

# Building Exterior Wall Assembly Flammability: Have We Forgotten the Past 40 Years?

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This article addresses the disturbing movement in the U.S. towards trading off exterior wall assembly fire performance safety requirements in the building code when internal sprinklers are present in buildings. This has occurred in certain areas of the country and a similar code change was attempted in April 2015 during the 2018 International Building Code development hearings.



**Figure 1: April 3, 2013 - Gronzy-City Towers, Chechnya**

Source:  
<http://www.skyscrapercity.com/showthread.php?p=121823108>

High-rise building exterior walls are at risk of fire events consuming entire faces of buildings. Such fires have occurred in countries situated in the developing world, the Middle East, Europe, and in Asia. Where have such fires not been a significant problem...in the United States.

What makes the US different than those countries where such exterior wall fires are occurring? The fire protection engineering community in the U.S. foresaw the increasing use of combustible components in exterior wall construction decades ago. Through industry-funded research, an appropriate test method was developed to determine if a given wall assembly could support a self-accelerating and self-spreading fire up the wall, either via the outside surface, through concealed spaces within the wall, or by spreading fire into interior floor areas on stories above. The test method, which today is titled NFPA 285, *Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components*, has been applied nationally via adoption in the model building codes, and has resulted in an existing building stock with exterior walls that are inherently resistant to self-propagating fires.

Now that building energy conservation initiatives are increasingly taking center stage in the U.S. and beyond, there is a desire by the design community to use an increasing amount of combustible components within high-rise exterior wall construction, for insulating materials, for cladding, and for water resistive barriers (WRBs). The well-proven, decades-old NFPA 285 fire safety requirement, which ensures that the resulting construction won't allow vertical fire spread, is now said to be an inconvenience to areas of the building industry. The reaction to this "inconvenience" has been a handful of successful attempts convincing select jurisdictions to strike out the model code (IBC) requirements for exterior wall fire safety. There have also been some unsuccessful attempts to modify the IBC to reduce its requirements for exterior wall fire safety, aiming to eliminate the NFPA 285 requirement completely for high-rise buildings.

Given the present push to try to eliminate fire safety requirements, with the goal of allowing unfettered latitude in the use of plastics in exterior walls, this seems to be a good time to review how and why exterior wall flammability limitations were codified in the U.S. in the first place, take a look at the rest of the world where such requirements don't exist, and discuss the options for a future in which fire safety and building energy efficiency can be balanced.

## **Origin of NFPA 285**

The first exterior wall assemblies to use a significant amount of combustible materials were EIFS (Exterior Insulation Finish System) walls. These used a layer of insulating material such as expanded polystyrene, polyurethane, or polyisocyanurate. EIFS systems were first developed in Europe during the 1950's. As the name for the system indicates, it is an insulating system installed on the exterior of buildings. It can be fashioned to look like concrete, stucco, and even brick. Because of this, it can easily be mistaken for substantial non-combustible construction. In a widely publicized fire in the U.S. northeast during the late 1980's, the fire department that was battling a large building fire was shocked to see the neighboring building 20 ft. away catch fire. They thought it was a concrete building.

EIFS is made up of a substrate, usually substantial and non-combustible, then the expanded plastic insulation, usually polystyrene, then a mesh, a basecoat that covers the mesh, and a finish coat that can be made to look like anything.

It was clear to fire safety and to code enforcement professionals that some test method needed to be developed to sort out the safe and acceptable EIFS designs from those that would pose an unusually high risk of outside wall ignition and of fire propagation. Such a test would need to evaluate the following potential fire spread risks when exposed to an ignition source:

- a) Vertical flame propagation over the face of the wall covering
- b) Vertical flame propagation within (inside) the combustible core or components
- c) Flame propagation over the interior surface from one story to the next
- d) Lateral (i.e. sideways) flame propagation to adjacent compartments

The research to develop such a test method was funded by the Society of Plastics Industry (SPI). Clearly, it was in the interest of the plastics industry to provide a method to distinguish the safe from the less-safe uses of wall construction using plastic materials. Establishing the construction details for the safe use of plastic materials that would not increase the risk of out-of-control fire spread could allow for the reasonable increase in the use of plastic materials, such as of EIFS walls.

