RICHMOND
INTERNATIONAL CODE COUNCIL 2018

Welcome to the

2018 Annual Conference Educational Sessions

Session: Foam Plastic Insulation – Exterior Wall Fire Safety

Sponsored by ORACLE

Foam Plastic Insulation – Exterior Wall Fire Safety

Presentation Overview

- Overview of Recent Global Fire Events
- IBC Requirements for Exterior Walls Using Foam Plastic Insulation
- Applicable Fire Test Standards
- Identifying Common Exterior Wall Assemblies
- Fire Safety: Design Through Inspection
- Interactive Q&A: How can industry and the code enforcement community work to promote greater fire safety?

Overview of Recent Global Fire Events

Grenfell Tower Fire Tragedy

- June 14, 2017 Fire
- Multiple investigations
- Hundreds of similarly clad buildings
- Large-scale fire test results made public

Grenfell Tower Fire Tragedy

- Independent Review of Building Regulations and Fire Safety:
  - New regulatory framework for “higher risk residential buildings”
  - Liability – expanded and more rigorous duties
  - Stronger change control process
  - A more effective performance-based testing scheme
  - Product labeling

Global Fire Safety Landscape

- Other global fires:
  - Melbourne's Docklands
  - Marco Polo Apartments
  - Dubai's Torch Tower
  - Trump Tower
  - Sao Paulo's high-rise
- Are there common causes of, and solutions to, these events?

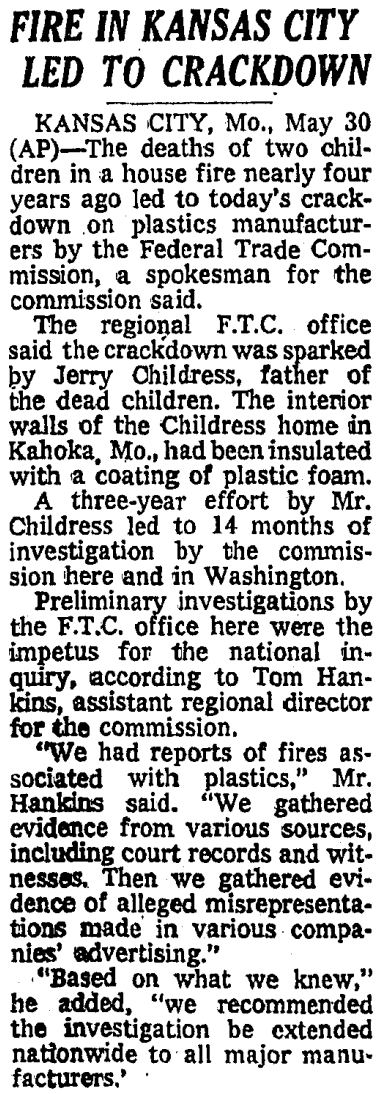
IBC Requirements for Exterior Walls Using Foam Plastic Insulation

IBC Requirements

- Chapter 14 – Exterior Walls
- Chapter 26 – Foam Plastic

How do these IBC Chapters create the fire safety requirements for exterior walls containing foam plastic insulation?

Genesis of Chapter 26 (Foam Plastic) in the IBC



FIRE IN KANSAS CITY LED TO CRACKDOWN

KANSAS CITY, Mo., May 30 (AP)—The deaths of two children in a house fire nearly four years ago led to today's crackdown on plastics manufacturers by the Federal Trade Commission, a spokesman for the commission said.

The regional F.T.C. office said the crackdown was sparked by Jerry Childress, father of the dead children. The interior walls of the Childress home in Kahoka, Mo., had been insulated with a coating of plastic foam.

A three-year effort by Mr. Childress led to 14 months of investigation by the commission here and in Washington.

Preliminary investigations by the F.T.C. office here were the impetus for the national inquiry, according to Tom Hankins, assistant regional director for the commission.

"We had reports of fires associated with plastics," Mr. Hankins said. "We gathered evidence from various sources, including court records and witnesses. Then we gathered evidence of alleged misrepresentations made in various companies' advertising."

"Based on what we knew," he added, "we recommended the investigation be extended nationwide to all major manufacturers."

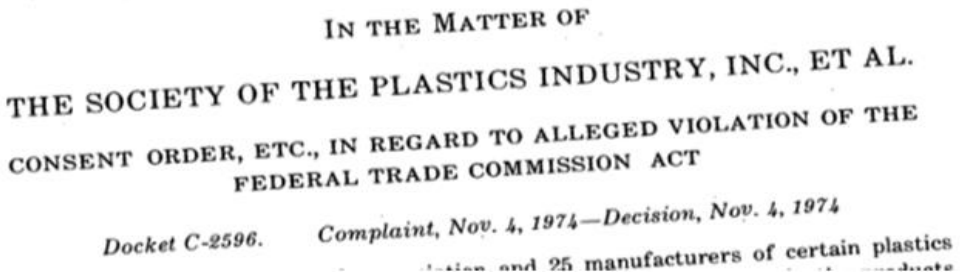
Childress Home Fire

1969 Clack County, MO

- Two children died
- Exposed polyurethane foam plastic insulation sold as "non-burning" or "self-extinguishing"
- Parents won a suit against the manufacturer
- Led to a 14 month investigation by the US Federal Trade Commission

Genesis of Chapter 26 (Foam Plastic) in the IBC: The FTC Investigation & Consent Decree

- US FTC filed a complaint against the Society of the Plastics Industry, ASTM and 25 manufacturers of foam plastic insulation for deceptive fire performance marketing.



IN THE MATTER OF

THE SOCIETY OF THE PLASTICS INDUSTRY, INC., ET AL.

