The Voice of the Fire Sprinkler Industry

Tuesday e-Tech Alert

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Editor – Russell P. Fleming, P.E.

Best Questions of June 2008

We have selected the following questions as the "Best of June 2008" answered by the engineering staff as part of the NFSA's EOD member assistance program:

Question 1 – Sprinklers in Partially Concealed Space

In designing a mall tenant space I have encountered a condition that I would like clarification on. If the non-rated partition separating the sales area and the storage room to the rear of the space is constructed to 6 inches above the ceiling and not extended to the deck / structure, do I have to be concerned about protecting the non-combustible construction above the sales area ceiling? There would be no separation between these areas since the framing or sheeting stops at the ceiling level. The area in question is above acoustical lay-in ceiling tile and in no way would or could be used for storage since the ceiling is not substantial enough to support anything. I would protect the storage room floor and also the sales floor, but not the space above the sales area ceiling. Is this a correct approach? If not, please refer me to the section in NFPA 13 that would help in making this determination.

Answer: The space above the ceiling must be protected by sprinklers when it can be subjected to the intense heat of a fire event. Firefighters can be compromised when the heat from a fire weakens a building's structural elements. This can happen in the scenario you have described if a fire occurred in the back of the tenant space. Therefore, you should apply NFPA 13, Section 8.15.22.1. This section states, *"Where spaces have ceilings that are lower than the rest of the area, the space above this lower ceiling shall be sprinklered unless it complies with the rules of 8.15.1.2 for allowable unsprinklered concealed spaces."* Since the space above the ceiling does not qualify as a "concealed space" you would need sprinkler protection in this area.

This issue was heavily debated during the last cycle of NFPA 13. The 2007 edition maintained the requirement to provide protection in cases like yours. The Committee discussion eventually upheld the requirement that you must either close the space above the ceiling to create a concealed space or protect it.

The debate was strong enough that additional proposals were created for the 2010 NFPA 13 cycle that is now in progress. In the proposal phase, the Committee has voted to allow sprinklers to only partially extend into a non-combustible space like the one you have described. This proposal may or may not become part of the 2010 edition of NFPA 13, but it does indicate that the Committee at least partly agrees with your line of thought.

Question 2 – Levels of In-Rack Sprinklers with Large Drop Ceiling Sprinklers

There appears to be a conflict in the 2007 edition of NFPA 13 when using large drop sprinklers for storage over 25 ft in height. As an example, for protection of a Class II commodity stored up to 30 ft in a 35 ft building with multiple row racks, Table 16.3.2.1(a) calls for a 20–sprinkler (30-sprinkler for dry systems) design at minimum 25 psi plus 1 row of in-rack sprinklers. Section 16.3.2.2 says that for in-racks with large drop sprinklers, use the criteria in 16.3.4. Section 16.3.4.1.3 (for multi row racks) sends me to Figures 16.3.4.1.3(a-c). I assume I could use any of the figures, but every one but (a) would require more than one level of in-racks whereas Table 16.3.2.1(a) clearly says I only need one level. Obviously, the easy answer would be to

use figure (a) since it only requires one level anyway, but am I reading something wrong? Could I use the other figures and only use one level instead of what the figure requires?

Answer: NFPA 13 has never handled the issue of large drop sprinklers at the ceiling with in-rack sprinklers very well. Section 16.3.2.2 does not send you to 16.3.4 for all issues regarding in-rack sprinklers. Instead, it only sends you there for three pieces of information:

1) Sprinkler spacing (horizontal distance between sprinklers). This is a maximum of 10 ft between sprinklers for all class I-IV commodities.
2) Design pressure. Section 16.3.4.3.1 requires a discharge of 30 gpm, so the design pressure would be 29 psi for a k-5.6 sprinkler or 14 psi for a k-8 sprinkler.
3) Hydraulic calculation information. According to section 16.3.4.3, you would calculate 6 in-rack sprinklers for class I, II or III and 8 in-rack sprinklers for Class IV, adding them to the large drop sprinkler demand at the ceiling, balancing at the point of connection.