As shown in Figure 2, the fire test protocol that was developed used a full-scale, 26 ft. tall, 2-story test assembly. This apparatus would allow observations regarding what would happen when fire starts in or on one story of a building. Could it spread at least one full story higher? If so, then it would be reasonable to assume that after spreading to that story above, it could then spread to one more floor above, and so on and so on.



Figure 1: SPI wall fire propagation test  
Courtesy of JENSEN HUGHES

An ignition source needed to be standardized. As is common in reaction-to-fire testing, an ignition source was chosen that would be capable of causing some initial ignition, and that the ensuing fire behavior would be dependent on the tested material itself. Bounding the ignition source at the upper end, the ignition source should be within the order of magnitude of some true-to-life fire ignition. The ignition source chosen was an extension of flaming out of a lower floor fire compartment “window”. This would simulate a possible flashover fire in the lower floor. Such a fire might not occur in each and every fire incident in a multi-story building. However, even with automatic sprinkler protection provided throughout the inside of a building, a flashover fire is a real and known possibility, for example in the case of a fire with the sprinkler protection water supply impaired or shut off. According to data from the NFPA<sup>1</sup>, automatic fire sprinklers operated effectively in 87% of all reported fires where sprinklers were present in the fire area and fire was large enough to activate them. Most of the recorded sprinkler performance failures were due to water supply impairments, such as a shut sprinkler control valve. So an exterior wall ignition scenario wherein fire sprinklers do not control a fire should definitely be considered credible and realistic.

As will be discussed later, when exterior wall assemblies are used that are not tested and shown to meet the pass/fail criteria of NFPA 285, ignition sources as weak as discarded smoking materials and barbecue grills have been reported to have caused ignition of wall assemblies, resulting in complete, full-building-height fire spread.

This SPI full-scale test program that developed the initial fire test protocol, included fire spread performance observations of the following wall types:

- a calibration wall made of gypsum board,
- a baseline wall that was a code-approved non-combustible wall assembly,
- three steel-clad polyurethane foam walls, and
- an EIFS wall.

Visual observations, measurements, and comparisons of these tests allowed some clear pass/fail criteria to be developed. The standardized test procedure would distinguish between walls that would allow fire to self-propagate along the wall beyond the ignition zone, and those that would result in self-extinguishment a reasonable distance from the ignition zone.

With the availability of a standardized test method that could identify exterior wall assemblies that would resist fire spread despite having combustible components, the Uniform Building Code (UBC) adopted the method in its 1988 edition as Test Standard 17-6. The addition of the test requirement was not constraining, but rather permissive, in that it now allowed wall assemblies that would normally be prohibited, due to their combustible components, to be used in the building types that would otherwise require non-combustible exterior walls. Those building types would today be referred to as building construction Types I, II, III and IV (per IBC nomenclature).

In 1994, a reorganization of the UBC re-designated the test standard as Test Standard 26-4.

In the early 1990's, an SPI-sponsored test program aimed to revise the test procedure. The revisions made the test easier and less expensive to perform. A modified test assembly was developed that shrank the size slightly, creating what became known as the "intermediate-scale multi-story apparatus" (ISMA). The test procedure was made more convenient, such as by changing the fuel source from a wood crib to gas burners. The gas burners provided a comparable time-temperature profile and similar flame extension from the lower story window as did the originally-used wood crib. The test assembly could now be feasibly installed and operated indoors, within a suitable test facility, thus avoiding weather-related challenges of the original full-scale test. Most importantly, correlation tests were done and calibration requirements were established to ensure that the revised, smaller-scale test lead to the same conclusions (pass/fail) as the original full-scale test. This revised test assembly and test procedure were published as UBC Test Method 26-9, and this was adopted into the 1997 UBC.

The NFPA Committee on Fire Tests was given the UBC 26-9 test, and revised it editorially to conform to NFPA format. This was issued in 1998 as NFPA 285, an American National Standard.

## Understanding NFPA 285

Figure 2 shows an example of an NFPA 285 test.

