIA…..

Firestop Contractors International Association

FREE PDF MOP, SPECIFICATION for Code Officials, Fire Marshals,

& Specifiers with Design Firms

Life Safety Digest FREE for ALL

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FCIA – Firestop Contractors International Association

- **Info@FCIA.org for FREE Webinars**
- **Info@FCIA.org FREE Life Safety Digest**
- **INFO@FCIA.org FREE FCIA MOP PDF**
- **UL/ULC, FM 4991 Contractor Programs**
- **ASTM Inspection Standards**
- **IAS AC 291 Inspection Agency Accreditation**
- **FCIA Firestop Education**
  - **Firestop Certificate &** Individual Knowledge
- **Resources - VISIT FCIA.org**

FCIA Actions –

- ***NEW Education for Careers in Firestopping!!***

- ***FCIA's Firestop Education Program (FEP)***
  - ***3.5 Hours Level 1 – LAUNCHED***
  - ***16.5 Hours Level 2 - LAUNCHED***
  - ***4.0 Hours Level 3 – LAUNCHED***

- ***24 Hours Education…***
- ***30++ Hours = Education & Exams –***
  - ***Members – Unlimited Subscription***
  - ***Non-Members – Visit FCIA.org***
  - ***SPECIFIERS, Code Officials, Fire Marshals – FREE Level 1***

FCIA – Firestop Contractors International Association

- Canada – Symposiums, National Prescence, NBCC, NFC
- Qatar - Doha FCIA Symposium; Members
- India - Mumbai/Ahmadabad – Fire Safe Build India – IIT-G
- UAE - Dubai – FCIA Symposium; Civil Defence
- Saudi Arabia - Riyadh – BIG5 Show; UL, ICC, TBWIC
- Mexico/LATAM - CONAPCI/AMRACI
- Australia/New Zealand – FPA, Etc.

FCIA – Firestop Contractors International Association

- **UL/ULC, FM 4991 Contractor Programs**
  - DRI's
  - Exams for Contractors, Inspection Agencies

  IAS AC 291 Inspection Agency Program
  - Responsible Individuals / Competence

- **ASTM Inspection Standards – ASTM E2174 & ASTM E2393**
  - ***High Rise, Category III & IV, R>250 ('21), NFPA 1, NFPA 101 Appx. & in Specifications Worldwide***

- **Watch FCIA.org for Webinar Announcements!**

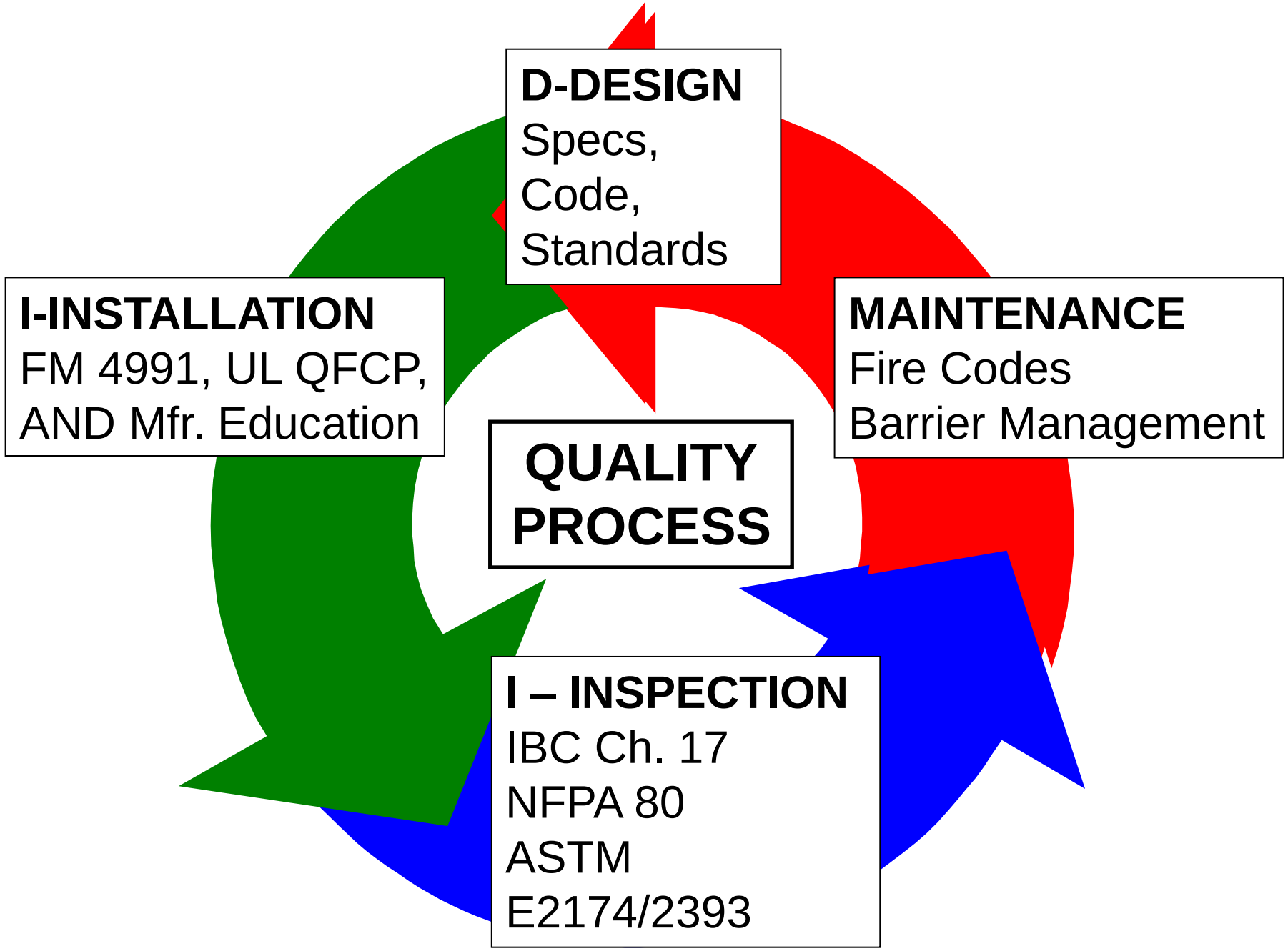
FCIA Actions –2024

- Conferences:
  - FCIA MENA - India
    - FSBI – January 31 - February 3, 2024
  - Dubai – June 4-6, 2024
  - Doha – June 9-10, 2024
  - FCIA ECA @ Oklahoma City, OK, USA – April 30 - May 3, 2024
  - FCIA CAN @ TBD, Canada – September, 2024
  - FCIA FIC @ Palm Springs, CA – November 5 - 8, 2024
- Webinars & Symposiums
- Code Development & Standards Discussions -
- Committee Action
- International Discussions

Systems & Materials….