CONSENT ORDER, ETC., IN REGARD TO ALLEGED VIOLATION OF THE FEDERAL TRADE COMMISSION ACT

Docket C-2596. Complaint, Nov. 4, 1974—Decision, Nov. 4, 1974

and 25 manufacturers of certain plastics

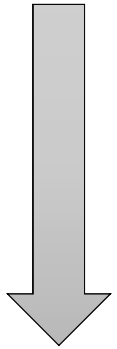
- 1974 Consent Decree signed by SPI and 25 manufacturers
  - Notification of prior purchasers of their foams
  - Sponsor product research – ($5M), leading to the 1980 Final Report of the Product Research Committee
  - 1976 Uniform Building Code sections specifically addressing foam insulation fire test requirements

Construction Types in the IBC

Construction Types

(from IBC Chapter 5 and 6)

Combustible



Non-Combustible

Type V Combustible Construction

Type IV Heavy Timber Construction

Type III Non-Combustible Exterior

Type II Non-Combustible Exterior and Components

Type I Non-Combustible Materials and Structure

- *Each Type has an "A" and a "B" sub-category*
- *"A" has increased fire protection requirements*

Construction Type Examples

Type V

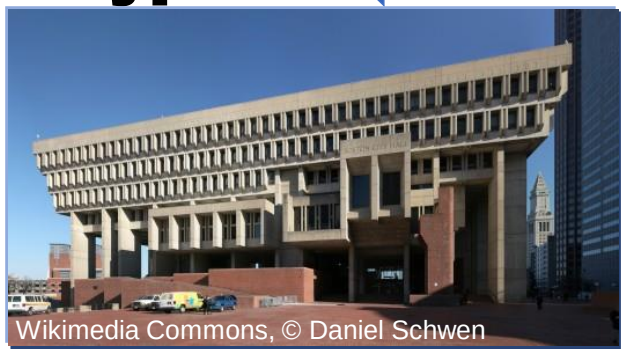
Type IV

Type III

Combustible

Non-Combustible

Type I

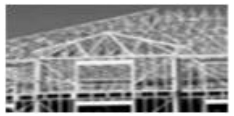


Type II

Building Height by Construction Type

Maximum Building Height (IBC Table 503)

Including 1-story sprinkler system increase

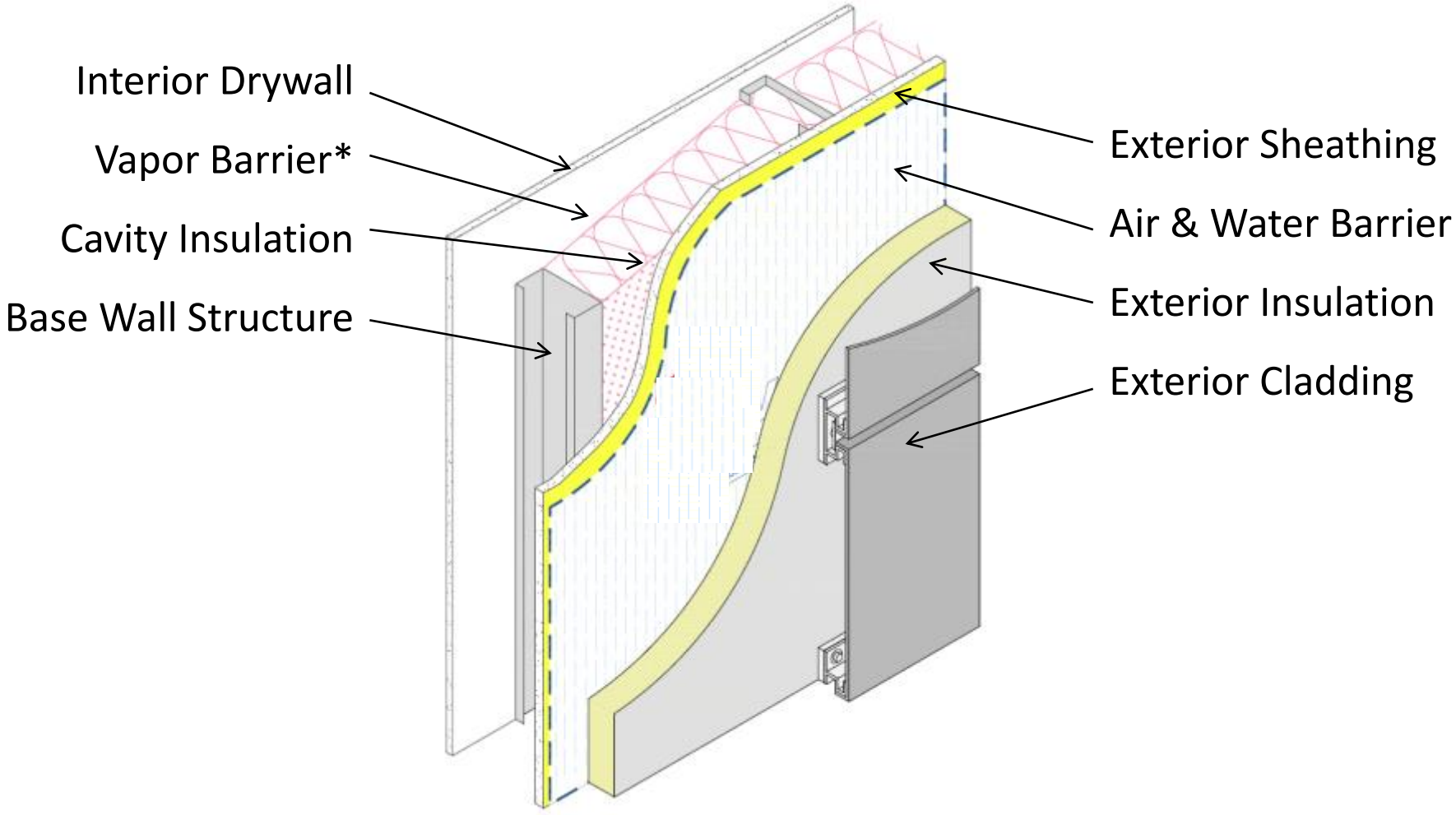




	Type V Combustible	**Type IV** Heavy Timber	**Type III** Non-Combustible Exterior	**Type II** Non-Combustible Components	**Type I** Fire-Rated Structure
Assembly***	3	4	4	4	Unlimited
Education	2	4	4	4	Unlimited
Business	4	6	6	6	Unlimited
Factory/Ind	4	6	5	6	Unlimited
High Hazard	4	6	6	6	Unlimited
Institutional	3	5	5	5	Unlimited
Mercantile	4	5	5	5	Unlimited
Residential	4	5	5	5	Unlimited
Storage	5	6	5	6	Unlimited
Utility	3	5	4	5	Unlimited