The assembly is considered to have failed the test, and categorized as allowing unacceptable flame propagation, if any of the following are observed (slightly simplified):

- 1) A temperature > 1000°F at 10 feet or higher above the top of the window opening, as measured by thermocouples mounted on the surface of the test specimen. This temperature is considered to be evidence of a luminous flame at that location.
- 2) Flames visually observed on the exterior face of the specimen at 10 feet or higher above the top of the window opening
- 3) Flames visually observed on the exterior face of the specimen at 5 feet or further from the centerline of the window opening
- 4) Temperature rise > 750°F within any combustible wall components more than ¼ inch thick
- 5) Temperature > 1000°F within any wall cavity air space

- 6) Temperature rise > 500° F in the second story room, measured 1 in. from the interior surface of the wall assembly
- 7) Flames visually observed within the second-story test room.

Figure 3 shows the post-test damage to a foam plastic insulated wall.

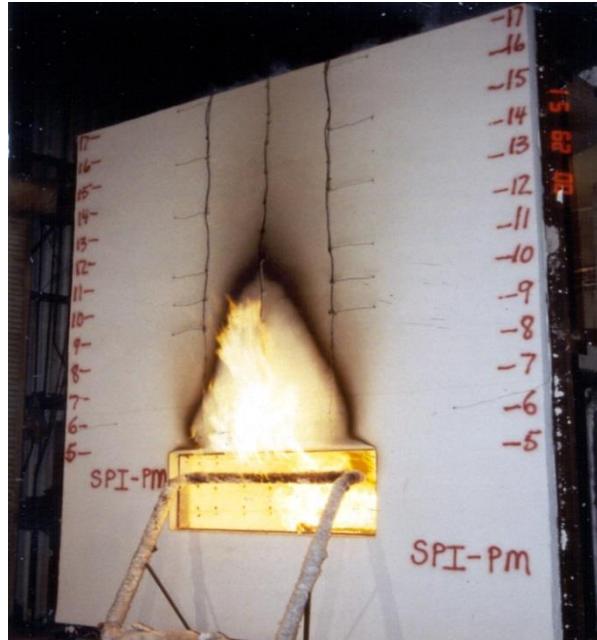


Figure 2: NFPA 285 ISMA test  
Courtesy of JENSEN HUGHES

### So what if walls are not tested to NFPA 285?

The model building codes in the US have included limitations, for a few decades, on the use of combustible components in exterior walls of Types I, II, III and IV buildings, subject to certain allowances and exceptions. Those requirements include the need for compliance with NFPA 285 and its predecessor tests. As a result, the US has a building stock that can be mostly assumed to be free of the danger of unfettered multi-story vertical fire spread on outside walls. The notable exception is Type V buildings, which are combustible buildings that can have combustible exterior walls, but which are therefore significantly limited in their maximum height and area, depending on building occupancy.

In other countries, particularly in developing countries where the emphasis has been on maximum economic growth and development, building code requirements related to fire safety are notably weaker. For construction of exterior building walls, many jurisdictions have very few fire safety restrictions at all, allowing designers and materials suppliers to dictate the construction materials and assembly methods for exterior building walls. Such countries have provided, and continue to provide, loss lessons for what can happen when combustible materials in exterior non-load bearing wall assemblies are not limited to proven, fire-tested assemblies.

No organization or agency is known to systematically collect detailed summaries of fire incidents involving exterior wall fires around the world. The media have at least captured many of the more interesting ones. These will briefly be shown and summarized here to reveal “what if NFPA

testing was not required". Note that complete details are not offered for each incident, as the countries in which these incidents occurred for the most part do not have an open system of public fire investigation and reporting. Facts that seem to have been verified by local news media or local technical experts are reported below. The incidents are presented in chronological order, starting with the most recent.



Figure 1: Post-test damage to foam plastic insulated wall  
Courtesy of JENSEN HUGHES

Overall, reading available incident descriptions clearly indicates that without sufficient regulation for the combustibility of exterior walls:

- building walls can be readily ignited.
- vertical fire spread may be unlimited.
- fires sometimes spread to the interior of the building (depending on numerous factors, such as geometry), although often they have caused only minimal damage to building contents
- it takes months to years to rehabilitate a building after its exterior wall has been substantially burned away.
- building residents or commercial occupants will suffer substantial losses and hardships
- loss of life to firefighters or civilians can occur.
- injuries almost always occur.

