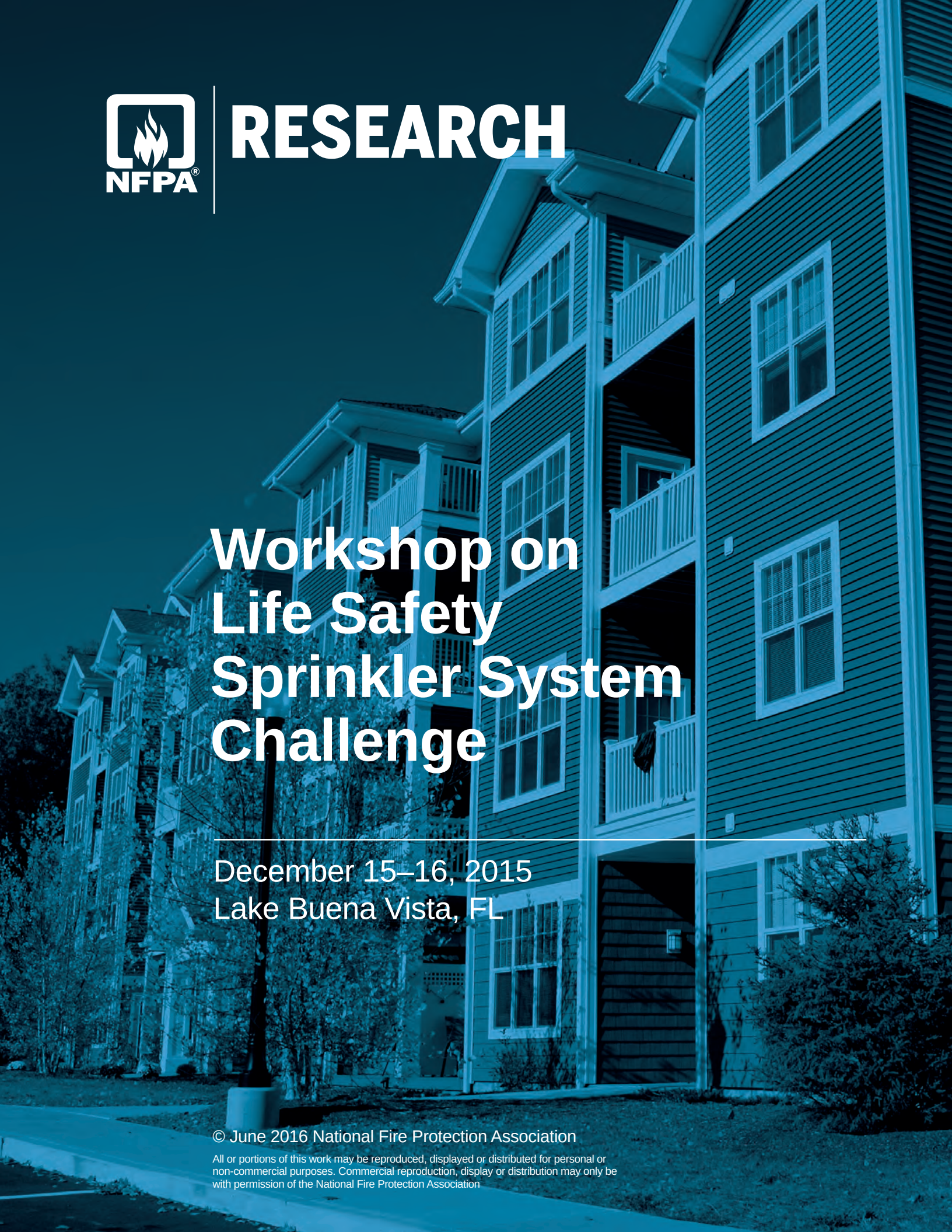

NFPA® RESEARCH

Workshop on Life Safety Sprinkler System Challenge

December 15–16, 2015
Lake Buena Vista, FL

Preface and Acknowledgements

This report summarizes the results of the National Fire Protection Association (NFPA) Life Safety Sprinkler Systems Challenge Workshop, held December 14-15, 2015, in Lake Buena Vista, Florida and sponsored and hosted by NFPA.

“Fire Sprinklers Save Lives”. This isn’t just a line for a bumper sticker or a catchy phrase. Automatic sprinkler systems — when properly designed, installed and maintained do save lives. The same is true for the other building systems (fire alarm and detection), building construction and fire resistance rated wall, floor and ceiling assemblies that complete the built environment. It is best when all of these factors work in harmony – the result is lives saved, property saved, first responders saved.

On rare occasions, however, a fire occurs in which just the wrong combination of events transpire where the sprinkler systems operates as intended, yet extensive property damage still results. It is these rare cases when use of life safety only sprinkler systems offer the “lives saved” benefit, but not necessarily the property saved benefit. This workshop and this report provides a focus on that sort of scenario with the emphasis being on systems designed to meet NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes* and NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies.*

The central theme of the workshop was to look at the low probability, high consequence fires in multi-family dwellings where the sprinkler system did not control the fire and an extensive loss occurred. The loss referred to here is centered on the loss of the building, loss of personal contents — and loss of one’s home. As expected, the typical fire scenario where this occurs includes fire ignition outside of protected areas. It could be in a pile of mulch at the base of the structure, a lightning strike to the roof, or an exterior balcony or any other space where sprinklers were not required to be installed by the standard. As the history of NFPA 13D and 13 R hit the 40-year and 26-year ranks respectively, the experience, use and performance becomes clearer and taking time to understand that performance is necessary.

Likewise the expectations and limitations of the systems became quite clear. Any system or any feature specified by the NFPA codes and standards has a limit. While the goal of NFPA 13R is to provide safety to the occupants — something it always does — it is also intended to offer “improved protection against property damage”.

The implications of system performance can be debated when “all of the occupants escape safely from the fire, yet the building suffers substantial property damage”. It is not easy to say the system worked as intended and designed when the building is a total loss.

The workshop gathered a group of diverse stakeholders over a two day period to look at the many angles associated with this scenario. Insurance, designers, contractors, authorities having jurisdiction, industry representatives, code consultants, first responders and others looked at this challenge from their viewpoint. As NFPA is often times able to do, we sought out to gain a range of perspectives. Looking at the two extremes of our attendees, we heard everything from: “NFPA 13R works as intended – don’t change a thing” to “get rid of NFPA 13R”. While extreme positions are not where most things fall, there was tremendous acknowledgement that while it does work (no life loss), it can be a challenge to describe “success” when the building is a total or near total loss. Conversely, there was equal acknowledgement that the model codes as well as NFPA 13R itself have been adaptable at modifying some conditions such as now requiring sprinkler protection on exterior balconies.

The purpose of the workshop was to identify the issues and challenges, consolidate them and suggest ways forward. Some of the proposed solutions will involve changes in the codes and standards

development arena while others will include how first responders approach fires in certain residential buildings that are provided with NFPA 13D or NFPA 13R systems. In addition, the workshop was intended to acknowledge the very rare, but possible outcome where NFPA 13R type systems do not save the contents or the property, but they do save the people — the main purpose of the system.

While the workshop report contains numerous ideas, all which will require further scrutiny and study (deservedly so), several ideas and concepts did come forward as a priority. These include:

- NFPA 13R/13D are effective standards that reduces loss of life and building damage due to a fire event.
- To consider or make any changes to NFPA 13R/13D, better (more refined) data needs to be identified as well as collected on a consistent basis. A national database that describes fire events with information on building type/codes would assist in making intelligent changes to any sprinkler standards.
- What other role is there for more robust data? We have a very good system for finding out when the NFPA 13R system performance results in substantial property damage — but nothing really tracks how many true "success" (no life loss, minor property damage) events we experience.
- Are there better ways to bring clarity to the goals, objectives and performance metrics of NFPA 13D/NFPA 13R sprinkler systems?
- To achieve a better understanding of the use and goals of NFPA 13R/13D, dedicated educational and training programs are necessary to ensure all stakeholders fully understand the standards.
- To provide further building protection, more consideration needs to be given to sprinkler protection of attics, balconies, and other large unprotected areas in a building.
- What are some alternative considerations beyond sprinklers that can be given to the allowable, unprotected areas found in a building protected with NFPA 13R? Specifically, attics, balconies, exterior corridors, other large unprotected spaces.

While these bullet points show some of the most common themes, the report also captures every idea and concept that was put forth. A somewhat subtle yet critical idea discussed in the report surrounds the concept of community risk reduction (CRR). CRR programs offer one way to help bridge the connection between our regulatory environment in the everyday activities we engage at work, home, or in between. In turn, that discussion is on the doorsteps of resiliency and its implication on how we protect the residential environment in 2016.

I want to extend my thanks to everyone who helped with the workshop. NFPA staff who played a key role were Linda MacKay, who managed the invitation letters, preparation of materials, and tracking of the logistical information for the workshop; Rachel Abrams and Holly Roderick who managed the NFPA hotel contract; Debbie Baio, who managed the workshop SharePoint site; Bernadette Travis and Nancy Wirtes provided production and editorial review assistance on the final report; Matt Klaus and Greg Harrington who reviewed resource materials for the workshop and provided on-site support at the event.

Dalila Ujaque, Senior Events Manager at the Hilton Orlando Buena Vista Hotel, made sure that all of our on-site needs — room set ups, audio visual equipment, food — were accommodated and in place.

Special thanks are extended to Energetics Incorporated's Walt Zalis and workshop team members Tommi Makila and Rebecca Price for their assistance in facilitating the workshop and preparing this report. They offered expert facilitation, kept the workshop participants engaged, and were amazing to work with. In other words, they put the work in the workshop.

The contents of this report would not have been possible without the specialized knowledge and insight provided by the recognized experts who gathered for this event. Their understanding, points of view, suggestions and ideas have been captured in the report to reflect the course of our deliberations. The contributors took time from their demanding schedules to participate in the workshop and share their insight which forms the basis of this report. I'm truly thankful and grateful for all the information that you shared. These individuals are listed in Appendix A.

Robert E. Solomon, PE

Division Manager for Building and Life Safety Codes, NFPA

May 2016

Disclaimer

This report was prepared as an account of a workshop sponsored by NFPA. The information contained in the report is based on the input of numerous professionals and subject-matter experts. While considerable effort has been taken to accurately document their input, the final interpretation of this information resides with the report authors. The views and opinions expressed herein do not necessarily state or reflect those of NFPA.

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1 Introduction

1.1 Overview

Since the first automatic sprinkler systems started to appear in buildings in North America in the 1870s, developing a set of standardized rules to select, design, install, and maintain the systems has been a main consideration of fire protection mitigation strategies for buildings. NFPA 13, *Standard for the Installation of Sprinkler Systems*, has served that role since 1896. NFPA 13's subsequent derivatives, NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, and NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*, emerged on the scene in 1975 and 1989, respectively, to help address the fire safety problem specifically in the residential environment. NFPA's initiative to develop those standards can be traced directly to the report *America Burning*, issued by the National Commission on Fire Prevention and Control on May 4, 1973.

Fire sprinklers serve as one of the most effective life safety and property protection elements. According to NFPA statistics, buildings protected with sprinkler systems perform better during fire events. From 2007–2011, the deaths per 1000 fires was 85% lower in residential properties with wet pipe sprinklers than in residential occupancies with no automatic extinguishing equipment. The average property loss per fire was reduced by 56% in residential occupancies with wet pipe sprinklers compared with those without.

Expanded use of NFPA 13D and NFPA 13R in the last 20 years has been beneficial; however, a fire can occur with no life loss or injury but with extensive property damage. Due to the property damage, some sprinkler proponents, authorities having jurisdiction (AHJs), and insurance interests are left to question how such an outcome would be considered a "success." NFPA has been compelled to move forward with a broad dialogue on "life safety" — only sprinkler systems in order to help answer those questions.

The NFPA Life Safety Sprinkler Systems Challenge Workshop gathered professionals who have various expertise in working with life safety sprinkler systems, specifically in buildings where NFPA 13D and 13R are utilized. The workshop provided an opportunity for these experts to address the use of these NFPA standards and to consider the following:

- The success of model codes has resulted in the installation of automatic sprinkler protection into more types of multifamily and single-family dwellings than ever before. It is important to acknowledge and recognize how the multifamily housing industry and hotel/motel industry have supported that effort.
- In recent years, as more long-term experience is gained with these systems, NFPA has been made aware of a measurable number of fires in multifamily housing units protected with NFPA 13R systems in which the building has been a total loss or has had significant property damage. Within the scope of NFPA 13R, such fires can be described as a "success" since there was no loss of life, a goal that is consistent with the scope of NFPA 13R.
- AHJs and insurance interests are expressing concern over this performance level, which has led NFPA to scrutinize the issue on both the macro- and the micro-scale.
- Expectations of the insurance industry and of homeowners have to be considered because, although both groups know whether a building has sprinklers, they might not realize that the type of system was designed not for property protection but for life safety protection.

1.2 Workshop Scope and Objectives

The purpose of the workshop was to provide background, purpose, and utilization of life safety (NFPA 13D/NFPA 13R) sprinkler systems, including the history, use, limits, and potentially less than optimum outcomes. The end goal was to determine an action plan for where and how NFPA can better inform the constituency affected by NFPA 13D and NFPA 13R. The following general themes and questions were covered during the discussion:

- Is it acceptable to have some level of extensive fire damage in some buildings protected with automatic sprinklers and designed to a national standard? If so, what are the losses deemed to be acceptable?
- What information is needed by those who adopt, promulgate, enforce, and advocate for residential sprinkler laws?
- What information is needed by those who respond to fires in such environments and those who insure the contents and structures in such properties?

After almost 40 years (NFPA 13D) and 26 years (NFPA 13R) of experience with automatic sprinkler systems that are primarily designed to offer a tremendous life safety benefit, it is important to evaluate the positive impact these systems have had on reducing life loss. At the same time, it is equally important to look at those circumstances in which the life safety goal is achieved but significant property damage may result. The workshop was designed to look at those outcomes, acknowledge the performance metrics, and determine if anything different needs to be done.

The workshop was intended to engage a range of stakeholders to have a focused and open dialogue on fires in certain multifamily residential occupancies where systems were present, predominantly systems that comply with NFPA 13R *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*. System performance achieved its main goal of life safety but some level of extensive property damage occurred. While greatly expanded use of NFPA 13R systems has resulted in countless lives saved and, in the vast majority of cases, reduced property damage, there are a number of publicized cases in which some level of extensive property damage, including total building loss in some situations, has resulted.

This report captures and organizes the ideas provided by the workshop participants. An emphasis is placed on recommendations to appropriate National Fire Protection Association (NFPA) technical committees, other standards developers, the first responder community, and building designers to consider in their future planning activities. NFPA has made this report available on its website (www.nfpa.org/lifesafetysprinkler).

1.3 Workshop Format

The two-day program began with speakers and panelists selected for their substantial knowledge and unique perspectives on fire and life safety. Following several moderated panel sessions, participants moved into two facilitated breakout sessions. Each participant was assigned to a specific breakout session in order to (1) engage all contributors, (2) ensure every group would have a good mix of perspectives and backgrounds, and (3) create good group dynamics and continuity of discussion. The groups were organized around the following broad areas:

- Group A — Regulatory and Response Challenges
- Group B — Design and Construction Challenges

The facilitated process on the first day utilized a compression planning technique with a storyboard system. Over a very short time period (a few hours), the groups focused on achieving consensus on

major organizational objectives while establishing specific priorities and desired outcomes and measures.

Prepared questions targeted for each breakout area were posed to the group members during brainstorming sessions. While each group had some similar questions, their unique feedback based on background and discipline were valuable to the creation of this report. The brief responses to the questions were captured on index cards, collected, and affixed to a physical storyboard. If necessary, similar concepts were consolidated. The storyboard allowed all generated ideas to remain visible throughout the workshop for participants to refer to and build upon.

Brainstorming sessions continued in the breakout groups on the second day. After capturing additional ideas and combining them with the first day's outcomes, the workshop participants prioritized the generated ideas using consensus voting based on their perception of which ideas would provide the most impact on improving the use and understanding of NFPA 13D and NFPA 13R across a range of stakeholders.

Participants were divided into small groups to brainstorm the identified metrics and means of measuring and achieving life safety success in a fire situation, including when substantial property damage may occur. The workshop concluded with each group presenting highlights from its breakout session.

1.4 Report Layout

The remainder of this document presents the results of the workshop. Section 2 contains the results of the two breakout sessions (Regulatory and Response Challenges; Design and Construction Challenges). Section 3 provides a summary of the workshop and its findings.

Throughout Section 2, participants' output is featured in tables and draft work plans, as well as discussed in the text. This output represents the ideas raised by participants in response to brainstorming questions posed during the breakout sessions. These sections also provide context and background information to enhance understanding of the discussion of results. In most cases, participants' responses have not been edited, but in some instances, the ideas have been minimally amended to improve clarity while maintaining original intent; some responses have been consolidated to avoid duplication and to identify common themes. The included tables objectively lay out ideas generated by the participants; the included draft work plans expand on a few participant-prioritized ideas that could have the most impact on improving the use and understanding of NFPA 13D and NFPA 13R across stakeholders. The draft work plans attempt to expound on concepts, lay out a notional method for implementing them, and identify additional information relevant to the idea.

The appendixes provide additional information on the workshop, including the list of participants, relevant codes and documents, a list of acronyms, the workshop agenda, presentation materials, and other materials.

2 Workshop Output

2.1 Group A: Regulatory and Response Challenge

2.1.1 Introduction

The experience with NFPA 13R systems over the past 20 years has been excellent. Although performance statistics are not maintained separately for NFPA 13R systems, the January 2009 NFPA report on sprinkler performance for 2003–2006 showed that the combined performance for the occupancy in which NFPA 13R systems are used most, apartments, was 98 percent. This is higher than that for the average of all types of structures, including those protected with NFPA 13 systems. Although the allowed omission of sprinklers from certain building areas to improve economics of system installation has occasionally led to extensive property damage, reports from the field indicate this is a rare event. Typically described as a low probability–high consequence event, it is unfortunately the type of event that draws attention. However, the question still needs to be raised — even when life safety sprinkler systems save lives, is a total property loss still considered a "success"? There is an opportunity to review and adjust regulations if necessary, as well as to educate first responders and other stakeholders on the use and application of NFPA 13R systems. Group A included mostly stakeholders representing insurance companies, regulators, and first responders. Therefore, questions were focused to gather feedback that will be most helpful for those stakeholder types.

2.1.2 Influencing Factors That Result in Extensive Fire Damage

To begin the brainstorming sessions, stakeholders were asked to define specific characteristics of a building that would allow fire to spread quickly in an unprotected area. Ideas tied to materials (e.g., wood and foam insulation) and various construction techniques (such as the large size of specific unprotected areas) were the general themes of the discussion. Table 1 presents Group A's list of influencing damage factors that allow some large fires to develop. The discussion question was as follows:

> ***Focus Question 1a: What are the influencing factors, including modern era construction, such as engineered lumber, modular construction techniques, and structural adhesives that allow fires in unprotected spaces to spread more rapidly, thus causing extensive damage?***

Table 1. Brainstorming of Damage Factors Allowing Extensive Fire Damage

Damage Factors	

• Energy codes
  o Energy code requirements driving use of exterior foam [e.g., expanded polystyrene (EPS)]
• Wind-driven fires
• Failure of chlorinated polyvinyl chloride (CPVC) sprinkler pipes
• Foam insulation
• Less durability of construction material
  o Poor construction quality
  o Wood construction predominant
• Large areas of lightweight construction
  o Lightweight trusses
• "Unlimited" area too large
• Larger surface-to-mass ratio; heat release rate vs. heat content
  o High surface mass ratio in well-ventilated space (basic physics)
• Buildings out of NFPA 13R scope not protected properly
	• Delay of water application on fire due to access
	  o Height
	  o Distance (from fire apparatus)
	  o Tactics
	  o Obstructions
	• Reduction of firefighting budgets
	• Longer fire department response times
	• Draft stopping
	• Contents/open spaces/access
	• Changes to passive systems
	  o Failure of passive systems (due to poor construction/ later changes and modifications to building)
	• Pathways allowing fire spread from exterior to concealed spaces and then to attic
	  o Exterior siding plus insulation materials
	  o Combustible exteriors
	• No access to void spaces

2.1.3 Data Reporting and Analytics

To consider any updates or changes to NFPA 13R, trusted data and analysis of the data are required to make informed decisions. Agreed-upon baselines for various building and fire data points would allow stakeholders to speak the same language when discussing building design and first responder tactics in a building that utilizes NFPA 13R. Several ideas emerged concerning baseline data and their use, including how to best measure the true height of a building, as well as how to best determine a building's fire risk. There also are specific data that should be collected to support codes, as well as specific methods of data collection that should be developed. Discussion focused on how insurance companies can share the investigative data they collect, as well as methods to simplify and require data collection following a fire. Table 2 breaks down the discussion between establishing data baselines for buildings and fire events and collecting data after a fire event. The dots (•) to the right of selected ideas represent participant-identified priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion questions were as follows:

Focus Question 1a: What data should be collected for developing better baseline and codes? What can be accomplished with new data?

Focus Question 1b: What steps need to be taken to collect better data tied to large fires with serious loss of property?