Source: 2012 International Building Code

Building Envelope Assembly Components



** Vapor Barrier's use and location in the wall is climate specific*

Applicable Fire Test Standards

IBC Exterior Wall Related Fire Tests and Reports

Product Properties

- **ASTM E84** Surface Burning Characteristics
- **ASTM E1354** Cone Calorimeter Test
- **ASTM E136** Combustible Materials
- **ICC ES Reports** *(compliance aid, not a test method)*

Assembly Properties

- **ASTM E 119 or UL 263** Fire Rated Walls
- **NFPA 268** Radiant Ignitibility of Assemblies
- **NFPA 285** Walls With Combustible Components

History of NFPA 285

Energy Crisis:
Leads to increased exterior insulation applications

1988:
Uniform Building Code adopts UBC 17-6

1997:
Uniform Building Code adopts UBC 26-9

2000:
IBC begins requiring NFPA 285 testing

1970's → 1980's → 1990's → 2000's → 2010's

Late 70's:
SPI develops full-scale test

Full-scale Fire Test
UBC 17-6 / UBC 26-4

1998:
NFPA adopts UBC 26-9 as NFPA 285

Reduced-scale Fire Test
UBC 26-9 / NFPA 285

2012:
IBC expands NFPA 285 testing to WRB

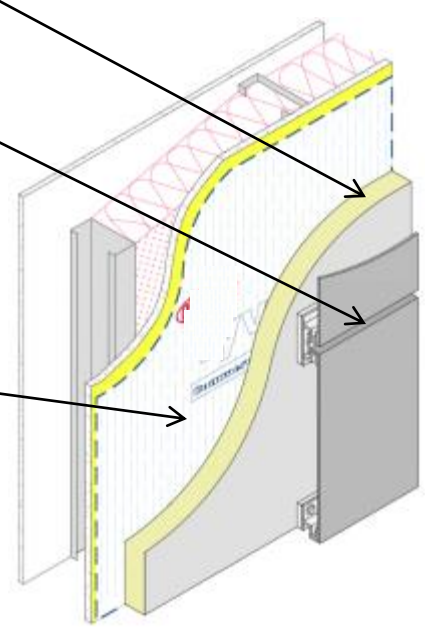
2015 & 2018
IBC has approved WRB exceptions based on material properties and fuel load potential

Source: "NFPA 285: What you Need to Know" by Jesse J. Beitel – JBED Summer 2012 issue

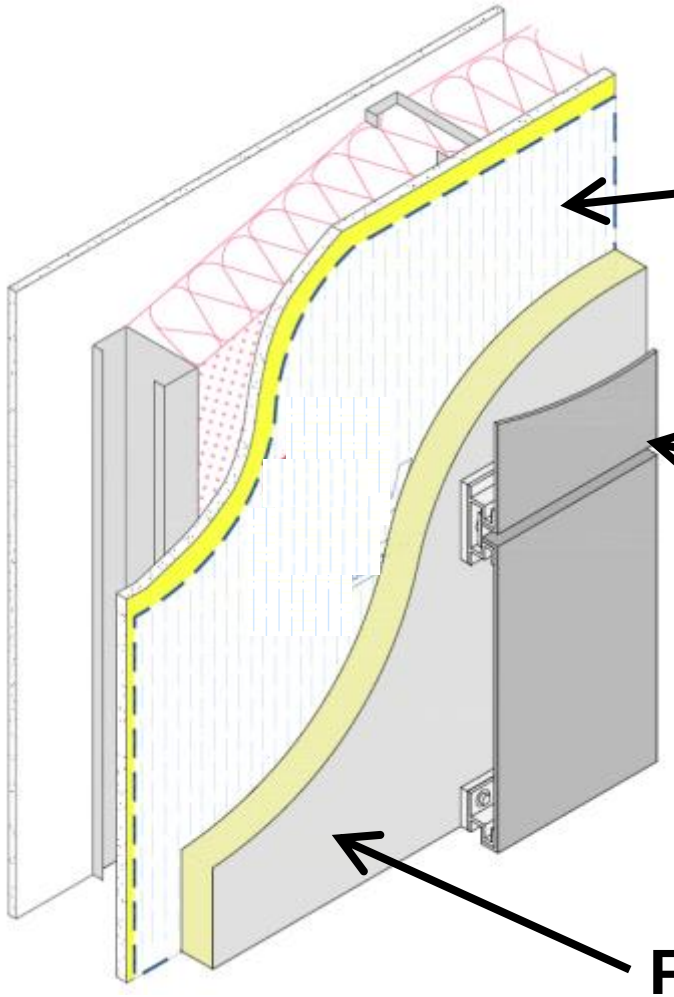
IBC NFPA 285 Testing – Material Triggers

- **Foam Plastic Insulation (Ch. 26)**
  - Applies to Type I – IV construction (~1988)
  - **Applies to buildings of any height**
- **Combustible Exterior Cladding (Ch. 14)**
  - EIFS - (~2000 IBC)
  - MCMs - (~2003 IBC)
  - FRPs - (~2009 IBC)
  - HPLs - (~2012 IBC)
- **Water-Resistive Barriers (Ch. 14)**
  - Applies to Type I, II, III, IV buildings over 40 ft
  - Applies to combustible WRB's - (2012 IBC)

NFPA 285 REQUIRED



IBC Combustible Component Requirements



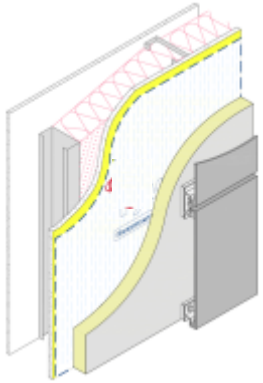
Air & Water Barriers –§1403.5

Combustible Claddings

- EIFS - § 1408.2
- MCM - § 1407.10
- FRP - § 2612.5
- HPL - § 1409.10

Foam Plastic Insulation – § 2603.5.5

IBC Combustible Component Requirements

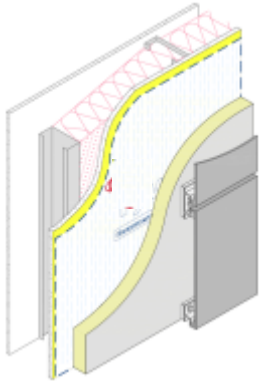


- **Foam Plastic Insulation**
- **Combustible Claddings** (EIFS, MCM, FRP, HPL)
- **Air & Water Barriers**