“TOTAL FIRE PROTECTION”

- Effective Compartmentation
  - Fire Barriers, Fire Walls, Floors, Smoke Barriers
  - Firestopping, Fire Dampers, Swinging and Rolling Fire Doors, Fire-Rated Glazing
  - Fire-Resistive Protection for Ductwork
- Detection & Alarm Systems
- Sprinkler Suppression Systems
- Education & Egress –
  - Building Owners & Managers, Building Occupants and Firefighters


D-DESIGN
Specs,
Code,
Standards
MAINTENANCE
Fire Codes
Barrier Management
I – INSPECTION
IBC Ch. 17
NFPA 80
ASTM
E2174/2393
I-INSTALLATION
FM 4991, UL QFCP,
AND Mfr. Education
QUALITY
PROCESS

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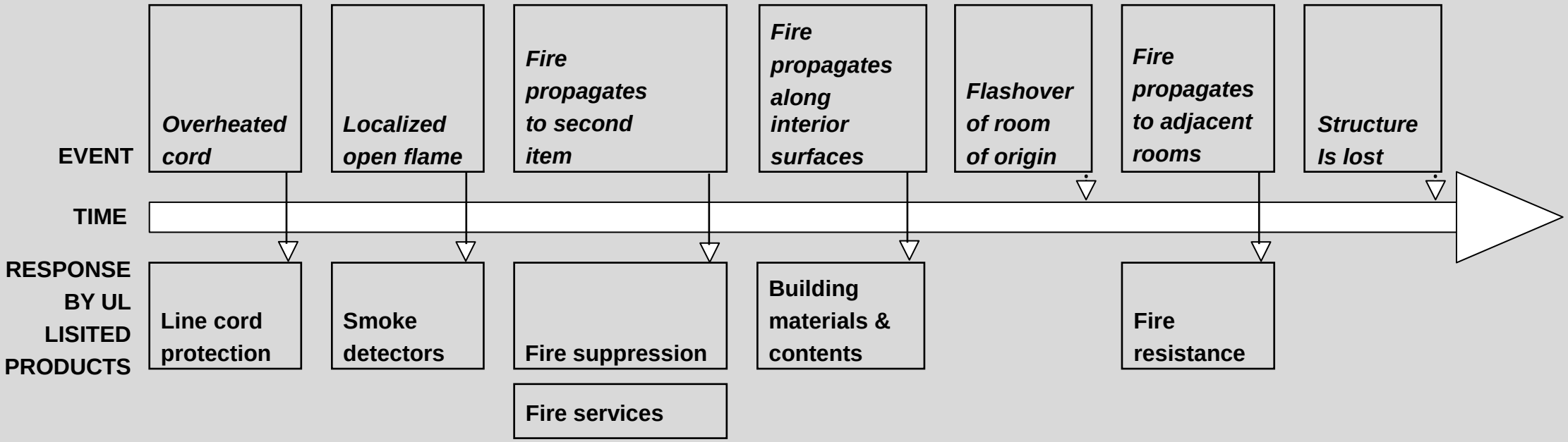
Fire Event Timeline



Reaction to Fire vs Fire-Resistance What's the Difference???

- Reaction to Fire
  - Reaction to fire standards address keeping a small fire small
  - Evaluates flame propagation over the surface of the material – i.e. surface flammability
  - Based on the requirements of the following Chapters of the International Building Code:
    - Chapter 8 – Interior Finishes
    - Chapter 15 – Roofing Assemblies and Rooftop Structures
    - Chapter 26 – Plastics
    - Perhaps others

Fire-Resistance vs Reaction to Fire What's the Difference???

- Fire-Resistance
  - Assumes you already have a post-flashover fire condition
  - Evaluates the ability of the materials and methods of construction to resist the long-term impact of fire
  - Intended to contain the fire to the room or floor or origin and to maintain structural integrity of the building

Fire-Resistance vs Reaction to Fire What's the Difference???

- Based on the requirements of Chapter 7 of the International Building Code covering Fire and Smoke Protection Features
  - Structural fire resistance
  - Containment of the fire
- Requires the protection of all breaches in the barriers
  - Penetrations
  - Joints and Voids
  - Opening Protectives
  - Duct and Air Transfer Openings

Reaction to Fire vs Fire-Resistance
What Should and Should Not Happen?

Reaction to Fire – What Fire Resistance is NOT

Interior Finishes – IBC Chapter 8

- Referenced Standards
  - Steiner Tunnel
    - UL 723 / ASTM E84 – Test for Surface Burning Characteristics of Building Materials
  - Room Corner Tests
    - NFPA 286 – Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
    - NFPA 265 – Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

Interior Finishes – IBC Chapter 8 Cont.

- Flooring Testing
  - ASTM E648 / NFPA 253 – Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
  - DOC FF-1 / ASTM E2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials

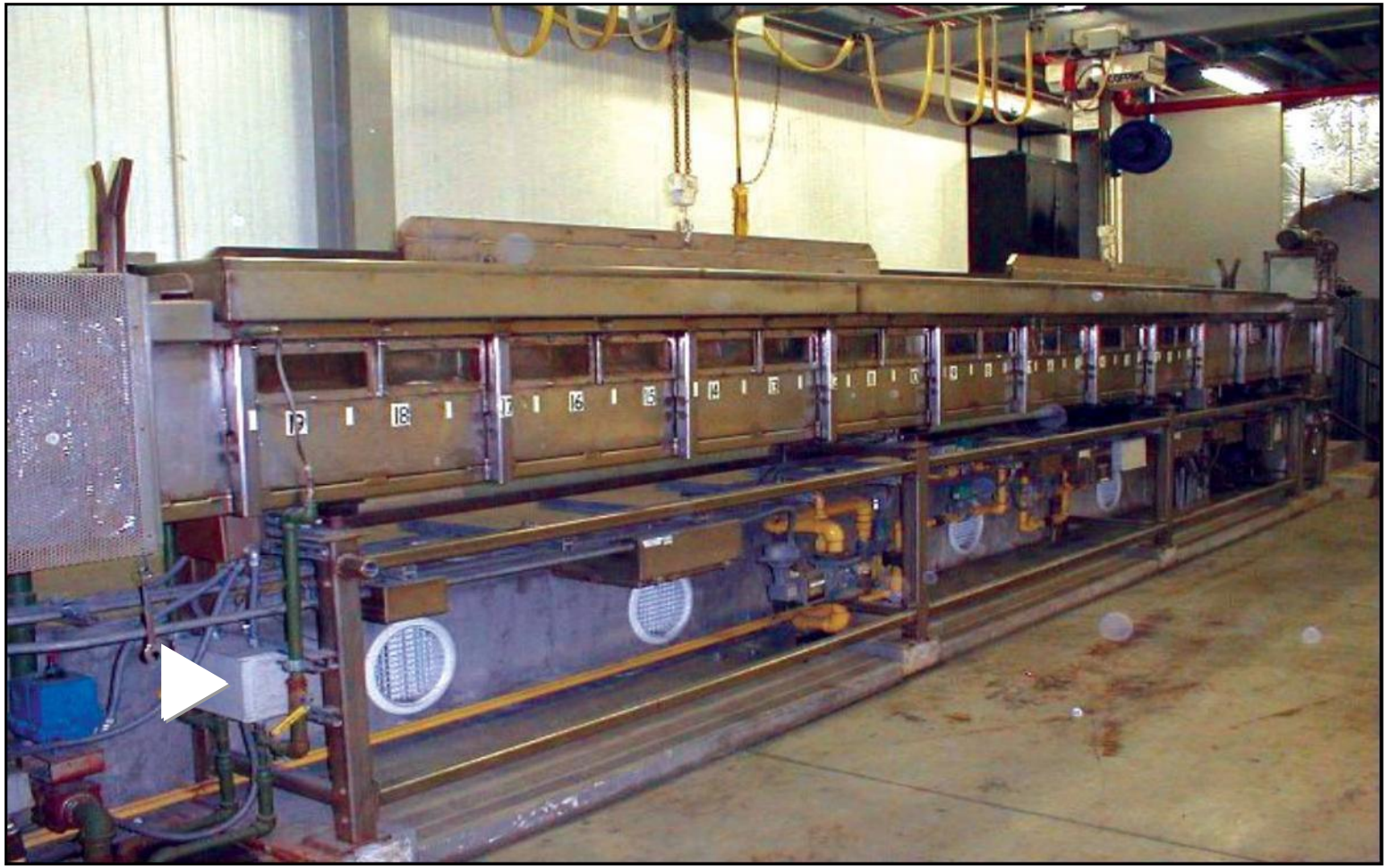
UL 723 / ASTM E 84 (Steiner Tunnel) Test

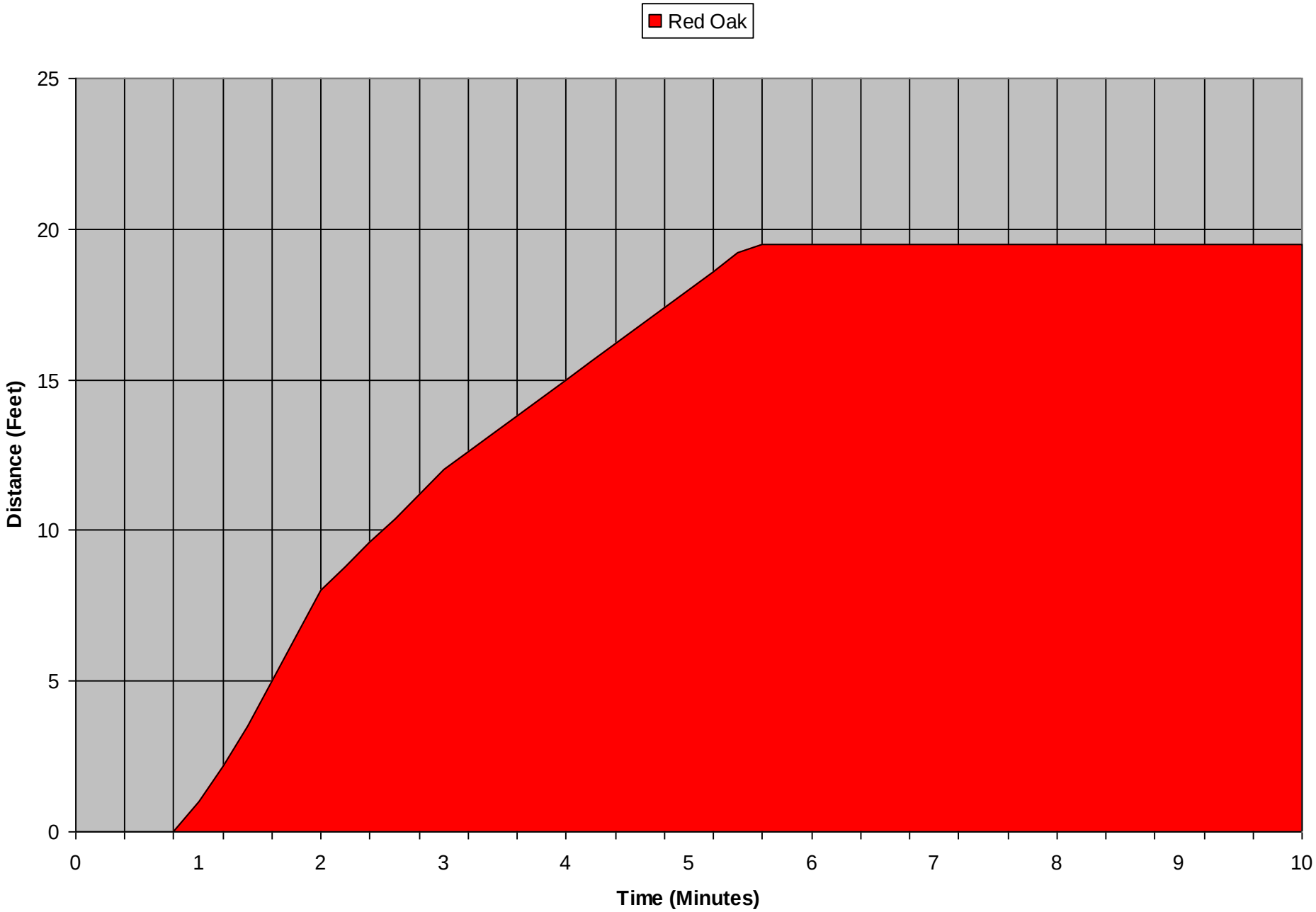
- Measures ***Surface Burning Characteristics***
  - Flame Spread Index (FSI)
  - Smoke Developed Index (SDI)
- Measures performance of material under test relative to comparative samples of:
  - Inorganic reinforced cement board (FSI / SDI = 0)
  - Red oak (FSI / SDI = 100)