Table 2. Data Reporting and Analytics

Data Reporting and Analytics	
Data Baselines	**Data Collection**

• Special height: Distance from A to B (ground or grade level to highest point) — measurements need to be agreed upon
• Number of people in the building that is on fire/number of people threatened
• Gallons of water needed for extinguishing the fire
• Better statement: How do we incorporate current information?
  o Step 1. Incorporate plans into data, type of construction, realtors information, violations, etc. •(1)
  o Step 2. Better investigation and assessment of cause and damage
  o Step 3. Assessing risk factors into protection strategies
• Failure mode: Educate data collector to look for /capture things that didn't work
• Total impact to the community
  o Fire loss more than building contents: lost revenue and community impact
  o Community expectation of acceptable loss •(1)
• Status and condition of current requirements
• Insurance loss reports: Convince the insurer that they would benefit from sharing
• Find what's broken: Enhance current collection, training at collection point — who is providing the info and what is the quality of the info
• Develop survey and improve ability to get data from potential providers (post–large fire)
• Accurate/ complete real-time feedback, incentives
• Building features/ construction: Correlate to actual fire performance
• Year building was constructed and applicable code under which it was built
• Built under which code and age of the building All sprinkler activations with fire area details
• Did more than two sprinklers activate? Analysis of sprinkler system after fire
• Did sprinkler piping system (CPVC) fail? •(1)
• Risk assessment (frequency and construction) ••••(4)
• Building in compliance with codes and standards?
  o Track code improvements/changes
  o Code or standard used and how did it perform? •••••(5)
  o Percentage of buildings (according to year built) required by AHJ to have 13 D/R plus 13?
  o Match code/ standard with fire loss. Reporting data (performance)
	• Fire cause
	  o Create baseline information/database
	  o Training on loss
	  o Reporting
	• Get Investigation Reports data into NFIRS
	• Data from insurance companies •••••(5)
	  o How to pool insurance data?
	• Central fund for fire investigation and reporting •(1)
	• Make it simple
	• Make it law
	• Mandate reporting by funding source (volunteer fire companies received 30% to 70% of annual budgets from state and county monies. Failure to report on NFIRS can result in loss of funds.) ••(2)
	• Renew NFPA fire investigation program
	  o Fund NFPA to investigate all fires
	• Investigation reports: building performance
	• What can be learned from more detailed investigation or data?
	  o Identify specific data needs — test before finalizing
	  o Inspection data on multifamily dwellings •(1)
	• Communicate to all a simple why and how
	• Contractors have 411, which is valuable, but they don't know what to do with it ••(2)
	• Improve cooperation between building department and fire department •••(3)
	• Commitment is key
	• Educate industries on the importance of the data they provide
	• Dedicate group/agency to investigate large losses •(1)
	• Third-party Investigation and State Fire Marshal Division
	
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• What factor most affected the loss? Was loss expected? • Cause and origin of fire: Why? Help establish what happened and how the fire started, to better narrow down causes and how to prevent similar fires • System type: Number of automatic sprinklers activated • Better understanding of risk/safety factors based on the system • Post-event large fire: Code in effect; area of origin; should it have been contained based on scope of coverage by code or standard? • NFPA 25 on building components •(1) • Operations: • WOF (water on fire) — time • FO (fire out) — time • VL (ventilation location) —See National Association of State Fire Marshals (NASFM) report "Conquering the 'Unknowns' "	

2.1.4 Possible Code Changes

The preceding section focused directly on NFPA 13D and NFPA 13R, specifically on how elements of the codes can be updated or sometimes completely changed, in order to further protection of buildings from fire. While there are ways to improve codes, it is important to remember that current codes are very effective at reducing fire damage and loss of life. While discussion of changes to the codes are acceptable, no updates should be made at the expense of already effective set of rules, which was the general theme of the session. Concerns discussed earlier in the workshop tied to agreed-upon methods of measuring building height were once again a point of discussion, as were limiting the size of unprotected space in buildings and adding sprinklers in large spaces such as balconies. Table 3 includes NFPA 13D and NFPA 13R update considerations and how to update those codes for pedestal-style structures or larger/other structures for further building protection. The dots (•) to the right of selected ideas represent participant-identified priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion questions were as follows:

Focus Question 1a: Taking NFPA 13D and NFPA 13R into consideration, how would you update those codes for pedestal-style structures or larger/other structures for further building protection? What other building types would be appropriate for use of NFPA 13D/13R?

Focus Question 1b: What other updates are necessary to the code for maximum building and occupant safety?

Focus Question 1c: What changes to NFPA and ICC codes and standards are necessary now or in the future? Focus on fire retardant–treated materials and measures for protecting attics, as well as building height measurements.

Table 3. Possible Code Changes

Code Implications		
Updating the Code		**Code Changes**
• Accounting for slopes and abrupt grade changes • K.I.S.S. (keep it simple stupid)— Grade plane measurable • Count stories above grade, from grade plane, or from fire department access, not the top of the pedestal •(1) • Research full-scale fire performance •(1) • Outside-the-box new technology to protect attics with 0.02 gpm/ft^2 dry pipe sprinkler system • Size of the buildings off which it is acceptable to build the roof: o 4 story pedestal o 3 story o 2 story o 1 story house	• Don't make things worse! •••(3) • Risk assessment • Acceptable level of risk? ••(2) • Limit area square footage of building ••••••(6) • Sacrificial buildings acceptable? • Limit Life Safety reductions to "X" living units • Extend/reduce height limit to that which the fire department can safely reach ••••(4) • Leave requirements for area, height, and access to building/fire code ••••(4)	• Adding sprinkler systems to the balconies and other large unprotected areas to address/further reduce large losses • Increase protection for high (elevated) attics•(1) o Look at alternatives (soffit, attic separations) ••(2) o Wet pipe sprinklers for attics •(1) • Sprinklers in all occupied places 1. Dry pipe not the solution 2. Close loopholes in code to address construction tradeoffs in process plus fire department capabilities 3. Conditioned attics • Real fire walls •(1) • What are we trying to achieve? (Stop flashover) ••(2) • "Intent" section: Acknowledgement that code does not provide solutions to all the problems; some sacrifices • Overall disconnect on understanding of code (goals/objectives) • "Prevent them all or keep them small" (fires) • 13R: Clarify in annex presumption that International Building Code (IBC) or *NFPA 5000* is in effect •(1) • Need to explore the idea of NFPA *101* scope/limit on sprinkler system type instead of 13R •(1) • Need to explore NFPA 25 revision to include sprinklers •••(3) • If existing codes were followed, would there be any total-loss fires? • Do politicians truly understand acceptable losses? • Should 13R and 13D be allowed for board and care? (cognitive and physical disabilities or age) • Building officials, architects, developers, and public need to be more connected with fire department capabilities and loss expectations ••(2)

2.1.5 Education and Awareness

Table 4 is a long list of ideas for better educating and training stakeholders who interact with NFPA 13R buildings, especially fire fighters and first responders. The general theme of the discussion focused on the importance of educating emergency personnel on the use of NFPA 13D/13R life safety sprinklers and on understanding the nuances of the standards. This education should be shared with entry-level personnel as well as officers and high-ranking officials. While much of the discussion focused on first responders, the importance of educating the media and the general public on how these standards work and affect buildings and homes was also noted. Table 4 shares not only the ideas generated for NFPA 13D/13R training and education pieces but also the competing/ complementary goals between NFPA 13D and NFPA 13R. The discussion led into the focus question on education and training. The dots (•) to the right of selected ideas represent participant-identified

priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion questions were as follows:

Focus Question 1a: What are the competing/complementary goals between NFPA 13D/13R– and NFPA 13–type sprinkler systems?

Focus Question 1b: What educational/training pieces can be developed to assist first responders? Focus on educational pieces about NFPA 13D/13R or training to identify NFPA 13D/13R buildings or best practices when operating in an NFPA 13R/13D building.

Table 4. Education and Awareness

<table>
<tr><th colspan="2">Education and Awareness</th></tr>
<tr><th>Goals of NFPA 13D/13R</th><th>Education and Training Pieces</th></tr>
<tr><td>

Complementary cost-effective solutions
Complementary limited impacts of fire
Acceptable loss of building/contents
Control growth; affect development (affordability); community fire protection strategy; infrastructure
Cost of property protection (13R does a lot)
13R/13D competing: Getting sprinklers in smaller residential buildings; will cost less than NFPA 13

<table>
<tr><th>•</th><th>13</th><th>13R</th></tr>
<tr><td>Protect Property</td><td>✓</td><td></td></tr>
<tr><td>Reduce OP</td><td>✓</td><td>✓</td></tr>
<tr><td>Save Lives</td><td>✓</td><td>✓</td></tr>
<tr><td>Enhance Life Safety</td><td>✓</td><td>✓</td></tr>
<tr><td>FF Safety</td><td>✓</td><td>✓</td></tr>
<tr><td>Reduce Operations Interruption</td><td>✓</td><td>✓</td></tr>
</table>

Life safety vs. property •(1)
Greater affordability with 13D and 13R
Reliability
Continuity
Business
Occupancy
Data points

Cost differential
Performance
Cost
Density (water)
Retrofit potential

</td><td>

1. Building owner:

Corporate
Risk management

2. Dwelling Owners concerning 13D
Elected official — impact of decisions today and last 3 to 4 generations •(1)
Educate politicians/ decision makers about impact benefits of sprinklers and agency services
Development community: tie site plus Building Code issues to the risk
Community and politicians are impacted by taxes for lack of automatic fire protection systems, fire stations, personnel, water supply resources, etc.
Fire protection not a negotiated “add on” •(1)
Educate media on design goals of NFPA 13R ••••••(6)
Plan review disclaimer •••(3)

Applicant notification
Full disclosure

Good property protection in occupied areas (including balconies)
Transparency concerning process
Rein in over promising advocates: expectations?
Sound bites — media •(1)
Identify and focus true parties that can describe and affect the outcome ••(2)
Awareness: Publish/highlight presence or not? Impact of sprinklers
Prepare/ distribute press release templates about sprinkler successes •••(3)
Educate dwelling occupant upfront; owner’s manual awareness
Community planning and local officials ••••(4)

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</td></tr>
</table>

o Water supply o Occupancy-type conflict • Fire service: 13D and 13R require our help, train building occupants to not count on any help	• Property insurers: what are they doing? Fire services: NFPA 13E, "assume no A/S (automatic sprinklers)" • How to communicate with occupants? • Public benefits of any sprinklers •••••(5) • Educational NFPA White Paper •••(3) • Source material already In the 13D/13R handbook • Clarify training code tradeoffs on life safety and property protection • Owners awareness (to buyer/renter from developer) • Tactical operations ••••••••••(10) o Officers o Difference in coverage o Attic separation o Video/non-boring way to educate o 1 hour–2 hours • Fire service o Fire fighters • (1) o Incorporate FFs to deliver; case studies, compatibles; hit source o Not necessarily entry level; corner office o Not regional but locally and ongoing o Officer training on sprinklers o Fire service needs to support from top down and across; fire service ↔ fire marshal

2.1.6 Success Metrics of NFPA 13R

The final group discussion topic for Group A focused on which metrics best represent the success of NFPA 13R. It was again noted that the standard currently works well, especially for limiting loss of life, as well as limiting damage if the fire originates in a protected area. This theme was consistently echoed throughout the workshop. Other constraints to the success of NFPA 13R are discussed here, such as the proper implementation of other building codes in concert with NFPA 13R. The discussion also tied back to maintaining better data on buildings to help determine why NFPA 13R sprinkler systems fail to limit property damage in specific events. Table 5 represents all ideas developed by Group A as they worked to define the success metric for NFPA 13R system performance. The dots (•) to the right of selected ideas represents participant-identified priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion question was as follows:

Focus Question 1a: How should we define the success metric for NFPA 13R system performance? How to change or update the metric for further protection?

Table 5. Success Metrics

Success Metrics

• Already defined under purpose in code
• Except for lightning fires, roof still there ••••(4)
  o Limited to room of origin
  o Re-occupancy
• Human error vs. success/failure metric •(1)
• Track perceived failures
• Fewer than 30 units displaced for extended time
• Success metric is 13R •••••(5)
  o No loss of life
  o Fire originating in the protected area controlled with limited building damage
• No preventable loss of life
• "As an adjunct to municipal fire suppression services" •(1)
• Standard vs. code issue ••(2)
  o Is this a building code issue? •••(3)
• Acceptance by industry for universal use in all new structures
• Standard represents a consensus of interested and knowledgeable stakeholders
• No more building checks ••(2)
• Clear absolutes (site vs. property) •(1)
  o Correct
  o Complete
  o Concise
  o Absolutes (life safety vs. property protection)
• Scottsdale, AZ
  o Planning
  o Builders
  o Fire team

2.1.7 Group A Priority Areas

Following the discussion and brainstorming periods, stakeholders in Group A were tasked with prioritizing the ideas they felt would have the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. Votes could be cast only for ideas on Tables 2 through 5. In some instances, those priority areas were larger ideas made up of several discussion points across the breakout session. As a reminder, these priority items in no way should be viewed as discounting or setting aside the other concepts that were identified. Further details on each priority are in the following Draft Work Plans 1 through 4.

- **Firefighter/First Responder Training/Awareness of NFPA 13R** (Draft Work Plan 1)**:** As discussed during Group A's education and training breakout (Table 4), firefighters and first responders were identified as a major stakeholder group that needs better education tied to NFPA 13R and what it covers and includes. This education is necessary not only to learn about the intricacies of the standard, but how to speak to others about a fire event in a NFPA 13R building.
- **Data Process: What Codes Was Used and How Did It Perform?** (Draft Work Plan 2): This priority area focuses on the main discussion points during the data analytics breakout (Table 2) and aims to determine causes of major fire events in buildings protected by NFPA 13R, as well as solutions utilizing data.

- **Public and Media Education Through Careful Strategy** (Draft Work Plan 3): As discussed during the education and training breakout session (Table 4), the general public and the media also need access to training materials for NFPA 13R to fully understand its use, limitations, expectations, and impact.
- **Protecting Attics — Code or Standard Issue? What Is the Gap?** (Draft Work Plan 4): This priority is from the discussion of possible code changes (Table 3) and focuses on the code proposal found in Appendix F. The proposal to require extra attic protection for tall buildings.

DRAFT WORK PLAN 1: Fire Fighter/First Responder Training

Description: Training program outline for fire service members on the performance and limitations of sprinkler systems and NFPA13R. This educational program will provide the information on system performance and possible tactical options for the operating officers.

Goals:

- Improved operations of the fire companies in facilities with sprinkler systems
- Enhanced inspections by front line companies with the increased understanding and knowledge about the different systems

Implementation Plan

Major Tasks	Educating fire service on occupancy types and required protection
	Type of sprinkler system and coverage area
	Potential tactical operations
	Company inspection opportunities
	Case studies — comparable
	Extinguish exterior fires
	Target fire service members: chiefs/officers/fire fighters
Challenges	Funding new research
	Establishing education partners
	Funding education program
Major Milestones and Dates	Month 1: Establish partners
	Month 4: Outline of program
	Month 7: First Draft
Adoption:	Applicability to fire fighters

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Other Issues

Roles and Responsibilities of the Stakeholders	IAFF/IAFC
	NFPA
	AWC
	UL
	Insurance
Qualitative Impacts/Benefits	Better operations equals better Standard performance
	Limiting making up process of violations
Existing Related Resources	NFPA
	UL FSRI
Further Concepts	Follow-up meeting for committee

DRAFT WORK PLAN 2: Data Process – What codes were used & how did it perform?

Description: Understanding the circumstances (area of origin, item first ignited, primary contributors to flame spread, most recent inspection), building age and code provisions in place for incidents in which there were significant losses in buildings with NFPA 13D/13R systems. Knowledge gained can be used to improve life safety and property protection in codes and standards arena; regulatory and legislative arenas; fire fighter tactics, strategies, and training; education for the public, the enforcement community, and design professionals.

Goals: To understand how the provisions of the different codes and editions affect outcomes and to determine whether additional provisions are necessary in codes/standards based on those findings.

Implementation Plan

Major Tasks	Determine where the project will be housed (NFPA) Define scope of project in terms of retrospective timeframe
	Develop a simple questionnaire Identify sources for data and outreach to sources of data
	Identify relevant incidents (Residential buildings with NFPA 13/13D/13R systems, flame/fire damage beyond the room of origin, loss of life or significant injury, property damage beyond $50,000)
	Identify data collecting organization
	Implement data analysis and reporting plan
Challenges	Existence, quality, and availability of data
	Willingness of data sources to provide data
	Implementing data collection, analysis, and reporting without creating legal issues

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Major Milestones and Dates	3 months: Develop/test questionnaire and set scope
	3-6 months: Outreach articles and presentations
	6-12 months: Data analysis and reporting plan
Adoption	Outreach, convince data reporters that data from specific fire events can be used

Other Issues

Roles and Responsibilities of Stakeholders	NFPA: Administration, data analysis
	Fire service, including state fire marshals, building departments
	Data reporting
	Project advisory board
	Various members of the fire service and state fire marshals: outreach
Qualitative Impact/Benefits	Improved operations of fire companies in facilities with sprinkler systems In addition, enhanced inspections by front line companies with the increased knowledge.
Existing Related Resources	NFPA (IT department, data analysis department)

DRAFT WORK PLAN 3: Public and media education through focused strategy

Description: Provide accurate and focused information to dispel public myths and misunderstandings about fire sprinkler protection

Clarify for all stakeholders the benefits, functions, features, and limits of residential sprinkler system design and operation

Goal: Better public education and understanding of the scope and functions of residential automatic fire sprinklers

Implementation Plan

Major Tasks	Maintain commitments to the ongoing efforts of the Home Fire Sprinkler Coalition in public education and outreach for NFPA 13D in one- and two-family dwellings
	Establish partnerships with International City/County Management Association (ICMA), National League of Cites (NLC), and urban planning organizations to explain benefits of automatic sprinkler protection
	Develop talking points for public information officers in anticipation of or after significant events (sprinkler saves, major losses, etc.)
Challenges	Overcoming perceived risks and consequences of fire incidents affecting "me"
	Removing stakeholders' perceived self-interest out of the debate and agreeing on standards of honesty and integrity (fire protection industry, home builders, etc.)
	Establishing credible relationships to obtain a foothold with partner organizations

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Major Milestones and Dates	Within one year, convert NFPA 13D/13R Handbook Part III, Supplement 2 into a public-facing white paper
	Within six months, obtain commitment from groups represented at this workshop to distribute white paper to their constituents
	Within 18 months, market and disseminate residential sprinkler talking points through NFPA and organizational networks
Adoption	Develop public awareness campaign for younger population to become aware of sprinkler benefits in the built and dwelling environment Encourage design community to embrace codes, standards, and built-in fire protection Need our own "cheerleaders" and "advocates"

Other Issues

Roles and Responsibilities of Stakeholders	Distribute marketing/advocacy materials through membership and stakeholder channels
	NFPA staff involved in white paper development
	Codes and standards development organizations respond to recommendations for improvement
Qualitative Impacts/Benefits	Increased awareness of proper scope, use, and application of NFPA 13R among planning and legislative entities Increased public awareness of fire sprinkler performance expectations
Existing Related Resources	Home Fire Sprinkler Coalition
	Center for Campus Fire Safety
	Codes and standards development organizations
Further Concepts	Overcoming long-standing perception that preventable fires are "accidents" Resurrecting importance of teaching/advocating "primary" fire prevention

DRAFT WORK PLAN 4: Protecting attics – code or standard issue? What is the gap?

Description: The draft code proposal for the IRC is shown in Appendix F. As drafted, it requires extra attic protection for tall buildings but no changes to NFPA 13R. Similar changes are being presented for NFPA *101* and *NFPA 5000*.

Implementation Plan

Major Tasks	Submit public input for appropriate building code (NFPA *101*/*NFPA 5000*/IRC/IBC)
Challenges	Following code-making process
Major Milestones and Dates	PI deadline for 2021 editions of NFPA codes and ICC codes (in 2018).
Adoption	Part of the consensus code-making process.

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Other Issues	
Roles and Responsibilities of Stakeholders	TC members To Continue dialogue on issue through development of 2018 editions of all relevant NFPA and ICC codes and standards
Qualitative Impacts/ Benefits	Improves fire fighter access to attics in tall buildings or provides additional protection measures of the attic.

2.2 Group B: Design and Construction Challenge

2.2.1 Introduction

As previously stated, the experience with NFPA 13R systems over the past 20 years has been excellent. However, the question still needs to be raised: even when life safety sprinkler systems save lives, is significant or total property loss still considered a "success"? There are existing opportunities to better align the NFPA sprinkler standards with the fire, life safety, and building codes in order to better protect buildings, as well as educate stakeholders on the use and application of NFPA 13R systems. Group B included mostly building and fire systems designers, as well building construction stakeholders. While similar questions were at times asked of both Groups A and B, the groups' specific constituents allowed for different yet insightful responses to the same question.

2.2.2 Influencing Factors That Allow Extensive Fire Damage

To begin the brainstorming sessions, specific characteristics of a building that would allow fire to spread quickly in an unprotected area were defined. Ideas tied to materials (e.g., wood and foam insulation) and various construction techniques (such as the large size of specific unprotected areas) were the general themes of the discussion. Table 6 presents Group B's list of influencing damage factors that allow some large fires to develop. The discussion question was as follows:

> ***Focus Question 1a: What are the influencing factors, including modern era construction, such as engineered lumber, modular construction techniques, or structural adhesives, that allow fires in unprotected spaces to spread more rapidly, thus causing extensive damage?***

Table 6. Brainstorming of Damage Factors Allowing Extensive Fire Damage

Damage Factors	
• They don't — exacerbated by size and fire fighter access • Taller/broader — get more attention • Lightweight engineered lumber, attic ventilation, flimsy draft stops • Price, price, price; speed of construction; cheap wood, light weight • Synthetic and recycled material • Code enforcement • Attic volumes, wood construction • Modern codes • Density of materials; use of combustible adhesives; openings in draft stops • Compartment vs. wide open space • Ignition source and location; construction and installation techniques; materials • Complexity and density of construction; plumbing pipes/electricity • Plastics in building construction (generally related to energy conservation)	• Undetected growth in unprotected or non-monitored areas • Thin materials (ignition, factor of safety, flame spread) • Penetration violations (e,g., fire stops and draft stops); see IFC Section 703 • Code allowances for building construction exceptions (building size, height, construction materials) • Ventilation; fuel (new wood building members, type of insulation); human error; lack of maintenance • Ventilation; flat vs. sloped roofs • Lack of or compromised compartmentation ([does not equal] speed issue) • Sporadic data • Response time (urban sprawl a factor) vs. full-time and volunteer fire departments • Non-compliant activities causing fires • Poor communication • Lack of maintenance

2.2.3 Data Reporting and Analytics

Before any updates or changes to NFPA 13R are considered, trusted data and analysis of those data are required in order to make informed decisions. Agreed-upon baselines for various building and fire data points would allow stakeholders to speak the same language when discussing building design and first responder tactics in a building that utilizes NFPA 13R. Several ideas emerged concerning baseline data and their use, including the availability of data on the makeup of existing building stock, as well as how to best determine a building's fire risk. On the topic of data collection, the establishment of a national database and the redesign of NFIRS stood out as general session themes. Table 7 breaks down the discussion between types of data and steps to collect data. The dots (•) to the right of selected ideas represent participant-identified priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion questions were as follows:

Focus Question 1a: What data should be collected for developing better baseline and codes? What can be accomplished with new data?

Focus Question 1b: What steps need to be taken in order to collect better data tied to large fires with serious loss of property?