Design Conditions Requiring NFPA 285

- Installations over 40’ (Type I, II, III, or IV)
- Installations of ANY Height
  - Foam Plastic insulation

IBC Combustible Component Requirements



- **Foam Plastic Insulation**
- **Combustible Claddings** (EIFS, MCM, FRP, HPL)
- **Air & Water Barriers**

Material Requirements, IBC Type I-IV Taller than 40’

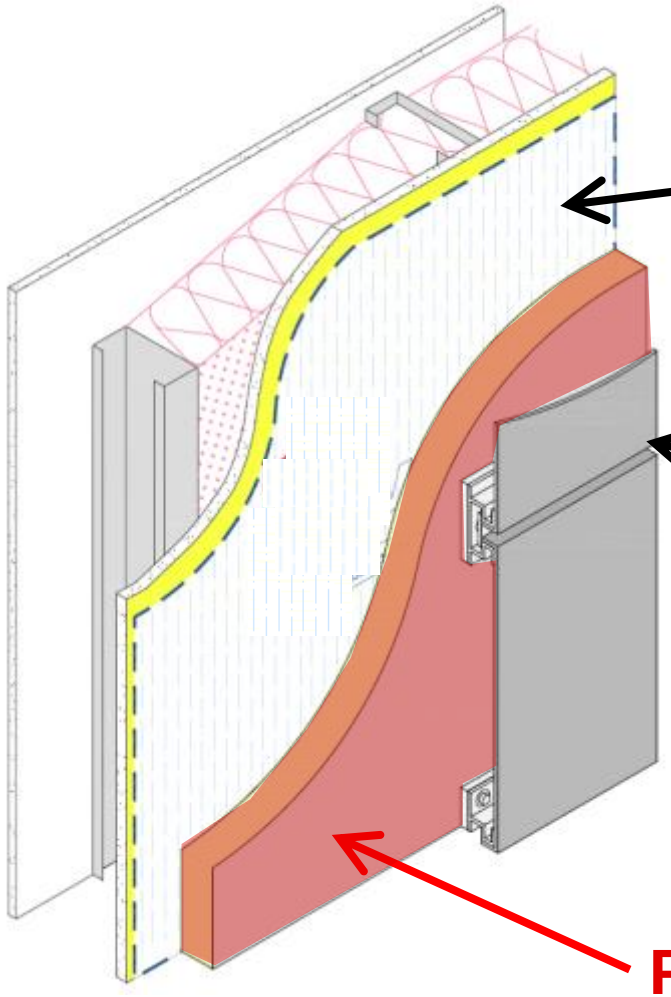
- Products are Labeled and Identified by manufacturer
- Flame Spread Index ≤25 (ASTM E84)
- Smoke Development Index ≤450 (ASTM E84)

Class A

- Maintain assembly fire rating (ASTM E119 or UL 263)
- Separated from interior by a Thermal Barrier (gyp. bd)

Identifying Common Exterior Wall Assemblies

NFPA 285 Wall Assembly: Exterior Insulation



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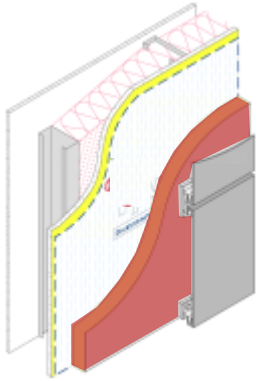
Foam Plastic Insulation – § 2603.5.5

NFPA 285 Wall Assembly: Exterior Insulation



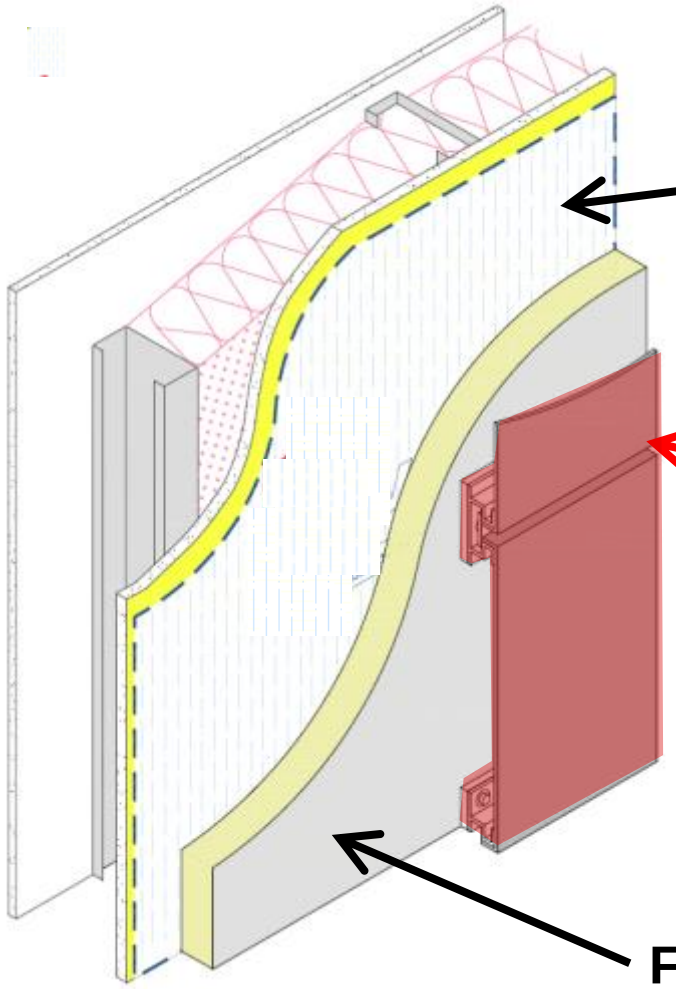
Common Insulation Types

Most Common Continuous Insulation Types Used

- **XPS (Extruded Polystyrene)**
  - R-value: ~5 R/in
  - Permeability: ~0.8 perm-in
- **Polyisocyanurate**
  - R-value: ~6 R/in
  - Permeability: ~0.75 perm-in
- **Mineral Fiber**
  - R-value: ~4 R/in
  - Permeability: ~54 perm-in