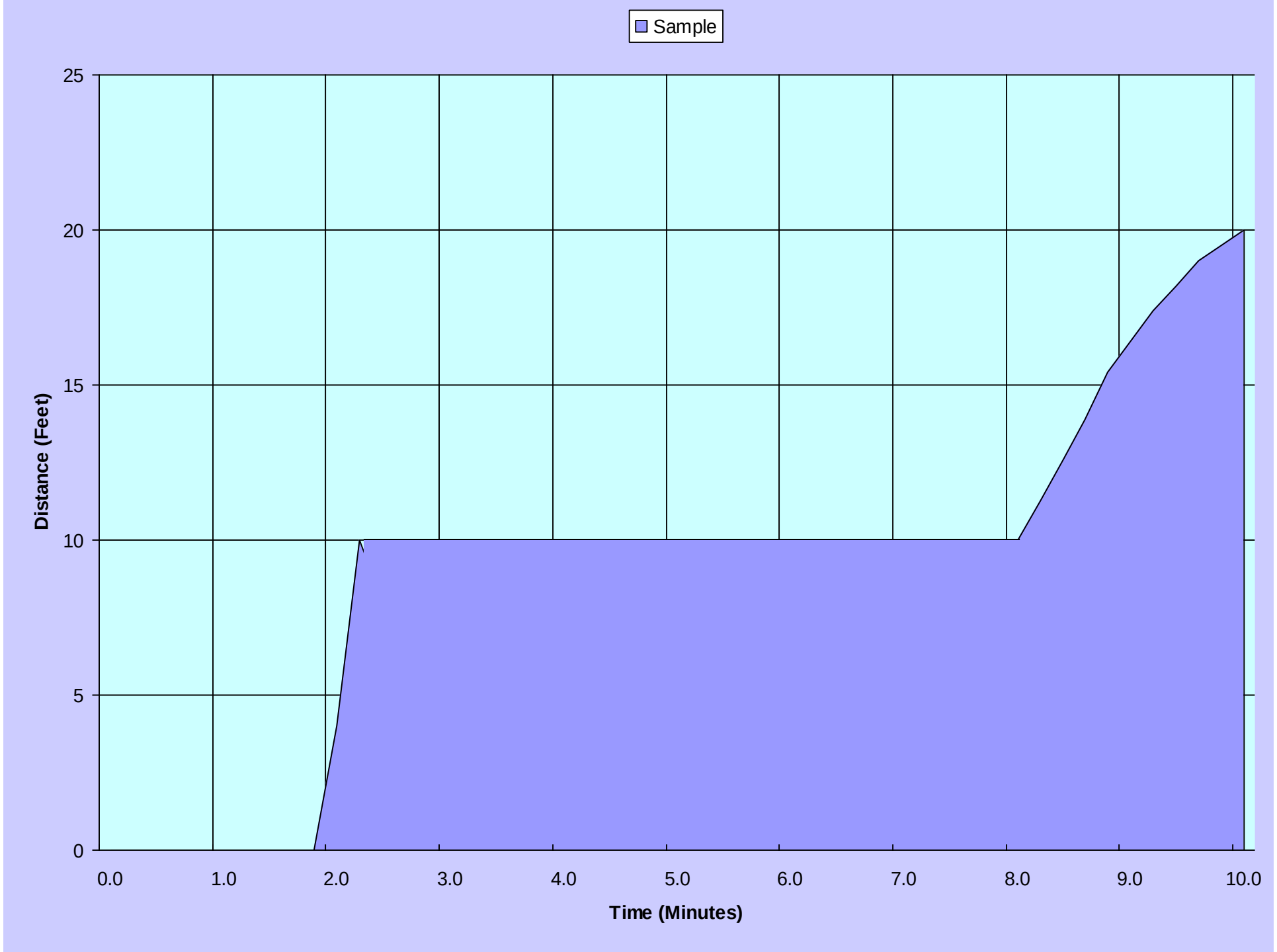
UL 723 / ASTM E 84 (Steiner Tunnel) Test Cont.

- IBC requires Class A, B or C performance based on occupancy and the use of sprinklers
  - Class A – FSI of 0 to 25, SDI of 0 to 450
  - Class B – FSI of 26 to 75, SDI of 0 to 450
  - Class C – FSI of 76 to 200, SDI of 0 to 450

