Addressing the Performance of Sprinkler Systems: NFPA 25 and Other Strategies

Workshop Summary

December 9 & 10, 2013
Renaissance Blackstone Chicago Hotel, Chicago, IL

FOREWORD

On December 9 and 10, 2013, the Fire Protection Research Foundation hosted a workshop in Chicago, IL that examined the performance of sprinkler systems. The objective of the workshop was to develop possible solutions to sprinkler system design and installation deficiencies that can lead to performance issues.

The first day focused on the current status of the problem including: a presentation on the sprinkler performance issues based on fire experience; a panel presentation of insurers that included discussion of the sprinkler performance problems based on non-fire issues; a presentation on the foundation and scope of NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*; and a panel discussion on the expectations of inspection, testing and maintenance activities and NFPA 25.

The second day of the workshop was spent in breakout groups discussing possible solutions to sprinkler performance problems. The morning was spent discussing whether NFPA 25 and/or NFPA 13, *Standard for the Installation of Sprinkler Systems*, are part of the solution and how changes could be implemented in these two documents, e.g. changes to scope, enforcement. The afternoon was spent discussing other strategies that could be part of the solution, e.g. other codes and standards. Also included in the afternoon was a discussion on how these other strategies could be implemented.

The Research Foundation expresses gratitude to the all those that participated in the workshop. Special thanks are extended to the following for helping plan the event: Matt Klaus, NFPA; John Hall, NFPA; and Bill Koffel, Koffel Associates. Special thanks are also extended to those that participated as speakers and panelists at the event.

This workshop summary report has been prepared by Amanda Kimball, Research Project Manager for the Fire Protection Research Foundation, with assistance from the workshop participants. The information contained herein is based on the input of numerous professionals and subject-matter-experts. While considerable effort has been taken to accurately document this input, the final interpretation of the information contained herein resides with the report author.

About the Fire Protection Research Foundation

The Fire Protection Research Foundation plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

About the National Fire Protection Association (NFPA)

NFPA is a worldwide leader in fire, electrical, building, and life safety. The mission of the international nonprofit organization founded in 1896 is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. NFPA develops more than 300 codes and standards to minimize the possibility and effects of fire and other hazards. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/freeaccess.

Keywords: automatic sprinkler systems, automatic extinguishing systems, automatic suppression systems, sprinkler performance, NFPA 25, inspection, testing, maintenance

Contents

Executive Summary

On December 9 and 10, 2013, the Fire Protection Research Foundation hosted a workshop in Chicago, IL that examined the performance of sprinkler systems. The objective of the workshop was to develop possible solutions to sprinkler system design and installation deficiencies that can lead to performance issues.

In John Hall's report, *US Experience with Sprinklers* (2013), reasons for sprinkler system ineffectiveness during fire events are cited. In instances where systems activated but were ineffective, 44% of these cases were a result of water not reaching the fire, while 30% were due to not enough water being released to control the fire. Some of the specific causes for these two types of system ineffectiveness include sprinkler obstructions, preventing water from reaching the fire, and the sprinkler system design not being appropriate (including delivered density) for the hazard present, possibly because the hazard had changed without a sprinkler system design evaluation. Some of the causes that contribute to sprinkler ineffectiveness during fire events are not addressed by NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, or any other NFPA standard.

Consequently, as a practice of good fire protection and life safety, the question becomes: what should be done? Some of the questions that were presented and discussed at the workshop included:

- Should NFPA 25's scope be reconsidered?
- Should a new standard on conducting design evaluations be developed?
- Should NFPA 3, *Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*, address a periodic system "re-commissioning activity" for some or all occupancies?
- Should these re-commissioning events be addressed by the occupancy chapters of NFPA 101, *Life Safety Code*?
- Should the provisions in NFPA 1, *Fire Code*, be supplemented so as to require inspection reviews that can address the adequacy of a system?
- Should this just sit with the owners and regulatory process as it currently does, with the hope that the problem resolves itself organically?

Overall there was general consensus that NFPA 25 should remain a wear and tear document and that it is for the most part ok in its current state. Some suggestions were made to remove Sections 4.1.6 and 4.1.7 (addressing changes in occupancy and hazard) from the 2014 edition of NFPA 25 and move to another document (e.g. installation standards, fire code). Since it was agreed that NFPA 25 should remain a wear and tear document, it could include the triggers for design evaluations/hazard analysis, but the actual requirements for evaluations and analysis should be covered elsewhere, such as NFPA 13, *Standard for the Installation of Sprinkler Systems*, NFPA 1, the building codes, or even NFPA 3 or 4, *Standard for Integrated Fire Protection and Life Safety System Testing*. Some language from other documents (NFPA 30, *Flammable and Combustible Liquids Code*) was suggested as a template for a trigger in NFPA 25. A suggestion was made to develop an evaluation template for inclusion in the annex of NFPA installation standards. Another suggestion was made to form some interview questions for owners (e.g. have you done anything to change storage practice, room configuration, etc.). This could be something that is included as

part of the inspection items in NFPA 25 or in another document (like the fire code) and could be a trigger for a design evaluation.

It was suggested by many that the requirements for design evaluations should be determined by occupancy type/hazard. For low hazard occupancies, design evaluations may not be required (or at least not on a frequent basis). Require design frequencies on a regular basis for those occupancies with higher hazards (e.g. warehouses, industrial facilities). It was also suggested that maybe complex systems (e.g. deluge and water mist) should not be included in NFPA 25 because they need hazard analysis. Design evaluations or hazard analyses should not be carried out by inspectors because the inspectors do not have the right skill set.

There were concerns raised that NFPA 25 is not being followed in its current state, so it is not ideal to add requirements. In fact, several suggestions were made to simplify the inspection, testing, and maintenance (ITM) frequencies in NFPA 25 by specifying a base frequency of quarterly or annual. There was also a question posed about having different ITM frequencies for low vs. high hazard occupancies. Some also questioned the frequency with which design evaluations should be required. A suggestion was that the frequency of design evaluations should be hazard/risk based.

Enforcement is a major concern. Fire and building department budgets continue to be cut, which reduces the resources available for enforcement. There is reliance on the annual inspections to catch any issues. It was noted during the insurer's panel that insurance inspections should not be relied on because they are often not covering 100% of properties. Enforcers need more tools at their disposal. For example, reporting mechanisms from inspectors could be one tool. Authorities Having Jurisdiction (AHJs) could require inspectors to send all inspection reports or at least those that identify any major impairments. Some suggested that it may be better for AHJs rather than inspectors to red tag systems. Also, a suggestion was made to survey AHJs to find out how NFPA 25 is being used (what provisions are they enforcing).

Everyone agreed that education around the design deficiency issue, as well as the current requirements of NFPA 25, is ultimately important. Education of all parties is required: inspectors, AHJs, owners, and the general public. It was noted that it is easier to educate the inspectors and AHJs than owners and the general public. A specific educational initiative would be to educate AHJs about enforcement mechanisms such as, requiring compliance letters when there are changes in occupancy. One group suggested having a training symposium open to contractors and AHJs to cover current NFPA 25 requirements and design issues. This could be implemented by working with related membership groups (e.g. International Fire Marshals Association, International Code Council, American Society for Healthcare Engineering, American Society of Safety Engineers).

If design evaluations are implemented, the evaluation triggers need to be reviewed with building owners. Building owners should be given a list of items that would trigger a design evaluation. Other education suggestions were to have an education program for owners and AHJs on what to expect from inspections. Owner expectations of inspections are different than what is often provided. A specific suggestion made by a couple of groups would be to develop an NFPA 25 guideline for owners/general public that is a few pages long and covers the major issues. One group suggested an ITM App that could be used by building owners that links to their calendars and sends reminders of ITM deadlines. Another suggestion to reach owners was to have an NFPA booth at trade shows directed at building owners and managers (e.g. Building Owners

and Managers Association, International Facility Management Association) that specifically includes information on ITM of sprinkler systems.

Based on Marty's presentation the number one problem is closed valves. It was felt that we should focus on addressing this problem. It could be helpful to develop a PSA or another training module for building owners and facility managers to remind them to check their valves regularly to make sure that they are open. One suggestion was made for more root cause analysis of the specific issues related to shut valves and the lack of water problems discussed by Marty. It is unknown what changes may be needed without more detailed information. Marty suggested that the sprinkler industry should provide input into the next version of NFIRS (v 6.0).

Background

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, specifies the minimum requirements for periodic inspection, testing, and maintenance (ITM) for fire pumps, sprinkler systems, standpipe systems, and many other water-based fire protection systems. The intent of this standard is to confirm that the system components in place are in good working order and will function properly if a fire event occurs. However, the application of this standard, when considering inspection related activities, is limited to wear and tear issues and does not cover deficiencies in the design or installation of the system. It is explicitly stated in Chapter 4 of the standard that the property owner is responsible to obtain an evaluation of the fire protection systems before any changes are made related to occupancy, use, process, or materials and that this evaluation is not considered part of the normal ITM required by the standard. However, this approach has been questioned due to the belief of many experts that it is not uncommon for obvious design deficiencies, such as unsprinklered areas or obvious spray pattern obstructions, to go unreported to owners despite the presence of a life safety professional conducting an inspection.

This is not to say that the inspector must be the individual to call out these design deficiencies, but rather, it highlights a gap in the standard where post-occupancy design evaluations may be needed. Many owners and Authorities Having Jurisdiction (AHJ) assume that the ITM service provider is providing a full design evaluation while the service provider is delivering only wear and tear inspection. Consider the example of a small storage facility that is appropriately designed to NFPA 13, *Standard for the Installation of Sprinkler Systems*. At the time of issuance of the certificate of occupancy, the building stored Class III commodities on 15 foot racks. The sprinkler system was properly designed and considered to be appropriate for that hazard. As the owner continues to develop his business, he offers new products and begins storing Group A plastics on racks up to 25 feet in height. Unbeknownst to the owner, his sprinkler system is now insufficient. This item would not be picked up on during an inspection per NFPA 25; however, a major life safety and property protection risk could exist. Some of these hazards may be picked up as part of a permitting process that includes submittal of design drawings and inspections, but that assumes that the owner and his contractor follow the regulatory process.