*Source: 2009 ASHRAE Handbook-Fundamentals, * 1997 ASHRAE Handbook-Fundamentals*

NFPA 285 Wall Assembly: Combustible Cladding



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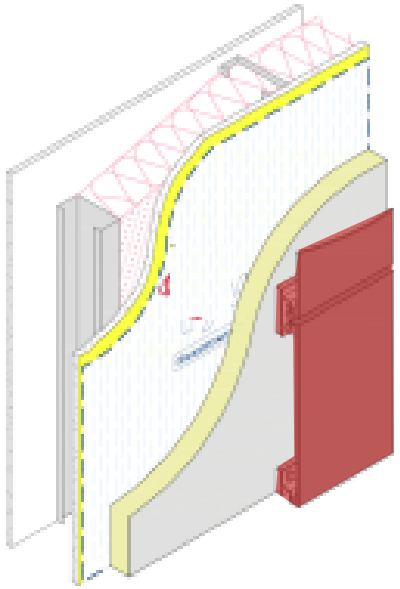
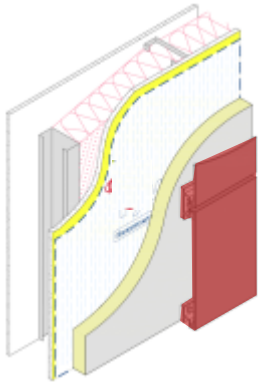


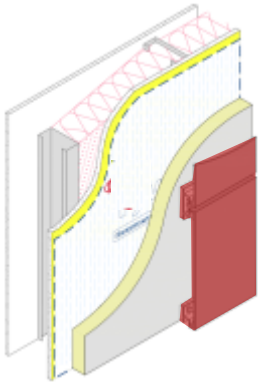
- **<u>Combustible:</u>**
  - Exterior Insulation Finishing Systems (EIFS)
  - Metal Composite Materials (MCMs)
  - Fiber Reinforced Plastics (FRPs)
  - High Pressure Laminates (HPLs)
- **<u>Non-Combustible:</u>**
  - Brick / Masonry / Stone / Terracotta
  - Concrete / Cementitious Stucco
  - Fiber Cement Boards / Panels

NFPA 285 Wall Assembly: Exterior Cladding

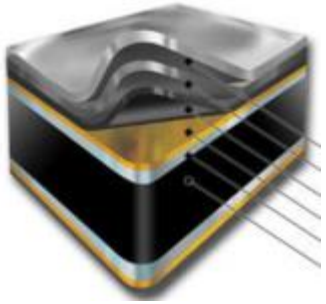


- **Exterior Insulation Finishing Systems (EIFS)**
  - IBC regulates under “Foam Plastic” Requirements
  - Meets the EIFS performance requirements of ASTM E2568
- **Metal Composite Materials (MCMs)**
- **Fiber Reinforced Plastics (FRPs)**
- **High Pressure Laminates (HPLs)**

NFPA 285 Wall Assembly: Exterior Cladding

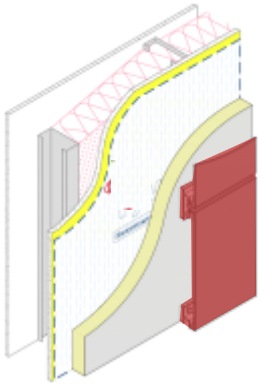


- Exterior Insulation Finishing Systems (EIFS)
- **Metal Composite Materials (MCMs)**
  - Excludes “Foam Plastic” core materials
  - Different core materials have different fire performance characteristics
  - Available in Open and Closed Joint Systems
  - Approximate 4mm-12mm panel thickness



- Fiber Reinforced Plastics (FRPs)
- High Pressure Laminates (HPLs)

NFPA 285 Wall Assembly: Exterior Cladding

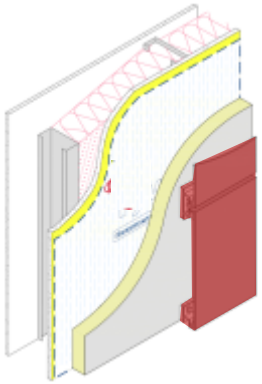


- Exterior Insulation Finishing Systems (EIFS)
- Metal Composite Materials (MCMs)
- **Fiber Reinforced Plastics (FRPs)**
  - Foam cores comply with “Foam Plastic” Req’s
  - Installations less than 40’ above grade
    - Limited to 10% area when separation <10’
    - Flame Spread Index ≤200 (ASTM E84)
    - Fireblocking Required

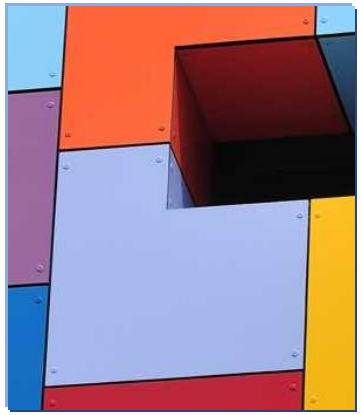
http://www.cranecomposites.com

- High Pressure Laminates (HPLs)