Exterior wall fires have not typically had much interaction with the building contents, other than to sometimes start new fires inside the building, often on multiple floors. When such ignition occurs, the inherent building compartmentation, lack of continuity of combustible contents, or automatic sprinklers, if provided, have limited the interior fire damage in the vast majority of incidents.

The fires propagate along the exterior walls without contribution from the building contents. Given this fact, it should be plain that whether or not a building has automatic sprinklers will not make a difference to the extent of the exterior wall fire. Some have suggested that providing an automatic fire sprinkler system inside of a building should be considered as an alternative to the NFPA 285 test requirement for exterior walls with combustible components. The history of combustible exterior wall fires shows that the provision of sprinklers would not have had a significant impact on the magnitude of the exterior wall fires. However, in the case where exterior wall ignitions have occurred from fires that started inside a building, which is *not* the case in the majority of fires, then it is fair to say that having the initial indoor fire controlled by sprinklers could have prevented the exterior wall from being ignited in the first place. With the multitude of possible ignition scenarios, as seen in the actual fires, preventing only the interior fire spread scenario, via sprinklers, would not eliminate the danger created by exterior wall construction that would allow self-propagating fires.

**It is a disconcerting thought though, in the case where NFPA 285 is waived, that the whole outside of your building could be on fire yet the internal sprinkler heads may never activate!**

**Baku, Azerbaijan, May 19, 2015<sup>ii</sup>**

- 15 people killed
- 63 injured
- 16 story building



Source: <http://www.rferl.org/content/azerbaijan-baku-fire-apartment-deaths/27024769.html>

### **Marina Torch, Dubai, February 21, 2015<sup>iii</sup>**

- tallest residential building in the world in 2011 (79 stories)
- Source of ignition: barbecue grill on 51<sup>st</sup> floor balcony
- Fire damage extended 28 stories to top of building
- 101 apartments damaged



Source: <http://www.skyscrapercity.com/showthread.php?p=121823108>

### **Grozny-City Towers, Grozny, Chechnya, April 3, 2013<sup>iv</sup>**

- 40 story hotel and apartment building
- Fire spread along entire height
- 8 hour fire duration
- No one injured or killed in the blaze
- Building repaired and re-opened 2015

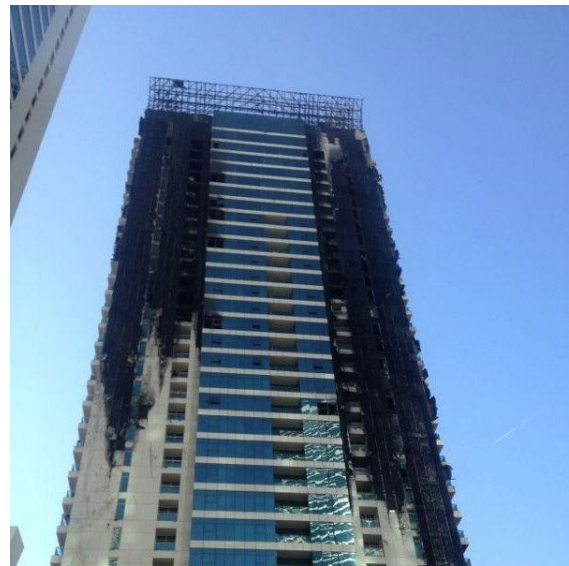




Source: <http://www.skyscrapercity.com/showthread.php?p=121823108>

### **Tamweel Tower, Dubai, November 18, 2012<sup>v</sup>**

- Fire origin: cigarette discarded onto pile of waste materials left by workers next to building
- 5-1/2 hr. fire duration
- Some cars parked below caught fire due to falling/burning debris
- Fire spread to interior residential units
- Building partially gutted and not repaired as of end of 2014
- Repair cost estimated at \$21 Million