So, when using large drop sprinklers at the ceiling and in-rack sprinklers in accordance with Table 16.3.2.1(a), you only need to install one level of in-rack sprinklers using the three criteria discussed above.

Question 3 – Why Pressure Relief Valves on Wet Gridded Systems?

According to NFPA 13, relief valves are required on gridded wet pipe systems to relieve potential temperature induced pressure spikes. Can you explain why this occurs in gridded systems and not tree or loop configurations?

Answer: The relief valve is installed to handle overpressurization of the system. This can be caused by temperature increases for water that gets trapped by the system check valve. The difference between a tree system and a gridded system is the amount of air that gets trapped in the piping. A tree system contains a lot of air that gets pushed to the end of the lines. This air can be compressed when the temperature rises in the system allowing for expansion and contraction as needed without significant stress on the piping and the fittings. In a gridded system there is very little air trapped. This means that when the water expands or contracts the pressure has to be handled by the pipe and fittings. Section 7.1.2 was added to the standard after the determination that failures of fittings in the field on gridded systems were due to this overpressurized situation.

Question 4– Flexibility on Maximum System Size Limitation

Can you ever, in any circumstances, protect a building with one system that is larger than 52,000 square feet? The building ‘m dealing with is 52,800 sq. ft. If you measure inside to inside it is 52,122 sq. ft., including 40,000 sq. ft. warehouse and 12,122 sq. ft. office area. Is it common practice in cases like this to protect both areas with a single system because it is of no consequence and would be to confusing to separate this building into two systems? Would most governing authorities allow this to be only one system?

Answer: Most AHJ’s would probably allow you to protect a 52,800 sq ft facility with a single system if they understood where the 52,000 sq ft rule came from. There are some AHJ’s however, that are bound by the letter of the law, and the law says, “52,000 sq ft maximum per system”.

Going back to old editions of NFPA 13, such as the 1953 edition, Light Hazard had a maximum spacing of 196 sq ft per sprinkler, and there was no maximum number of sprinklers that could be installed on a single system. The maximum spacing for Ordinary Hazard was 130 sq ft per sprinkler and you were generally limited to 400 sprinklers on a system, which is generally cited as the basis of the maximum system size of 52,000 sq ft.

When hydraulic calculations arrived, we know the Sprinkler Committee needed to limit the size of systems that were being designed using the hydraulic calculation method rather than the pipe schedule method. This number of 52,000 sq ft was already a practical limit so it makes sense that the Committee would choose this number. Still, considering that there were no limits on a light hazard system in the pipe schedule method, you can see where an AHJ might not have a problem accepting an extra 800 sq ft. In all cases of applying NFPA standards, the AHJ decides the issues of tolerances.

Question 5 – Running Pipe through Areas Protected by Preaction Systems

Is it acceptable to run a preaction main through another preaction system room that is covering UPS, battery or electrical rooms? I'm not sure if this is not allowed or possibly just considered bad practice.

Answer: Most mechanical systems are not permitted to be run through electrical rooms. The codes and standards refer to them as “foreign systems”. However, most codes have an exception for sprinkler system piping intended to serve that room. One of the exceptions in the National Electrical Code (NFPA 70) is found in Section 110.34(f), which states, “Piping and other facilities shall not be considered foreign if provided for fire protection of the electrical installation.” This clarifies that you should not run an express main for another system through an electrical room, but only the main providing the fire protection for that room.

Question 6 – Double Use of Water Curtain Sprinklers

In accordance with NFPA 13 (2007 edition) Sections 8.15.4.1. and 8.15.4.3.1, is it the intent of water curtain sprinklers spaced 6 ft apart to solely act as a water curtain, or can the coverage also be utilized for protection in the opposite direction of the curtain/opening?

Answer: The answer is "yes," but only where spray sprinklers are being used. If a special nozzle is being used to create a water curtain, then the adjacent floor area cannot assume protection from the nozzle. Also, the hydraulic calculations need to address this area appropriately. In theory, if the adjacent floor area is ordinary hazard, then the sprinklers could be up to 15 feet apart (from the water curtain spray sprinkler to the next sprinkler protecting the floor area). Multiple calculations may be needed in order to find the hydraulically most demanding area.