Steiner Tunnel Video



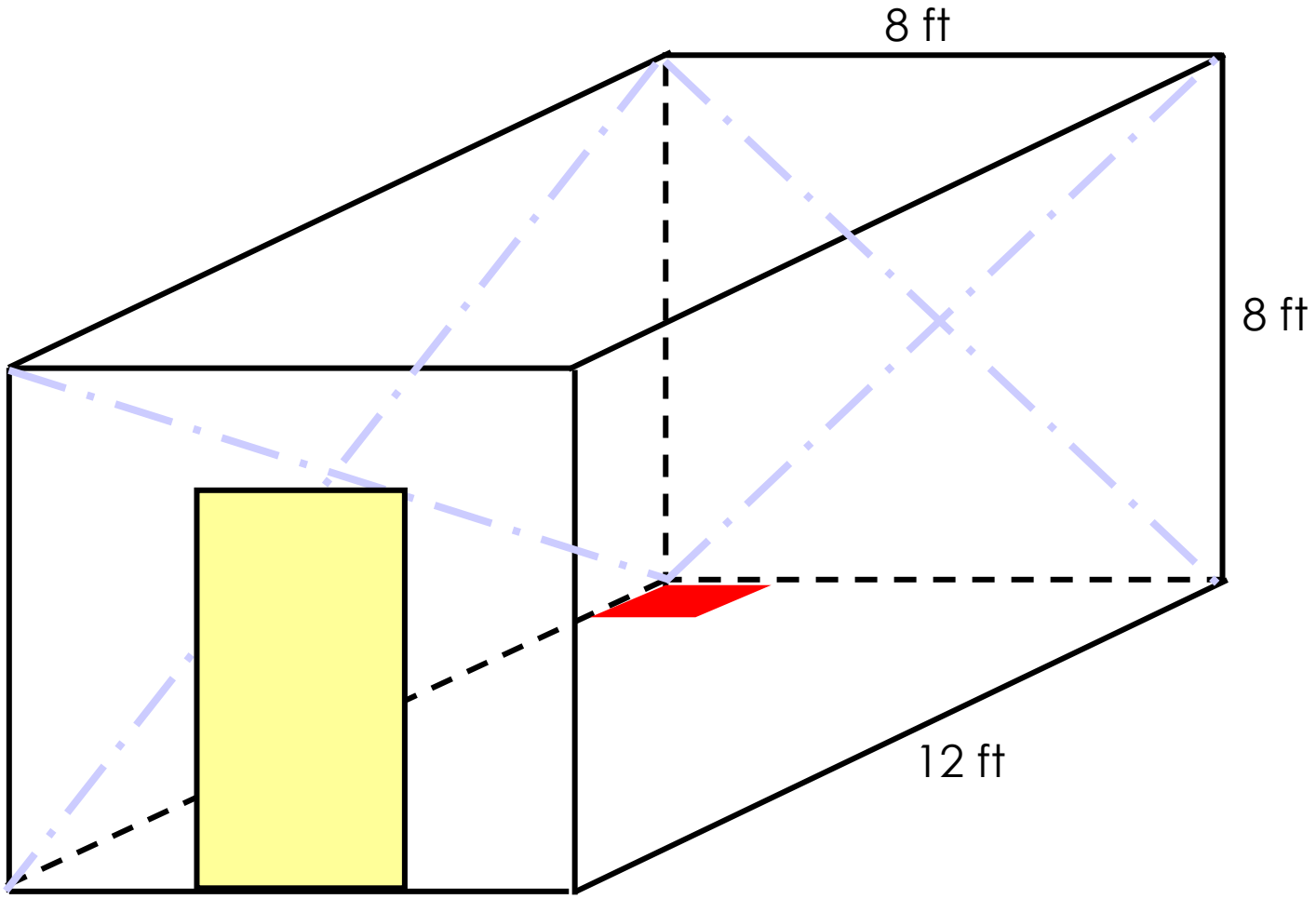

Red Oak
25
20
15
10
5
0
Distance (Feet)
0
1
2
3
4
5
6
7
8
9
10
Time (Minutes)


Sample
25
20
15
10
5
0
Distance (Feet)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Time (Minutes)

NFPA 286

- Evaluates surface flammability of wall, ceiling, or wall and ceiling interior finish materials other than textiles
- Considered one of four enclosed corner tests
- Developed as a spin-off NFPA 265
- Advantage of corner testing over Steiner Tunnel testing is ability to determine if material will stay in place on wall and/or ceiling
- Standard is a test method only
- Acceptance criteria detailed in code based on test method specified in Standard

NFPA 286 Cont.



NFPA 286 Cont.

- Test room constructed of steel studs / calcium silicate or gypsum board
- Material under tests installed on walls, ceiling, or walls and ceilings as specified by manufacturer
- Coatings installed on standard substrate
- Collection hood located above doorway to collect by-products of combustion

NFPA 286 Cont.

- Thermocouples installed at various points around room
- Paper flashover targets installed on floor at two locations
- Heat flux meter installed on floor
- Fuel provided by gas burner, calibrated in test room to provide rate of heat release of 40 kW and 160 kW

NFPA 286 Cont.

- Gas burner ignited and adjusted to provide 40 kW fire for 5 min
- Gas flow increased to provide 160 kW fire for an additional 10 min
- Condition of Acceptance from IBC
  - During the 40 kW exposure, flames shall not spread to the ceiling
  - The flame shall not spread to the outer extremity of the sample on any wall or ceiling
  - Flashover, as defined in NFPA 286, shall not occur
  - The peak heat release rate throughout the test shall not exceed 800 kW
  - The total smoke released throughout the test shall not exceed 1,000 m^2

NFPA 265

- Evaluates surface flammability of textile and expanded vinyl wall covering materials
- Other than the burner and gas flow rate, test method is very similar to NFPA 286
- Standard is a test method only
- Acceptance criteria detailed in code based on test method specified in Standard
- Condition of Acceptance from IBC
  - Very similar to NFPA 285