NFPA 285 Wall Assembly: Exterior Cladding

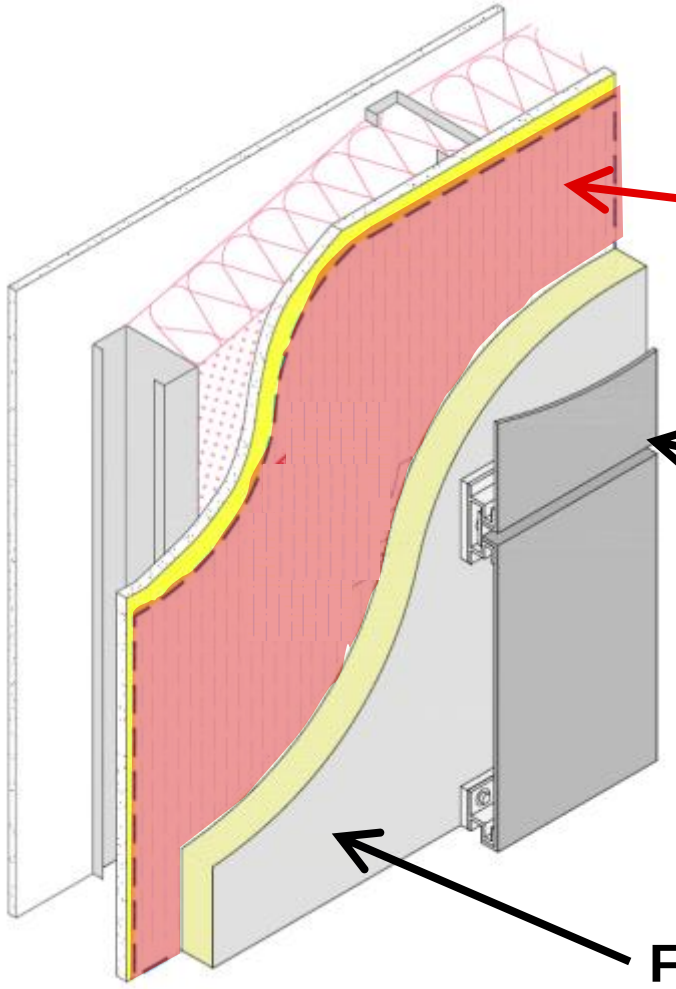


- Exterior Insulation Finishing Systems (EIFS)
- Metal Composite Materials (MCMs)
- Fiber Reinforced Plastics (FRPs)
- **High Pressure Laminates (HPLs)**
  - Available in Open and Closed Joint Systems
  - Approximate 4mm-12mm panel thickness
  - Different core materials have different fire performance characteristics
  - Installations less than 40’ above grade
    - Limited to 10% area when separation < 5’



http://www.trespa.com

NFPA 285 Wall Assembly: Air & Water Barrier



Air & Water Barriers –§1403.5

Combustible Claddings

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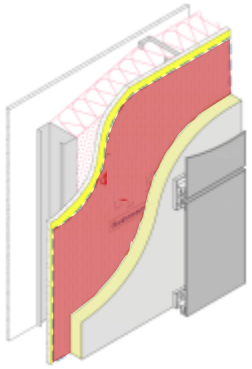
Foam Plastic Insulation – § 2603.5.5

NFPA 285 Wall Assembly: Air & Water Barrier

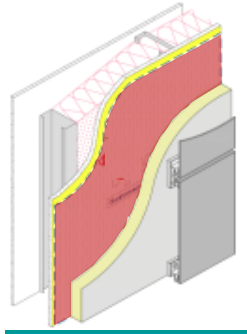


COMBUSTIBLE

- **Water Resistive Barriers (WRBs)**
  - **Building Wraps**
  - **Self Adhered Building Wraps**
  - **Self Adhered Membranes**
  - **Fluid Applied Membranes**
- 2012 IBC: Installations over 40’ above grade must meet the requirements of NFPA 285 (Type I, II, III, or IV)

2015 IBC has approved WRB exceptions based on material properties and fuel load potential

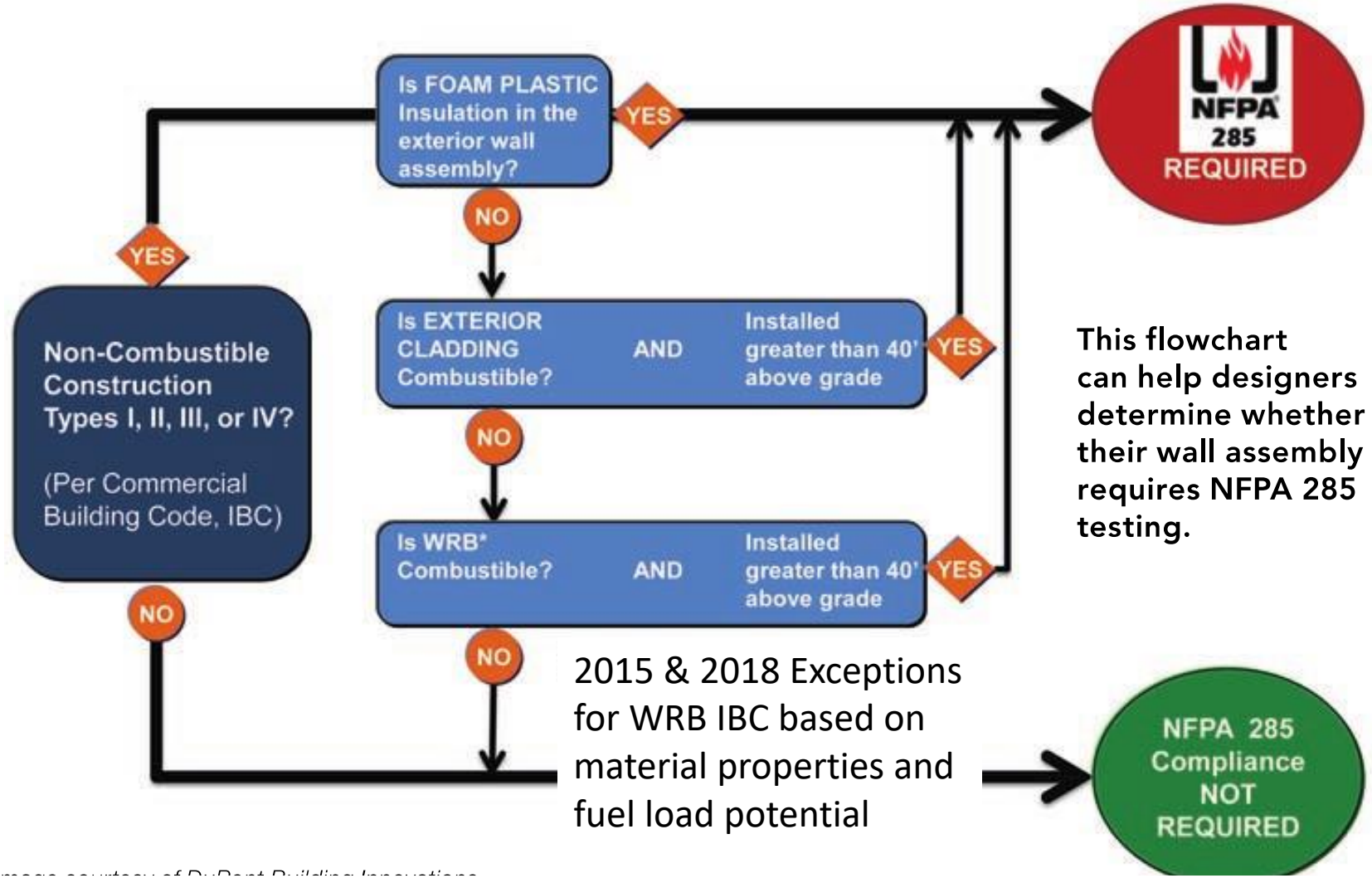
NFPA 285 Wall Assembly: Air & Water Barrier