Table 7. Data Reporting and Analytics

Data	Steps
• How many owners change design concepts in order to meet NFPA 13R vs. NFPA 13 ••(2) • NFIRS (collection needs) •(1) o Construction type o Type of sprinkler system (13, 13R, 13D) o Occupancy classification per building code • Fire origination, cause, monetary value of property damage, loss of life (if any), and jurisdiction; NFPA 13, 13R, 13D, or none? •(1) • System type (13, 13R, 13D…), used outside of scope? • Construction type, building design (e.g., unprotected area), causative factors, better investigations • Fire origin in sprinklered vs. non-sprinklered areas; status of sprinkler system (more details) • Design document retention; modifications (e.g., attics used for storage) • Location and types of ignition sources o Compliance with regulations o Value and type of damage • What type of system was installed? Did the fire begin in an unsprinklered area? Did the sprinklers put out the fire? • Need more details on: o Response: Who, when o Activation: How many sprinklers o Codes, ordinances, changes, appeals • Are there systems present? Did they function? • Normalized fire loss data • Support appropriate changes based on identified loss • How many fires are caused by end user modifications after building certificate of occupancy • System type, building use, fire location (origin → spread) • Fire behavior of building contents • Building and system plans, fire investigation reports • Become the most efficient fire service possible • Existing codes' effectiveness	• National database and sharing of data across/from different stakeholders (e.g., owners, insurers) ••••••••••••••(14) o Data from insurance companies/sharing of information between private and public stakeholders • Redesign NFIRS •••••••••(9) o 13R specific reporting criteria o Need better data on all fires o Expand NFIRS data collected, increase amount of data sent • Mandate NFIRS reporting ••(2) • Education — fire service, media o Fire service education (our reporting is less than ideal); improvements needed to get better data o Make everyone aware of need for solutions (fire suppression systems, fire prevention, protection) o Need better training of fire departments to fill out NFIRS form • Uniform participation in data collection • NFPA investigate and compile data • Release of liability — in-depth analysis not shared with public because of liability concerns • Seek proper post–fire investigation and evaluation of code performance

2.2.4 Possible Code Changes

Section 2.2.3 focused directly on NFPA 13D and 13R, specifically on obstacles that prohibit use of the code in low-rise residential occupancies. Cost stood out as the major obstacle to code implementation in that scenario, and methods to overcome the challenge were discussed, such as establishing a new version of NFPA 13R. The legal ramifications of building losses involving NFPA 13R are also explored below in Table 8. While legal action is often taken regardless of the results of a fire in an NFPA 13R building, steps can be taken to define expectations of these systems depending on the nature of the fire. The dots (•) to the right of selected ideas represent participant-identified priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion questions were as follows:

Focus Question 1a: What are the current obstacles that prohibit use of NFPA 13 systems in low rise residential occupancies? If possible, indicate any solutions.

Focus Question 1b: What are the legal ramifications of building losses involving NFPA 13R?

Table 8. Code Implications

Current Obstacles	Legal Ramifications
Solutions to obstacles: • Develop NFPA 13R 2.0 (in response to the cost obstacle) •••••••(7) • Eliminate NFPA 13R (in response to the cost obstacle) •(1) • Another permutation of NFPA 13 (in response to the cost obstacle) • Offset cost by incentives, impact fees, permit fees, insurance costs • **Obstacles:** • Cost vs. affordability — varies by location o Freezing problems (slope, drains, maintenance) •(1) • Cost, politics • Cost: attics, time delays, dry systems, underground use of CPVC vs steel • Money, water supply, time (design and install), and size of pipes • NFPA 13 mandate would lead to no sprinklers required in multifamily dwellings • No obstacles but disincentive: economics, cost in cold climate, access to attic, etc. • Water supply and pressure • Areas required to be protected (exterior unheated) • Required study ROI vs. risk analysis as a precondition to using an NFPA 13R system • Renovation vs. new sprinkler requirement • Push back of developers and political pressure to allow low-cost alternatives • Laws that prohibit code • Special certification for designers/installers • Cost/codes allow (preclude vs. prohibit)	• Undetected fires in non-sprinklered spaces • Lawyers will find a way to sue on any loss • Renters insurance • Insurance reductions, registration/certification for type of use • Clear expectations, life vs. property protection, information requirement • Loss due to exposure of CPVC to non-compatible materials • NFPA 13R not applied correctly • Potential lawsuits from multiple parties, lack of payment or reduced awards from insurance carrier • Cost — accept it!; perception of coverage • Maintenance issues • Misunderstanding of purpose of system • None beyond standard liability question • Public relations are damaged • Should be nothing if properly installed and maintained • Expectation setting, don't "oversell" NFPA 13R to get them used • Lawyer fees even if developer prevails, nothing left to examine • If built to code, should be none but then there are lawyers • You get sued

2.2.5 Draft Stops

Draft stops are used in buildings to slow down the spread of fire and to starve fire of oxygen before it can grow to the point of causing severe damage to the building or structure. A draft stop is typically a material, device, or construction installed to restrict the movement of air within open spaces of concealed areas of building components (e.g., crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies, and attics). While this tactic is necessary, draft stops need to be consistently and properly designed and installed in order to be effective. The main themes from the draft stop discussion focused on regular inspection of draft stops in buildings by a certified architect or engineer after installation, as well as the idea of replacing draft stops with more effective methods, such as actual

firewalls and sprinkler systems. Table 9 includes more information about the discussion. The discussion question was as follows:

Focus Question 1a: How do we ensure draft stops are being properly designed and installed, as well as inspected? Indicate if you have a design or policy idea.

Table 9. Draft Stops

Ideas
• Review and inspection •••••••(7) o Keep it simple, it's not rocket science, regular inspection of NFPA 13R buildings o Require annual third-party inspections of draft stopping, dampers, and penetrations in NFPA 13R buildings o Design certification by responsible architect/ engineer and inspection o Require an assembly be provided by the design professional on the construction documents o Education, permit system (penetrations, etc.) o Mandated inspections focusing on draft stops • Get rid of draft stops and require firewalls or sprinklers •••••••(7) • Define when, where, and how easily ••(2) o Require something legitimate • Education •(1) • Identify intent and verify performance with respect to fire • Clear and coordinated code requirements (concealed spaces) • Training (designer/fire department/installer/trades/maintainer) • Mandate QA program • Liability of accessing heights and concealed spaces • Age-old problem! We can't fix "stupid" • Education, draft curtains/draft stops

2.2.6 Education and Training

Table 10 is a long list of ideas to better educate and train stakeholders who interact with NFPA 13R buildings. While Group A focused more on insurers and first responders, Group B discussed tactics for educating a broader base of stakeholders, including building owners/managers and developers. The general theme of the discussion focused on sharing information on the agreed-upon goals of NFPA 13R, as well as considering renaming the code to simply "Life Safety Sprinkler Systems." Table 10 share not only the ideas generated for NFPA 13D and NFPA 13R training and education pieces but also the group's discussion on competing/complementary goals between NFPA 13D and NFPA 13R. The discussion led into the focus question on education and training. The dots (•) to the right of selected ideas represent participant-identified priorities that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion questions is were follows:

Focus Question 1a: What are the competing/complementary goals between NFPA 13D/13R and NFPA 13 type sprinkler systems?

Focus Question 1b: What educational training pieces are necessary to educate various stakeholders concerning the application of NFPA 13D/13R? How can the required performance be defended? Indicate your stakeholder focus.

Table 10. Education and Training

Goals	Educational Training

• Cost: NFPA 13R and NFPA 13D vs. NFPA 13 •(1)
  o Common: life safety
• NFPA 13: life safety and property; NFPA 13R/13D: life safety only
• Provide life safety — all provide some level of property protection to save lives
• Life safety vs. property protection; areas of protection
• Cost of providing the property protection in a commercial system vs. residential system
• NFPA 13D/13R/13: provide time for egress
  o NFPA 13D/13R: provide limited property protection
  o NFPA 13: provides fire control and property protection
• Life safety vs. life safe and property protection
  o Early detection options in unprotected areas
• Avoiding ambiguous scope and purpose of documents
• Property protection, life safety (cost), time to escape
	• Educate the developer to take the high road (choose NFPA 13); home fire sprinkler coalition — website and video ••••••••••(10)
	• The fire service is changing — life safety now accomplished differently, Community Risk Reduction (CRR) the "new norm" — engage all stakeholders ••••••••(8)
	• Stakeholders need to know the goals of each system ••••••(7)
	  o Life safety is achieved
	  o Basic information, constant turnover
	  o Level of protection afforded by NFPA 13R system companion to NFPA 13 system (property owners, tenants, authorities — all real estate industry)
	  o Developer/designer: outline the specific objective of residential sprinkler protection
	  o NFPA 13D/13R — sharing information differently (NFPA 13D — homeowners, NFPA 13R — developers)
	  o Clarify intent, purpose, and scope for everyone
	  o Fire fighters, designers, inspectors, contractors, and trade workers need to understand the goals of the systems
	• Rename NFPA 13D and NFPA 13R to create clear distinction ••••(4)
	  o Life safety sprinkler system
	• No loss of life in NFPA 13R; stakeholders: occupants •••(3)
	• Property managers and owners need to be trained in limitations of the system and required to train tenants and refresh training for multi-year tenants •(1)
	• Media perception of sprinkler system expectation to save property even if NFPA 13R •(1)
	  o Train, be ahead of the game
	• Defend performance — note residential fire death rate, sprinkler success, and damage comparisons •(1)
	  o Defending NFPA 13R goals: fire data success for lives saved and losses over past 25 years since adoption of NFPA 13R
	• Hollywood wrong about possible sprinkler problems (water damage); stakeholders: everyone, the public!
	• Educate:
	  o Public (users, regulators, funding source)
	  o Fire fighters (limitations of systems and structures)
	• Side-by-side burns — educational video produced by NFPA for end users
	• Manage expectations: educate occupants at time of lease signing; NFPA 13R, NFPA 13D, or none; — stakeholders; occupants and owners
	• A flyer with every grill sold from NFPA explaining the danger of using on a balcony
	• Developers concerned with money — need more incentives to upgrade to NFPA 13 → insurance benefits?

2.2.7 Success Metrics of NFPA 13R

The final group discussion topic for Group B focused on what metrics best represent the success of NFPA 13R. It was again noted that the standard currently works well, especially for limiting loss of life, as well as limiting damage if the fire originates in a protected area. More data is necessary to establish proper success metrics, as a national database detailing fire events in NFPA 13R buildings could provide true success parameters for the standard. Table 11 represents all ideas developed by Group B as they worked to define the success metric for NFPA 13R system performance. The dots (•) to the right of selected ideas represent an participant-identified priority that could provide the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. The discussion question was as follows:

Focus Question 1a: How should we define the success metric for NFPA 13R system performance? How to change or update the metric for further protection?

Table 11. Success Metrics

Definition

• No change; communicate current expectations better •••••••••(9)
• NFPA 13R early detection systems reduce property loss in X percent of protected buildings ••••••••(8)
• Create a national database and track all incidences before defining success/failure ••••(4)
• Baseline NFPA 13R life safety → new/add tradeoffs (incentives) in building fire for attic upgrade •••(3)
• A total burndown or total roof loss with no injuries or death is success for NFPA 13R •(1)
  o To the general public, elected officials, and media that seems silly; is it embarrassing?
• Systems operating vs. impaired systems •(1)
• Limit buildings areas/heights, building code requirements •(1)
• NFPA 13R prevents life loss in 95 percent of protected buildings. NFPA 13R prevented property loss beyond area of origin in X percent of protected buildings. •(1)
  o Based on a limited property protection: How many lives saved? How much saved in property loss?
• New success definition: no loss of life, fire either controlled or alarm activated when fire/heat detected in an unoccupied space •(1)
• Success — no loss of life (system related)
• Sprinklers vs. non-sprinklers (money and life)
• Success only defined only as no deaths or injuries to occupants
  o For further protection, re-evaluate tradeoffs and exceptions given in all fire and building codes
  o How can we possibly assume that the level of protection is the same in all systems?
• Number of buildings with sprinklers due to NFPA 13R
• Greatly improved protection against injury and loss of life.
  o Greatly improved protection against property damage where fire originates in sprinklered area
• Number of lives saved; fires in areas with sprinklers — saves; track lives saved and get the information out
• System supervision/maintenance; inspection, testing, and maintenance (ITM)
• Probability of dying in NFPA 13R property vs. non-sprinklered
  o Plane crash analogy — flying is "safe," NFPA 13R is "safe"
• Injuries of occupants in covered buildings
• Individuals displaced
• If property protected, minimal loss if fire starts in sprinklered area
• Consider changes to codes or standards to greatly reduce potential danger from fires in attics

2.2.8 Group B Priority Areas

Following the discussion and brainstorming periods, stakeholders in Group B were tasked with prioritizing the ideas that they felt would have the most impact on improving the use and understanding of NFPA 13D/13R across stakeholders. Votes could be cast only for ideas in Tables 7 through 11. In some instances, the priority areas are broader ideas made up of several discussion points across the breakout session. Further details on each priority can be found in Draft Work Plans 5-9.

- **Enhanced National Database for Fire Incidents** (Draft Work Plan 5)**:** As discussed throughout the workshop, current databases do not adequately support or meet the requirements necessary to support decision making with regard to NFPA 13/13R or 13D. An improved and updated database solution is necessary to truly assess the effectiveness of current codes.
- **Success Metrics — No Change to NFPA 13R Safety to Life Scope** (Draft Work Plan 6): This priority area focuses on managing and communicating the expectations of NFPA 13R by following steps to rename the standard to more observably include lifesaving scope.
- **13R Added Attic Protection Option** (Draft Work Plan 7): Priority was given to further protection of attics, by utilizing a cost-effective form of attic sprinklers to reduce damage and protect other parts of the building from fire.
- **Educate Stakeholders on Difference Between NFPA 13 and NFPA 13R** (Draft Work Plan 8): This priority came from the education and training discussion (Table 10) and aims to encourage building developers/owners to utilize NFPA 13 instead of NFPA 13R, providing further protection for currently unprotected areas.
- **Community Risk Reduction (CRR), "The New Norm"** (Draft Work Plan 9): With a focus on risk, this priority area aims to facilitate creative options to address the changing expectation of what a sprinkler save means.

DRAFT WORK PLAN 5: Enhanced National Database for Fire Incidents

Description: NFIRS does not adequately support or meet the requirements necessary to support decision making with regard to NFPA 13/13R or NFPA 13D. An improved and updated NFIRS or alternative database solution is necessary to truly access the effectiveness of current codes.

Goals:

- Determine effectiveness and adequateness of the standard
- Support intelligent decision making on code changes that improve desired outcomes

Implementation Plan

Major Tasks	Review and update NFIRS. Identify gaps of needed information. Required field for sprinkler information is needed.
	Provide both resources and education to reporting bodies.
	Provide some form of incentive for mandatory reporting for the NFIRS system.
Challenges	Bureaucracy and willingness to participate (or lack thereof).
	Compelling the reporting bodies and fire departments to report, and report
	Buy-in from all stakeholders.

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Major Milestones and Dates	Evaluate current status of NFIRS.
	Identify data/variables that need to be collected.
	Determine if NFIRS meets the objective. If not, create an alternative database between NFPA and the insurance industry.
Adoption	Buy-in from related code setting bodies, e.g. NFPA/ICC.
	Acceptance by stakeholders that the path toward data collection can indeed be realized.

Other Issues

Roles and Responsibilities of Stakeholders	U.S. Fire Administration (USFA)
	NFPA
	International Fire Code (IFC)
	International Association of Fire Fighters (IAFF)
Qualitative Impacts/Benefits	Better metrics
	Improved decision making on code implementation and code changes
	A movement towards analytics
Existing Related Resources	Engagement of insurance companies in combined data collection

DRAFT WORK PLAN 6: Success Metrics - No Change to NFPA 13R Safety to Life Safety Scope

Description:

- Manage expectations of NFPA 13R
- Communicate expectations of 13R systems

Goals:

- Change title of NFPA 13R and 13D to initiate a change of perception
- Reflect scope/purpose in title

Implementation Plan

Major Tasks	Develop media kit, pre-fire/post-fire
	Support pre-planning of FD
	Impress importance of legislative/political support of fire code/ building code
Challenges	Multiple stakeholders
	National Association of State Fire Marshals (NASFM) and International Association of Fire Chiefs (IAFC) cooperation of NFPA 13R fires/losses.
	Knowing limitations of NFPA 13R
Major Milestones and Dates	2019 a major rewrite of NFPA 13R; change title
Adoption	Planned social media response campaign

(continues on next page)

Other Issues

Roles and Responsibilities of Stakeholders	NFPA, IAFC, NASFM, ICC
	Code official chapters
	Municipal officials
Qualitative Impacts/ Benefits	Improved relationships
	Established media kits/responses
	Fewer poor responses
	Better enforcement
Existing Related Resources	Fire data, NFPA standards
	Exploiting existing ordinances in the positive

DRAFT WORK PLAN 7: 13R Added Attic Protection Option

Description: Determine a cost-effective way to provide some form of attic sprinkler protection, possibly at eave lines with antifreeze or dry systems.

Goals: Added property protection, reduce image of sprinklered buildings burning

Implementation Plan

Major Tasks	Write codes for spacing and design criteria (number of sprinklers to calculate) define
	Determine if any tradeoffs can be allowed to offset cost, in some updated codes in future
	FPRF testing, full scale and modeling
Challenges	Use of antifreeze, which will be in a concealed space
	Inventing a sprinkler specific to eaves
	Identifying the causes of roof burn offs — FPRF literature
Major Milestones and Dates	Buy-in of existing antifreeze or development of listed antifreeze
	Completion of full-scale testing and evaluation of data
Adoption	Tradeoff to offset cost
	ROI that the added protection reduces loss — no timetable

Other Issues

Roles and Responsibilities of Stakeholders	AHJ
	Building community
	Fire protection community (design, installation, maintenance)
	National Multifamily Housing Council

(continues on next page)

Qualitative Impacts/Benefits	Higher level of property protection
	More recognition from insurance companies (monetary)
Existing Related Resources	Existing fire testing
	FPRF

DRAFT WORK PLAN 8: Educate Stakeholders on Differences between 13 and 13R

Description: Influence/encourage developers/owners to utilize NFPA 13 instead of NFPA 13R

Goals: Get owners to protect unprotected areas; minimize low-frequency high-consequence events

Implementation Plan

Major Tasks	Get to the owner/developer early and educate
	Development/zoning/AHJ initial process/agency to encourage 13 systems
	Get A&E and contractor community to promote NFPA 13 over NFPA 13R; more than likely, no insurance break for NFPA 13R, only for NFPA 13
Challenges	Establishing the window of opportunity to engage the development agency with the owner
	Cost — convincing owner to go with NFPA 13 vs. NFPA 13R
Major Milestones and Dates	Owners that voluntarily opt for NFPA 13 over NFPA 13R
	AHJs creating incentives to use NFPA 13
Adoption	Incentives to jurisdictions and owners
	Reduce tap, permit, and impact fees

Other Issues

Roles and Responsibilities of Stakeholders	AHJs, Development Zoning Agency, owners, developers
	General contractors
Qualitative Impacts/Benefits	Protection in areas currently unprotected
	Less property loss
Existing Related Resources	Educate municipal league/city, county organizations about long-term community gain from NFPA 13 systems

DRAFT WORK PLAN 9: Community Risk Reduction (CRR), "The New Norm"

Description: Allows for creative options to address the changing expectation of what a sprinkler save means; will assist in facilitating a cultural shift within the fire service to a less reactive, more proactive approach

Goals:

- Expectation alignment
- Assist the fire service in becoming more efficient in achieving their mission
- Community outreach focused on multi-family and fire prevention

Implementation Plan

Major Tasks	Risk assessment in multi-family dwellings and alignment with acceptable losses
	Prioritize risks and develop mitigation strategies and tactics
	Prepare and implement: code changes, education programs, outreach, and training
Challenges	Regional differences
	Cultural shifts in thinking
	Communication
Major Milestones and Dates	Inclusion/adoption of NFPA 1300 (currently in early development)at the state and national levels
	Education on the impacts of CRR on multi-family communities for assessing life/property protection
Adoption	Community outreach: fire service, developers, designers, occupants, politicians
	Provides for local autonomy and control over the final product

Other Issues

Roles and Responsibilities of Stakeholders	The fire service to take the CRR to their communities and work to involve all community partners
Qualitative Impacts Benefits	Continual monitoring and assessment of CRR in regard to results
	CRR continually evolving to meet changing needs and expectations
Existing Related Resources	Vision 20/20
	NFPA 1300

3 Workshop Summary

There is no question that NFPA 13R/13D have been effective in reducing loss of life and, in many cases, further property damage as result of a building fire. The *NFPA Life Safety Sprinkler Systems Challenge Workshop* held December 15–16, 2015, brought together various stakeholders to share current understanding on NFPA 13R/13D and to discuss ways to improve the standards from various stakeholder standpoints, including building system designers, insurance experts, first responders, as well as building and fire engineers. Participants identified the most beneficial ideas raised during discussion and developed those concepts into notional implementation plans. Four high-level themes emerged from the discussions:

- NFPA 13R/13D are effective standards that reduce loss of life and building damage due to a fire event.
- In order to make improvements to NFPA 13R/13D, better data need to be identified as well as collected on a consistent basis. A national database that describes fire events with information on building type/codes would assist in making intelligent changes to any sprinkler codes and standards.
- To achieve a better understanding of the use and goals of NFPA 13R/13D, dedicated educational and training programs are necessary to ensure all stakeholders fully understand the standards.
- To provide further building protection, more consideration needs to be given to sprinkler protection of attics, balconies, and other large unprotected areas in a building.

This report summarizes the results of the workshop and provides crucial findings that NFPA 13R/13D stakeholders can build upon as they take steps to making buildings safer with further developed codes and systems. This report along with additional information on the topic can be found on the NFPA website at (www.nfpa.org/lifesafetysprinkler).

Completion and issuance of this report do not represent the end of these discussions, nor is it implied that all the issues have been identified and solved. The workshop afforded an opportunity for the stakeholder groups identified in the report to meet in one place at one time to exchange ideas and open up the communication.

The information in this report is not intended to be static. Rather, it is intended to be used as a resource for standards development organizations (SDOs), code developers, first responders, and members of the architectural and engineering professions. Numerous NFPA Technical Committees will be reviewing the report in detail and setting in motion a process to evaluate the requirements of various NFPA codes and standards. The goal of this review is to ensure that standards like NFPA 13R/13D are consistently meeting safety and other requirements as buildings age and evolve.

Appendix A. Workshop Participants

The following individuals attended the NFPA Life Safety Sprinkler Systems Challenge Workshop and contributed input that serves as the basis of this report.

NFPA Life Safety Sprinkler Systems Challenge Workshop Roster
December 15-16, 2015

Marty Ahrens
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Session B

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Appendix B. Related NFPA Codes and Documents

NFPA 13
The purpose of this standard shall be to provide a reasonable degree of protection for life and property from fire through standardization of design, installation, and testing requirements for sprinkler systems, including private fire service mains, based on sound engineering principles, test data, and field experience. Sprinkler systems and private fire service mains are specialized fire protection systems and shall require knowledgeable and experienced design and installation.
http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=13

NFPA 13D
The purpose of this standard shall be to provide a sprinkler system that aids in the detection and control of residential fires and thus provides improved protection against injury and life loss. A sprinkler system shall be designed and installed in accordance with this standard to prevent flashover (total involvement) in the room of fire origin, where sprinklered, and to improve the chance for occupants to escape or be evacuated.
http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=13d

NFPA 13R
The purpose of this standard shall be to provide a sprinkler system that aids in the detection and control of residential fires and thus provides improved protection against injury, life loss, and property damage. A sprinkler system shall be designed and installed in accordance with this standard to prevent flashover (total involvement) in the room of fire origin, where sprinklered, and to improve the chance for occupants to escape or be evacuated. The layout, calculation, and installation of sprinkler systems installed in accordance with this standard shall only be performed by people knowledgeable and trained in such systems.
http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=13R

Case Study: Wells, NY: March 21, 2009; NFPA 13D Loss
This case is being reported separately because it involves a sprinkler system installed in a group home (Residential Board and Care — Small, per NFPA *101*®). The facility opened in May 2008 and was protected with a sprinkler system designed to meet the requirements of NFPA 13D. The fire originated on a rear enclosed porch. The porch had a roof and screened sides. The porch was not provided with sprinkler protection. While there is some debate based on the amount of enclosure on the porch whether sprinklers should have been installed, they were not. The fire spread into the space above the ceiling and moved across the facility over the occupied spaces.