In John Hall's report, *US Experience with Sprinklers* (2013), reasons for sprinkler system ineffectiveness during fire events are cited. In instances where systems activated but were ineffective, 44% of these cases were a result of water not reaching the fire, while 30% were due to not enough water being released to control the fire. Some of the specific causes for these two types of system ineffectiveness include sprinkler obstructions, preventing water from reaching the fire, and the sprinkler system design not being appropriate (including delivered density) for the hazard present, possibly because the hazard had changed without a sprinkler system design evaluation. Some of the causes that contribute to sprinkler ineffectiveness during fire events are not addressed by NFPA 25, or any other NFPA standard.

Even for ITM activities that are clearly within the scope of NFPA 25, there are questions about the relative effectiveness of the standard to produce the mandated ITM activities and of the mandated activities to produce the intended sprinkler reliability conditions. Such gaps in reliability might not be addressable

through changes in the standard itself but might be addressable through other related changes in requirements or in common practice. Alternatively, it would be useful to know if there is a significant gap in sprinkler performance that we do not know how to reduce or eliminate.

Consequently, as a practice of good fire protection and life safety, the question becomes: what should be done? Some of the questions that were presented and discussed at the workshop included:

- Should NFPA 25's scope be reconsidered?
- Should a new standard on conducting design evaluations be developed?
- Should NFPA 3, *Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*, address a periodic system "re-commissioning activity" for some or all occupancies?
- Should these re-commissioning events be addressed by the occupancy chapters of NFPA 101, *Life Safety Code*?
- Should the provisions in NFPA 1, *Fire Code*, be supplemented so as to require inspection reviews that can address the adequacy of a system?
- Should this just sit with the owners and regulatory process as it currently does, with the hope that the problem resolves itself organically?

Workshop Overview and Agenda

This two-day workshop was conducted in Chicago, IL on December 9 and 10, 2013. The workshop agenda is shown in Table 1. The first day was focused on the performance problems and current inspection, testing, and maintenance practices. The second day involved two workgroup discussions on the possible solutions to sprinkler performance problems.

Table 1: Workshop Agenda

Day 1: Where are we?		
9:15am	Welcome, Introduction, and Workshop Goals	Amanda Kimball, Fire Protection Research Foundation
9:30am	Sprinkler Performance in US Fires	Marty Ahrens, NFPA
10:15am	Break	
10:45am	Panel Discussion: What is the insurer's perspective on sprinkler performance and NFPA 25?	**Moderator:** Bill Koffel, Koffel Associates **Panelists:** Ken Linder, Swiss Re Top Myers, Myers Risk Services Brandon Frakes, XL GAPS Dave Fuller, FM Global
12:15pm	Lunch (on your own)	
1:45pm	Where does NFPA 25 fit in? • Foundation of NFPA 25: Scope, roles, and responsibilities	Matt Klaus, NFPA Bill Koffel, Koffel Associates

	• What sprinkler performance problems does NFPA 25 address?	
2:45pm	Break	
3:15pm	Panel Discussion: Expectations of ITM and NFPA 25	**Moderator:** Amanda Kimball, Fire Protection Research Foundation **Panelists:** Russ Leavitt, Telgian Richard Ray, Cybor Fire Protection Company Brock Mitchell, Extended Stay Hotels John Lake, City of Gainesville
4:45pm	Wrap Up Day 1	Amanda Kimball, Fire Protection Research Foundation
Day 2: Where do we go from here?		
9am	Overview of Day 1; Objective for Day 2	Amanda Kimball, Fire Protection Research Foundation
9:15am	Breakout Groups for Topic 1	
	Topic 1: Is NFPA 25 and/or NFPA 13 (part of) the solution? 1. What sprinkler performance problems can be effectively addressed by changes to NFPA 25 and/or NFPA 13? a. Changes to scope b. Changes to content c. Changes in how the standard is implemented or applied d. Changes on how the standard is enforced	
10:15am	Break	
10:45am	Reports from Topic 1 Breakout Groups	
12pm	Lunch (on your own)	
1:30pm	Breakout Groups for Topic 2	
	Topic 2: Are other strategies (part of) the solution? 1. What are some major alternative or complementary protocols (particularly those implemented in another code or standard)? 2. Which problems unaddressed by NFPA 25 are addressed by other protocols? 3. Where are these other protocols implemented? What are triggers for their use? Any ideas on when, where, and how to implement going beyond current practice?	

2:30pm	Break	
3:00pm	Report from Topic 2 Breakout Groups	
4:15pm	Summary of Workshop	Amanda Kimball, Fire Protection Research Foundation
4:30pm	Adjourn	

Workshop Participants

Below is a list of all those that participated in the workshop.

Table 2: List of Workshop Participants

First	Last	Company/Organization
Mark	Agostinho	USA Fire Protection
Marty	Ahrens	NFPA
Kerry	Bell	UL LLC
Tracey	Bellamy	Telgian Corporation
Cecil	Bilbo	Academy of Fire Sprinkler Technology, Inc.
George	Bogris	Whitney Bogris
Michael	Bosma	The Viking Corporation
Robert	Caputo	Fire & Life Safety America
Wayne	Carson	Carson Associates, Inc.
Shane	Clary	Bay Alarm Company
David	de Vries	Firetech Engineering, Inc.
Les	Easter	Atkore International
James	Fantauzzi	North East Fire Protection Systems Inc.
James	Feld	University of California Berkeley
Russell	Fleming	National Fire Sprinkler Association, Inc.
David	Frable	US General Services Administration
Brandon	Frakes	XL GAPS
David	Fuller	FM Global
Scott	Futrell	Futrell Fire Consult and Design
Kenneth	Isman	National Fire Sprinkler Association, Inc.
Sultan	Javeri	SC Engineering
Larry	Keeping	Professional Loss Control
Lynn	Kenney	ASHE-AHA
Amanda	Kimball	FPRF
Matt	Klaus	NFPA
William	Koffel	Koffel Associates, Inc.
John	Lake	City of Gainesville

First	Last	Company/Organization
Russell	Leavitt	Telgian Corporation
John	Leblanc	FM Global
Kenneth	Linder	Swiss Re
Tom	Long	Exponent
Norb	Makowka	NAFED
Jeannene	Meisman	Reedy Creek Fire Department
Brock	Mitchell	Extended Stay Hotels
Top	Myers	Myers Risk Services, Inc.
Rita	Neiderheiser	Road Sprinkler Fitters
Jon	Nisja	MN State Fire Marshal Division
Erik	Olsen	Chubb Group of Insurance Companies
Matthew	Osburn	Canadian Automatic Sprinkler Association
Rich	Pehrson	Pehrson Fire P.C.
Donato	Pirro	Electro Sistemas De Panama, S.A.
Richard	Ray	Cybor Fire Protection Company
David	Royse	Potter Electric Signal Company
Giulio	Scartozzi	Atkore International
J.	Sheppard	Sheppard & Associates, LLC
Larry	Shulman	Pacific Gas & Electric Company
George	Stanley	Wiginton Fire Protection Engineering
Cathy	Stashak	Office of the Illinois State Fire Marshal
Peter	Thomas	Victaulic
Cutter	Tyllia	API Group
Darrell	Underwood	Underwood Fire Equipment, Inc.
Marianne	Waickman	ASSE International
Tristan	Wilson	Liberty Mutual Property
Keith	Woller	Road Sprinkler Fitters
Ken	Wood	Office of the Illinois State Fire Marshal

Day 1 Presentations

Presentation: Sprinkler Performance in US Fires – Marty Ahrens, NFPA

Marty Ahrens from NFPA's Fire Analysis and Research Division kicked off the presentation with a discussion of the sprinkler performance problems based on fire experience. Marty's presentation material was based on John R. Hall's June 2013 report "Sprinkler Performance in US Fires". Her presentation slides can be found in Appendix A. The statistics in the report and presentation are based on reported fires in 2007-2011, derived from detailed data collected by the United State Fire Administration's National Fire Incident Reporting System (NFIRS) and NFPA's annual fire department experience survey.

For all types of systems (wet pipe and dry pipe), sprinklers operated effectively in 87% of fires. Wet pipe systems operated effectively 89% of the time and dry pipe system operated effectively 76% of the time. Sprinklers (all types) were more effective in home fires and less effective in fires involving storage.

In non-confined fires large enough to operate (9% of fires), sprinklers (all types) failed to operate due to the reasons shown in Figure 1.

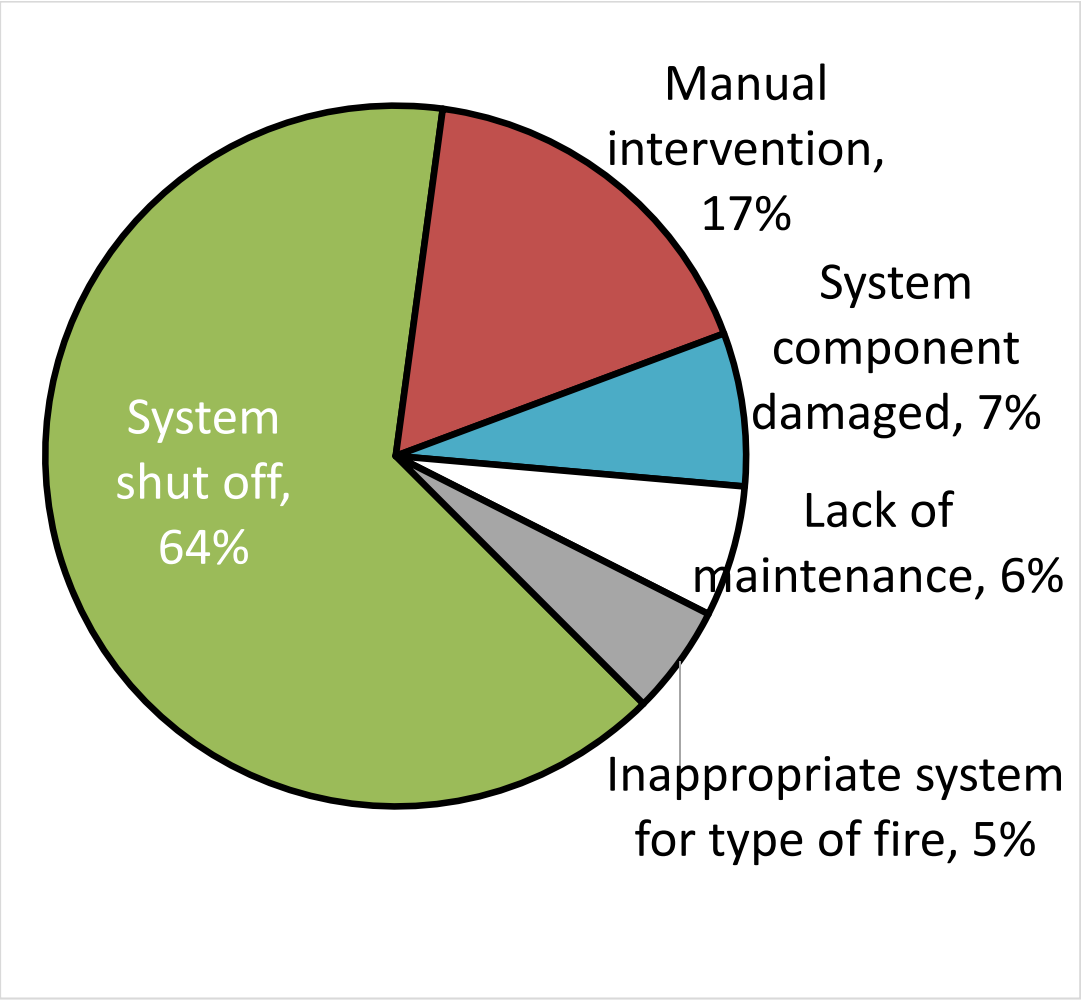


Figure 1: Reasons for sprinklers (all types) not operating (in non-confined fires large enough to operate)

The following clarifications were made during discussion: rekindle fires are considered separate events, water not reaching the fire could refer to several different situations (data is not confined to any single situation), and damaged system component could refer to issues such as freezing. It was noted anecdotally that inappropriate systems are more often seen in warehouses. Based on the data, inappropriate systems were less of a problem with dry type sprinklers.