IBC NFPA 285 Test Requirements for WRBs

	Pre-2012	2012	2015
NFPA 285 Test Req's	None	Installations over 40' above grade must meet the requirements of NFPA 285 (Type I, II, III, or IV)	
Exceptions	N/A	None	**1.** WRB is the only combustible wall component and the wall has a non-combustible covering (Table 1405.2) **2.** WRB is the only combustible wall component and: -ASTM E84 Product Test: -flame spread index of 25 or less -smoke-developed index of 450 } Class A -ASTM E1354 (Cone Calorimeter)Product Test: -Incident radiant heat flux of 50 kW/m2. -Effective Heat of Combustion of less than 18 MJ/kg -Peak Heat Release Rate less than 150 kW/m2 -Total Heat Release of less than 20 MJ/m2 **3.** Windows and doors, and window/door flashings

IBC & NFPA Test Requirements



This flowchart can help designers determine whether their wall assembly requires NFPA 285 testing.

Image courtesy of DuPont Building Innovations

Acceptable Compliance Paths

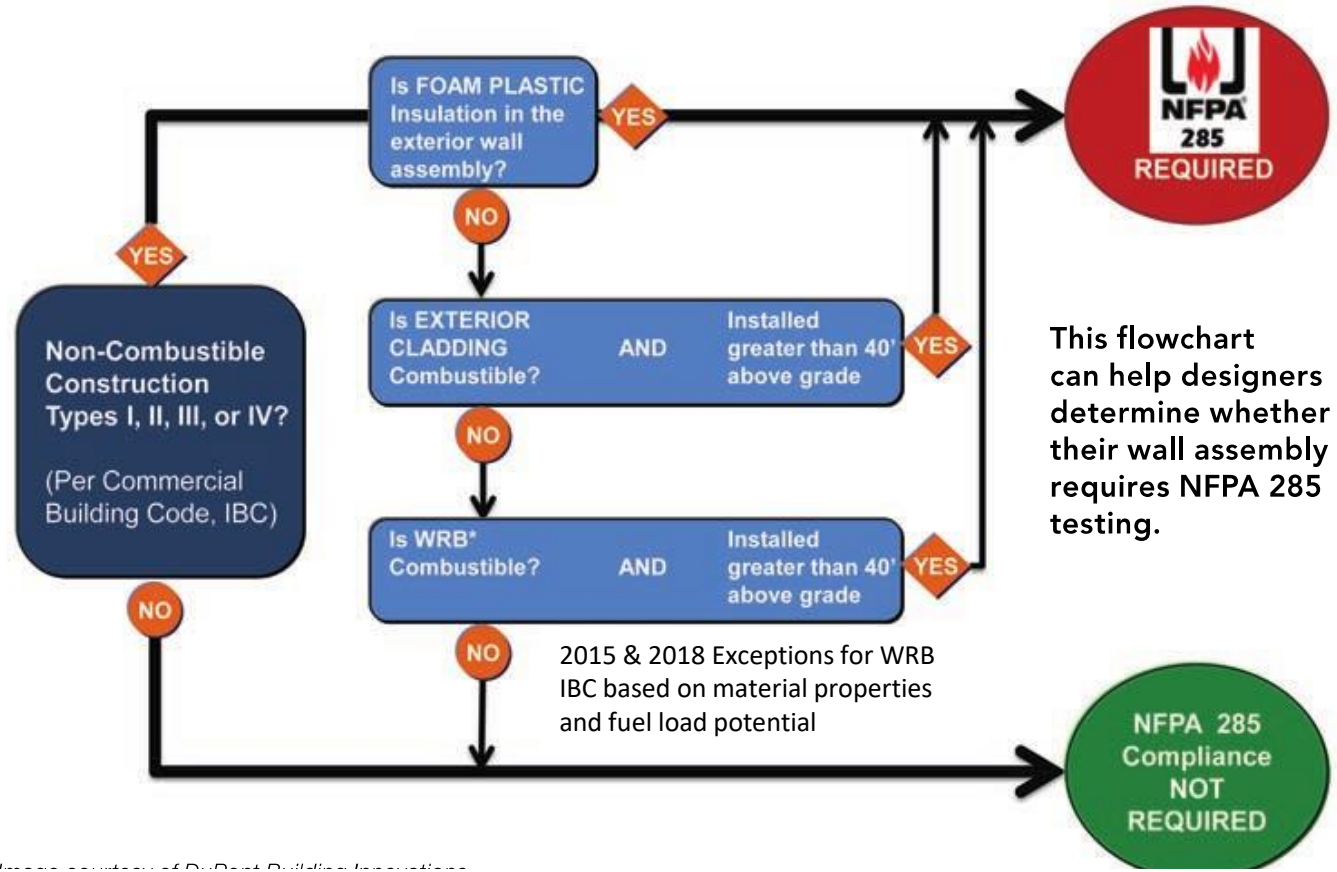


Image courtesy of DuPont Building Innovations

This flowchart can help designers determine whether their wall assembly requires NFPA 285 testing.