The nine residents of the facility had a mix of mobility and cognitive disabilities. The two staff members present at the time of the fire moved eight of the residents to a mud room at the front of the building and then proceeded to relocate them to the outside into the parking lot. During this movement, some of the residents returned to the building — in their minds, a “safe place.” Four of the nine residents perished in this fire.

Appendix C. Acronyms and Abbreviations

A&E	architecture and engineering
AHJ	authority having jurisdiction
AWC	American Wood Council
CPVC	chlorinated polyvinyl chloride
CRR	community risk reduction
FCAC	Fire Code Advisory Council
FD	fire department
FF	fire fighter
FM	fire marshal
FPRF	Fire Protection Research Foundation
FO	fire out
HFSC	Home Fire Sprinkler Coalition
HVAC	heating, ventilation, and air conditioning
IAFC	International Association of Fire Chiefs
IAFF	International Association of Fire Fighters
IBC	International Building Code
ICC	International Code Council
ICMA	International City/County Management Association
IFC	International Fire Code
IFMA	International Fire Marshals Association
ISO	International Organization for Standardization
ITM	inspection, testing, and maintenance
NASFM	National Association of State Fire Marshals
NFIRS	National Fire Incident Reporting System
NFPA	National Fire Protection Association
NLC	National League of Cities
NMHC	National Multifamily Housing Council
QA	quality assurance
ROI	return on investment
SDO	standards development organizations
SVA	security vulnerability analysis
TC	Technical Committee
UL	Underwriters Laboratories
UL FSRI	UL's Firefighter Safety Research Institute
USFA	United States Fire Administration
VL	ventilation location
WOF	water on fire

Appendix D. Workshop Agenda

National Fire Protection Association (NFPA)

Life Safety Sprinkler Systems Challenge Workshop

Tuesday – Wednesday, 15-16 December 2015

Hilton Orlando Lake Buena Vista, FL - South Ballroom

Workshop Agenda

WORKSHOP GOALS AND OBJECTIVES:

After almost 40 years (NFPA 13D) and 26 years (NFPA 13R) of experience with automatic sprinkler systems that are primarily designed to offer a tremendous life safety benefit, it is important to evaluate the positive impact these systems have had on reducing life loss. At the same time, it is equally important to look at those circumstances when the life safety goal is achieved but significant property damage may result. This workshop has been designed to look at those outcomes, acknowledge these performance metrics and determine if anything different needs to be done.

OVERARCHING AND RELEVANT TOPIC AREAS:

Workshop Questions:

- Can we (or do we need to) refine the loss data on fires involving NFPA 13R?
- How do modern era building design and construction techniques coupled with combustibility/flammability characteristics of modern home furnishings influence the discussion?
- Are there shortfalls in the code provisions, enforcement provision, or both that can improve upon the anticipated level of performance?
- Are NFPA 13D and NFPA 13R still being used as intended when they were first developed?

DAY ONE AGENDA (15 DECEMBER 2015):

8:15 am	Sign-in/Continental Breakfast	
9:00 am	***Welcome and Introductions***	**Robert Solomon,** NFPA **Richard LePere**, Fire Chief, Reedy Creek Improvement District **Jerry Wooldridge**, Building Official, Reedy Creek Improvement District

9:30 am	***Genesis of NFPA 13D and NFPA 13R — Technology, Trends and Timing***	**Kerry Bell,** Underwriters Laboratories **Robert Solomon,** NFPA
10:30 am	Networking Break	
10:45 am	***Experience with NFPA 13R Systems — Who has them? How well do they work?*** ***What if we don't have them?***	*Session Discussion Leader*: **Gary Keith,** FM Global Associate. *Panelists*: **Marty Ahrens**: NFPA **Jeff Shapiro**: International Code Consultants **David Hague**: Liberty Mutual Insurance **Maurice Pilette:** Mechanical Designs Limited **Roland Huggins:** American Fire Sprinkler Association **Steve Peavey:** Altamonte Springs Fire Department The discussion leader will introduce the subject with brief remarks on NFPA 13R and a quick introduction of panel members. The six panelists will respond to a series of questions and provide their expert perspectives on trends on these topical areas of NFPA 13R. This is followed by open plenary discussion and Q&A with all participants.
12:00 pm	Lunch (provided)	
1:15 pm	***Building Design Issues and NFPA 13R— Construction Techniques; Building*** ***Materials; First Responders — How are we connecting?***	*Discussion Leader*: **William Koffel** – Koffel Associates *Panelists*: **Sam Francis** – American Wood Council **David Collins** – Preview Group **Jeff Hugo** – National Fire Sprinkler Association **Andy King** – Franklin (TN) Fire Department **Butch Browning** – Louisiana State Fire Marshal's Office **Sean DeCrane** – Cleveland Fire Department The discussion leader will introduce the subject with brief remarks on NFPA 13R and a quick introduction of panel members. The six panelists will respond to a series of questions and provide their expert perspectives on trends on these topical areas of NFPA 13R. This is followed by open plenary discussion and Q&A with all participants.

2:15 pm	***Breakout Session Framing: Identify Challenges, Education, Code Implications and Integrations.***	Overviews of each Breakout Group: Rules; Process; Expectations; Group Reporting
2:20 pm	**BREAK: Move to Breakout Sessions**	
2:35 pm	***Breakout Session A: Regulatory and Response Challenge***	A facilitated discussion with recommendations for reviewing, revising, and creating both existing and new codes and standards provisions with a focus on application, enforcement, and operational challenges that will support the necessary balance between life safety and property protection. Participants have been identified in advance of the session to provide leading thoughts to spark ideas and discussion. The group will present a 15-minute summary of its discussions and recommendations in plenary session on Day 2.
2:35 pm	***Breakout Session B: Design and Construction Challenge***	A facilitated discussion with recommendations for reviewing, revising, and creating both existing and new codes and standards provisions with a focus on modern era construction and administrative challenges that will support the necessary balance between life safety and property protection. Participants have been identified in advance of the session to provide leading thoughts to spark ideas and discussion. The group will present a 15-minute summary of its discussions and recommendations in plenary session on Day 2.
5:00 pm	Return to Plenary	
5:15 pm	**Group Reports and Wrap Up for Day 1**	
5:30 pm	Reception for All Attendees	

DAY TWO AGENDA (16 DECEMBER 2015):

8:00 am	Coffee/Continental Breakfast	
8:30 am	***Day 1 Summary; Introduction to Day 2***	
8:45 am	***Case Study-Tivoli Apartment Fire- July 2015***	**Jason Herr*man*** – *Florida State Fire Marshal's Office* ***Tim Ippolito*** – *Seminole County Fire Marshal's Office* ***Pete Schwab*** – Wayne Automatic Fire Sprinklers Inc.
9:15 am	***Return to Break-Out Sessions***	
9:15 am	***Breakout Session A: Regulatory and Response Challenge (Continued)***	
9:15 am	***Breakout Session B: Design and Construction Challenge (Continued)***	
12:30 pm	Grab and Go Lunch (Working Lunch) – Break-Out Groups (Continued)	
2:00 pm	***Break-Out Group Reports*** – ***What are the Ways Forward?***	Each break-out group has 15 minutes to report the results of the discussions and recommendations from Days 1 and 2.
2:30 pm	**Next Steps, Concluding Remarks, and Comments from Participants**	
2:30 pm	Adjourn Day Two	

Appendix E. Workshop Presentations

E-1 NFPA-Robert Solomon

Special Welcome- Reedy Creek Improvement District

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Agenda: Life Safety Only Sprinkler Systems (Day One)

Welcome and Introductions

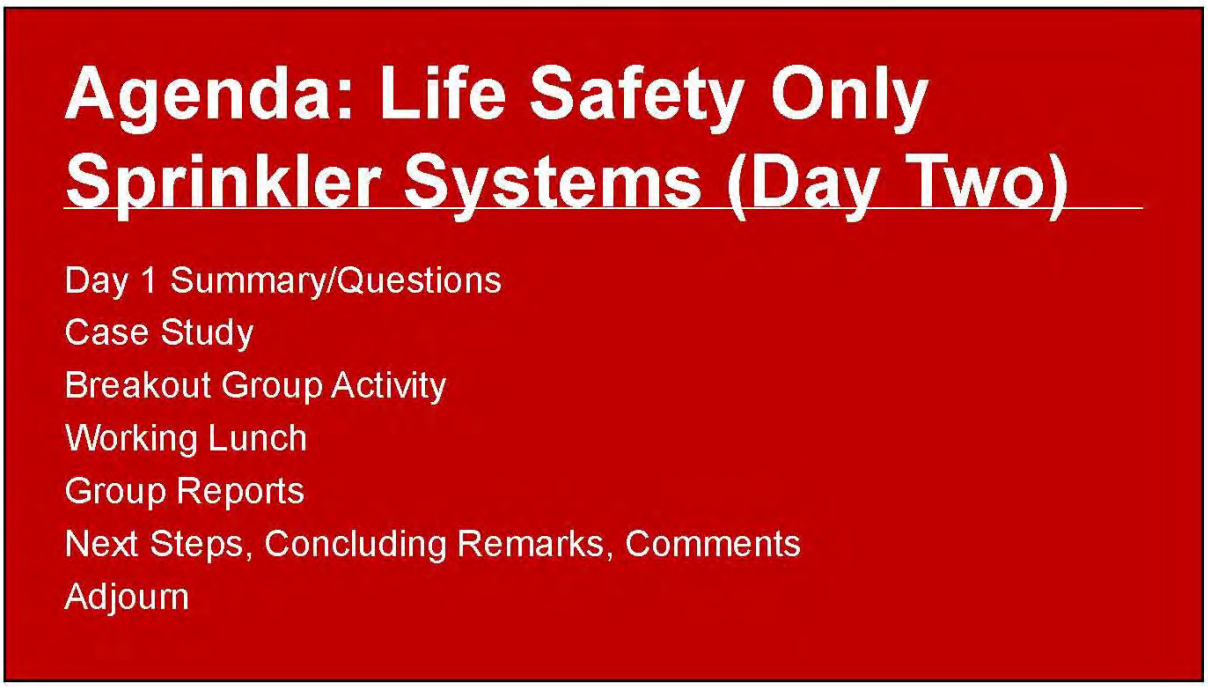
Genesis of NFPA 13D and NFPA 13R-Then and Now

NFPA 13R Systems Panel 1: Who Has them? How well do they work? What if we don't have them?

Lunch

NFPA 13R Systems Panel 2: Building Design; Construction Techniques; First Responders. How Are We Connecting?


Agenda: Life Safety Only Sprinkler Systems (Day One)
Break Out Session Framing (Or-Putting the "Work" in Workshop)
Breakout Group Activity (You have Been Preassigned)
Group Highlights/Wrap Up
Adjourn
Reception


Agenda: Life Safety Only Sprinkler Systems (Day Two)
Day 1 Summary/Questions
Case Study
Breakout Group Activity
Working Lunch
Group Reports
Next Steps, Concluding Remarks, Comments
Adjourn

Genesis of NFPA 13D and NFPA 13R

Then and Now

What if??

- Residential Fire Problem
- Technology Advances
- Fast Response Sprinklers
- State Models
- NFPA 13D/NFPA 13R
- Scope Creep

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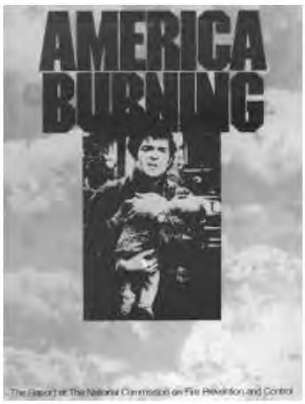
Genesis of NFPA 13D and NFPA 13R

Then and Now



U.S. HOME STRUCTURE FIRES FACT SHEET

U.S. fire departments responded to an estimated average of 357,000 home structure[1] fires per year during 2009-2013. These fires caused an annual average of

- 2,470 civilian fire deaths,
- 12,890 civilian fire injuries, and
- $6.9 billion in direct damage.

- 92% of all structure fire deaths resulted from home fires.
- On average, seven people died in U.S. home fires per day.

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Technology

Detection Perfection- Circa 1963

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Fast Response Sprinkler Technology

Some Really New Stuff

What	Who/When
"Sensitiveness" Test	Factory Mutual Fire Insurance-1884
Duraspeed	Grinnell Company-1935
Faster is Better	NFPA 13 Subcommittee on Fire Research-1966
QR Design-Feasible QR Design-Valuable to LH AND Life Safety Design Fires	NFPA 13 Quick Response Subcommittee-1971
Life Hazard Reduction (LHR) Sprinkler	UL-1973/1974

Old Challenge-New Standards

You Want To Do What?

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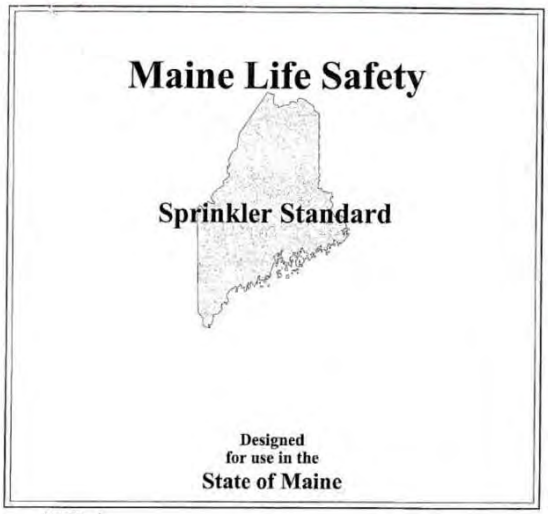
11

Old Challenge-New Standards



Department of Insurance

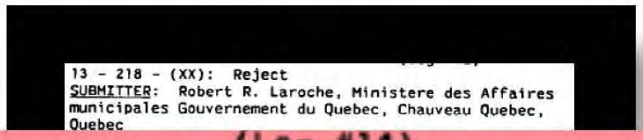
State Fire Marshal:
Chapter 4A-45

Minimum Standards For Light Hazard Sprinkler Systems

12

NFPA 13R Development: 1987-1989

- Small buildings
- Residential only; or
- Any light hazard


13 - 218 - (XX): Reject
SUBMITTER: Robert R. Laroche, Ministere des Affaires municipales Gouvernement du Quebec, Chauveau Quebec, Quebec

(Log #14)

13 - 219 - (Entire Standard): Accept in Principle
SUBMITTER: Harry Shaw, Operation Life Safety
RECOMMENDATION: Develop new standard or add new text as follows:

NFPA 13R Development: 1987-1989 Concept

- NFPA 13D > **NFPA X** < NFPA 13
- Limit to Multi-Family
- Limit to 3 stories
- Implementation of Florida Standard delayed

My real concern is within the next two to five years I expect thousands of communities will undertake residential sprinkler programs with the interest of life safety. Can we ask them to wait?

NFPA 13R Development: 1987-1989 Concept

- NFPA 13D > **NFPA X** < NFPA 13
- Limit to Multi-Family (apartments, hotels, dormitories)
- Limit to ~~3~~ 4 stories
- 4 habitable stories or 50 feet above grade
  - Is a basement a story?
  - What is a story?
  - Story below ground level in front-and above ground level in rear

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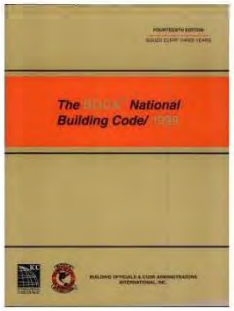
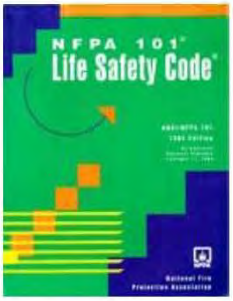
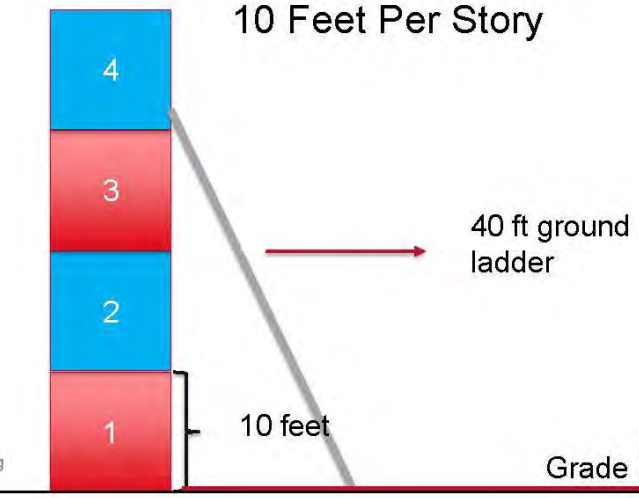
NFPA 13R Development: 1987-1989 Concept





nfpa.org 16

What Did 4 Stories Mean to the TC in 1988?

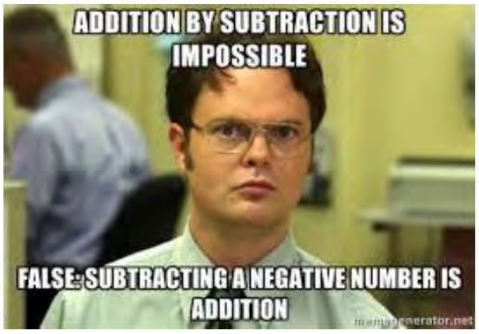


nfpa.org

17

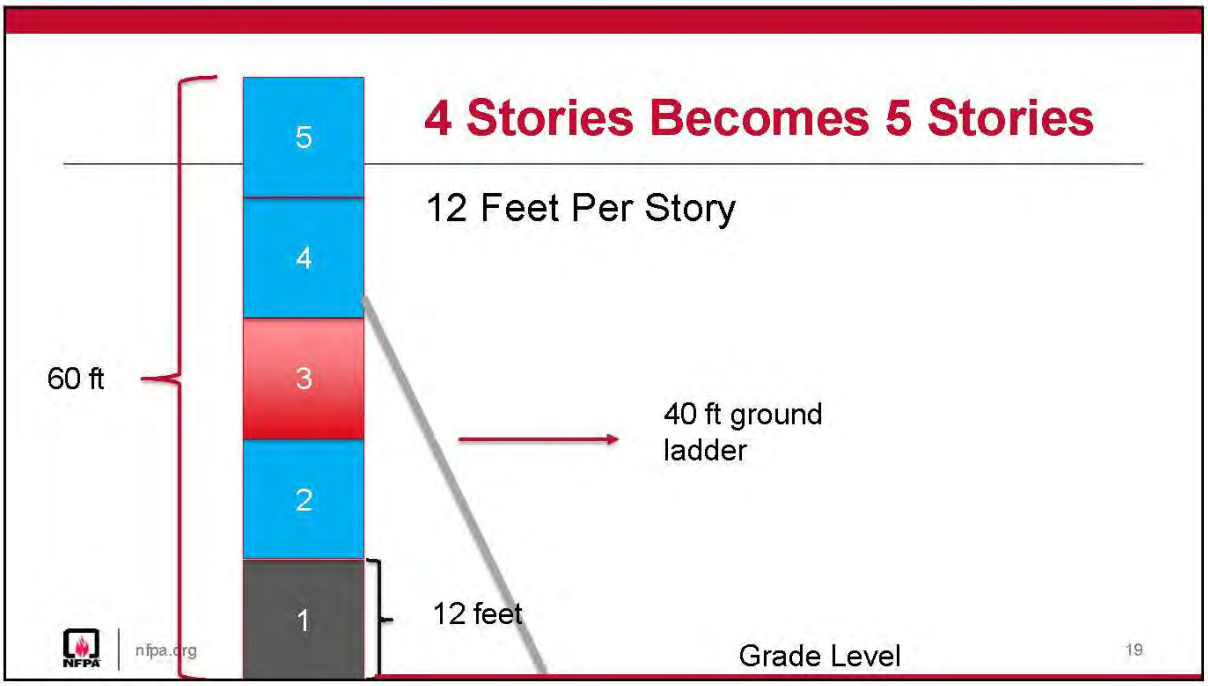
NFPA 13R Development: 1987-1989

Economics



nfpa.org

18


4 Stories Becomes 5 Stories
12 Feet Per Story
5
4
3
2
1
60 ft
40 ft ground ladder
12 feet
Grade Level
nfpa.org
19


4 Stories Becomes 5 Stories
nfpa.org
20

Dimensional Becomes Engineered

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Legacy Becomes Synthetic

nfpa.org

22

Measuring Success

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Measuring Success

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Measuring Success

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25

Measuring Success

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DAVID PATERSON

4 dead in New York group home fire

March 21, 2009

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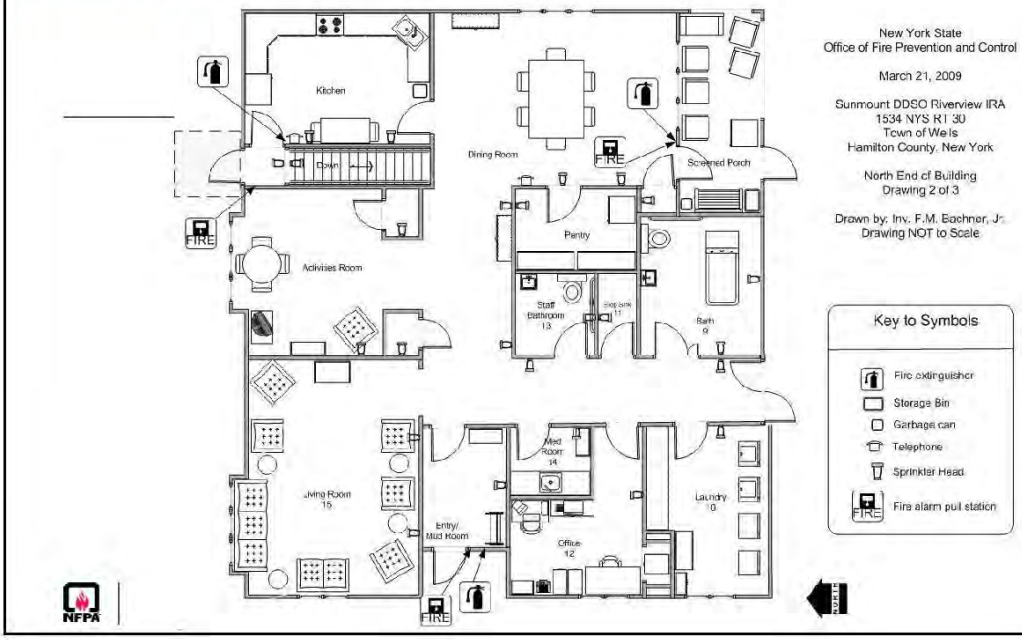
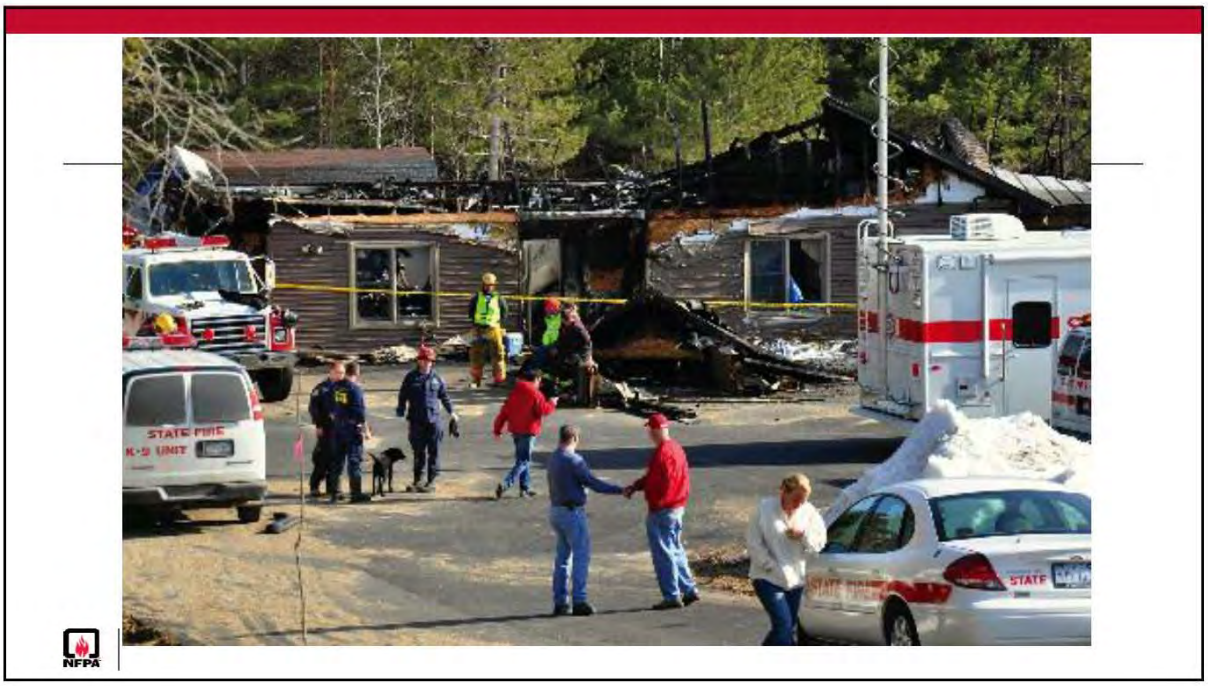
Four people were killed early Saturday after a fire broke out at a state-run group home for mentally disabled residents in upstate New York, the governor's office said.