In non-confined fires when sprinklers (all types) operated ineffectively (4% of fires), it was due to the reasons highlighted in Figure 2.

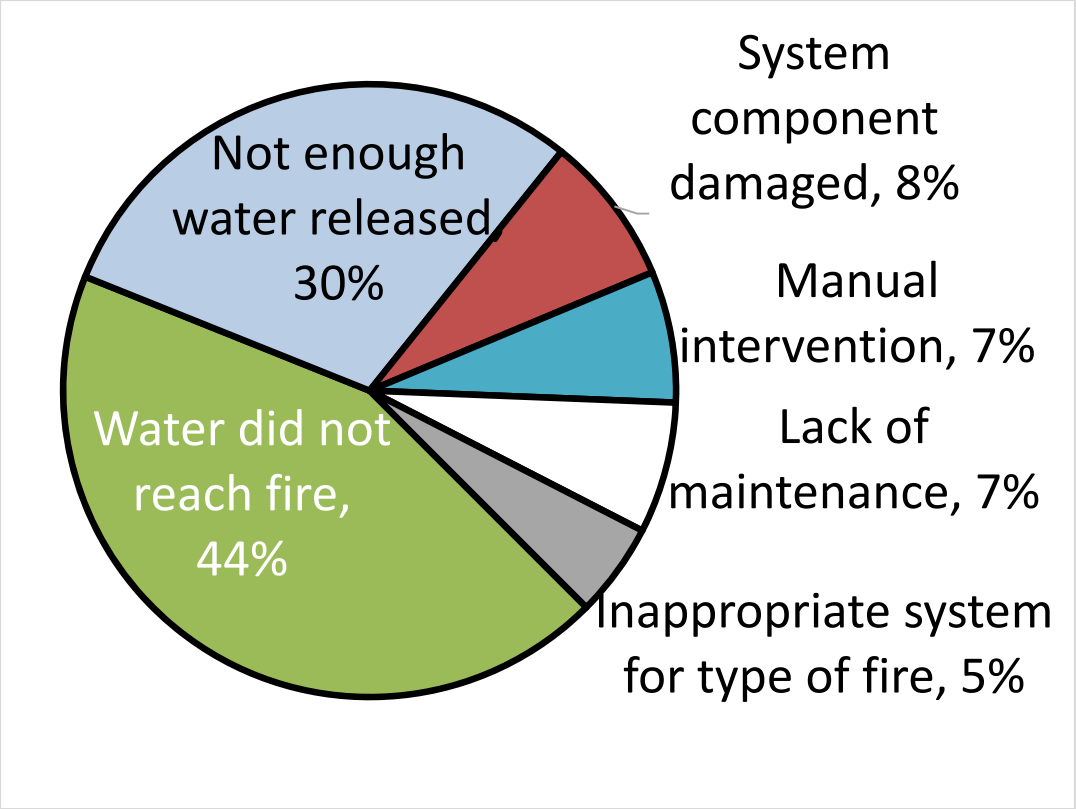


Figure 2: Reasons for sprinklers (all types) operating ineffectively (in non-confined fires)

Marty gave some case study examples of the issues shown on Figure 2. An example of water not reaching the fire is a 2004 fire in an Arizona convention center. The convention center was being used for a film set and there was a cover over the set that prevented water from reaching the fire seat. This fire resulted in an $8 million loss. An example of a fire in which the sprinklers did not discharge enough water was a 2006 fire in an Oregon food processing plant. The sprinkler system was fed by a water storage reservoir and more than 250 sprinklers fused but were ineffective due to a lack of water pumped from the reservoir. The fire pump room was found covered with an oily residue and the fuel tank for the fire pump was empty. The result was a $3.1 million loss.

System component damage could refer to damage from roof or other structural collapse during a fire. An example of a loss with a lack of system maintenance is a 2005 fire in a textile manufacturing plant in South Carolina. A wet pipe system was present, but ineffective. It was found that the sprinkler heads were coated with cotton dust. The result of this fire was an $8 million loss.

Marty continued to compare sprinkler failure/ineffectiveness reasons by occupancy. For wet pipe systems, system shut off was the largest reason for failure and was consistently the biggest issue across homes, eating and drinking establishments, store and office occupancies, and manufacturing. Eating and drinking establishments had a higher incidence of damaged system components and lack of maintenance than other occupancies. It was noted by workshop participants that one of the issues with eating and drinking establishments are sprinkler heads being painted. For wet pipe systems that were ineffective, water not reaching the fire was a much larger issue for eating and drinking establishments. For those incidents where

a wet pipe system was ineffective in an eating and drinking establishment, water not reaching the fire was a problem 66% of the time.

A 2007 study of non-fire activations from Massachusetts, Minnesota, and Austin, TX showed that no water was released in half of these occurrences. Breaks or other damage was a bigger issue for warehouses (38% of non-fire activations) over homes, assembly, retail, business, and manufacturing. Homes were more likely to have activation with water outside system (water release where should not have gone). This includes leaks, freezing, and nearby heat activations.

After Marty's presentation there was discussion about how the NFIRS forms are actually filled out. It was noted that training the fire service on how to fill out the reports does provide improvement in the data. However, the data is pretty good overall. Marty suggested that the sprinkler industry provide input into the next version of NFIRS (v 6.0). Some specific suggestions included:

- It is difficult to compare older information from previous versions of NFIRS. It would be helpful to see longer trends.
- Currently, NFIRS does not have the capability to record the age of property or system (or what the system was designed to).
- Need clarification on how fires in attics with no sprinklers are recorded.
- It could be helpful to develop a list of specific follow up questions when sprinkler failure/ineffectiveness is noted on the report.

Panel Discussion: What is the insurer's perspective on sprinkler performance and NFPA 25?

The first panel discussion featured representatives from the insurance industry discussing their perspective on sprinkler performance issues and the role of NFPA 25. Panelists were:

- Ken Linder, Swiss Re
- Top Myers, Myers Risk Services
- Brandon Frakes, XL GAPS
- Dave Fuller, FM Global

The panel was moderated by Bill Koffel, Koffel Associates. Bill posed several questions to the panel for discussion.

What are some of the primary failure modes or events that you are seeing in the field?

> It was noted that the big non-fire issues are freezing and water damage claims, accidental discharge claims (e.g. someone knocking heads off a rack), corrosion, and aging of underground piping; however, emphasis is on the fire problems in insurance rather than the non-fire problems. The issue of impairments was discussed by the panelists. Fire pump impairments are an issue with time of impairment getting longer. It was also noted that insurers consider hidden impairments, or those not known to exist (e.g. a sprinkler system shut down for maintenance and then inadvertently left out of service after work was completed), and that these are a serious issue. NFPA 25 only considers

emergency and pre-planned impairments. Insurers are also seeing problems related to shut valves (both before and during fires). It was emphasized that education of clients is important.

As a follow-up question, to the extent that NFPA 25 might not include some of these non-fire issues, is there anything that should be added to NFPA 25?

The requirements in NFPA 25 have all come from issues that we have encountered in the field. It was noted that the insurers of the sprinkler installers already deal with design and installation issues. The inspection companies are often sued for these types of issues and they often just have wear and tear experience. However, it would be better to have design and installation issues covered by something other than NFPA 25.

As an insurance carrier – are you comfortable where NFPA 25 is on design and installation issues?

Regardless of what is included in the document, there is a focus on client training/education to make them aware of issues related to design and installation of sprinkler systems and how they can negatively impact business.

It was pointed out that one issue for some occupancy types is that owners are given recommendations by the sprinkler inspectors and then ignored unless the fire department or AHJ is requiring the recommended changes. This is much less of an issue with healthcare or industrial type occupancies. A suggestion was made that recommendations from inspections be sent to the insurers and/or the AHJ.

In the article I authored that was published in the NFPA Journal, I posed a question "What is the enforcement mechanism to ensure that the owner's responsibilities are being met?" I received an email stating that, "Certainly the insurance carriers can't be relied upon; most, if not all, require no notification of inspections." Do you believe that a requirement to send the inspection and test reports to insurance carriers will help address the issues?

From the enforcement perspective, AHJs cannot just rely on the insurance inspections. They do not always cover 100% anymore. Enforcers need to find another way to get inspections done. AHJs need to initiate contact with owners.

A couple of specific examples were given in discussion of this question. In North Carolina, NFPA 25 is adopted and is successful in the urban areas. The issues are in the facilities in rural areas. Education and enforcement are key. It was noted that FM Global developed a tool for rural clients. FM decided that they did not want to require system reports back to FM because they did not want to shift the responsibility off the owner. In Gainesville, FL, if an ITM inspector finds issues in the facilities and sends a report to loss prevention, the issues may more likely be addressed.

It was also noted that if a sprinkler inspector does red tag a system, the company will likely lose the inspection job. There is a view that the decision to red tag a system should be made by the local AHJ rather than the sprinkler inspector.

A brief discussion on data followed. It was noted that the source of the data is important; is it coming from a state or jurisdiction that enforces NFPA 25, or not? We need this information to have an idea of whether NFPA 25 is effective in its current form.