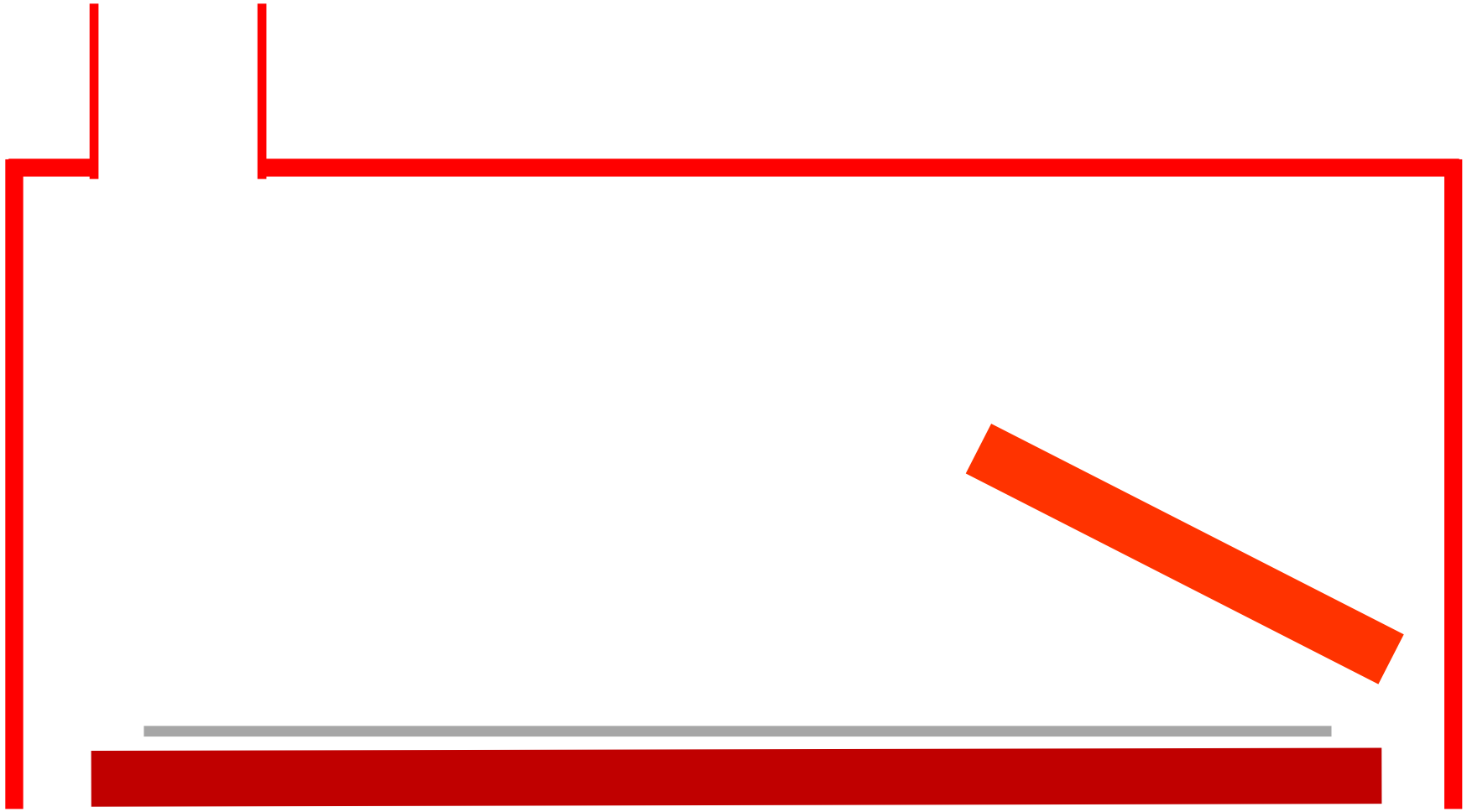
NFPA 253 / ASTM E648

- NFPA 253 / ASTM E648 – Standard Method Test for Critical Radiant Flux of Floor Coverings Systems Using A Radiant Heat Energy Source (First Edition – 1978)
- Evaluates surface flammability of floor covering materials based on radiant heat exposure
- Original concept developed by the Armstrong Cork Company in 1966

NFPA 253 / ASTM E648 Cont.

- Test method developed by the National Bureau of Standards in the early 70s
- Standard is a test method only
- Acceptance criteria detailed in code based on test method specified in Standard

NFPA 253 / ASTM E648 Cont.



NFPA 253 / ASTM E648 Cont.

- Furnace calibrated to relate radiant flux to distance from radiant burner
- Furnace preheated using radiant panel burner for 1-1/2 hr
- Floor covering material installed on substrate placed at bottom of furnace chamber
- After 5 min, sample ignited using pilot burner
- Test continued until maximum flame propagation occurs

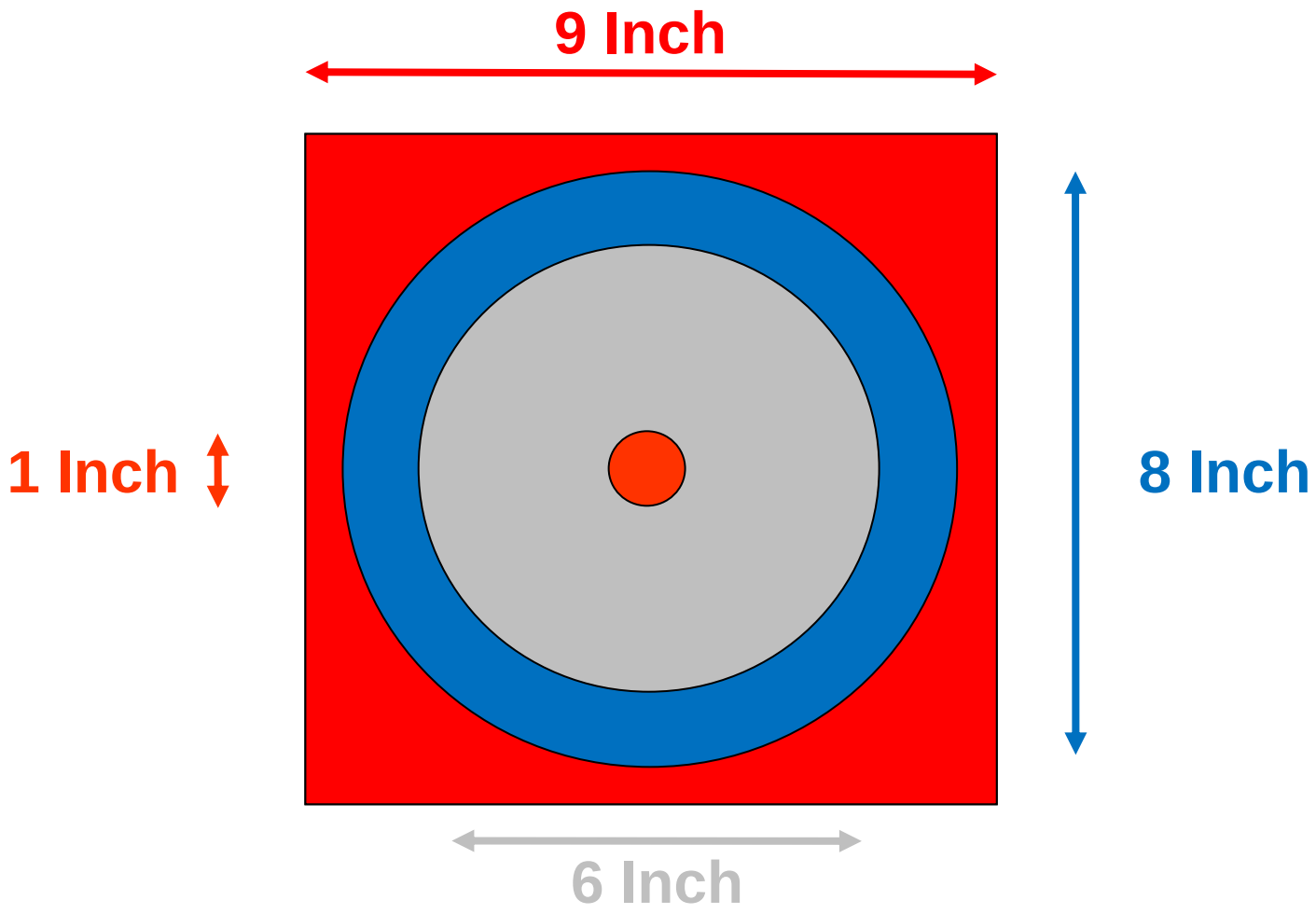
NFPA 253 / ASTM E648 Cont.