The fire started at about 5:30 a.m. at the facility in Wells, New York, about 70 miles north of the state capital of Albany, where nine residents lived, and two staffers were on duty at the time of the fire.

Two victims died at the site of the fire and two died during hospitalization, according to a statement from New York Gov. David Paterson's office.

A fire killed four people at a state-run group home for the mentally disabled in Wells, New York.





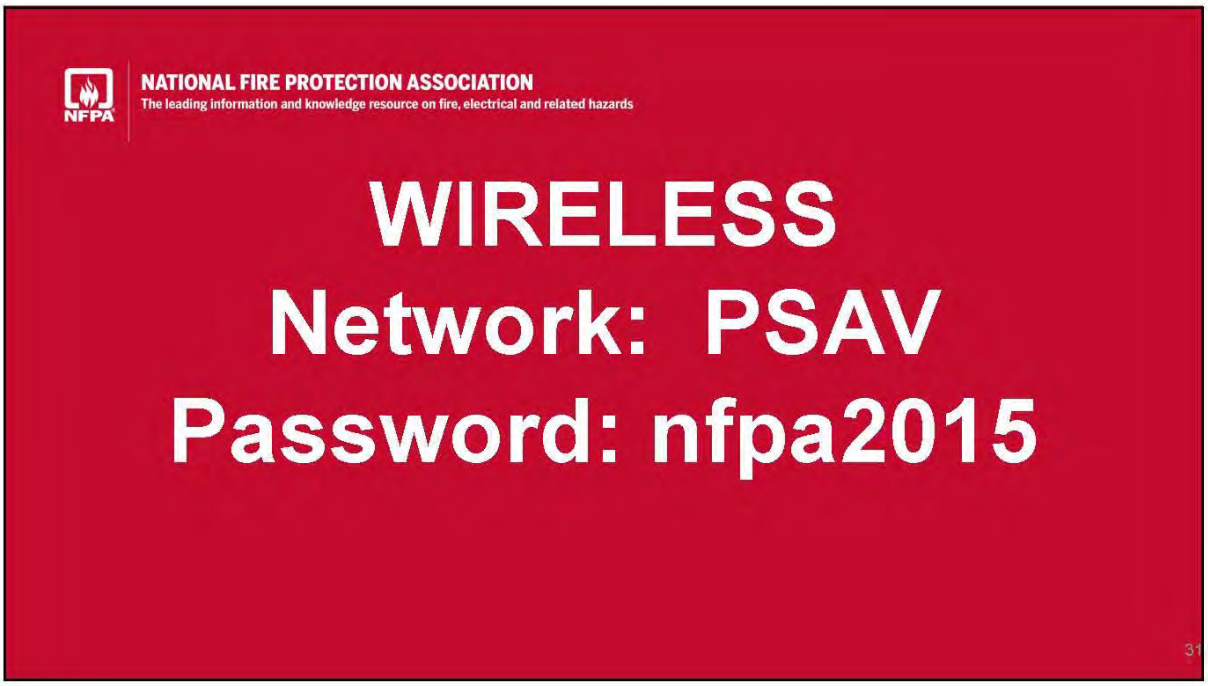
NFPA

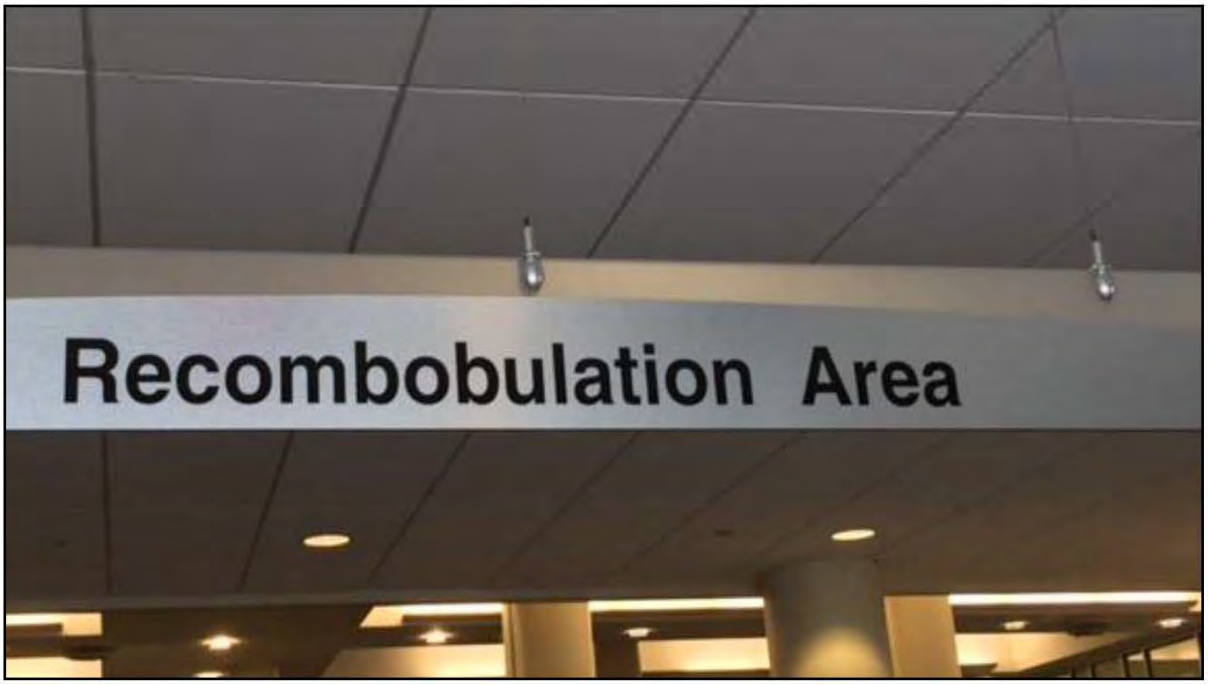
NFPA

NATIONAL FIRE PROTECTION ASSOCIATION

The leading information and knowledge resource on fire, electrical and related hazards

Thank You


NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards
WIRELESS
Network: PSAV
Password: nfpa2015


Recombobulation Area

Appendix E-2

UL-KERRY BELL

Evolution of Residential Sprinklers and Associated Fire Risks

Life Safety Sprinkler Systems Challenge Workshop

15 December 2015

Kerry M. Bell, P.E.
Corporate Fellow &
Principal Engineer
UL LLC

Presentation Overview

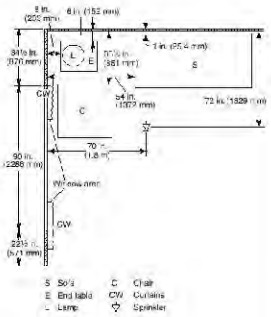
- Residential Sprinklers – Historical Perspective
  - Early years – Research & Development of Standards
  - Transition years -1980's
  - 1990's to Present
- Evolution in fire risks and challenges

2

Residential Sprinklers – Historical Perspective

Early Years

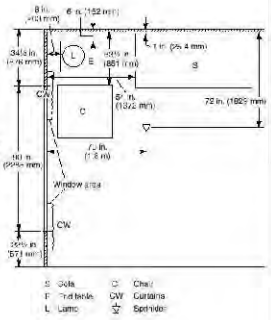
- 1970's – The United States Fire Administration (USFA) provided funding for research to develop a low cost sprinkler system for use in single family dwellings focused on life safety rather than property protection.
- With funding from the USFA, FM conducted series of full-scale fire tests in residential structures located in Los Angeles which served as a reference point for the development of the fire test protocol eventually published in UL's Standard for Residential Sprinklers, UL 1626.



Residential Sprinklers – Historical Perspective

Early Years

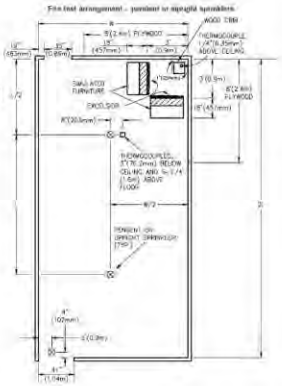
- Key Criteria Established for Tenability during Egress:
  - Requirements at eye level [5.25 ft. (1.6 m) above floor]:
    - Maximum gas temperature of 200 ºF (93 ºC)
    - Maximum carbon monoxide concentration of 1500 ppm
  - Maximum ceiling temperature of 500 ºF (260 ºC)
- Minimize water demand for the sprinkler system



Residential Sprinklers – Historical Perspective

Early Years (Cont.)

- **1979-1980** – UL works with the sprinkler community to establish comprehensive performance requirements for residential sprinklers.
- **October 1980** – First version of UL 1626 (Outline of Investigation) was developed which included a fire test protocol using simulated furniture located in the corner of a room with combustible wall surfaces. (Fire test scenario found to be the most challenging during the Los Angeles full scale fire test series).



Residential Sprinklers – Historical Perspective

Early Years (Cont.)

- **1980** - NFPA 13D was approved requiring the use of listed residential sprinklers for systems in one- and two-family dwellings and mobile homes.
- **1981** – UL promulgates first Listing for a residential sprinkler, Grinnell Model F954 at 18/13 gpm flow and 41/22 psig pressure requirements for one/two sprinkler design criteria based upon a 12 ft. by 12 ft spacing.

Residential Sprinklers – Historical Perspective

Transition Years -1980's

- **1982** – Flush pendent sprinkler listed for 16 by 16 ft. (4.9 x 4.9 m) coverage area at 17 gpm (62 Lpm) at 20 psi (1.4 bar). Two manufacturers.
- **1983** – Flush horizontal sidewall sprinkler listed for 14 by 14 ft. (4.3 x 4.3 m) coverage area at 21 gpm (80 Lpm) at 14 psi (0.95 bar). Two manufacturers.
- **1985 –** NFPA 13 was revised to permit the use of residential sprinklers in dwelling units
- **1989** – Flush pendent sprinkler listed for 16 by 16 ft. (4.9 x 4.9 m) coverage area at 12 gpm (45 Lpm) at 8 psi (0.54 bar). Concealed pendent sprinkler listed for 14 by 14 ft. (4.3 x 4.3 m) coverage area at 17 gpm (62 Lpm) at 10 psi (0.68 bar).Six manufacturers.
- **1989** – NFPA 13R was approved

Residential Sprinklers – Historical Perspective

1990's to Present

- **1990's** – Sprinkler industry develops new residential sprinkler products in a broad range of aesthetically pleasing styles demonstrating compliance with UL 1626 requirements with rated flows yielding discharge densities less than 0.05 gpm/ft^2.
- **Late 1990's to 2001** – UL and FM undertake research to recalibrate the residential fire test protocol and reduce observed fire test variability

Residential Sprinklers – Historical Perspective

1990's to Present (cont.)

- **2000 - 2002** – The joint UL/FM research effort led to:
- Adoption of revisions to the ANSI/UL 1626 (Standard for Residential Sprinklers for Fire Protection Service) fire test protocol that enhanced test repeatability and relevancy to challenging fire scenarios anticipated in residential occupancies.
- Revisions to NFPA 13D and 13R requiring a minimum discharge density of 0.05 gpm/ft^2 which maintained an economically viable residential sprinkler protection scheme that helped contribute to a dramatic growth in the usage of residential sprinkler protection.

Residential Sprinklers – Historical Perspective

Today

- Residential sprinkler usage continues to increase in the United States and Canada.
- Residential sprinkler usage is gaining traction in other geographic regions with substantial use in the following regions:
  - Scandinavian Countries (Sweden, Norway, Denmark and Finland)
  - United Kingdom and Ireland
  - Australia and New Zealand

Evolution of Fire Risks and Challenges

UL's Firefighter Safety Research Institute (FSRI) is dedicated to increasing firefighter knowledge to reduce injuries and deaths in the fire service and in the communities they serve. Working in partnership with the fire service, research departments and agencies, FSRI conducts and disseminates cutting-edge research and training programs that focus on the changing dynamics of residential, commercial and industrial fires, and the impact they have on the fire service tactics and strategies.

Overview of UL Firefighter Research

2006 - Structural Stability of Engineered Lumber under Fire Conditions
2007 - Firefighter Exposure to Smoke Particulates
2008 - Impact of Horizontal Ventilation
2009 - Firefighter Safety and Photovoltaic Systems
2009 - Basement Fires (NIST ARRA)
2010 - Impact of Vertical Ventilation
2010 - Governors Island Testing with FDNY and NIST
2011 - Exterior Fire Spread and Attics Fires
2012 - Study of Positive Pressure Ventilation in Homes
2013 - Impact of Fire Attack Utilizing Interior and Exterior Streams
2013 - Cardiovascular and Carcinogenic Risks of Modern Firefighting (IFSI)
2014 - Study of the Fire Service Training Environment: Safety, Fidelity, and Exposure


Structural Stability of Engineered Lumber
Firefighter Exposure to Smoke Particulates
Impact of Horizontal Ventilation
Firefighter Safety and Photovoltaic Systems
Governors Island Testing with FDNY and NIST
Study of Positive Pressure Ventilation in Homes
Impact of Vertical Ventilation
Exterior Fire Spread and Attics Fires
13


General Test Arrangement for Conducting for Comparing Modern vs. Legacy Floor/Roof Assemblies
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Assembly	Structural Element	Type	Ceiling	Finish Rating (min : sec)	Protective Membrane Breach	Allowable Deflection L/240 = ¾" (min : sec)	Fire Fighter Breach (min : sec)
1	2x10 Joist Floor	Legacy	None	0:45	0:00	3:30	18:35
2	Wood I Joist Floor	Lightweight	None	0:30	0:00	3:15	6:00
8	2x10 Joist Floor	Legacy	Lath and plaster	74:00[1]	74[1]	75:45	79*
3	2x10 Joist Floor	Legacy	Regular gypsum wallboard	15:30	23:30	35:30	44:40
4	Wood I Joist Floor	Lightweight	Regular gypsum wallboard	7:45	17:45	3:30	26:43
5	Metal Gusset Truss Floor	Lightweight	Regular gypsum wallboard	10:45	16:30	20:45	29*
6	Finger (Glued) Joint Truss Floor	Lightweight	Regular gypsum wallboard	12:15	16:00	24:00	26:30
7	2x6 Joist & Rafter Roof w/ 2/12 pitch	Legacy	Regular gypsum wallboard	15:15	15:45	[3]	38[2]
9	Roof Metal Gusset Truss w/ Shingles and 2/12 pitch	Lightweight	Regular gypsum wallboard	13:45	13:45	[3]	23:10

* - Denotes approximate time

1 - Denotes total failure of ceiling - plaster & lath had deflected down to & was supported by TC's prior to event

2 - Kneeling fire fighter fell over & flaming impacting on

3 - Denotes not applicable to roof structures

Modern Unprotected 12" Composite I Floor Joist - Ceiling Assembly # 2 Pre- and Post-Test Photos Collapse Time = 6:03 Large Percentage of Floor is Detached from Test Frame

Modern 14" Gusset Plated Floor Truss - Gypsum Ceiling Assembly # 5 Post Photos Collapse Time = 29:00

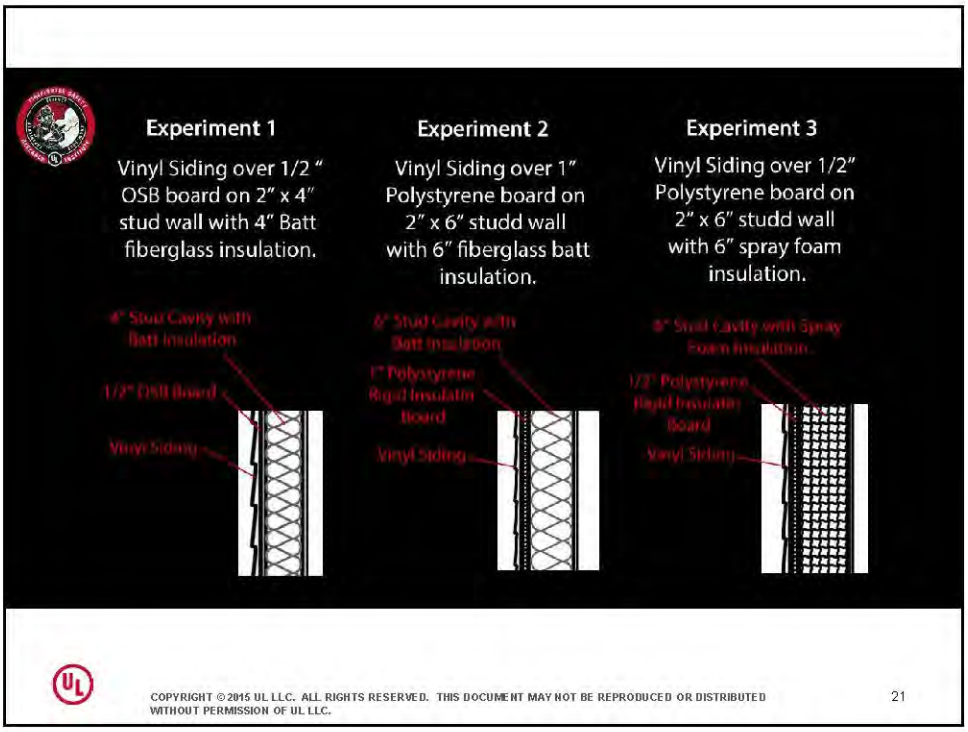
Modern 14" Finger (Glued) Jointed Floor Truss w/ Gypsum Ceiling Assembly #6 Post Photos Collapse Time 26:30

Legacy vs. Modern Furnishings Test

COMBUSTIBLE ELEMENT DESCRIPTION	Legacy Room	Modern RoomTest 10
Wall Material	½ inch Painted Cement Board	½ inch Painted Gypsum Board
Floor Covering	Unfinished Hardwood	Carpet and Padding
Sofa	Cotton Covered w/ Cotton Batting	Microfiber Covered Polyurethane Foam
Coffee Table	Solid Wood	Engineered Wood
End Table(s)	Two w/ Lamp Having Polyester Shade	One w/ Lamp Having Polyester Shade
Toys	Wood Toy Bin w/ Multiple Wood Toys	Plastic Toy Bin w/ Plastic Tub and 4 Stuffed Toys
Curtains	Cotton w/ Metal Rod	Polyester w/ Metal Rod
Additional Items	Miscellaneous Accessories	Miscellaneous Accessories
Ignition Source	Lit Candle Next to Sofa	Lit Candle Next to Sofa