NFPA 25 states that the inspector is not required to identify design/installation issues. How does one draw the line between design/installation issues and maintenance issues, especially when the use or operations within buildings change quite often? For example, if the storage is too close to a sprinkler the inspector is to note it but if a room is protected as a light hazard but now has miscellaneous storage the inspector is not required to note it.

Is there a need to tighten up the document? It was stated that NFPA 25 should be a pure document that lists the requirements to properly maintain a system. When NFPA 25 was first developed, the goal was to include provisions that focused on keeping a system operational. There was not much emphasis on responsibilities and roles. The word "performance" is used in various instances in NFPA 25. This allows an opening for design issues in interpretations. A suggestion was made that an NFPA 25 guide may be helpful.

Some have said that sprinkler systems should be "re-commissioned" at some frequency. Do you agree that there is a need for such re-evaluation and if so, what should the frequency be?

This question goes back to the issue of building flexibility into the standard. This may make sense for complex systems, but may not be needed for simple systems. How do you write that type of provision into the document? It was noted that the component action replacement requirements in NFPA 25 do already address this issue somewhat. It was stressed again that education on the ITM topic is needed on many levels.

From a slightly different perspective, does NFPA 25 go beyond what people are willing or capable of doing?

The standard is viewed as the bare minimum, but every provision in NFPA 25 is there for a reason. There are many different perspectives on this, but the requirements in the standard need to be reasonably enforceable.

What are you seeing with old vs. new systems in terms of losses?

It is being found that data is not being collected on new systems. It was discussed that old equipment that is properly maintained, usually performs well. New equipment that is not maintained is often not as reliable. Insurers are not seeing performance issues that specifically relate to system age.

A follow up question was posed about harsh environments. NFPA 25 treats them all equally, but should we differentiate in the standard? It was stated that this is a bigger issue than NFPA 25. The question again is how do you build in flexibility in a code or standard? There are many variables and each facility is different. Someone needs to address these different issues, although no one is currently doing this.

What about taking inspection out of the document – just leave testing and maintenance?

It was generally agreed that inspection should be left in the standard. Shut valves are a big problem, and as a result we need to inspect for these regularly. It was noted that there are a lot of tradeoffs in the building codes because of the presence of sprinklers. Because of this, the inspection part needs to remain in the standard.

It was suggested that maybe this is a terminology issue and perhaps the standard should require visual checks instead of inspections. A specific example was made of the requirement to maintain a minimum 40 degree Fahrenheit temperature. The intent of the requirement was to try to identify likely issues that could lead to freezing, but not necessarily consider every possible scenario.

The insurers were then asked for final thoughts on any additional issues.

- The rapid rate of change in the industry has allowed us to build more effective and less expensive systems, but these systems often make ITM more difficult.
- There are limited enforcement resources for ITM activities and the number is not getting larger. Is there a way to use technology (e.g. monitoring, etc.) to help drive the cost down for ITM activities?
- It was noted that there is a need for statistical data to feed into the requirements.
- There is a need to consider the end user of the document in the language and requirements.

Presentation: Where does NFPA 25 fit in? - Matt Klaus, NFPA and Bill Koffel, Koffel Associates

Matt Klaus provided the history of the NFPA 25 standard. It started as NFPA 13A, *Recommended Practice for Maintenance of Sprinkler Systems*. In 1990, NFPA 25 was approved as a standard. Although design evaluations are not currently included in NFPA 25, there is nothing in the scope of NFPA 25 or in the scope of the Technical Committee that eliminates the possibility of design evaluations being a part of the standard.

NFPA 25 has separated from NFPA 13A's approach of recommended practice to just covering wear and tear issues. Matt noted that some other documents that could be used to cover the issue of design evaluations were NFPA 1, *Fire Code*; NFPA 3, *Recommended Practice on Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*; NFPA 4, *Standard for Integrated Fire Protection and Life Safety System Testing*; and NFPA 101, *Life Safety Code*.

Matt suggested that maybe re-commissioning could be determined by occupancy type with more complex occupancies requiring this exercise. He also pointed out that NFPA 72, *National Fire Alarm and Signaling Code*, has a visual inspection requirement that includes wear and tear as well as a design evaluation portion. The main issue is the management of change.

He also described some of the specific complaints that he has heard, including that inspections will pick up a bent hanger rod but not an unsprinklered room, and system tagging is left to states with no uniformity. Matt noted that NFPA receives a lot of questions on NFPA 25 Chapters 1 (Administration), 4 (General Requirements), and 14 (Obstruction Investigation) from NFPA members.

Bill Koffel provided some additional thoughts and discussion points related to the current NFPA 25 scope and design evaluations. Does NFPA 25 (and any other processes in place) result in a level of reliability that is expected? Sprinkler effectiveness data has pretty much remained the same, while operational reliability

has been subject to some change. Owners think that they are getting more from inspections; however, in reality, only specific aspects of NFPA 25 are covered. He posed the question – how can we reasonably expect owners to recognize problems (e.g. different packaging for stored goods, etc.)?

Some issues are covered by the building permit process, such as change in occupancy classification. However, commodity changes would not trigger a permit. Neither would a change from a patient sleeping room to a storage room in a hospital. Also, if issues are covered though the building permit process, this would usually be under the purview of the building official instead of the fire marshal. Building officials do not necessarily know a sufficient amount about fire protection.

The main issue is one of liability and NFPA 25 is becoming very liability driven. The standards making process is not meant to satisfy every legal situation. If an inspector points out some areas that are not sprinkler protected, but misses others, they could be sued. There needs to be some reasonable limits.

Bill suggested that there may be an issue with the term "inspection". Inspection contracts should not be overarching (e.g. full NFPA 25 inspection, complete evaluation). Inspectors should not be expected to evaluate the applicability of the design, but they should be familiar with the original assumptions of the design. This should apply beyond fire to water issues as well. He stated that there may be a need for different levels of inspections, but also cautioned that if design evaluations are included, there needs to be limitations.

NFPA 25, Chapter 4, gives building owners a lot of responsibility – is this appropriate? For HVAC, plumbing, and electrical issues, owners know there is a problem because of issues during everyday use. This is different for sprinkler systems. However, contractors cannot carry all the liability; owners need to have some responsibility.

There was a Certified Amending Motion for NFPA 25 to add identifying areas where sprinklers are not present to inspections. It was not moved, but this is likely to be brought back. It only covered if sprinklers were provided; it did not address inadequacy of sprinklers. Sprinkler coverage is something that should be obvious to owners, but unless you have trained them to know what to look for, they will not know. He stressed that owners need education. Some of the Highly Protected Risk (HPR) insurers are willing to take on education, but what about the rest?

Panel Discussion: Expectations of ITM and NFPA 25

The second panel discussion featured owner, enforcer, and installer representatives discussing their perspectives on the roles and responsibilities of NFPA 25 and ITM. Panelists were:

- Russ Leavitt, Telgian
- Richard Ray, Cybor Fire Protection Company
- Brock Mitchell, Extended Stay Hotels
- John Lake, City of Gainesville, FL

The Panel was moderated by Amanda Kimball, Fire Protection Research Foundation. Each panelist had a few minutes to present his viewpoint and then there was some general discussion between the panelists and the workshop participants.

John Lake discussed the question, “Is what needs to be done to properly maintain a sprinkler system in NFPA 25?” His viewpoint is that it is not. He stated that NFPA 1 and NFPA 13 send you back to NFPA 25 for all inspection, testing, and maintenance issues, but NFPA 25 does not give you all the necessary information to keep a sprinkler system working effectively. If NFPA 25 does not contain this information, there is nothing to point back to. This makes it difficult to red tag a system. As an alternative example, the *International Fire Code* considers alternations and changes, and it sends you back to the installation standard.

Brock Mitchell noted that during the previous discussion, it was stated on multiple occasions that owners should know about sprinkler systems. He disagrees with this and finds the statement unreasonable and unrealistic. For example, hotel managers are tasked with getting rooms filled, not maintaining systems. He noted that most of the discussion has been focused on changes, but needs to also consider the systems already in place. His view is that AHJs should already be inspecting these buildings. Brock also mentioned that to conduct design evaluations, the inspector would need to know the design assumptions, which are often unavailable. He further emphasized that the field technicians doing the inspections do not have the skill set/training to do these design evaluations.

Richard Ray’s view was that NFPA 25 should stay a wear and tear document. If design evaluations are required, they should not be in the standard. He suggested that design evaluations may not be necessary for all occupancies, but may be beneficial for warehouses and industrial type facilities. He suggested that NFPA 25 should not be expected to take the place of the permit process when alterations are made. Richard’s view is that NFPA 25 is doing its job, but it is not always being enforced. He cited the example of Illinois, which is progressive with sprinkler installations, but not always with enforcement. He posed the question of, “What is keeping AHJs from enforcement?”, and then speculated that maybe NFPA 25 is too much (i.e. ITM activities are too frequent).

Russ Leavitt presented a slightly different viewpoint because he has had the opportunity to play multiple roles in the ITM process, including: inspector, owner representative, and third party enforcer. Telgian has dealt with 14,000 jurisdictions and his view is that the main issue is the lack of education. Russ stated that we need education of all parties: owners, AHJs, and inspectors. NFPA 25 is meant to provide a “reasonable degree of protection”, but what is reasonable? We need to know the cost to benefit ratio. He gave an example of a tool that AHJs could use now, which is the retroactivity clause in NFPA 13. This clause allows AHJs to require retroactivity of any portions of the standard where they feel there is “an unacceptable degree of risk”. Russ cautioned that if design evaluations are required, that they should be done under the current adopted code/standard because it is too difficult to determine the edition used at the time of construction and what variances, etc. were allowed.

After the panelists presented their viewpoints, there was general discussion between the panel and the workshop participants. On the topic of enforcement, it was noted that staffing levels have dropped in prevention and it is common to now rate buildings high, medium, and low risk. The risk level determines inspection frequency. It was pointed out that some dialogue with the AHJ needs to happen about inspection activities. The staffing levels are not going up, so the resources for enforcement are going to remain limited. This is true for both urban and rural areas. By cutting Fire Department resources, the communities are

actually relying more on sprinkler systems. If the inspector sends the AHJ the report (and continues to do so on a regular basis), this could resolve some issues.