- **NFPA Tested System**

OR

- **Test New Assembly**

OR

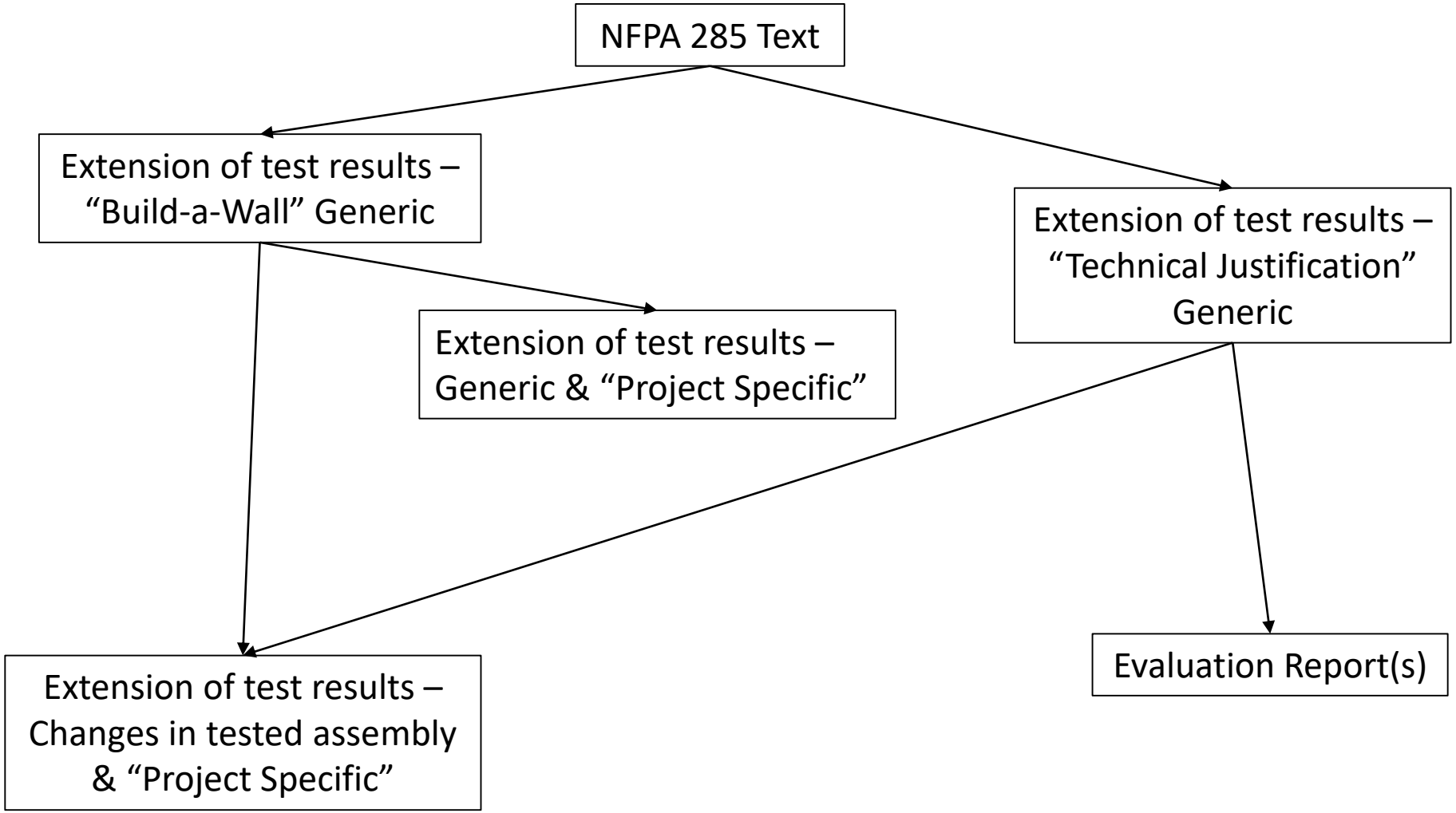
- **Engineering Judgment based on tested NFPA 285 assembly**

Fire Safety: Design Through Inspection

Engineering Judgements (EJs)

- Consider EJs to include analysis reports, ESRs, etc.
- EJs can be “generic” or they may be “specific” to a building or condition
- EJs may or may not require a PE stamp. Depends!
- EJs extend results to a wall assembly not “specifically” tested
- Change to one or more of the tested wall components or their location in the wall
- “Generic” EJs typically provide design documents for manufacturers, architects and specifiers
- “Specific” EJs are typically for architects, general contractors, and Code Officials
- EJs are allowed by code (Section 104.11) when accepted by Code Official

Flow of EJs


NFPA 285 Text
Extension of test results – "Build-a-Wall" Generic
Extension of test results – Generic & "Project Specific"
Extension of test results – "Technical Justification" Generic
Extension of test results – Changes in tested assembly & "Project Specific"
Evaluation Report(s)

How is an EJ done?

- Who does it?
  - Qualifications
  - Differences between organizations
- What are the boundaries?
  - How far can one extrapolate or interpolate?
- How is a substitution / change determined to be OK?
  - Additional testing
  - Experience
- Does the EJ provide technical justification?
  - Especially in “specific” EJs

The question that EJ should answer . . .

Does the variation, change or substitution still provide a wall assembly that exhibits the same or similar fire performance as the NFPA 285 test(s) are form the baseline?

NFPA 285 EJs

703.3 Methods for Determining Fire Resistance

The application of any of the methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E119 or UL 263. The required *fire resistance* of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures:

1. *Fire-resistance* designs documented in approved sources.
2. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in Section 721.
3. Calculations in accordance with Section 722.
4. Engineering analysis based on a comparison of building element, component or assemblies designs having *fire-resistance* ratings as determined by the test procedures set forth in ASTM E119 or UL 263.
5. Alternative protection methods as allowed by Section 104.11.
6. *Fire-resistance* designs certified by an approved agency.

Interactive Q&A: How can industry and the code enforcement community work to promote greater fire safety?

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Thank You For Attending

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