19

20


Experiment 1
Vinyl Siding over 1/2 " OSB board on 2" x 4" stud wall with 4" Batt fiberglass insulation.
Experiment 2
Vinyl Siding over 1" Polystyrene board on 2" x 6" studd wall with 6" fiberglass batt insulation.
Experiment 3
Vinyl Siding over 1/2" Polystyrene board on 2" x 6" studd wall with 6" spray foam insulation.
4" Stud Cavity with Batt Insulation
1/2" OSB Board
Vinyl Siding
6" Stud Cavity with Batt Insulation
1" Polystyrene Rigid Insulation Board
Vinyl Siding
6" Stud Cavity with Spray Foam Insulation
1/2" Polystyrene Rigid Insulation Board
Vinyl Siding
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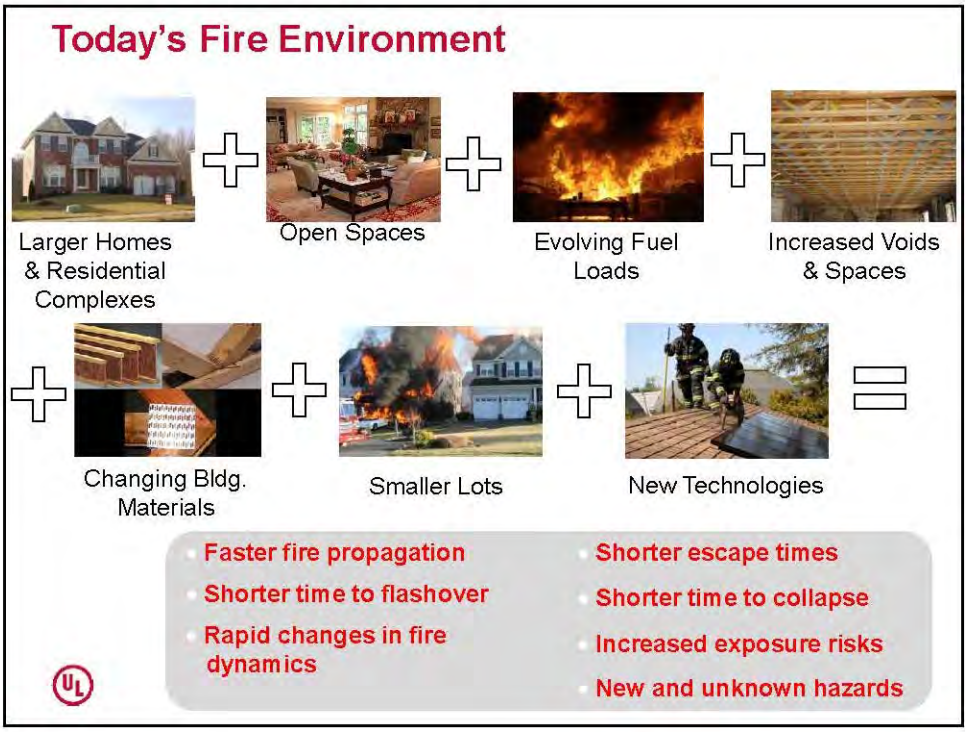
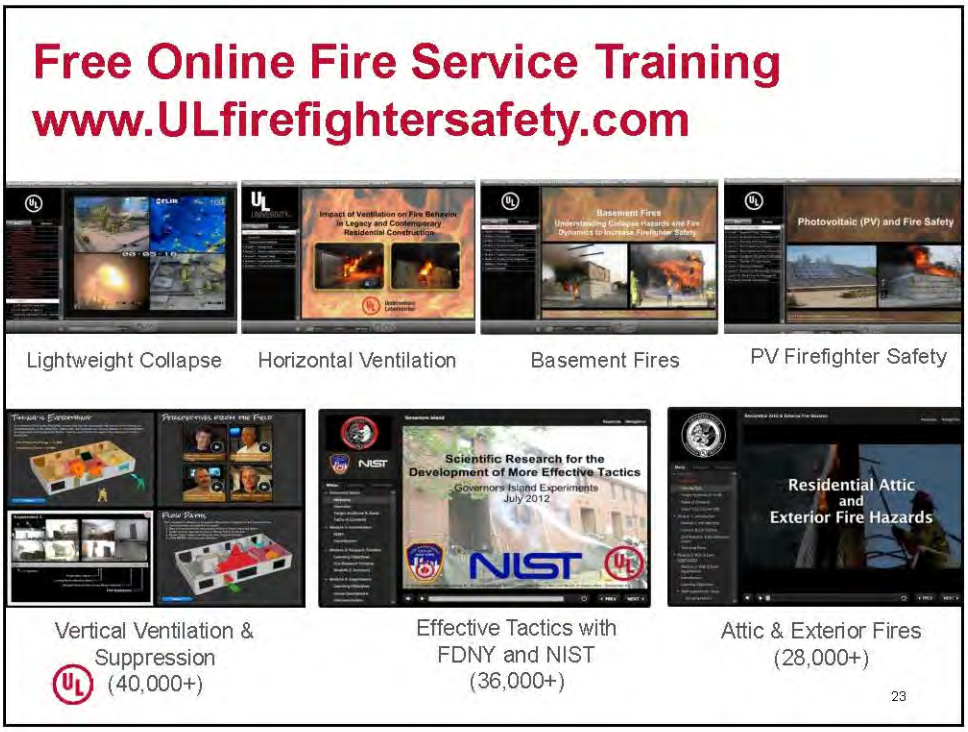
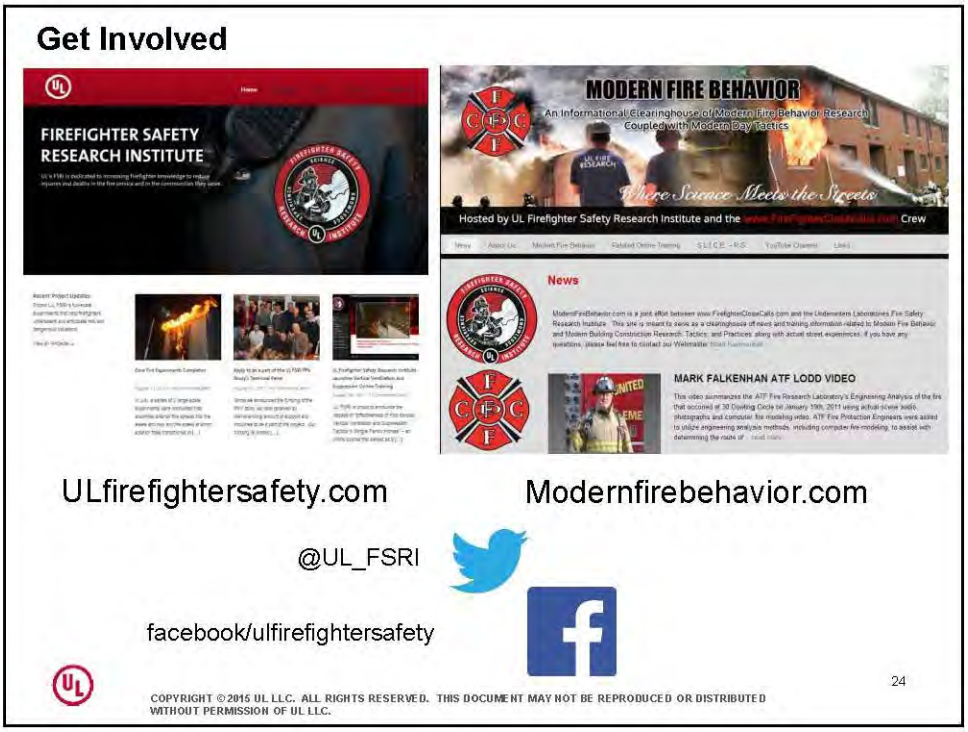
21


Today's Fire Environment
Larger Homes & Residential Complexes
Open Spaces
Evolving Fuel Loads
Increased Voids & Spaces
Changing Bldg. Materials
Smaller Lots
New Technologies
Faster fire propagation
Shorter time to flashover
Rapid changes in fire dynamics
Shorter escape times
Shorter time to collapse
Increased exposure risks
New and unknown hazards


Free Online Fire Service Training
www.ULfirefightersafety.com
Lightweight Collapse
Horizontal Ventilation
Basement Fires
PV Firefighter Safety
Vertical Ventilation & Suppression (40,000+)
Scientific Research for the Development of More Effective Tactics
Governors Island Experiments
July 2012
NIST
Effective Tactics with FDNY and NIST (36,000+)
Residential Attic and Exterior Fire Hazards
Attic & Exterior Fires (28,000+)
23


Get Involved
FIREFIGHTER SAFETY RESEARCH INSTITUTE
MODERN FIRE BEHAVIOR
An Informational Clearinghouse of Modern Fire Behavior Research Coupled with Modern Day Tactics
Where Science Meets the Streets
Hosted by UL Firefighter Safety Research Institute and the Crew
News
MARK FALKENHAN ATF LODD VIDEO
ULfirefightersafety.com
Modernfirebehavior.com
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QUESTIONS and DISCUSSION

Contact Information:

Steve Kerber, Director, UL Firefighter Safety Research Institute

Stephen.kerber@ul.com

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Summary

- Where installed within areas of a residential structure, the protection afforded by residential sprinklers has been validated through extensive research and decades of successful performance.
- Residential sprinkler protection use is expanding to other geographic regions around the globe.
- The fire challenges associated with building structures are continuously evolving and are more challenging today compared to legacy structures.

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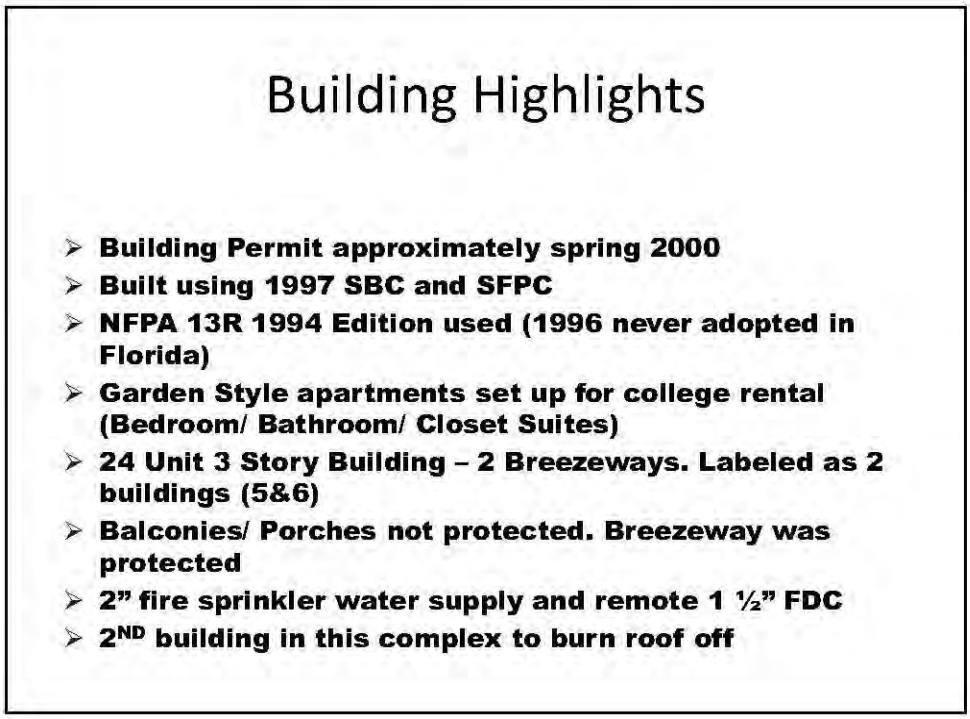
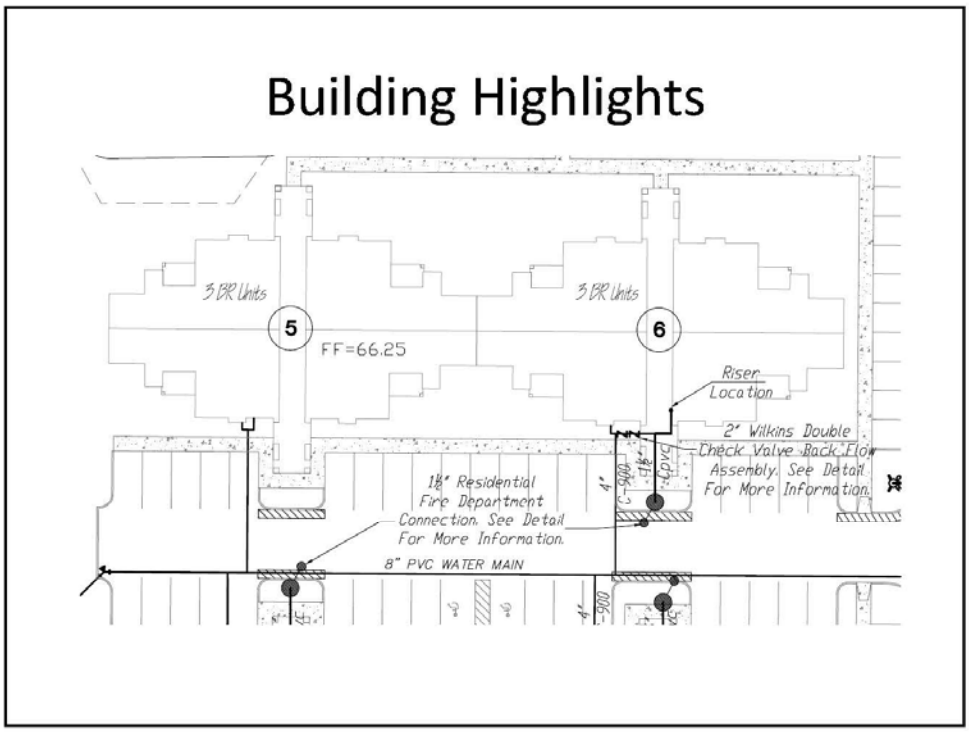
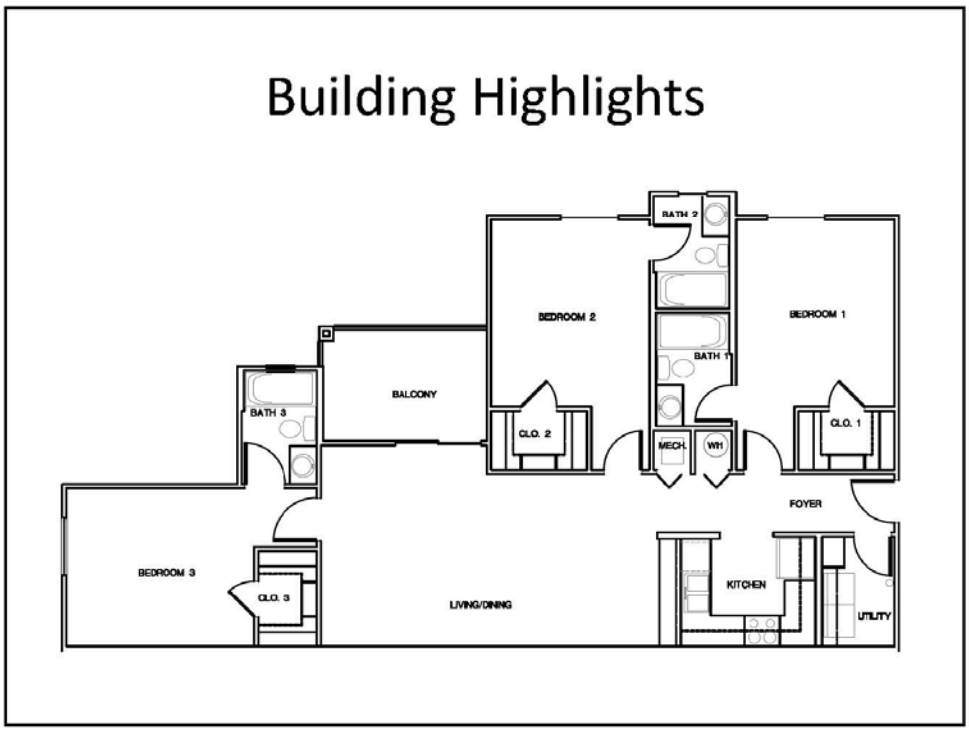
Appendix E-3.

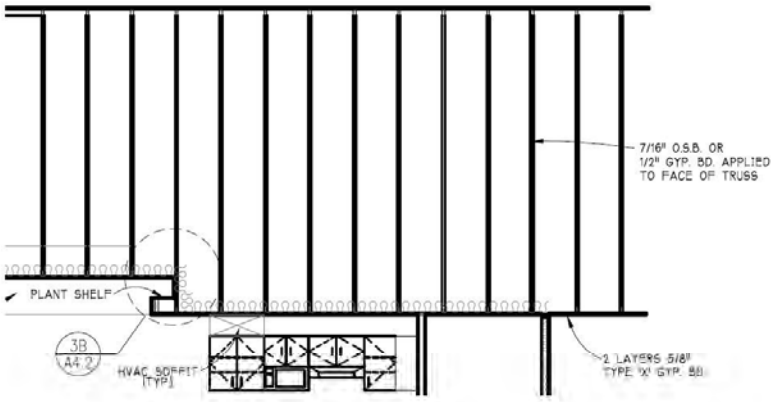
Tivoli Apartment Fire




Building Highlights
3 BR Units
5
FF=66.25
3 BR Units
6
Riser Location
2" Wilkins Double Check Valve Back Flow Assembly. See Detail For More Information.
1½" Residential Fire Department Connection. See Detail For More Information.
8" PVC WATER MAIN

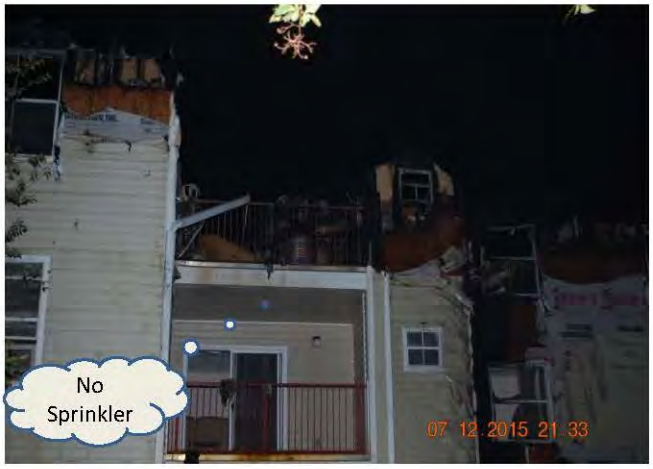

Building Highlights
BATH 2
BEDROOM 2
BEDROOM 1
BATH 1
BALCONY
BATH 3
CLO. 2
CLO. 1
MECH.
WH
FOYER
BEDROOM 3
CLO. 3
LIVING/DINING
KITCHEN
UTILITY

Building Highlights



Point of Origin

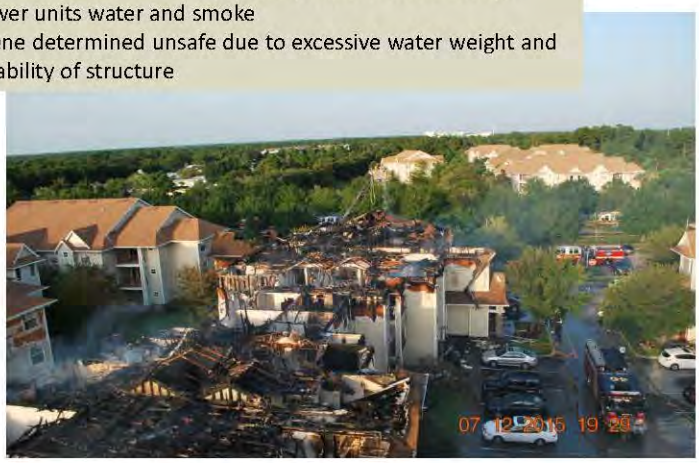
Point of Origin



Origin and Cause Investigation

Origin and Cause Investigation

- Top floor units lost to fire, smoke, water & heat damage
- Lower units water and smoke
- Scene determined unsafe due to excessive water weight and instability of structure



Apt 302

Soot stains absent

Undamaged chair

Suspected Forman Grill

Interior wood framing unburned

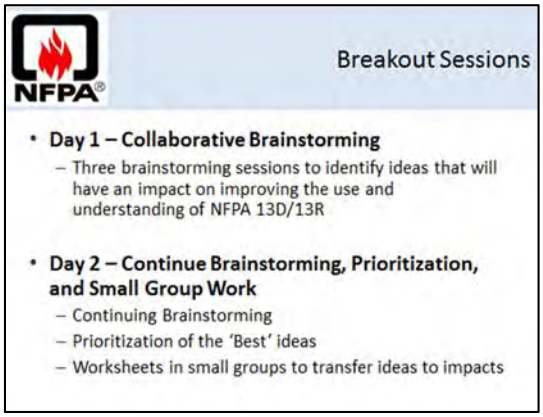
Tivoli Apartment Fire

Unoccupied apartment, ATF
Unable to gain access
Three tenants were interviewed along with several witnesses
No one was on the porch prior to the fire
Report of fireworks in the area

Questions?

Appendix E.

Facilitation Process



Appendix F. Workshop White Paper

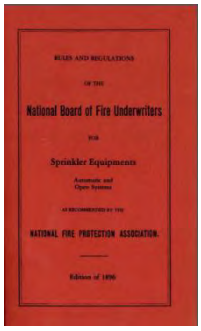
EVALUATING THE EFFECTIVENESS AND USE OF "LIFE SAFETY ONLY" SPRINKLER SYSTEMS

Fire sprinklers have been and continue to be one of the most effective life and property protection elements. According to NFPA statistics buildings protected with sprinkler systems perform better during a fire event. In 2007–2011, the death rate per 1000 fires was 85 percent lower in residential properties with wet pipe sprinklers than in residential occupancies with no automatic extinguishing equipment (82 percent reduction for homes). Likewise, the average property loss per fire was reduced as well: 56 percent reduction in wet pipe–sprinklered residential occupancies compared with those with no automatic extinguishing equipment (68 percent reduction in average home fire property damage).

Although expanded use of NFPA 13D and NFPA 13R in the last 20 years has been beneficial, on occasion, a fire occurs that results in extensive property damage but no life loss or injury. That can leave sprinkler proponents, AHJs, and insurance interests scrambling to explain how such an outcome is a sprinkler "success." The background and the challenges, along with examples, of that dilemma are discussed in this briefing paper, which has been developed by NFPA staff. Extensive publicity following the Edgewater Fire in New Jersey in January 2015 has compelled NFPA to move forward with a broad dialog on "life safety only" sprinkler systems.

BACKGROUND

Since the first automatic sprinkler systems started to appear in buildings in North America in the 1870s, developing a set of standardized rules to select, design, install, and maintain the systems has been a main consideration of fire protection mitigation strategies for buildings. NFPA 13, *Standard for the Installation of Sprinkler Systems*, has served that role since 1896. NFPA 13's younger siblings, NFPA 13D and NFPA 13R, emerged on the scene in 1975 and 1989, respectively, to help address the fire safety problem specifically in the residential environment. NFPA's initiative to develop those standards can be traced directly to the *America Burning* report issued by the National Commission on Fire Prevention and Control on May 4, 1973. Recommendation 75 taken from Chapter 16 of the report states:



> **75**. The Commission recommends that the proposed U.S. Fire Administration support the development of the necessary technology for improved automatic extinguishing systems that would find ready acceptance by Americans in all kinds of dwelling units.

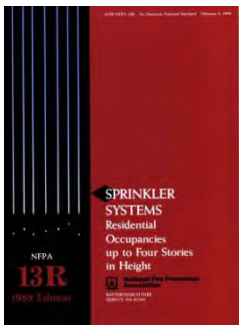
It was this recommendation that prompted the Technical Committee on Automatic Sprinklers to appoint a subcommittee in May 1973 to prepare the *Standard on the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes*. The new standard was submitted and adopted at the NFPA Annual Meeting in Chicago, Illinois, May 12–16, 1975. The approach taken to address the portion of the *America Burning* report that would help with the "acceptance" part of the recommendation related to the areas that were to be protected with automatic sprinklers. Just as it still does in 2015, the 1975 standard permitted sprinklers to be omitted in certain spaces of the home. Those spaces related to the area of origin and being where the incidence of life loss from fires that started in such areas was low. This approach lessened the number of sprinklers, the quantity of pipe and associated material, and labor costs, thus perhaps making the systems more palatable (cost-wise) to the homeowner. The

result, however, was (and still is in 2015) coverage of what amounts to about 85 percent of the home.