It was stated that the permit process would not fix this because it will not work in rural areas. Part of the problem is that volunteer fire departments are often put into the position to do plan reviews, despite not having the necessary training. It was also pointed out that the permit process would not catch all of the issues. For example, when the volume of storage in a facility increases, and there is no change in tenant or occupancy, there is not necessarily a requirement for a permit even though this poses a change for sprinkler protection.

Owners view inspectors as their partners. When an inspector red tags a system it changes the relationship with the owner. They are no longer partners. This puts inspectors in an awkward position. It was suggested that maybe there should be a way for inspectors to identify possible issues and hand over to enforcers to follow up, but several others believed that this should be included in NFPA 25. It was further postulated that if enforcers are not visiting the facility, it is less likely that the system is being properly maintained, inspected, and tested.

A discussion was started on what the term “inspection” means and how we should be educating inspectors to do proper inspections. It was stated that inspections and evaluations are two different things and they should not be done by the same people. It was also suggested the evaluations may be cost prohibitive if done on a regular basis.

A question was posed to the group, “If the contractor does what NFPA 25 asks, but did not identify a design deficiency, is this ok?” There was a viewpoint expressed that this is not ok because ITM inspectors are in the building annually and, due to staffing/budget cuts, enforcers are not necessarily visiting buildings at this frequency. It was pointed out that selling sprinklers is hard enough (compared to other types of building systems) – how can we ask the average person on the street to know/care about sprinklers? Any requirements need to be reasonable.

It was questioned what the liability to the owner is if NFPA 25 is not followed. It was then clarified that full NFPA 25 inspections are not usually being done anyway. Most states are focused on annual, some have quarterly; but no one could think of an example of a jurisdiction that is doing a full inspection program per NFPA 25. Due to competition, inspection companies are often writing up two contracts for customers: one is per NFPA 25 and one is per what the jurisdiction will allow. However, it was noted that in some cases, inspection companies are now being asked to do design evaluations. This is mostly in larger, more complex buildings. Service providers have to decide how much liability to take.

It was discussed where design evaluations should be addressed if made a requirement. A poll of AHJs in Florida asked the preferred location (i.e. document) for prescribed design evaluations. The results of the poll found inclusion in NFPA 13 was preferred, since that is where the installation criteria is located. It was questioned why sprinkler systems should be singled out. Egress systems, fire compartment walls, and other systems could also benefit from periodic evaluations. If a full re-evaluation of all systems is made a requirement, it would make most sense to include it in a more general document like NFPA 1 or to address specific occupancies in NFPA 101 or the building code. Another suggestion was to include design evaluations as part of NFPA 3 and NFPA 4.

A suggestion was made to form some interview questions for owners (e.g. have you done anything to change storage practice, room configuration, etc.). This could be included as part of the inspection items in NFPA 25 and act as a trigger for a design evaluation. Instead of including the survey in NFPA 25, it was suggested that it could be included in NFPA 1. There are already triggering limits for egress and other issues in NFPA 1. There was a view that NFPA 25 should be kept simple and not as complicated as NFPA 13. It was suggested that maybe NFPA 25 is already too complicated with all of the changes made to ITM frequencies, so if design evaluations are required, they should be triggered by another document/process.

Day 2 Breakout Groups

Breakout Topic 1: Is NFPA 25 or NFPA 13 (part of) the solution?

The participants were split into seven breakout groups to discuss how NFPA 25 and NFPA 13 could possibly address the issue of performance problems. This could include changes to scope, to content, in how the standard is implemented or applied, or how the standard is enforced. The suggestions below are split out by groups.

Group 1 made the following points:

- The structure of NFPA 25 is pretty good and overall it covers the ITM issues. The triggers for a design evaluation could be in 25, but the evaluation process should be included in 13, which covers the steps for designing a system.
- Firstly, we need to educate inspectors. NFPA 25 should be a “mechanic’s guide” that does not access adequacy of the system unless pointing to another document.
- As part of education, include NFPA 1 when talking to AHJs about enforcement. Educate AHJs about enforcement mechanisms such as requiring compliance letters when there are changes in occupancy.
- Specifically discuss the design evaluation triggers with the building owners, give the owner a list of items of what to look for and educate the owners about the list.

Group 2 discussed the following:

- Suggested taking out the requirements for who is responsible for what. Should the document just list the things that you need to do (and timeframes) to ensure current system works? Then, can rely on contracts for responsibilities.
- It was noted that everything points back to 25 for ITM issues, but for design issues does not point back to any document.
- Discussed changing NFPA 1 language. Already covers ITM, but need to have something that deals with changes.
- Also discussed education. There is a need to educate property owners, but there is a cost issue.
- Suggested that surveying the AHJs to find out how 25 is being used (what are they enforcing) would be useful. Possibly work with the International Fire Marshals Association (IFMA).
- It was noted that there are no training requirements in 25. The document just references “qualified person” or “qualified personnel” to undertake the activities. Also, there are different types of

inspections and inspectors: insurance inspector, contractor, etc. Need to consider this in the codes/standards.

- The group ended by saying that right now we have nothing addressing the design issue. This is a problem that will get worse

Group 3 discussed the following points:

- Based on Marty's presentation, after 25 years of NFPA 25, the number one problem is closed valves. Should focus on fixing this problem.
- Suggested the following changes to NFPA 25 scope:
    - Make it a wear and tear document with protocols for solutions
    - Need to simplify document and the frequency of ITM
- There are variations in how NFPA 25 is applied. Simplifying would help with this issue.

Group 4 made the following points:

- The big concern is the current lack of application of the standard.
- NFPA 25 should set the base minimum to ensure water comes out of sprinklers. The frequencies should reflect this (less frequent ITM). May want to consider a base frequency of quarterly/annually for all activities. Cost of inspections is an issue; there needs to be a base level of frequency.
- The scope needs to be clearly stated. The goal is to get water out of sprinkler heads; not assess adequacy of system. Need to align scope to this goal.
- Agreed that education is critical. This includes education of inspectors (easier); challenge is educating the public and AHJs.
- Is it reasonable to expect an inspector to find a missing sprinkler? What do they do with this information? What does this mean? Design adequacy issues should not be included in NFPA 25.

Group 5 discussed the following:

- How do you get NFPA 25 to the owner and have the owner understand the requirements? End users do not necessarily know what they are doing/not doing.
- Should add coverage issues (missing sprinklers) to NFPA 25 as well as a requirement to report deficiencies to AHJs.
- Want more root cause analysis related to the problems of shut valves and lack of water discussed by Marty. It is unknown what changes are needed without research.
    - Why is valve security still a problem with all of the valve monitoring?
- Do we know what the serious problems in sprinkler system failures are (examples: are painted sprinklers a problem, 5-year-old pressure gauges a problem)?
- Do we want NFPA 25 to have a change in scope? Should it be wear and tear (make sure what is there works – mechanically going to function) or cover management of change (hazard change/occupancy change)?
    - General view is that NFPA 25 is not being executed as is, so do not want to add to it
    - Freeze and break issues in cold climates are a result of NFPA 25 not being followed
    - Maybe develop a simple civilian guide (few pages in length) vs. entire copy of NFPA 25

- NFPA 25 should be trimmed down. Separate wear and tear issues from hazard analysis. NFPA 25 should focus on wear and tear. Maybe complex systems (deluge and water mist) should not be included in NFPA 25 because they need hazard analysis.
    - Should there be different ITM requirements for low hazard occupancies (hotels, apartments, office buildings, schools, etc.) vs. higher hazard occupancies (warehouses, storage, HPR, etc.)?
- Enforcement is a problem from contractor perspective. They are on the hook for problems, but often cannot compel them to be fixed.
- Suggested changes to enforcement:
    - Reporting mechanism to AHJs – major impairments/red-tagging notice to AHJs
    - Some (many) state/local AHJs amend NFPA 25 (either by rule or practice)
    - Seems to be two extremes: nothing is being enforced or everything is being enforced

Group 6 addressed the following:

- Agree that there is a problem involving changes in occupancies – specifically special hazards, storage facilities.
- Need additional statistics on performance/sprinkler adequacy for occupancy changes.
- Design evaluations are outside the scope of 25 – focus in 25 should remain on wear and tear.
- Trigger for sprinkler adequacy should be addressed by building and fire codes; appropriate design standards.
- Suggested the possibility of a new ITM standard that is process driven (i.e. it would include specific hazards, occupancies).

Group 7 made the following points:

- General consensus of the group is that they are happy with the scope of 25.
- However, regarding the content of 25 – could be simplified to be more user friendly.
- Implementation – maybe fire codes are not clear enough when they point to 25?
- Echoed that enforcement and education are issues:
    - Can we have education programs for owners and AHJs on what to expect from inspections?
    - Owner expectations of inspectors are different than what inspections typically provide

During the group reports, several suggestions were made that NFPA 25 needs to be simplified. Participants were asked to discuss simplifying the frequencies in NFPA 25 and in some cases lengthening the time between some activities.

- If go to quarterly (minimum basis), need annex material because may actually need to do some things more frequently.
    - Pointed out that Annex is not enforceable
- Determining that what is there is in working order requires a different set of skills than a hazard analysis/design evaluation.
- Hazard evaluation needs to be done – whether in 25 or not – maybe add an owner's chapter to 25.

- Do not have justification for exact timeline for design evaluations – should have a hazard/risk based frequency.
    - Noted that reporting vs. how often ITM is done are different issues
- Need to review how NFPA 25 is referenced in NFPA documents that have design/installation requirements. May need to change wording in these documents.
- A lot of discussion has been focused on warehouses, but cannot just focus on warehouses (what about changes in other occupancies?). However, it was also noted that this is an occupancy driven issue and warehouses do present a larger issue due to frequent changes.
- It was pointed out that NFPA 13 has a retroactivity clause; 25 does not, except where related to comparison of water supplies.
- Note that there is a need to keep the standard simple in order for it to be used and enforced. However, it was also noted that the primary cause of failure is closed valves – what message does reducing frequencies give?

Breakout Topic 2: Are other strategies (part of) the solution?

The same seven breakout groups reconvened to discuss alternative strategies to address performance issues including the questions:

- What are some major alternative or complementary protocols (particularly those implemented in another code or standard)?
- Which problems unaddressed by NFPA 25 are addressed by other protocols?
- Where are these other protocols implemented? What are triggers for their use? Any ideas on when, where and how to implement going beyond current practice?