- Flame propagation distance recorded and critical radiant flux calculated based on calibration data
- Critical radiant flux is the radiant heat flux at which sample will not support combustion

DOC FF-1

- Department of Commerce Test DOC FF-1 – Standard for the Surface Flammability of Carpets and Rugs
- Developed by Department of Commerce many decades ago
- Conducted in a 12 in. by 12 in. by 12 in. chamber
- Uses Methenamine pill as ignition source

DOC FF-1 Cont.



DOC FF-1 Cont.

- Eight individual sample tested per construction of floor covering
- Acceptance Criteria
  - Charring shall not extend to within 1 in. of steel plate in 7 of 8 samples

Plastics – IBC Chapter 26

- Referenced Standards
  - Steiner Tunnel
    - UL 723 / ASTM E84 – Test for Surface Burning Characteristics of Building Materials
    - UL 1256 – Fire Test of Roof Deck Construction
  - Room Corner Tests
    - NFPA 286 – Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

UL 1256

- Measures flammability on underside of roof deck constructions using foamed plastic insulation on top of deck
- Sample incorporates a longitudinal seam in the roof deck along centerline of furnace chamber, which allows involvement of foam plastic
- Uses Steiner Tunnel furnace
- Maximum allowable flame propagation during 30 minute fire exposure
  - 10 feet in 10 min
  - 14 ft in 30 min

Fire-Resistance – What Reaction to Fire is NOT

Fire-Resistance-Rated Construction Cont.

- Assumes you already have a post-flashover fire condition
- Evaluates the ability of the materials and methods of construction to resist the long-term impact of fire
- Intended to contain the fire to the room or floor or origin and to maintain structural integrity of the building
- Based on the requirements of Chapter 7 of the International Building Code covering Fire and Smoke Protection Features

Building & Fire Code Requirements

- International Codes –
  - New and Existing Buildings – International Building Code – Chapter 7
  - Maintenance – International Fire Code – Chapter 7
- NFPA Codes –
  - New and Existing Buildings – NFPA 5000 & 101 – Chapter 8
  - Maintenance – NFPA 101 & 1
- Canadian Codes –
  - New and Existing Buildings – National Building Code of Canada
  - Maintenance – National Fire Code of Canada
- UAE Fire and Life Safety Code – Chapter 1, Section 21
- Other Worldwide Codes
- ***Minimum requirements*** - ***Construction*** & ***Maintaining Protection***

Fire Resistance

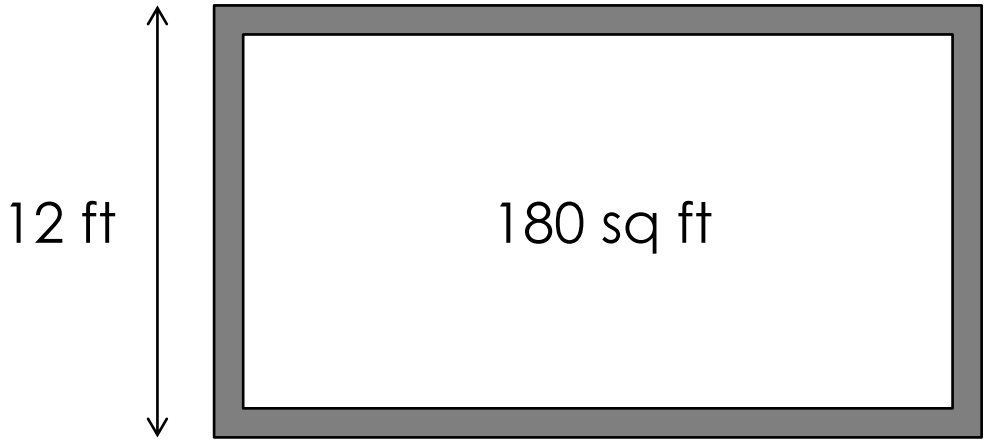
- **Products Become Designs, Systems & Assemblies Based on Testing**
  - **Fire & Smoke Barriers - Fire Separations** – ASTM E119 / UL 263
  - **Firestopping** – UL 1479 / ASTM E814, UL 2079 / E1966, E2307, E2837 **…**test methods…”
  - **Swinging/Rolling Fire Doors** – UL 10B, UL 10C, NFPA 252
  - **Fire Rated Glazing** – UL 9, NFPA 257, UL 263 / ASTM E119
  - **Fire/Smoke Dampers** – UL 555, UL 555S, UL 555C, UL 263 / ASTM E119
- **All tests are conducted for some hourly time period**

Fire Resistance

- Chapters 3, 4, 5, 6 and 10 establish the required ratings
- Chapter 7 establishes how the rating is determined
- Rating expressed as an Hourly Time Period
- Ratings range from 1/2 to 4 hours
- Contain Fire to Room or Floor of Origin and Maintain Structural Integrity