Source: <http://www.madhyamam.com/en/node/6489>

Source: <https://en-maktoob.news.yahoo.com/lightbox/fire-rips-through-residential-building-in-jumeirah-lake-towers->

[slideshow/burnt-parts-of-tamweel-tower-photo-326033247.html](http://slideshow/burnt-parts-of-tamweel-tower-photo-326033247.html)

**Polat Tower, Istanbul, Turkey, July 17, 2012<sup>vi</sup>**

- 42 story tower
- Fire started by faulty air conditioning unit
- Damage along entire height



Source: <http://www.dailymail.co.uk/news/article-2174853/Polat-Tower-Firefighters-huge-blaze-engulfed-150m-Istnbul-skyscraper.html>

## Al Tayer Tower, April 28, 2012<sup>vii</sup>

- Ignited by cigarette butt
- Aluminum cladding panels
- 45 vehicles destroyed at ground level due to burning elements falling on them



Source: [http://www.khaleejtimes.com/kt-article-display-1.asp?xfile=data/nationgeneral/2012/June/nationgeneral\\_June49.xml&section=nationgeneral](http://www.khaleejtimes.com/kt-article-display-1.asp?xfile=data/nationgeneral/2012/June/nationgeneral_June49.xml&section=nationgeneral)

**Shanghai, November 15, 2010<sup>viii</sup>**

- Building exterior wall was being retrofitted with “fire-retardant” combustibile insulation
- Fire occurred during remodeling work
- Reported ignition source: welder’s torch
- 58 killed, 70 injured
- 28-story building destroyed



Source: <http://images2.sina.com/english/china/p/2010/1114/U101P200T1D348082F14DT20101114234726.jpg>

## Qatar, November 2010

- Unoccupied; construction 95% complete



Source: <http://www.mzhany.com/2010/11/electrical-short-circuit-after-95.html#more>

## Wooshin Golden Suites, Busan, Korea, October 1, 2010<sup>ix</sup>

- 38 story residential building above 4 story commercial podium
- Fire ignited at electrical socket on 4<sup>th</sup> floor
- Flame damage extended from 4<sup>th</sup> floor to penthouse
- 12,200 ft<sup>2</sup> of interior space damaged
- Wall panels: aluminum composite panel with 3 mm polyethylene core
- Damage ~ \$3.3 Million



Source: <http://www.tus-fire.com/?p=1761>;



Source: <http://www.koreaherald.com/view.php?ud=20101118000855>

**Mandarin Oriental Hotel, Beijing China, February 9, 2009<sup>x</sup>**

- 34 story hotel
- Ignited by fireworks
- Building unoccupied, pending completion
- Structure severely damaged, reconstruction unknown
- 1 firefighter killed, 7 people injured



Image source: <http://my.firefighternation.com/forum/topics/fire-claims-building-at-cctv?q=forum/topics/fire-claims-building-at-cctv>

Shopping mall, Qiqihar, China, November 19, 2008<sup>xi</sup>



Source: <http://cn.epochtimes.com/b5/8/11/21/n2336786p.htm>

## Harbin, China, October 10, 2008<sup>xii</sup>

- 20 floor residential building
- Building under construction, not yet inhabited
- 



Source: [http://i.telegraph.co.uk/multimedia/archive/01007/harbin-fire\\_1007258i.jpg](http://i.telegraph.co.uk/multimedia/archive/01007/harbin-fire_1007258i.jpg)

It is not unusual for burned or burning pieces of a combustible exterior wall to rain down on the area below. This will interfere with, or even prevent, firefighter access to the building. It can damage or destroy firefighting equipment that is necessarily located near the building, such as laid fire hoses. Perhaps most importantly, it can block or make very hazardous the egress path for occupants trying to escape from the building.