Group 1 discussed the following additional ideas and language for the introduction and enforcement of system evaluations:

- Add the word “design” to the title of NFPA 13.
- Need mandated language for evaluation within the building and fire codes – IBC, IFC, NFPA 1, and NFPA 101.
- In NFPA 25 Annex, add a list of items that need consideration when determining if an “evaluation” is required (keep Sections 4.1.6/4.1.7 related to changes in occupancy and hazards). Examples: new kitchens areas, change of storage contents, storage arrangements and many more.
    - Develop an evaluation template for inclusion in the annex of NFPA installation standards (property description, design criteria, system description, compliance analysis)
    - Direct owner to correct NFPA installation standard

Group 2 made the following points:

- Is it a standard issue or a code issue?
    - The view is that design evaluations are a code issue
- Building official has an obligation to address design issues, but they need a tool. Suggested approach should be to take NFPA 25 (2014 Edition) Sections 4.1.6 and 4.1.7 (addressing changes in occupancy and hazard) and insert into NFPA 101/5000 and NFPA 1 (and IBC/IFC). If this is

done, officials have a tool to direct the owner when these changes on occupancy and commodities occur.
    - This simplifies the 25 document (and lowers the cost of inspections)
    - If the cost of inspections is increased by adding more requirements, could end up doing fewer inspections
- Need education around the shut valve problem. Suggested developing a PSA/training module to reduce the frequency.

Group 3 made the following suggestions:

- When copy of 25 is left with building owner, a simplified summary (guideline) should also be provided.
- Maybe have a separate document that covers occupancy changes/evaluation triggered by 25 (but not in 25).
- Possible methods for education on current requirements:
    - PSAs (e.g. cover closed valve issue)
    - Symposium – maybe by chapters of related membership groups (e.g. International Code Council (ICC), Society of Fire Protection Engineers (SFPE), American Society for Healthcare Engineering (ASHE)) – open to contractors and AHJs
    - ITM App for building owners to use allowing them to tie into their calendar to remind them of inspections, etc.

Group 4 discussed:

- Generally agreed that the nuts and bolts for maintaining a water based system is already included in NFPA 25.
- Discussed fire code as a possible method for triggering design evaluations.
    - Should be for specific occupancies in 101/5000
- Education and enforcement are major issues, both fiscally and politically.
    - Education needed on all levels – installers, inspectors, AHJs, owners
    - To reach owners – trade shows (facilities management associations, Building Owners and Managers Association (BOMA)) – NFPA booth at trade shows that specifically includes ITM of sprinkler systems
- Possible triggers for design evaluations:
    - When a new occupant goes into a building (or building sold) – business license triggers an inspection
    - During due diligence process by owner – may not fit into code this way
- Need basic documentation (design basis) for when system is originally installed – needs to be written for the owner.
    - Not sure how to get this documentation to the owner – maybe by installer
- Need PSAs that address the closed valve issue (remind owners to check their valves to make sure they are open).
- Documents that cover wet/dry chemical extinguishing and fire alarm include periodic inspection to check if hazard has changed.

Group 5 discussed the following:

- There are cases where an evaluation of change is warranted but we are not certain where it belongs.
- Scope of NFPA 25 (2014 edition) seems to include change issues:
    - **Scope.** This document establishes the minimum requirements for the periodic inspection, testing, and maintenance of water-based fire protection systems and the actions to undertake when changes in occupancy, use, process, materials, hazard, or water supply that potentially impact the performance of the water-based system are planned or identified.
- Perhaps place design deficiencies and management of change issues (hazard changes, re-classifications, re-evaluations) into fire code (NFPA 1, IFC).
- Discussed definitions of the following: Inspection (visual look) vs. maintenance (putting your hand on something) vs. repair (fixing a deficiency).
- Possible suggestion: Add language from other NFPA standard such as NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, which reads:
    - 11.1 General
    - 11.1.1 A water spray system installed in accordance with this standard shall be properly maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, and NFPA 72, *National Fire Alarm and Signaling Code*, to provide at least the same level of performance and protection as designed
- Another possible suggestion: Add language from other NFPA Standard such as NFPA 30 (2012 edition), *Flammable and Combustible Liquids Code*, which reads:
    - **6.4.2 Management of Change.** The hazards analysis shall be repeated whenever the hazards leading to a fire or explosion change significantly. Conditions that might require repeating a review shall include, but are not limited to, the following:
        1) When changes occur in the materials in process
        2) When changes occur in process equipment
        3) When changes occur in process control
        4) When changes occur in operating procedures or assignments

Group 6 made the following suggestions:

- Suggestions have been made to take Sections 4.1.6 and 4.1.7, related to changes to occupancy and hazards, out of 25 and put similar language in installation standards. Noted that this approach is a bit unwieldy, where do you stop? Think that it may be better to put in NFPA 1 (gives building official something to fall back on).
- NFPA 25 should focus on wear and tear and let other documents take care of evaluations.

Group 7 made the following discussion points:

- Do not see a huge problem with NFPA 25 currently. It does what it is tasked to do.
- Stressed that we need education – maybe NFPA can develop a white paper or guideline that outlines the responsibilities of the end users of 25.
- Triggering mechanism should be in fire code (since this is where other systems are covered).

Summary

Overall there was general consensus that NFPA 25 should remain a wear and tear document and that it is for the most part ok in its current state. Some suggestions were made to remove Sections 4.1.6 and 4.1.7 (addressing changes in occupancy and hazard) from the 2014 edition of NFPA 25 and move to another document (e.g. installation standards, fire code). Since it was agreed that NFPA 25 should remain a wear and tear document, it could include the triggers for design evaluations/hazard analysis, but the actual requirements for evaluations and analysis should be covered elsewhere, such as NFPA 13, the fire code, the building codes, or even NFPA 3 or 4. Some language from other documents (NFPA 30) was suggested as a template for a trigger in NFPA 25. A suggestion was made to develop an evaluation template for inclusion in the annex of NFPA installation standards. Another suggestion was made to form some interview questions for owners (e.g. have you done anything to change storage practice, room configuration, etc.). This could be something that is included as part of the inspection items in NFPA 25 or in another document (like the fire code) and could be a trigger for a design evaluation.

It was suggested by many that the requirements for design evaluations should be determined by occupancy type/hazard. For low hazard occupancies, design evaluations may not be required (or at least not on a frequent basis). Require design frequencies on a regular basis for those occupancies with higher hazards (e.g. warehouses, industrial facilities). It was also suggested that maybe complex systems (e.g. deluge and water mist) should not be included in NFPA 25 because they need hazard analysis. Design evaluations or hazard analyses should not be carried out by inspectors because the inspectors do not have the right skill set.

There were concerns raised that NFPA 25 is not being followed in its current state, so it is not ideal to add requirements. In fact, several suggestions were made to simplify the ITM frequencies in NFPA 25 by specifying a base frequency of quarterly or annual. There was also a question posed about having different ITM frequencies for low vs. high hazard occupancies. Some also questioned the frequency with which design evaluations should be required. A suggestion was that the frequency of design evaluations should be hazard/risk based.

Enforcement is a major concern. Fire and building department budgets continue to be cut, which reduces the resources available for enforcement. There is reliance on the annual inspections to catch any issues. It was noted during the insurer's panel that insurance inspections should not be relied on because they are often not covering 100% of properties. Enforcers need more tools at their disposal. For example, reporting mechanisms from inspectors could be one tool. AHJs could require inspectors to send all inspection reports or at least those that identify any major impairments. Some suggested that it may be better for AHJs rather than inspectors to red tag systems. Also, a suggestion was made to survey AHJs to find out how NFPA 25 is being used (what provisions are they enforcing).

Everyone agreed that education around the design deficiency issue, as well as the current requirements of NFPA 25, is ultimately important. Education of all parties is required: inspectors, AHJs, owners, and the general public. It was noted that it is easier to educate the inspectors and AHJs than owners and the general public. A specific educational initiative would be to educate AHJs about enforcement mechanisms such as, requiring compliance letters when there are changes in occupancy. One group suggested having a training symposium open to contractors and AHJs to cover current NFPA 25 requirements and design issues. This

could be implemented by working with related membership groups (e.g. International Fire Marshals Association, International Code Council, American Society for Healthcare Engineering, American Society of Safety Engineers).

If design evaluations are implemented, the evaluation triggers need to be reviewed with building owners. Building owners should be given a list of items that would trigger a design evaluation. Other education suggestions were to have an education program for owners and AHJs on what to expect from inspections. Owner expectations of inspections are different than what is often provided. A specific suggestion made by a couple of groups would be to develop an NFPA 25 guideline for owners/general public that is a few pages long and covers the major issues. One group suggested an ITM App that could be used by building owners that links to their calendars and sends reminders of ITM deadlines. Another suggestion to reach owners was to have an NFPA booth at trade shows directed at building owners and managers (e.g. Building Owners and Managers Association, International Facility Management Association) that specifically includes information on ITM of sprinkler systems.

Based on Marty's presentation the number one problem is closed valves. It was felt that we should focus on addressing this problem. It could be helpful to develop a PSA or another training module for building owners and facility managers to remind them to check their valves regularly to make sure that they are open. One suggestion was made for more root cause analysis of the specific issues related to shut valves and the lack of water problems discussed by Marty. It is unknown what changes may be needed without more detailed information. Marty suggested that the sprinkler industry should provide input into the next version of NFIRS (v 6.0).

Attachment A: Sprinkler Performance in US Fires

Sprinkler Performance in US Fires

Based on John R. Hall's June 2013 report of the same name

Presented by
Marty Ahrens
NFPA Fire Analysis and Research
December 9, 2013

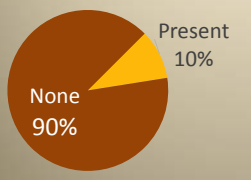
Overview

- Unless otherwise specified, a*ll estimates are based on reported fires in 2007-2011*
  - Exclude properties under construction
- Data sources
- Presence and type by occupancy
- Reliability and effectiveness
  - Overall and by occupancy
  - Heads operating
  - Reasons for failure or ineffectiveness
  - Examples
- Non-fire activations

Data sources

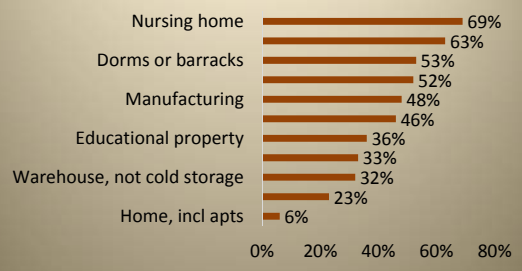
- Estimates were derived from detailed data collected by
  - USFA's National Fire Incident Reporting System (NFIRS) and
  - NFPA's annual fire department experience survey
- Unknown or missing data allocated proportionally
- NFIRS classifications do not always correspond with NFPA, census classifications, etc.