The development of the residential sprinkler in 1979 changed the way in which NFPA 13D systems were designed and installed. System design required a two-sprinkler operation, use of listed residential sprinklers, and a 10-minute water supply and continued to allow certain areas to be unprotected. While the standard was readily available, very few jurisdictions had rules that required NFPA 13D systems in homes. Progressive jurisdictions, among them Cobb County in Georgia did see the benefit of these systems in newly constructed homes, and a handful of residential sprinkler ordinances began to come along.

The residential fire problem continued to be (and still is) a central focus of fire protection and fire safety experts, and that problem is not exclusive to one- and two-family dwellings. Some jurisdictions started to test the scalability of NFPA 13D systems beyond its intended scope. One of those efforts was done at the state level in 1987 and was known as the Florida Affordable Fire Sprinkler Law. In essence, the provision combined certain concepts from NFPA 13 and NFPA 13D and allowed light hazard occupancies, with some emphasis directed at the residential setting, up to three stories in height to be protected with this hybrid system. The fundamental concepts of the law were well intentioned but left some gaps and holes in terms of how the systems were to be designed. Another similar statewide approach appeared in the northeastern part of the United States. The "State of Maine Standard for the Design and Installation of Life-Safety Sprinkler Systems" was first issued as a design guide by the state fire marshal in 1984 and was legally approved as a standard by the Maine Attorney General in 1988.

The Florida and Maine laws prompted the Technical Committee on Automatic Sprinklers to draft language for a second document to address the low rise residential environment. NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to Four Stories in Height*, was approved by the NFPA membership in November 1988. Like NFPA 13D, NFPA 13R allowed sprinklers to be omitted from certain areas where the incidence of life loss from fires in dwelling units is low.



During the deliberation and development of NFPA 13R, the committee did acknowledge that, as new residential construction came on line in the coming years that utilized NFPA 13R systems, *it was inevitable that there would be certain fires where the full life safety benefit of the system would not be*

100 percent effective, and fires with significant property damage or even fatalities would occur. This equally applied to NFPA 13D systems. It is important to keep the perspective on these fires — how often and how severe — in comparison to those fires where the respective standards performed as intended and not only saved lives but also minimized property damage. Likewise, offering no automatic sprinkler protection whatsoever usually results in extensive property loss, as well as a greater potential for injury and death to both the occupants and the first responders when a fire does occur.

INTRODUCTION

Since the first editions of NFPA 13D, *Standard for the Installation of Sprinkler Systems in One-and Two-Family Dwellings*, in 1975, and NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*, in 1989, myriad sprinkler system installations have saved countless lives and prevented many fire-related injuries to both building occupants and first responders. In addition, given the large coverage areas that these systems are designed to protect, property damage has been reduced.

In spite of those achievements, NFPA has been made aware, particularly in the last decade, of a measurable number of fires involving NFPA 13R systems with the "success factor" metric being no loss of life or serious injuries but where extensive property damage occurred. Similar experience has been found with NFPA 13D systems. [There is, however, one known case of a fire involving an NFPA 13D system that had multiple (four) fatalities; see **Annex B** for additional details]. In some of these fires, the extent of property damage was total and complete loss of the building.

While those experiences should in no way imply NFPA 13D and NFPA 13R systems are not useful, effective, or valuable in helping to manage the fire problem in the residential environment, the image of a burned-out shell of an apartment building or a structure with no roof remaining might cause the occupants, first responders, and insurance interests to ask "What is the point of such systems if this is the result?" While such outcomes are the exception and not the norm, they are the ones nonetheless that get local (and, on occasion, national) attention in the media. In general, our approach is not to look at or study the successes as much as to focus on the outcomes that are less than optimal. The number of planes that do

not crash, the number of bridges that do not collapse, or the number of first responders who are not injured on the fire ground are not studied as much as the exceptions to those scenarios.

NFPA statistics continue to indicate that buildings protected with sprinkler systems perform better during a fire event. In 2007–2011, the death rate per 1000 fires was 85 percent lower in residential properties with wet pipe sprinklers than in residential occupancies with no automatic extinguishing equipment (82 percent reduction for homes). Likewise, the average property loss per fire was reduced as well: 56 percent reduction in wet pipe–sprinklered residential occupancies compared with those with no automatic extinguishing equipment (68 percent reduction in average home fire property damage). That 56 percent reduction is not insignificant, and it would be expected that property insurance carriers are taking the risk factor into account compared with a similarly insured property protected per NFPA 13.

SYSTEM DESIGN AND INSTALLATION PHILOSOPHY

Automatic sprinkler systems that are designed primarily to achieve a life safety goal and objective in a residential property actually have an easier task compared with those systems that are designed to achieve a property protection goal. Systems designed with only the life safety objective, and hence the associated design options, provide automatic sprinklers in those areas where a very high percentage (88 percent) of fatal fires originate. By omitting sprinklers from certain areas, the material and design costs are lowered and the system still provides a high (but not absolute) level of property protection.

The one feature relating to areas of sprinkler coverage that distinguish NFPA 13D and NFPA 13R systems from NFPA 13 type systems are summarized in Table 1. To the extent feasible, the differences are described in the standards' purpose statements.

NFPA 13

1.2* Purpose.

1.2.1 The purpose of this standard shall be to provide a reasonable degree of protection for life and property from fire through standardization of design, installation, and testing requirements for sprinkler systems, including private fire service mains, based on sound engineering principles, test data, and field experience.

1.2.2 Sprinkler systems and private fire service mains are specialized fire protection systems and shall require knowledgeable and experienced design and installation.

NFPA 13D

1.2* Purpose.

1.2.1 The purpose of this standard shall be to provide a sprinkler system that aids in the detection and control of residential fires and thus provides improved protection against injury and life loss.

1.2.2 A sprinkler system shall be designed and installed in accordance with this standard to prevent flashover (total involvement) in the room of fire origin, where sprinklered, and to improve the chance for occupants to escape or be evacuated.

NFPA 13R

1.2* Purpose.

1.2.1 The purpose of this standard shall be to provide a sprinkler system that aids in the detection and control of residential fires and thus provides improved protection against injury, life loss, and property damage.

1.2.2 A sprinkler system shall be designed and installed in accordance with this standard to prevent flashover (total involvement) in the room of fire origin, where sprinklered, and to improve the chance for occupants to escape or be evacuated.

1.2.3 The layout, calculation, and installation of sprinkler systems installed in accordance with this standard shall only be performed by people knowledgeable and trained in such systems.

As noted, property protection is a main concern within NFPA 13 and to a lesser degree within NFPA 13D and NFPA 13R. In broad-based terms, the life safety performance benefit of a sprinkler system is exceeded when property protection is the main goal such as is found in NFPA 13 designs.

Other factors that distinguish NFPA 13D/NFPA 13R systems from NFPA 13 systems include the following:

1. Water supply configuration
2. Water supply source(s)
3. Water supply durations
4. Calculation procedures
5. Type of sprinklers allowed/required
6. Areas requiring sprinkler coverage

While the first five factors have the potential to influence the performance of the system, the primary challenge facing the ability of the system to control the fire is usually attributable to the sixth factor, the extent of the areas requiring (or not

requiring) sprinkler coverage. Each standard offers a list of spaces or areas that are not required to be protected with sprinklers.

Table 1 summarizes the exemptions.

TABLE 1 NFPA 13D/NFPA 13R Sprinkler Omissions		
AREA/SPACE EXEMPTED	**NFPA 13D**	**NFPA 13R**
Bathrooms ≤55 ft^2	Section 8.3.2	Section 6.6.2
Clothes Closet, linen closet, pantry (<24 ft^2; shortest dimension <3 ft^2; limited/non-combustible construction)	Section 8.3.3	Section 6.6.3
Garage, open attached porch, carport	Section 8.3.4	Section 6.6.5*
Attics and similar unoccupied spaces	Section 8.3.5	Section 6.6.6
Covered unheated projections at entrance/exit	Section 8.3.6	Section 6.6.5
Any porches, balconies, corridors, carports, porte cocheres, and stairs that are open and attached	No aimilar exception	Section 6.5.6
Ceiling pockets	Section 8.3.7	No similar exception
Other storage closets in garages and exterior areas	Section 8.3.8	Section 6.6.7

*NFPA 13R: Section 6.6.5 does not exempt garages from protection.

RECENT ACTIVITY

The outcome of fires in multifamily residential buildings and hotels/motels protected with NFPA 13R systems was raised sporadically as an issue in the late 1990s. As model life safety, building, and fire codes expanded and broadened the use of NFPA 13R systems in a variety of occupancies (hotels, motels, apartments, lodging/rooming, condominiums, residential board and care), the sample size increased, and it would be only a matter of time before the predictions made by the Technical Committee on Automatic Sprinklers in the late 1980s would materialize.

In the January/February 2010 *NFPA Journal* column HEADS UP, entitled "20 + Counting — A look at two decades of NFPA 13R," Russ Fleming of the National Fire Sprinkler Association (NFSA) noted correctly that some of the types of fires raised as a concern during the development of NFPA 13R did on occasion happen.

>> HEADS UP
SPRINKLER + SUPPRESSION SYSTEMS

> The experience with NFPA 13R systems over the past 20 years has been excellent. Although performance statistics are not maintained separately for NFPA 13R systems, the January 2009 NFPA report on sprinkler performance for 2003–2006 showed that the combined performance for the occupancy in which NFPA 13R systems are used most, apartments, was 98 percent, higher than that for the average of all types of structures, including those protected with NFPA 13 systems. Although the allowed omission of sprinklers from certain building areas for purposes of economical system installation has occasionally led to extensive property damage, reports from the field indicate this is a rare event.

While those fires that do lead to extensive property damage are the exception, NFPA had become aware of a series of fires that fell into that category, and many have occurred since 2012. It is because of these types of fires that these questions need asked: *Is it acceptable to have some level of extensive fire damage in some buildings protected with automatic sprinklers and designed to a national standard? And if so, what losses are deemed to be acceptable?*

A set of similar but more difficult questions surround the use of NFPA 13D and NFPA 13R systems where either of the following may occur:

- An occupant fatality
- A firefighter fatality or injury

Annex A provides a recent list of fires dating back to 2012 where extensive property damage occurred in buildings protected with automatic sprinklers designed to NFPA 13R achieved their life safety objective yet resulted in some level of devastating property damage. Annex B offers a separate summary for the March 2009 fire in Wells, New York, where four fatalities occurred in a residential board and care facility protected with NFPA 13D.

During the First Draft meetings of the Life Safety/Building Code Technical Committee on Residential Occupancies in August 2012, NFPA staff initiated a discussion on this subject as well as the recently expanded application of NFPA 13R systems to other types of construction configurations. The technical committee agreed to develop a Committee Input (CI) on the topics to gauge the level of interest or concern with the loss information. The response was underwhelming. No public comments on the CI were received, and there was no further discussion or action on the subject at Second Draft meetings of the committee in June 2013. The issue was raised, however, at the Second Draft meeting of the Correlating Committee on the Building Code in November 2013 and was identified as a future study item.

An Educational Session on the subject was held at NFPA's Conference and Exposition in June 2014. The presenters covered some of these issues and helped to keep the topic in the forefront.

On the code front, both the *International Building Code (IBC)* (2012 edition) and NFPA 13R (2013/2016 edition) now require the installation of a sprinkler on balconies in multifamily residential occupancies where the construction is defined as Type V (wood frame). Fires that originate on balconies is a common theme.

It is also important to look at what else has changed since 1988, when the first edition of NFPA 13R was issued. Expanded use of engineered lumber and lightweight construction in the multifamily residential environment is now the norm. Ongoing studies commenced by Underwriters Laboratories in 2008 indicate that those construction types can fail under fire conditions in approximately half the time (7 to 8 minutes) compared with traditional or dimensional lumber structural systems.

The scope of what NFPA 13R was originally envisioned to protect has also undergone a scope creep. Pedestal construction, in which the original four-story residential use is built on a noncombustible (concrete) base story, is now permitted as long as the total building height does not exceed 60 ft (19.4 m). While the original NFPA 13R concept assumed the height of the top floor would be approximately 30 ft above grade (and within reach of a 40 ft ground ladder carried by most fire departments), current era design puts that top floor at approximately 50 ft above grade and out of reach of most common fire department ground ladders.

This allowance is significant because it relates to the risks posed to first responders and building occupants. Unprotected roof spaces and concealed combustible spaces between floors at higher elevations would be expected to pose exponentially greater fire-fighting challenges.

Alternative construction features and designs such as the "donut hole" and offsite prefab modular construction might also cause new problems. In donut hole construction, annular corridor designs and exit stairs facing the donut hole are used to allow the corridor and stairs to be open to the atmosphere — a set of conditions that NFPA 13R allows the sprinklers to be exempted from. The challenges to NFPA 13R design that modular construction techniques could introduce are as yet unknown but nonetheless need to be included in the conversation.

Related discussion includes the effectiveness of draftstopping in the attic spaces of these multifamily structures. The Florida Building Commission and the University of Florida commissioned a study (U013-01 Final Report – July 10, 2014, *Evaluation of Draftstopping Within Type V Combustible Concealed Attic Spaces*) to look at the issue. Various types of draftstopping and common deficiencies surrounding it are discussed in the report. The report has received national attention and may well be a part of the dialogue and solutions moving forward.

In July 2015, the NFPA Technical Committee on Building Construction introduced a Committee Input (CI) to *NFPA 5000*® to engage and expand the exchange of ideas surrounding this subject. CIs serve as placeholders to allow a topic or subject that has yet to be fully vetted to be published so as to solicit specific public comment on the subject. The text (shown below) places a hard limit of four stories above grade plane when NFPA 13R is used.

7.5.2 Residential Sprinkler Increase.
For buildings classified as residential occupancies provided with an approved, electrically supervised automatic sprinkler system in accordance with NFPA 13R, the allowable number of stories for nonsprinklered buildings shall be permitted to be increased by one story, provided that the number of stories above grade plane does not exceed four.

The committee discussion on this subject also included the following points:

- Limiting the overall area of attics
- Limiting overall area of buildings using NFPA 13R
- Improving draftstopping techniques, including emphasis on inspection of draftstopping systems during the construction and inspection phases

This will allow the subject to be further scrutinized during the public comment period as work progress on the 2018 edition of *NFPA 5000*.

It is also important to recognize the change in societal expectations. Sprinkler systems that save lives are critically important, but displaced occupants who lose everything in a fire in such properties want answers. Expectations perhaps are higher in 2015 than they were in 1989. Resilient community efforts, many of which are initiated at the federal level, obviously maintain life safety as the first priority. Being able to survive, sustain, and recover from hazard-related events means we need to be looking at getting occupants and residents back to "normal" as soon as possible. How and where NFPA 13R fits into that goal are questions that need to be debated.

In the April 2015 issue of *Plumbing Engineer* ("Perception is Reality"), Sam Dannaway referenced the January 2015 fire at a luxury apartment complex in Edgewater, New Jersey, and noted that at least three occupants had to be rescued by the fire department. How many more rescues would have been needed, and what would have happened if that fire occurred at 4:30 AM instead of 4:30 PM can only be left to speculation. Dannaway goes on to raise some of the exact types of questions that need to be addressed. It is time to develop these answers and determine what needs to be done.

NEXT STEPS

Engaging a group of stakeholders in the broader discussion will help bring clarity to the issue at hand. The educational (awareness) aspect of the concern will help AHJs, fire service, insurance interests, and public educators understand the concerns and be prepared to make decisions about what systems are acceptable per the code provisions; expectations and limitations of the systems; identification of future areas for code development, research, or both; increased awareness of system uses; and differences between sprinkler systems designed using NFPA 13, NFPA 13D, and NFPA 13R.

A partial list of stakeholders to engage is given below:

Organization
AFSA
AHLA
AIA
APPA
AWC
FM Global
FPRF
FSNA
IAFC
IAFF
ICC
IFMA
Liberty Mutual Insurance
NASFM
NFPA
NFPA Correlating Committee on Building Code
NFPA Correlating Committee on Safety to Life
NFPA Technical Committee on Automatic Sprinklers
NFPA Technical Committee on Fire Code
NFSA
NMHC
NVFC
SFPE

These organizations will be invited to a two-day workshop to engage and discuss these issues and look at the technical part (codes/standards) and the educational piece. A suggested outline is to structure the workshop as follows:

Workshop Purpose: *Provide background, purpose, and utilization of life safety (NFPA 13D/NFPA 13R) sprinkler systems. Describe history, use, limits, and potential negative outcomes. Determine action plan for where and how NFPA can better inform the constituency that is affected by NFPA 13D and NFPA 13R.*

Questions to Be Answered: *Is it acceptable to have some level of extensive fire damage in some buildings protected with automatic sprinklers and designed to a national standard? If so, what are the losses deemed to be acceptable?*

Subjects to Be Considered: *What information is needed by those who adopt, promulgate, enforce, and advocate for residential sprinkler laws? What information is needed by those who respond to fires in these environments and those who insure the contents and structures in these properties?*

Since the first editions of NFPA 13D (1975) and NFPA 13R (1988), model codes from NFPA and ICC, including the legacy codes, have successfully worked to get automatic sprinkler protection into more types of multifamily dwellings. That success has translated to single-family dwellings as well. It is important to recognize how the multifamily housing industry has supported this effort along the way. They have been instrumental in the process that has driven more automatic sprinklers into the multifamily residential environment.

In recent years as more long term experience is gained with these systems, NFPA has been made aware of a measurable number of fires in multifamily housing units protected with NFPA 13R systems where the building has been a total loss or has had significant property damage. Within the scope of NFPA 13R, such fires can be described as a "success" since there was no loss of life, a goal that is consistent with the scope of NFPA 13R.

AHJs and insurance interests both are experiencing a concern over this performance level, which has caused NFPA to scrutinize this issue on the macro scale and the micro scale. At this point, the following elements should be discussed and the possible resulting actions considered:

- Ascertain the history and extent of loss in fires involving NFPA 13R systems where extensive property damage occurred. Current "data" are based on anecdotal accounts like newspaper/TV reports, which usually will not compel an NFPA technical committee to make changes. Real data is hard to develop — National Fire Incident Reporting System (NFIRS) reports indicate only if a system is present or not. They typically do not distinguish what type of system is installed or the extent of coverage.
- Discuss whether there are any influencing factors, including modern era construction, such as engineered lumber, modular construction techniques, or structural adhesives that allow fires in these unprotected spaces to spread more rapidly, thus causing extensive damage.
- Establish a baseline of the enhanced protection measures provided by these systems in actual fires (how many lives were saved; how much property and contents protection was provided due to the presence of these systems).
- Discuss whether the current draftstop provisions of the model codes are sufficient and if they are being properly designed and installed.
- Consider the effectiveness of draftstops and raise awareness of AHJs to make inspection of draftstops a priority in these residential environments. See, for example, Florida Building Commission/University of Florida Study [U013-01(July 2014)].

- Has the recent provision to require sprinkler protection on balconies addressed the issue as far as we need to go?
- Discuss scope and application of NFPA 13R systems to pedestal-style structures.
- Discuss the need to limit NFPA 13R systems to buildings with a certain maximum floor plate area. Consider the same concept for NFPA 13D in large single-family homes.
- Determine if and where changes to NFPA and ICC codes and standards might be necessary in the future. Look specifically at draftstopping rules, alternative protection measures in attics (detection), and expanded use of fire retardant–treated (FRT) wood and lumber.
- Determine what educational pieces can be developed to assist those in the regulatory environment in negotiating the ins and outs of NFPA 13D and NFPA 13R.
- Discuss the appropriate use of NFPA 13D and NFPA 13R systems in other than one- and two-family dwelling and multifamily dwelling environments.
- Discuss other considerations that arise.