Source: <http://gulfnews.com/news/uae/emergencies/fire-breaks-out-at-tamweel-tower-in-jumeirah-lake-towers-1.1106387>



Source: <https://en-maktoob.news.yahoo.com/lightbox/fire-rips-through-residential-building-in-jumeirah-lake-towers-slideshow/entrance-of-the-tower-after-the-fire-was-put-out-photo-326213051.html>



Source: [http://www.khaleejtimes.com/kt-article-display-1.asp?xfile=/data/crime/2012/October/crime\\_October4.xml&section=crime](http://www.khaleejtimes.com/kt-article-display-1.asp?xfile=/data/crime/2012/October/crime_October4.xml&section=crime)



Source: <http://gulfnews.com/news/uae/emergencies/fire-in-tecom-building-leaves-seven-families-homeless-1.1085854>



Source: <http://en.people.cn/90777/7878858.html>

## How does the IBC protect U.S. buildings from such incidents?

Explaining code requirements sufficiently to ensure complete and consistent compliance is beyond the scope of this document. However, an overview of the 2015 IBC requirements is provided here.

Overall, the IBC identifies each major category of combustible component in an exterior wall, and provides detailed limitations and allowances for each type. For each such combustible component, there are typically individual component requirements, such as ASTM E84 flame spread index limits and ASTM E1354 cone calorimeter heat release limits. Making compliance easier, each section also includes several exceptions and exemptions. For example, NFPA 285 compliance is exempted for combustible exterior cladding that is installed not higher than 40 feet above grade.

An excellent online resource for understanding the details of IBC requirements for exterior walls with combustible components is the Architectural Record Continuing Education Center, at [www.continuingeducation.construction.com/article.php?L=51&C=1076&P=1](http://www.continuingeducation.construction.com/article.php?L=51&C=1076&P=1)

The code mandates allowances and restrictions for the use of combustible components as part of exterior walls which evolved due to the desire by the design and construction communities to use such materials. The 2000 IBC and legacy codes initially addressed only the potential hazards of foam plastic insulation (IBC 2015 §2603.5.5) and EIFS (2015 IBC §1408.2). Fire safety requirements for Metal Composite Materials (MCM) were added to the 2013 IBC (2015 IBC §1407.10). Fiber Reinforced Plastic (FRP) was added to the 2009 IBC (2015 IBC §2612.5). The 2012 IBC included the addition of fire safety requirements for the use of High Pressure Laminates (HPL) (IBC 2015 §1409.10) and Water Resistive Barriers (WRB) (IBC 2015 1403.5).

The major manufacturers of combustible components used within exterior walls have responded to, and evolved with the code requirements, by conducting the code-mandated tests, and publishing those results. However, since NFPA 285 testing is an assembly test, not a component test, a complication arises when various combinations and permutations of exterior cladding, insulation, and WRBs are specified which have not been tested together. The results of the NFPA 285 assembly testing can also be affected by the joint type and arrangement between cladding panels, and by the details of cavities within the wall. One can see how a designer can end up with many wall arrangements for which the code-mandated *assembly* fire safety data does not exist.

The 2012 IBC makes the use of different WRBs somewhat easier by providing some exceptions to the need for testing based on material properties and fuel load potential, if the WRB is the only combustible wall component. Nevertheless, that blanket exception disappears if other components of the wall are also combustible.

## **National efforts and local amendments: removing exterior wall fire safety requirements**

As a result of the challenges of trying to use a large variety and combination of combustible components in the exterior walls in Types I, II, III and IV buildings, and due to the temptation to try to sidestep established fire safety requirements rather than to face the cost and complexity of complying with them, there has been a push from some within the building construction and building material industries to amend the building code to eliminate some of the requirements. To that end, Code change proposals were submitted in the 2015 IBC development process, and failed to be accepted. Code change proposals were again submitted in the 2018 IBC code development process. They were disapproved during the April 2015 Committee Action Hearings. They will likely be re-submitted again as Public Comments for consideration at the ICC Public Comment Hearings occurring October 2015.

In the meantime, those who would prefer to step around the established fire safety requirements have taken their fight to jurisdictions during the code adoption process. In a few instances, they have succeeded in having some of the fire safety constraints for exterior walls removed during the local code adoption. <sup>xiii</sup>

### **Washington, D.C., 2013 Building Code**

The IBC requirement for NFPA 285 testing for walls with a combustible WRB (1403.5) has been deleted in its entirety. The requirements for the acceptable use of foam plastic insulation (2603.5) have been waived if the building is provided with an automatic sprinkler system complying with either NFPA 13 or NFPA13R. As shown by loss history, the presence of automatic sprinklers will not impact the course of an exterior wall fire once the wall not meeting NFPA 285 is ignited. Granted, sprinklers can reduce the frequency of exterior wall ignitions due to a flashover fire inside the building, in the case where sprinklers operate and are effective. However, the frequency of outdoor ignition scenarios would be unaffected by sprinklers inside.