Reported fires with sprinklers present

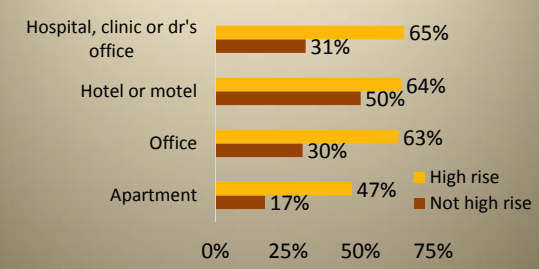


- "Present" means in fire area
- Sprinkler presence varies by occupancy
  - More common in institutional and high-rise properties
  - Present in only 6% of reported home fires

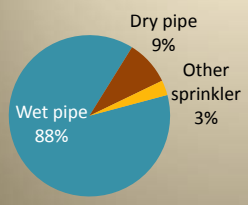
Sprinkler presence in reported fires by occupancy



Sprinkler presence: high rise or not

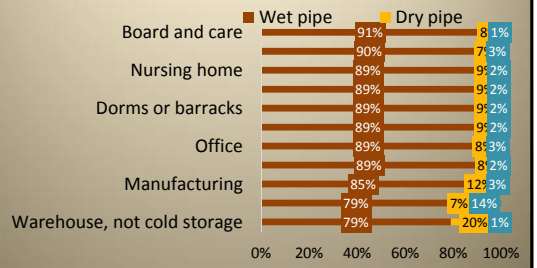


Types of sprinklers present



- Wet pipe is most common in all occupancies
  - Storage properties were more likely to have dry pipe than other properties were

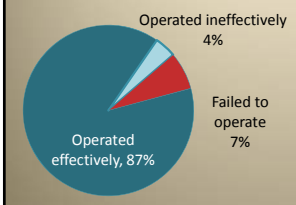
Sprinkler type by occupancy



Data edits and caveats

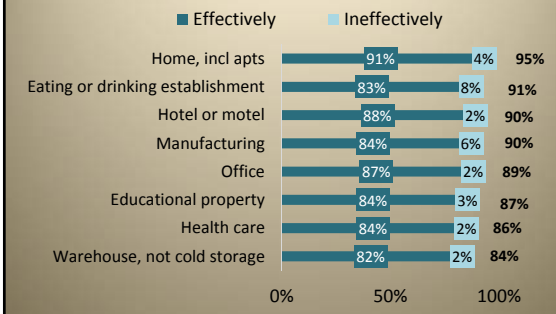
- If AES was coded as
  - "Present," but reason for failure or ineffectiveness was "not in fire area", then presence was given an NFPA code of "present outside of the fire area and did not operate"
- If performance was coded as
  - "Operated and not effective" and reason was "system shut off," then performance was changed to "Failed to operate"
  - "Failed to operate" and reason was "not enough agent" or "agent did not reach fire," then performance was changed to "Operated and not effective"
- Unclassified (other) reason for failure or ineffectiveness was treated as unknown and allocated proportionally
- Reliability and effectiveness estimates exclude
  - Fires with incident types indicating specific types of confined fires
  - Fires that were too small to activate sprinklers

In non-confined fires large enough to operate, sprinklers (all types)….

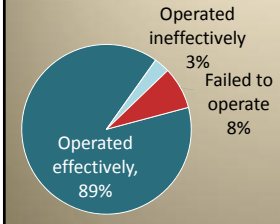


- Operated in in 91% of fires
  - Were effective in 96% of the fires with operation
- Multiplying 91% times 96% means that
- Sprinklers operated effectively 87% of the time

Sprinkler operation (reliability) and effectiveness by occupancy

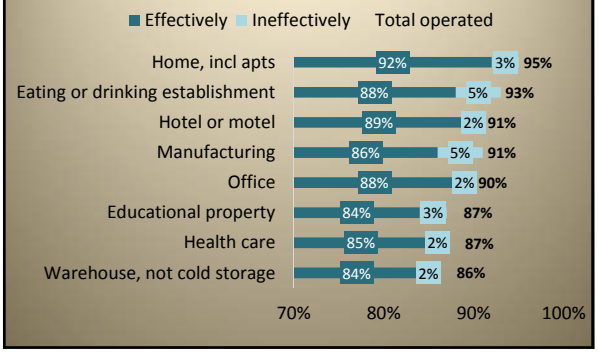


In non-confined fires large enough to operate, WET PIPE sprinklers

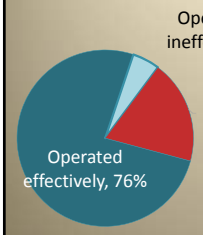


- Operated in in 92% of fires
  - Were effective in 96% of the fires with operation
- Multiplying 92% times 96% means that
- Wet pipe sprinklers operated effectively 89% of the time
- Reminder
  - Wet pipe accounted for 88% of sprinklers in

WET PIPE sprinkler operation (reliability) and effectiveness by occupancy

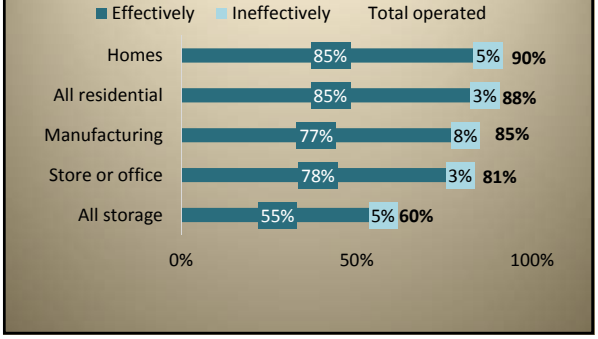


In non-confined fires large enough to operate, DRY PIPE sprinklers…

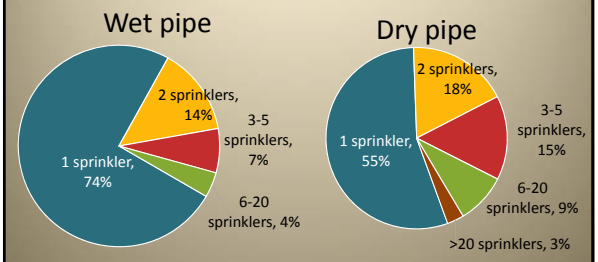


- Operated in in 81% of fires
  - Were effective in 94% of the fires with operation
- Multiplying 81% times 94% means that
- Dry pipe sprinklers operated effectively 76% of the time
- Reminder
  - Dry pipe accounted for 9% of sprinklers in reported fires

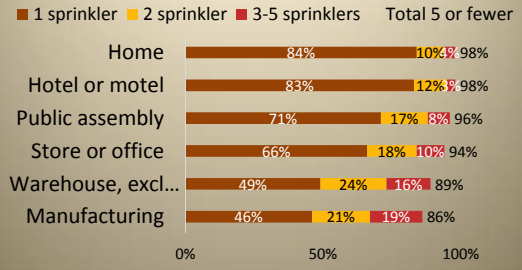
DRY PIPE sprinkler operation (reliability) and effectiveness by occupancy



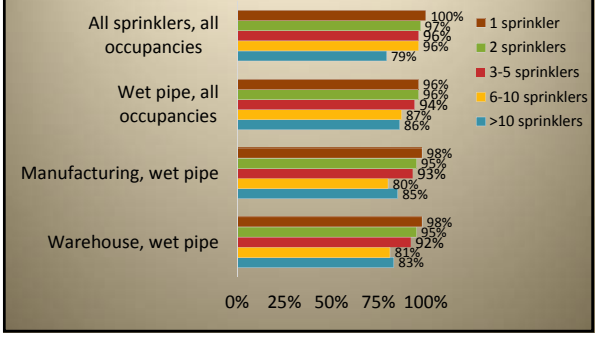
Number of wet and dry sprinklers operating



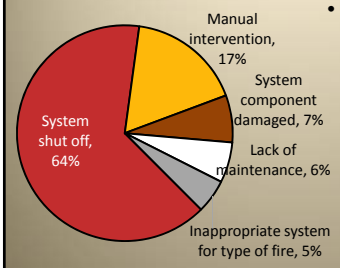
Number of operating wet sprinklers, by occupancy



Sprinkler effectiveness by number of operating sprinklers

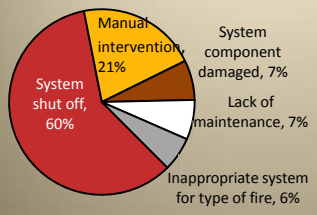


In non-confined fires large enough to operate, sprinklers (all types) failed to operate due to



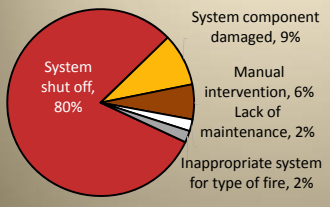
- Sprinklers of all types failed to operate in only 9% of these fires

In non-confined fires large enough to operate, WET PIPE sprinklers failed to operate due to



- Wet pipe sprinklers failed to operate in only 8% of these fires
- Reminder
  - Wet pipe accounted for 88% of sprinklers in reported fires

In non-confined fires large enough to operate, DRY PIPE sprinklers failed to operate due to

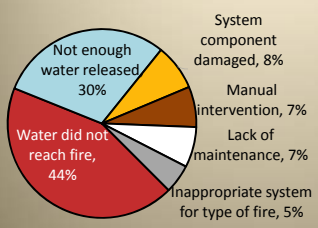


- Dry pipe failed to operate in 19% of these fires
- Reminder
  - Dry pipe accounted for only 9% of sprinklers in reported fires

Examples: Large fires with system shutoff

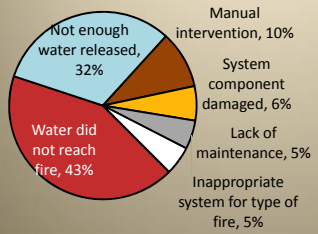
- Massachusetts, 2007 $26 million loss in former mill with 56 mercantile businesses
  - Combination wet and dry sprinkler, with a padlocked valve in area of origin
  - Welding (without permit) done in basement day before
- Maryland, 2005, $11 million loss
  - Incendiary fire in vacant warehouse spread to second warehouse
  - Sprinklers had been shut down when building became vacant