Floor/Ceiling or Roof/Ceilings

- Sample size – 180 sq ft / 12 ft
- Load applied – Per design



UL Image

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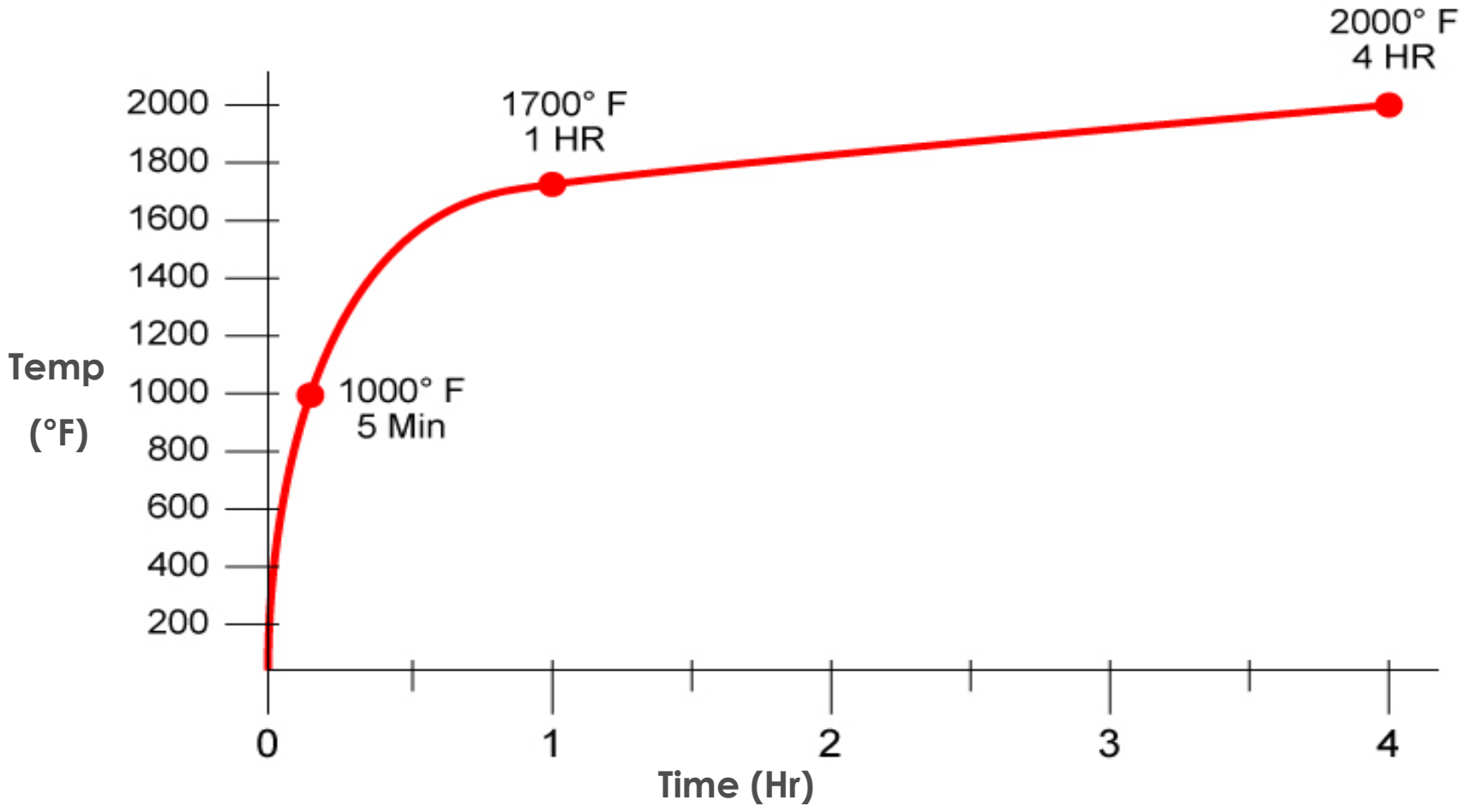
Time – Temperature Curve



Conditions of Acceptance
Floor/Ceilings or Roof/Ceilings

- Support load
- Flame passage
- 250ºF / 325ºF
- Support temperatures

Firestopping Penetrations for Continuity

- **Products become SYSTEMS Based on Testing**
- **'Field Erected Construction…Tested to…'**
  - Standards – UL 1479, ASTM E814, FM 4990, ULC-S115
  - US Ratings:
    - F Rating – Flame
    - T Rating – Temperature
    - L Rating – Smoke
    - W Rating – Water
    - M Rating – Movement

3M Photo

Firestopping Fire-Resistant Joints Systems for Continuity

- **Products become SYSTEMS Based on Testing**
- **'Field Erected Construction…Tested to…'**
  - Standards – UL 2079, ASTM E1966, ULC-S115
  - Assembly Rating – Flame & Temperature
  - L Rating – Smoke
  - W Rating – Water

Firestopping Perimeter Fire Containment Systems for Continuity

- **Products become SYSTEMS Based on Testing**
- **‘Field Erected Construction…Tested to…’**
  - Standards – ASTM E2307, ULC-S115
  - F Rating – Flame
  - T Rating – Temperature
  - Integrity Rating – Flame
  - Insulation Rating – Temperature
  - L Rating – Smoke

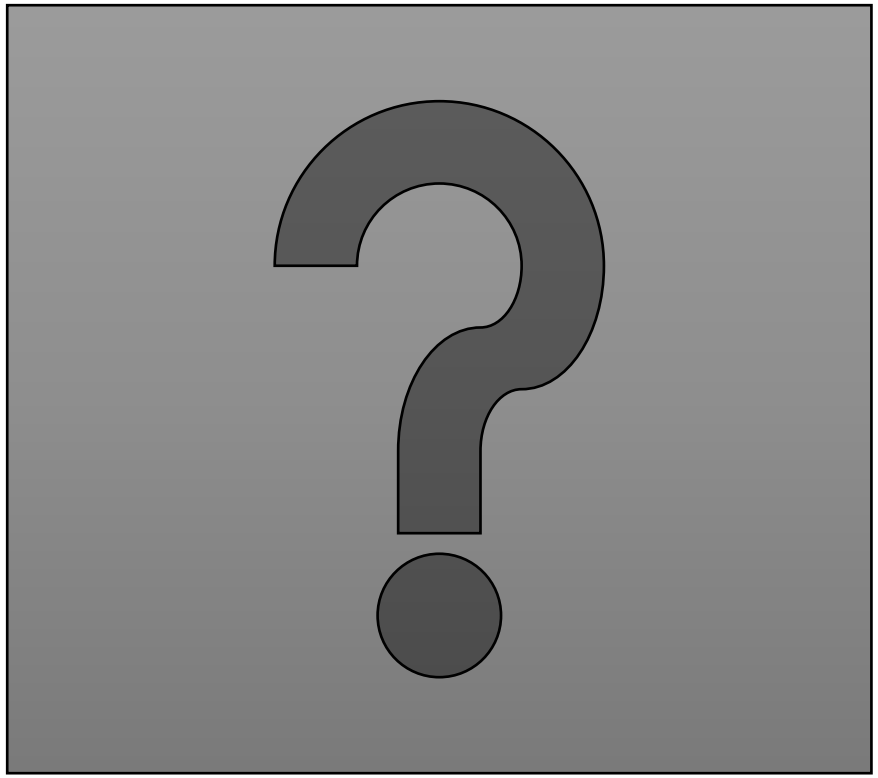
Summary

- Reaction to Fire
  - Reaction to fire standards address keeping a small fire small
  - Evaluates flame propagation over the surface of the material – i.e. surface flammability
- Fire-Resistance
  - Assumes you already have a post-flashover fire condition
  - Evaluates the ability of the materials and methods of construction to resist the long-term impact of fire

Summary Cont.

- Intended to contain the fire to the room or floor or origin and to maintain structural integrity of the building
- Requires the protection of all breaches in the barriers
  - Penetrations
  - Joints and Voids
  - Opening Protectives
  - Duct and Air Transfer Openings

Questions??



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