The DC building code also waives NFPA 285 testing for the use of foam plastic insulation (2603.5) if the exterior wall has either a noncombustible wall covering or fireblocking within the

wall. NFPA 285 testing over the past decades has not shown this to be a solution that could be depended upon.

Due to landmark buildings around the world catching on fire and their exterior wall fires making news around the world, representatives from many of the countries who have been affected by those fires have been looking for ways to improve what gets constructed in the future, through better codes and better code enforcement. It is ironic that the capital city of the United States is heading in the opposite direction. Having had no newsworthy exterior wall fires anywhere in the U.S., due to strong codes and strong code enforcement that most of the world would envy, those influencing the Washington DC code have set that city on a course to try to reverse the direction.

We will now wait and see what the future outcomes of such decisions are on these high rise buildings.

### **Minnesota State Building Code, Expected later 2015**

As in Washington DC, the requirements for WRBs (1403.5) are removed completely.

For foam plastic insulation (2603.5), an exception to NFPA 285 is being provided for low-rise sprinklered buildings, which also must meet the following:

- Sandwiched between NC and FRT
- 3 in. maximum
- Fireblocking around opening head, jamb, and sill conditions

The Minnesota amendments to the IBC regarding the use of foam plastic insulation are far less permissive than the very broad exceptions to NFPA 285 testing provided in DC.

### **Indiana Building Code, 2014**

Exemptions are provided if the building is sprinklered for the following combustible components:

- WRBs (1403.5)
- MCM (1407)
- HPL (1409)
- Foam plastic insulation (2603.5.5)

### **Massachusetts, proposals for state building code 9<sup>th</sup> edition**

An exemption to the requirements of 1403.5 (WRBs) are proposed for buildings with automatic sprinklers that are not high-rise buildings. Proposals similar to Washington DC are being considered for section 2603.5.5 (foam plastic insulation).

### **Questioning the wisdom of the code amendments**

A common thread in the state and local amendments is the allowance of unrestricted use of many combustible wall components when sprinklers are provided inside the building. As discussed earlier, the presence of sprinklers inside of a building will not affect the ignitability or the progress of an exterior wall fire, other than to reduce the probability of ignition due to the one

scenario of flashover of an inside compartment. Many of the disastrous fires enumerated and discussed earlier were ignited by sources such as cigarette butts, barbecue grills, and fires in waste materials near the wall. Such exterior ignition sources could be effective sources of ignition for unproven and untested materials being allowed in exterior walls due to the code amendments.

Although no review of the submitted arguments that lead to the various local amendments has been undertaken, the complete lack of quantification of the hazards now being allowed makes the amendments seem ill-considered. It is likely that the amendments are the product of a rationalization process, wherein the desired code relaxations were determined (requested) ahead of time, and a reason for the amendments was then offered, such as “sprinklers provided inside the building”. Due to the disconnect between what was removed from the code related to the construction of exterior walls, and the provision of sprinklers inside the building, it would be hard to assume that the amendments were based on any risk analysis or hazard analysis. The evidence would point more towards a rather inappropriate additional sprinkler trade-off.

### **Food for thought: IBC compliance options and ideas**

Testing of the past decades has unambiguously shown that it's the combination of all of an exterior wall's components and wall construction details (e.g. air gaps, attachment systems) that create a resulting wall that will or will not self-propagate fire away from the ignition source. Changing any one component in the complete assembly can result in the wall going from passing NFPA 285 to failing it, and vice versa. This is the main reason that NFPA 285 testing is specified in several code articles, instead of allowing some simpler and less expensive component tests.