In general, this was not the scenario that was envisioned when the section in NFPA 13 was written. The water curtain is designated to protect a vertical opening. However, as long as spray sprinklers are being used to create the water curtain, some credit can be given to the fact that they will cover some of the floor area too.

Question 7 – Water Curtains in NFPA 13R Applications

I have an existing 4-story dormitory, 3000 sq. ft. per floor, being sprinklered per NFPA 13R (2002 edition). All the floors are connected with two noncombustible open stairs, that open out to the main lobby at the bottom. The main lobby itself is approximately 500 sq. ft., 2 hour rated, with two exits to the outside. I am being asked to provide a water curtain per NFPA 13 Section 8.14.4.

Since NFPA 13R does not call for a water curtain around stairway and escalator openings, do the NFPA 13 requirements pertain to this situation?

Answer: No. The area you are addressing is a lobby space, which would be classified in the rules as "outside the dwelling unit." The confusion usually results from NFPA 13R referencing NFPA 13 for some criteria. However, Section 6.8.2.1 sends the user to NFPA 13 only for design criteria. This includes the discharge density for the sprinklers and design area that needs to be hydraulically calculated. The other main reference to NFPA 13 is for selecting the type of sprinklers for use outside the dwelling unit.

The location of sprinklers is covered in Section 6.9. The content addresses spaces that are inside and outside of the dwelling unit and does not send the user back to NFPA 13 for where the sprinklers need to be located. Therefore, if a water curtain is required, it would have to be from another source (such as the building code or insurance company), or NFPA 13R. In general, a water curtain in an NFPA 13R-type building is uncommon. In addition, the 2007 Edition of NFPA 13 has modified the language to note that the water curtain is really only necessary when the opening is required to be protected (or as an alternative to an enclosure) as allowed by the applicable building code.

Question 8 – Maximum Pressure Limitation for Standpipes

In what year was the maximum pressure limitation of 350 psi added to NFPA 14? I don't see it in the 1986 edition but the next edition I have is the 1993 edition and there are no lines beside the paragraph indicating a revision:

> 7.2* Pressure Limitation.
> The maximum pressure at any point in the system at any time shall not exceed 350 psi (24 bar).

Answer: The 1993 edition of NFPA 14 was the first to express this limitation in terms of pressure (Section 5-2), but the concept was in all previous editions in another form. In the 1990 and 1986 editions of NFPA 14, Section 2-1.4 (with its exception) limited standpipes to 400 ft in height. Given the elevation head, friction loss and requirements for pressure at the top of the standpipe, this amounted to about a 250 psi limitation for most systems. For editions of NFPA 14 older than 1986, the height limitation for any standpipe was 275 ft.

Question 9 – Pumps and Bypass Minimum Pipe Sizing

I have a 500 gpm fire pump. NFPA 20 Sections 5.14.3.4 and 5.15.5 indicate that the suction and discharge shall not be less than given in section 5.25. That would mean that the suction and discharge should be 5-inch diameter. But the suction supply piping, backflow and piping to fire pump, the discharge piping and the hydraulically calculated system supply is only 4-inch diameter. The engineer wants to use the friction loss in the 4-inch piping to keep the pressure from reaching 175 psi and having to install PRV's to meet the requirements of the NFPA 14 (200 edition). Can the piping be less than that specified in Table 5.25? Does the piping indicated in Sections 5.14.3.4 and 5.15.5 need to be increased to 5-inch? How much of the piping indicated in Section 5.14.3.4 needs to be increased? Also, what size should the bypass be? Section 5.14.4.2 indicates that the bypass should be the same size as the discharge in Table 5.25 or 5-inch but, again, the system supply piping is only 4-inch. Lastly, when does the bypass end or stop being the bypass? The installer seems to think that the bypass ends at the check value on the bypass loop, and that after the check valve it is part of the system. I think the bypass is the entire pipe from suction supply to the tee into the system supply header.