Outcomes of the workshop should be the following:

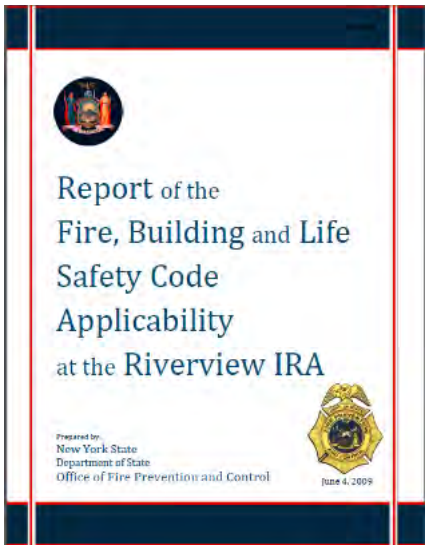
- Summarizing and publicizing the discussion in a workshop report
- Disseminating the report via web postings
- Considering PIs and PCs for the code development process
- Identify future research needs
- Developing educational needs and talking points for AHJs
- Raise awareness of anticipated performance differences in NFPA 13, NFPA 13D, and NFPA 13R
- Increased awareness of first responders of tactical decisions when operating in NFPA 13, NFPA 13D, and NFPA 13R environments

ANNEX A: Anecdotal Accounts of Fires Involving NFPA 13R Losses

DATE	LOCATION	SUMMARY	SOURCE
APR 2012	Anderson, SC	Unknown ignition on exterior of apartment building. 24 units affected.	wyff4.com- APR 12, 2012
APR 2012	Dartmouth, MA	Ignition outside second floor apartment unit on balcony. 16 units affected. $2,000,000.00 in damage.	whdh.com- APR 8, 2012
MAY 2012	Canton, GA	Unknown ignition at apartment building. 25 units affected.	11alive.com- MAY 25, 2012
JUL 2012	Williston, VT	Discarded smoking material (unknown if inside or outside) at hotel. 47 units affected. $1,000,000.00 in damage	wptx.com-JUL 8, 2012
JUL 2012	Middletown, PA	Lightning strike at apartment building. 7 FF injuries. 23 units affected.	phillyburbs.com-JUL 16, 2012
JUL 2012	St. Louis, MO	Unknown ignition source above top floor apartment. 197 units affected. Building was total loss but no dollar amount quoted.	St. Louis Post Dispatch-JUL 19, 2012
AUG 2012	Branson, MO	Unknown ignition source thought to be on a balcony of the condo unit. Building was total loss but no dollar amount quoted.	news-leader.com-AUG 2, 2012
AUG 2012	Clinton Township, MI	Discarded smoking material on balcony of third floor apartment. Fire moved into attic.	shelby-utica. patch.com-SEPT 2, 2012
SEPT 2012	Odenton, MD	Unknown ignition source of apartment building. Fire seen in/on roof area.	odenton.patch.com-OCT 1, 2012
DEC 2012	Marietta, GA	Unknown ignition source of dwelling unit in apartment building. 10 units affected.	cbsatlanta.com-JAN 24, 2013
FEB 2013	Charlotte, NC	Accidental ignition in attic space of apartment. Two FF injuries, one as the result of a roof collapse. 24 units impacted. $500,000.00 in damage.	Charlotte Observer-FEB 24, 2013
FEB 2013	Henrico County, VA	No information on ignition point in this apartment fire. One occupant injury. 28 units affected.	Richmond Times Dispatch-FEB 13, 2013
FEB 2013	Manassas, VA	Ignition in third floor apartment. Roof collapse trapped/disoriented several FFs but all got out safely. $300,000.00 in damage.	INSIDENOVA.com- FEB 19, 2013
FEB 2013	Wilmington, MA	Unknown ignition source in apartment building (possibly grill on balcony).	wilmington.patch.com-FEB 10, 2013
MAR 2013	Omaha, NE	Ignition in third floor apartment. Ceiling collapse trapped several FFs who were taken out by a RIC Team. 24 units affected.	wowt.com- MAR 22, 2013
JUL 2013	Plymouth, MA	Discarded smoking material on balcony of second floor condo. Fire moved into attic via exterior wall. 14 units affected. $2,000,000.00 in damage.	Quincy Patriot Ledger-JUL 9, 2013
JUL 2013	Kelowana, BC Canada	Ignition outside second floor apartment unit from gas grill on balcony. Fire moved into attic via third floor balcony.	Kelowna Capital News-JUL 17, 2013
AUG 2013	Boca Grande, FL	NFPA 13D. Vacant vacation home destroyed, two adjacent homes damaged.	fox4now.com-AUG 22, 2013
AUG 2013	Raleigh, NC	Ignition on third floor of apartment unit. 37 units affected.	wncn.com- AUG 24, 2013
FEB 2014	Roanoke, VA	Unknown ignition source in apartment building. 15 units affected and 42 residents displaced.	roanoke.com- FEB 14, 2014
FEB 2014	Omaha, NE	Cigarette ignition on second floor balcony of college dorm. 42 students displaced	omaha.com FEB 28, JUL 20, 2014

MAY 2014	Brockton, MA	13R system with dry pipe system in attic. 26 units affected, 38 resident displaced. Fire was contained to attic space immediately above area of origin.	Brockton, MA Fire Department
MAY 2014	Denham Springs, LA	Unknown ignition source in apartment building. 12 units affected.	wafb.com-MAY 20, 2014
NOV 2014	Haverhill, MA	NFPA 13D. Single-family home. $600,000.00 loss. System did not activate. (Possible flammable vapors in home during floor refinishing project.)	salemnews.com-NOV 11, 2014
NOV 2014	Raleigh, NC	Improperly discarded smoking material on balcony. 15 residents displaced and 12 units affected.	wncn.com-NOV 11, 2014
NOV 2014	Herndon, VA	Cigarette ignition on fourth floor balcony. 18 residents displaced. $1,250,000.00 in damage.	Wusa9.com-NOV 12, 2014
NOV 2014	Waldorf, MD	Cigarette ignition on balcony (floor unknown). Two families displaced. $600,000.00 in damage.	thebaynet.com-NOV 12, 2014
JAN 2015	Edgewater, NJ	Ignition in first floor concealed wall cavity caused by torch/soldering work plus delayed notification to FD. 400 residents displaced. $80,000,000.00 in damage.	northjersey.com-JAN 21, 2015
JUL 2015	Oviedo, FL	Accidental ignition affecting 24 units and displacing 75 occupants. Building reported as total loss.	wtsp.com-JUL 13, 2015
AUG 2015	Ponte Vedra Beach, FL	Unknown ignition affecting 20 units and displacing 30 occupants. Building reported as total loss.	actionnewsjax.com-JUL 17, 2015; AUG 7, 2015
SEPT 2015	Columbia, MD	Unknown ignition affecting 12 units. Building damage unavailable.	wbaltv.com-SEPT 7, 2015
SEPT 2015	Fairview Heights, IL	Unknown ignition affecting 4 units and displacing 21 occupants. Building damage unavailable.	bnd.com-SEPT 4, 2015

ANNEX B: Wells, NY; March 21, 2009 NFPA 13D Loss



This case is being reported separately because it involves a sprinkler system installed in a group home (Residential Board and Care – Small, per NFPA *101*®). The facility opened in May 2008 and was protected with a sprinkler system designed to meet the requirements of NFPA 13D. The fire originated on a rear enclosed porch. The porch had a roof and screened sides. The porch was not provided with sprinkler protection. While there is some debate based on the amount of enclosure on the porch and if sprinklers should have been installed, they were not. The fire spread into the space above the ceiling and moved across the facility over the occupied spaces.

The nine residents of the facility had a mix of mobility and cognitive disabilities. The two staff members present at the time of the fire moved eight of the residents to a mud room at the front of the building and then proceeded to relocate them to the outside into the parking lot. During this movement, some of the residents returned to the building — in their minds, a "safe place." Four of the nine residents perished in this fire.

Appendix G Code Proposal: Proposal requires extra attic protection for tall buildings but no changes to NFPA 13R

903.3.1.2, 903.3.1.2.1, 903.3.1.2.2, 903.3.1.2.3 (New), [F] 903.2.8.3, [F] 903.2.8.3.1, [F] 903.2.8.3.2,

Proponent: Jeffrey Shapiro, representing National Multifamily Housing Council (jeff.shapiro@intlcodeconsultants.com); Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2015 International Fire Code

Add new text as follows:

903.3.1.2 NFPA 13R sprinkler systems. *Automatic sprinkler systems* in Group R occupancies up to and including four stories in height in buildings not exceeding 60 feet (18 288 mm) in height above grade plane shall be permitted to be installed throughout in accordance with NFPA 13R.

The number of stories of Group R occupancies constructed in accordance with Sections 510.2 and 510.4 of the *International Building Code* shall be measured from the horizontal assembly creating separate buildings.

903.3.1.2.1 Balconies and decks. Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of *dwelling units* and *sleeping units* where the building is of Type V construction, provided there is a roof or deck above. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

903.3.1.2.2 Open-ended corridors. Sprinkler protection shall be provided in *open-ended corridors* and associated *exterior stairways* and *ramps* as specified in Section 1027.6, Exception 3.

903.3.1.2.3 Attics Attic protection shall be provided as follows:

1. Attics that are used or intended for living purposes or storage shall be protected by sprinklers.
2. Where fuel-fired equipment is installed in an unsprinklered attic, at least one quick response intermediate temperature sprinkler shall be installed above the equipment.
3. Where located in a building of Type III or Type V construction designed in accordance with Section 510.2 or Section 510.4 of the *International Building Code*, attics not required by Item 1 to have sprinklers shall comply with one of the following if the roof assembly is located more than 55 feet (16 764 mm) above the lowest level of required fire department vehicle access:
    a. Provide sprinkler protection.
    b. Construct the attic using noncombustible materials.
    c. Construct the attic using fire-retardant-treated wood complying with Section 2303.2 of the *International Building Code*.
    d. Fill the attic with noncombustible insulation.

The height of the roof assembly shall be determined by measuring the distance from the lowest required fire vehicle access road surface adjacent to the building to the eave of the highest pitched roof, the intersection of the highest roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance. For the purpose of this measurement, required fire vehicle access roads shall include only those roads that are necessary for compliance with Section 503.

4. Group R-4 Condition 2 occupancy attics not required by Item 1 to have sprinklers shall comply with one of the following:
    a. Provide sprinkler protection.
    b. Provide a heat detector system throughout the attic that is arranged to activate the building fire alarm system in accordance with Section 907.2.10.

c. Construct the attic using noncombustible materials.
d. Construct the attic using fire-retardant-treated wood complying with Section 2303.2 of the *International Building Code*.
e. Fill the attic with noncombustible insulation.

Revise as follows:

[F] 903.2.8.3 Group R-4 Condition 2. An *automatic sprinkler system* installed in accordance with Section 903.3.1.2 shall be permitted in Group R-4 Condition 2 occupancies. ~~Attics shall be protected in accordance with Section 903.2.8.3.1 or 903.2.8.3.2.~~

Delete without substitution:

~~**[F] 903.2.8.3.1 Attics used for living purposes, storage or fuel-fired equipment.** Attics used for living purposes, storage or fuel-fired equipment shall be protected throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.2.~~

~~**[F] 903.2.8.3.2 Attics not used for living purposes, storage or fuel-fired equipment.** Attics not used for living purposes, storage or fuel-fired equipment shall be protected in accordance with one of the following:~~

1. Attics protected throughout by a heat detector system arranged to activate the building fire alarm system in accordance with Section 907.2.10.
2. Attics constructed of noncombustible materials.
3. Attics constructed of fire-retardant-treated wood framing complying with Section 2303.2 of the *International Building Code*.
4. The *automatic sprinkler system* shall be extended to provide protection throughout the attic space.

2015 International Building Code

Add new text as follows:

903.3.1.2.3 Attics Attic protection shall be provided as follows:

1. Attics that are used or intended for living purposes or storage shall be protected by sprinklers.
2. Where fuel-fired equipment is installed in an unsprinklered attic, at least one quick response intermediate temperature sprinkler shall be installed above the equipment.
3. Where located in a building of Type III or Type V construction designed in accordance with Section 510.2 or Section 510.4, attics not required by Item 1 to have sprinklers shall comply with one of the following if the roof assembly is located more than 55 feet (16 764 mm) above the lowest level of required fire department vehicle access:
    a. Provide sprinkler protection.
    b. Construct the attic using noncombustible materials.
    c. Construct the attic using fire-retardant-treated wood complying with Section 2303.2.
    d. Fill the attic with noncombustible insulation.

The height of the roof assembly shall be determined by measuring the distance from the lowest required fire vehicle access road surface adjacent to the building to the eave of the highest pitched roof, the intersection of the highest roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance. For the purpose of this measurement, required fire vehicle access roads shall include only those roads that are necessary for compliance with Section 503 of the *International Fire Code*.

4. Group R-4 Condition 2 occupancy attics not required by Item 1 to have sprinklers shall comply with one of the following:
    a. Provide sprinkler protection.
    b. Provide a heat detector system throughout the attic that is arranged to activate the building fire alarm system in accordance with Section 907.2.10.
    c. Construct the attic using noncombustible materials.

d. Construct the attic using fire-retardant-treated wood complying with Section 2303.2.
e. Fill the attic with noncombustible insulation.

Revise as follows:

[F] 903.2.8.3 Group R-4 Condition 2. An *automatic sprinkler system* installed in accordance with Section 903.3.1.2 shall be permitted in Group R-4 Condition 2 occupancies. ~~Attics shall be protected in accordance with Section 903.2.8.3.1 or 903.2.8.3.2.~~

Delete without substitution:

~~**[F] 903.2.8.3.1 Attics used for living purposes, storage or fuel-fired equipment.** Attics used for living purposes, storage or fuel-fired equipment shall be protected throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.2.~~

~~**[F] 903.2.8.3.2 Attics not used for living purposes, storage or fuel-fired equipment.** Attics not used for living purposes, storage or fuel-fired equipment shall be protected in accordance with one of the following:~~

1. Attics protected throughout by a heat detector system arranged to activate the building fire alarm system in accordance with Section 907.2.10.
2. Attics constructed of noncombustible materials.
3. Attics constructed of fire-retardant-treated wood framing complying with Section 2303.2.
4. The *automatic sprinkler system* shall be extended to provide protection throughout the attic space.

Reason: This proposal is recommended as a response to fire-service concerns about suppressing a fire involving a tall pedestal building attic. Such attic or attics will be required to have increased fire protection. The proposed threshold is modeled after a combination of two existing code sections, Appendix D Section 105.1 (which establishes requirements for aerial ladder access based on attic height) and Section 903.2.11.3 (which uses 55 feet as a building height threshold related to sprinklers). Pedestal buildings that exceed 4 stories above grade plane, including the pedestal, are anticipated to be affected by this proposal, as would be some pedestal buildings with fewer stories that are located on sloped lots with fire department vehicle access roads required along a lower elevation portion of the perimeter. The intent of stating "required" fire vehicle access is to make it clear that, simply because access is available on an adjacent road or parking lot, that road need not be considered in the height measurement unless it is required as part of satisfying the code requirement for vehicle access to the building.

The permissible attic protection options for pedestal buildings are generally modeled after existing Section 903.2.8.3, which was added to the 2015 code for R-4 Condition 2 occupancies. However, based on feedback received during the drafting/review process for this proposal, it was decided to exclude the R-4's heat-detection option for pedestal building attic protection because numerous stakeholders did not consider heat detection as equivalent in safety to the other listed options.

Note that allowances to use noncombustible construction materials, fire-retardant treated wood, and filling with noncombustible insulation are already permitted by NFPA 13 as an alternative to installing sprinklers in concealed spaces in otherwise fully-sprinklered buildings. These allowances are duplicated in the proposed IBC/IFC text so that an architect or developer can identify the attic protection concern and permissible solutions early in the design process, as opposed to expecting building designers to know of these allowances buried deep in the text of NFPA 13. Having the exceptions in the IBC/IFC will make it clear that these NFPA 13 exceptions are appropriate for NFPA 13R attic protection as w ell, even though they are not included in NFPA 13R (because NFPA 13R doesn't ordinarily require attics to be protected).

Finally, the proposal relocates the existing requirements in 903.2.8.3 for enhanced attic protection in Group R-4 Condition 2 occupancies to the new Section 903.3.1.2.3 so that all IBC/IFC supplemental

protection requirements for NFPA 13R sprinkler systems are consolidated in one location. The existing requirements for R-4 Condition 2 were also revised with respect to fuel-fired equipment in attics to clarify that, in an otherwise unsprinklered attic, the entire attic wouldn't be required to be sprinklered based on the presence of fuel-fired equipment. Instead, NFPA 13R (Section 6.6.6.1 of the 2013 edition) only requires that a sprinkler be installed over the equipment in such cases.

Cost Impact: Will increase the cost of construction

The added requirement for attic protection will increase the cost of construction for affected buildings.

Appendix H. Summary of Panel Discussions

PANEL 1 EXPERIENCE

Experience with NFPA 13R Systems – Who has them? How well do they work? What if we don't have them? This particular group was asked to look at not only past experience but also recent experience involving use of NFPA 13 R sprinkler systems. The discussion captured the range of viewpoints and observations. A summary is contained below.

10:50 am to 12:00 Noon Panel Members/Perspective

Fire Loss Data – Marty Ahrens, NFPA

Owner/Developer – Jeff Shapiro, NMHC

Insurance User – Dave Hague, Liberty Mutual

NFPA 13R TC on Residential Occupancies View – Maurice Pilette

Contractor/Industry – Roland Huggins, AFSA

Enforcement Angle-Steve Peavey, Altamonte Springs, FL (IFMA)

Moderator-Gary Keith, FM Global

What do we know about hard loss data (dollars, injuries) in the NFPA 13R environment? What are some ideas to get better data collection?

- Fire Area Challenge – not well defined. What about systems in common areas only. Hard to finesse this info. Some reports say where sprinklers were present or not present. Sprinkler system type – not well defined.
- Don't see a lot of 13R fires – but when we do, attic fires tend to see lots of damage. Maybe a multi-million dollar loss. 30% - 40% comparable loss in sprinklered versus unsprinklered loss. Liberty Mutual Insurance: no credit for NFPA 13R system (reports may indicate no protection).
- Getting Better Data: some good NFIRS data. Omit the 6-story building from NFIRS and focus on 5-stories or less. Similar to NFPA 13 attic problem. Fire gets above sprinkler and spreads through the interstitial space/frequency of fires is not tremendous – but can be severe.
- Could NFPA do a survey to focus on specific fire events that look like 13R. What if NFPA did fire investigations again?
- Protect privacy of policy holders, litigation is often times tying stuff up. Can we get insurance fire loss data free of identifying characteristics?
- Fire Reporting Systems: not great participation. 60% of departments in Florida were reporting. Now at 80% - but how do you get fuller participation?
- 13R – Limited to 12,000 Ft^2. None in Massachusetts. State doesn't track the systems too well.
- $1/10^{th}$ of 1% of fires occurring in multi-family that got into attic. Is this a problem? Number of fires low/consequences are high.

How is the contractor/owner/developer/enforcement/manager support for sprinklers influenced by NFPA 13R?

- Yes, widespread support for use of NFPA 13R systems. Largely driven by the codes.
- During the development of NFPA 13R- it answered the life safety question in 1985/1989: that may be different now. You had incentives from 13R and the codes (legacy codes, NFPA 101) to get the sprinklers installed.
- Look at 2000 IBC – prior to this, you didn't have a driver to get sprinklers into multi-family in building codes to same extent. NFPA 101 (1991) first edition to allow use of NFPA 13R- with some incentives. NFPA 13R is essential to industry support in terms of sprinklers in multifamily dwellings.

What is the implication if NFPA 13R is not available?

- If it goes away, would sprinkler protection disappear as a Code provision? That is a concern. Even with NFPA 13, you can still have a scenario where fire in a combustible space can activate the sprinklers.
- Increase in fire deaths; more taxing on the fire service; more damage. May not see support for use of NFPA 13 systems in multifamily.
- Cost incentive goes out the window if you remove NFPA 13R.
- Concern that you would lose the mandate in the Model Codes. How or what do you potentially impact in the Model Codes if you enhance NFPA 13R – with more sprinklers?

What are some of the discussions around NFPA 13R in the NFPA TC – say in the last decade?

Usually get proposed changes to look at sprinklers on balconies (added in 2010 edition); add sprinklers to attics; building heights and measurement. TC didn't feel the experience warranted major changes. TC sees too many downsides and challenges.

What are some of the things you like/dislike about NFPA 13R?

- System is in the heated space/envelope. Need to look at when the experience drives change. Balconies; open air corridors.
- Need to keep it – if we need to focus on specific areas or target them, then stay focused there. Periodically we have an issue, statistically, we do not.
- Clarify to owner / developer / operator what the system does or doesn't do.
- Limit the size (sq. footage) of buildings where 13R is used. Look at number of stories. Can you generate information for the occupants? Developer/investor is long gone. Do you need to get more/better quality control and inspection, testing and maintenance of the systems?
- Look at building code – construction issues.

If you could wave a magic wand, NFPA 13R could be made better if:_____?

- Good time to look at all options.
- Attics beyond the reach of fire departments, need something.
- Look at assumption about construction techniques
- NFPA 1: Fire flow predictions for 13R in NFPA 1. Look at those incentives – do they make sense?
- What other alternatives: draft stopping, early warning (heat detectors) construction.

PANEL 2 Building Design

Building Design; NFPA 13R; Construction Techniques; First Responders – How are we connecting? This particular group was asked to look at the ever-changing construction techniques and use of modern era materials for building design. A summary is contained below.

1:15 pm-2:15 pm Panel Members/Perspective

Wood Construction-Sam Francis, American Wood Council

Architect/Design-Dave Collins, Preview Group/AIA

Contractor/Industry -Jeff Hugo, NFSA

First Responder-Sean DeCrane: Cleveland, OH FD/IAFF

Fire Chiefs-Andy King, Franklin, TN FD/IAFC

Enforcement Angle- Butch Browning, LA State Fire Marshal/NASFM

Panel Moderator-Bill Koffel, Koffel Associates

1989 era construction when NFPA 13R first came out is much different than 2015 construction. The same is true of many home furnishings. Are the differences significant enough that it needs to be viewed differently when 13R systems are being used now versus when the standard first came out?

- Previous discussions based on past. Is the current fuel package (based on 1980's NIST info) really the same?
- 1989 Edition of NFPA 13R based on 1985 and earlier construction types. Techniques are different! Spacing can be longer, floor to floor heights can be taller.
- Buildings burn faster and hotter. This is based on construction and furnishings. Education is needed across the board.
- What do we do/hope to do in this area?? How does sustainability fit in?? 1900 construction: 2" by 12" (actual not nominal).
- You get some level of structural frame protection. Modern era furnishings and contents versus legacy material. Structure/elements allow much larger buildings and spaces. Construction materials should not influence use of 13R, but maybe the contents should.
- Interior furnishings are a challenge. Exterior combustible siding/finish is a problem.
- Residential sprinklers can manage the synthetic furnishings and contents.

The standard has seen some "scope" creep in the last 15 years. While the original 4-story building concept was – 4 stories – it is now a 4-story building on top of a one story pedestal. Is that the right way to go about this?

- Range of applications and design clearly is different in 2015 versus 1989.
- Need to access the attic/roof by firefighters-always a challenge.
- Is a story relevant? Started with stories – and is now "low-rise" multi-family residential. Focus should be how tall and how measured! Adopt the high rise measurement concept - X number of feet. from the lowest level of fire department vehicle access.

- How do you access the building? 400,000 Ft^2 building with parking, 4-stories in height. That combination is okay by Code when NFPA 13R is applied.
- If you do 4-stories on a pedestal it is a 5-story building.
- Code provisions have to be adaptable to, and work with, capabilities of the local fire department.
- Look at impact on residents and community. How do we find more information?
- Look at how stories work in other countries.

Can you shed some insight into any known training or tutorial difficulties that Firefighters should be considering when fighting fire in the NFPA 13R environment? If there aren't any – should there be?

- What is out there? No distinguishing marking or building characteristic would tell us the building has a NFPA 13 R system. Or how does the officer know what is going on? Needing to look at tactical options.
- Firefighters focused on the people – are they out? Not too focused on the type of system.
- A certificate of occupancy (CO) is not always required – and even then, how detailed is the information about the system.

Architecturally, we now see these "doughnut hole" designs where building access is predominantly from the inside of the doughnut hole. That requires firefighters to first enter that quasi enclosed space to gain access and requiring occupants to pass through that space while leaving their dwelling units. What sprinkler system designs are best for that configuration?

- "Donut-Hole": Just one of the new designs and challenges.
- What is the fire department access to the building? Can you realistically plan for all those combinations? What/where and how do you account for that?
- Scoping for access should come from building and fire codes.
- Need to have resources (people) to make sure you can attack the fire. Is access just to building – or into building? Do you relate use to building construction type as well – exterior wall construction etc. NFPA 13R should dive into this more.
- Not sure if the Standard or the Code arena should address.
- Look at bigger picture of occupant and firefighter safety challenges. And need to look at what the community wants to / can do.

Who needs to be defining the "grade" and "lowest level of fire department vehicle access" – the building code, NFPA 13R or the local authorities?

- Measurement challenges. What is the best way to address the measurement of the building height??
- Keep trying to apply a uniform interpretation/measurement of the building height.
- Look at refined definition. Tie back to the lowest level of fire department vehicle access.
- Lowest level of fire department vehicle access. If changes to the measurement are made, then need to carry through all of the relevant codes and standards.

If you could wave a magic wand, NFPA 13R could be made better if:_____.

- Get more/better information out to the communities and stakeholders-desires, expectations.
- What is the standard of care for the systems? If 13R is not getting it done, then need to look at those targeted areas. Concealed spaces, draft stops, etc.
- Look at enhancement in gaps – soffits, attics with a fire barrier; what can be fed back into local fire department capabilities?
- What is local capability? Ground ladders only; number of people?
- Small number of events – but where does the effort go? Focus on building height. Fire department access; limit should focus on height (not story). If you tie scope to resources, then what happens when resources change?
- Reinforce that 13R has some limits on things it can do. Might be more of a media thing?? Education of the public.