Nevertheless, as is done with an endless list of other building assemblies that may have been specifically tested for performance, and for which some modified or substitute component or assembly is desired for a given project, it is always possible to submit for approval an alternate assembly under the “alternate materials and methods” provisions of the IBC (§104.11). The complexity of trying to propose substitutes for the components of an NFPA 285- tested assembly needs to be acknowledged here.

First, information upon which to generate an engineering judgment for submittal to the Authority Having Jurisdiction (AHJ) is not simple to obtain. Information on the construction details and components of past successful fire tests may be available as one or more of the following:

- Listings or other publications from Nationally Recognized Test Laboratories such as UL, Intertek, and Southwest Research Institute
- ICC Evaluation Service Reports (ESRs)
- Manufacturer-sponsored test reports
- Manufacturers' literature

An additional source of useful and applicable information could be a previously submitted and approved engineering judgment.

However, all of this scattered information has never been collected or organized in an easy-to-access and easy-to-use way. Using it all could feel like trying to fit together the pieces from different boxes of puzzles. Many competent engineering firms are navigating this challenging route, and are developing engineering judgments when called upon, to facilitate the approval of

some untested combination of construction details. But they would no doubt readily admit to the daunting challenge. One also needs to wonder if all of the engineering judgments being developed, which ostensibly aim for something that would/could pass NFPA 285, really would do as well as theorized.

How could the process of developing and approving engineering judgments be improved, to make IBC compliance with the NFPA 285 requirements more practical? A few ideas are proposed below.

- 1) NFPA 285 fire tests paid for by test sponsors (e.g. manufacturers) could be designed with engineering judgments in mind. For example, several very “liberal” conditions could be used for the assembly, so that the testing would obviously umbrella many other more stringent construction details. Of course, this is a financial risk to the test sponsor, since the liberal conditions could result in the test failure, when playing it safe instead could have given the desired “pass”. However, the reward for a successful test could be that the test sponsor’s products could then be more readily submitted for a wider variety of real-life wall applications.
- 2) An industry association or committee could collect the data from the disparate sources, standardizing and organizing the information’s reporting into a database. There would be a cost for such initial and ongoing work. However, there could surely be some compensating revenue to make the costs worthwhile. For example, the owner of the data could have a fee for its use. Or an industry association could spread the cost among numerous industry participants.
- 3) Develop and publish a guide through an ANSI-accredited process that would provide guidance for the development of engineering judgments, based on the extensive understanding and knowledge already gathered over several decades of NFPA 285 testing. A model for such a document would be the “extension of data” documents developed and published by ASTM Committee E05 (Fire Testing), such as the guides for extension of data from fire resistance tests performed in accordance with ASTM E119 and E814. Such a consensus-process document could collect and codify the expert judgment and internalized understanding from practitioners who have been involved in NFPA 285 testing for a long time. As a matter of fact, many of the people with the most experience with NFPA 285 testing have retired or are getting close to that mark, so it would be a wise idea for the industry to attempt to codify their extensive expertise before it becomes unavailable.
- 4) As a simpler version of No.3 above, an industry group, or professional association (e.g. SFPE) could endeavor to collect and publish some general guidance for some of the well-understood and/or well-known pitfalls and safe paths that should be understood for the development of engineering judgments related to NFPA 285.

There continues to be changes to the building codes through the ICC code process. We do so based on the collective knowledge of individuals and committees evaluating the information at hand. There are some associations beginning to take a closer look at this process with the hope of developing improved fire risk analysis models that can aid in the code development process to better understand the additional risk we may be adding to a building if we change material and/or system fire performance requirements.

What the U.S. has done for a few decades with respect to finding the ways that we can build very safe buildings despite the use of combustible components in exterior walls has worked. The U.S. does not have the embarrassing fire loss legacy of those countries who have allowed construction materials to go mostly unregulated.

When “nothing happens”, there is certainly the temptation to conclude that what we have done is overkill, or not needed. However, with other countries running the opposite experiment, and showing results that would clearly be unacceptable here, we should conclude that nothing happening is exactly what our target has been all along, and we should find the means and resources to continue the same safe path. However, continuing to follow that path could mean that some additional efforts and costs will need to be undertaken to continue to make that path acceptable to everyone.

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