In non-confined fires when sprinklers operated ineffectively, it was due to



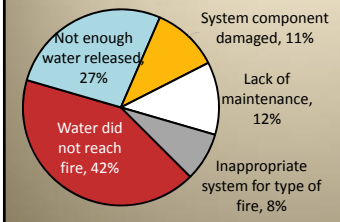
- Sprinklers of all types were ineffective in only 4% of these fires

In non-confined fires when WET PIPE sprinklers operated ineffectively, it was due to



- Wet pipe sprinklers were ineffective in only 4% of these fires
- Reminder
  - Wet pipe accounted for 88% of sprinklers in reported fires

In non-confined fires when DRY PIPE sprinklers operated ineffectively, it was due to



- Dry pipe sprinklers were ineffective in 6% of these fires
- Reminder
  - Dry pipe accounted for 9% of sprinklers in reported fires

Example: Large fire with lack of maintenance

- South Carolina, 2005 $8 million loss in textile manufacturing
  - Detection system was out of service
  - Wet pipe system was present but ineffective
  - Sprinkler heads were coated with cotton dust

Example: Large fire in which water did not reach fire

- Arizona convention center used for filming movie, 2004
  - $8 million loss
  - Detection alerted occupants
  - More than 30 heads operated
- Heat from halogen light ignited walnut dust and other parts of set resembling collapsing mine
  - Covering over set prevented water from reaching the fire seat
  - Sprinklers limited spread beyond the set

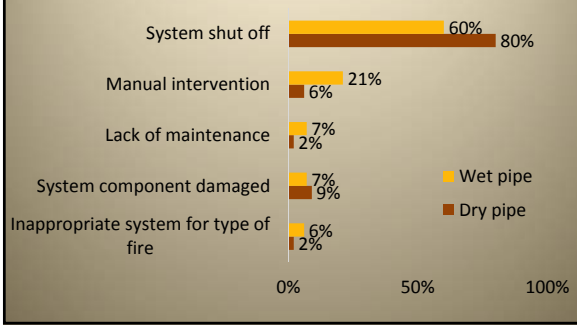
Example: Fire in which sprinklers did not discharge enough water

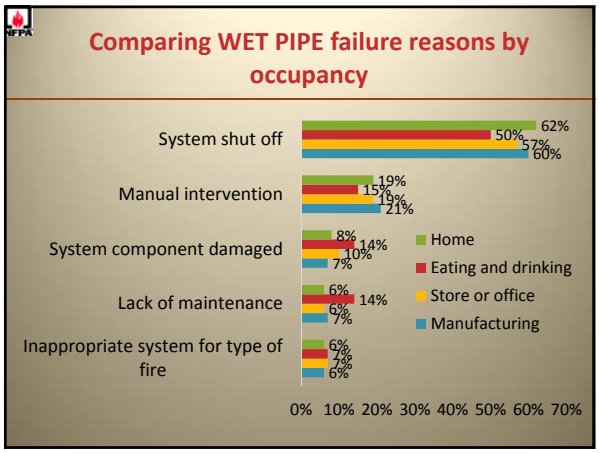
- Oregon 2006 food processing plant fire had $3.1 million loss
  - Fire started in drying oven
  - Sprinkler system was fed by a water storage reservoir
  - More than 250 sprinklers fused but were ineffective due to a lack of water pumped from the reservoir.
  - Fire pump room was found covered with an oily residue and the fuel tank for fire pump was empty

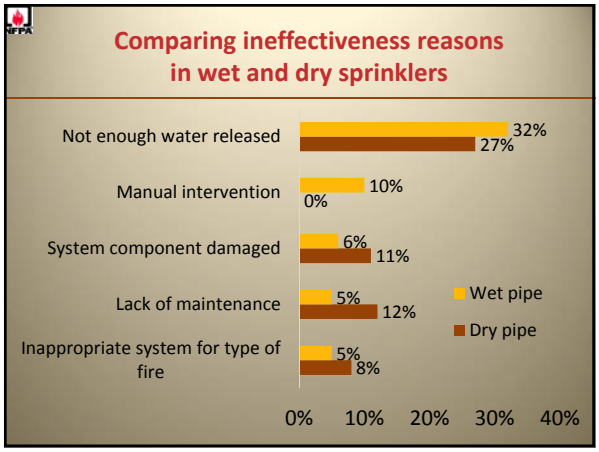
Example: Large fire with component damage

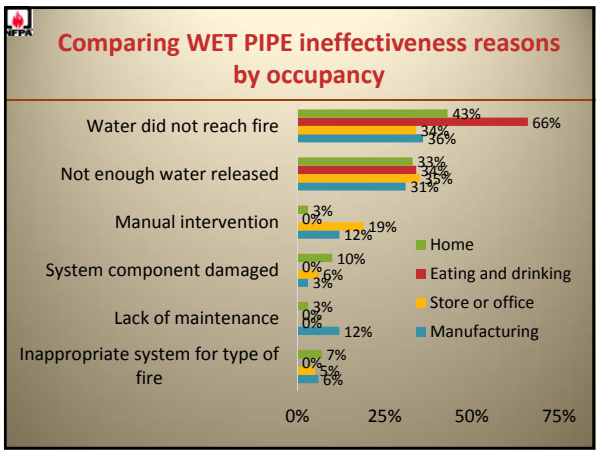
- Indiana, operating outdoor furniture and cushion manufacturing, 2005 $10 million loss
  - Wet and dry pipe system operated but riser rafters were damaged when the roof collapsed

Comparing failure reasons in wet and dry sprinklers

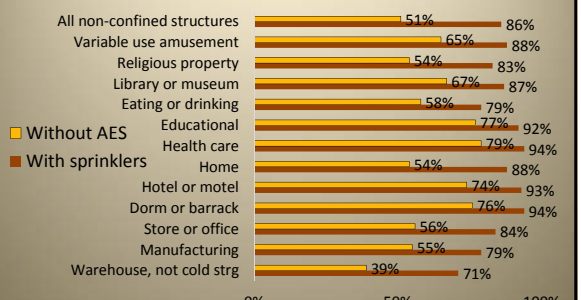



Comparing WET PIPE failure reasons by occupancy
System shut off
Manual intervention
System component damaged
Lack of maintenance
Inappropriate system for type of fire
62%
50%
57%
60%
19%
15%
19%
21%
8%
14%
10%
7%
6%
14%
6%
7%
6%
7%
7%
6%
Home
Eating and drinking
Store or office
Manufacturing
0% 10% 20% 30% 40% 50% 60% 70%

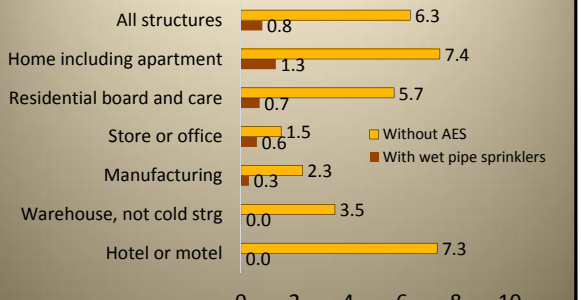

Comparing ineffectiveness reasons in wet and dry sprinklers
Not enough water released
Manual intervention
System component damaged
Lack of maintenance
Inappropriate system for type of fire
32%
27%
10%
0%
6%
11%
5%
12%
5%
8%
Wet pipe
Dry pipe
0% 10% 20% 30% 40%


Comparing WET PIPE ineffectiveness reasons by occupancy
Water did not reach fire
Not enough water released
Manual intervention
System component damaged
Lack of maintenance
Inappropriate system for type of fire
43%
66%
34%
36%
33%
31%
3%
0%
19%
12%
10%
0%
6%
3%
3%
0%
0%
12%
7%
0%
5%
6%
Home
Eating and drinking
Store or office
Manufacturing
0% 25% 50% 75%

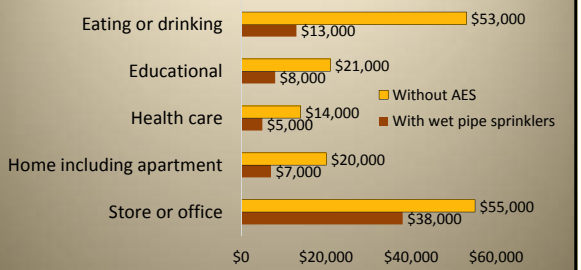
Percent of fires confined to room of origin with sprinklers (any type) or without AES



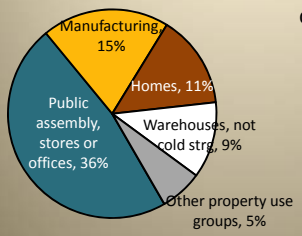
Civilian deaths per 1,000 reported fires without AES and with wet pipe sprinklers, by occupancy



Average loss per fire without AES and with wet pipe sprinklers, by occupancy



Non-fire sprinkler activations in 2003

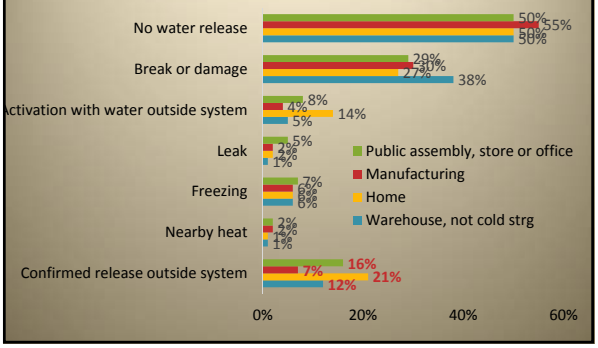


- Based on fire department responses
  - Often no water released, particularly with dry pipe systems
  - 2003 was last year all-incident database was received

Categories used on narratives of non-fire activations from MA, MN, and Austin, TX in 2007

- No water released
  - Definitely no water released except dry pipe system charging or release to drain or outside
  - Activation with no mention of water flow outside system
- Possibly water released
  - Break or damage to component
  - Activation with mention of water flow release outside system
  - Leak
  - Freezing
  - Nearby heat
- Confirmed water release outside system

Narratives of non-fire activations from MA, MN, and Austin, TX in 2007



In summary

- Sprinklers are most common in health care occupancies
  - Much less common in homes
- Wet-pipe sprinklers are more common than dry pipe
- Sprinkler are very reliable and effective
  - When present the operated in 91% of large-enough fires and effective in 96% of the time, meaning they operated effectively 87% of time
  - Wet pipe sprinklers are more reliable than dry-pipe
- The leading reason for failure to operate was system shut off
- Leading reasons for ineffectiveness were
  - Water did not reach fire
  - Not enough water released