Answer: We'll address your questions separately based on the 2007 edition of NFPA 20:

Q1) Does the suction/discharge piping need to follow the requirements of Section 5.25, which would call for 5-inch piping, even though the hydraulically calculated system works with a smaller diameter pipe (4-inch)?

A1) Yes, according to Sections 5.14.3.4 and 15.5.5 the suction/discharge piping and fittings, respectively, need to follow the requirements of Section 5.25. The purpose is to uphold the requirement in Section 5.14.3.3 that the suction pipe shall be sized such that, with the pump operating at 150% of rated capacity, the velocity in that portion of the suction pipe located within 10 pipe diameters upstream of the pump suction flange does not exceed 15 ft/s. This ensures that there will be less turbulent flow of the water in the piping. The smoother flow allows the water to traverse through the pump, gaining pressure, in an appropriate manner.

Q2) How much of the pipe needs to be the size specified in Section 5.25?

A2) As stated in the answer to question 1 and in Section 5.14.3.4, the suction pipe located within 10 pipe diameters upstream of the pump shall the size specified in Section 5.25. This means that the 4-inch diameter pipe can be used prior to the 10 pipe diameters required. For the discharge side, there is no specified length that this pipe size shall be maintained. However, it should extend at least as far as the discharge control valve since this is where the piping becomes part of whatever system the pump is feeding.

Q3) What size pipe should the bypass be?

A3) According to Section 5.14.4.2, the size of the bypass shall be at least as large as the pipe size required for discharge pipe as specified in Section 5.25. In your scenario, this means that the bypass would have to be the same 5-inch piping.

Q4) When does the bypass piping end?

A4) The bypass should begin in the suction pipe between the water supply and the suction control valve and end on the fire protection system piping, downstream of the discharge control valve for the pump. By placing the bypass pipe in this position, the pump can be isolated by closing the control valves on the suction and discharge sides with the bypass still able to feed water to the fire protection system. This arrangement can be seen in Figure A.5.14.4.

Question 10 – Pump Room Wall Ratings

In the 2003 edition of NFPA 20, Table 5.12.1.1 states that a 1-hour minimum rated separation is required in a fully sprinklered building. For a situation in which one of the four walls of the pump room is an exterior wall, we are being asked if this exterior wall needs to have a one-hour rating.

Answer: In most cases, the building code is going to require that the exterior wall have at least a 1-hr rating regardless of what NFPA 20 says. According to Table 601 of the International Building Code, all types of construction except Type 2-B and Type 5-B need at least a 1-hr rating on exterior walls. Most other building codes have similar requirements.

If you happen to have one of the two types of construction that are not required to have at least a 1-hr rating on the exterior wall, then you need to consider what is going to be on the other side of the wall, including looking at where the property line is. The intent of NFPA 20 is to have a 1-hr wall or 50 ft separating the pump room from any potential exposure problems. Looking at the other side of the wall, what are the potential exposures within 50 ft and what are they likely to be in the future? If you cannot guarantee that there will be no exposure concerns within 50 ft of the pump room in the future, then you need to provide the 1-hr exterior wall.

Question 11 – Definition of "Corrosion-Resistant" Pipe

Please take a look at these two paragraphs from NFPA 13 (2007 edition), both pertaining to dry pipe systems:

> **8.3.4.3** Sprinklers with nominal K-factors of K-4.2 (60) shall be permitted to be installed on dry pipe systems where piping is corrosion resistant or internally galvanized.
>
> **8.4.7.2* Galvanized Pipe.**
> **8.4.7.2.1** Where steel pipe is used in preaction and dry pipe systems, piping materials shall be limited to internally galvanized steel.
> **8.4.7.2.2** Nongalvanized fittings shall be permitted.

8.3.4.3 allows either corrosion resistant or internally galvanized. 8.4.7.2.1 only permits internally galvanized. Is it the intent to permit both in both cases? If the answer is yes, should 8.4.7.2.1 be re-written to include the verbiage of "corrosion resistant"?

Answer: Unlike 8.3.4.3, 8.4.7.2 relates to the use of steel pipe only. Typically, NFPA 13 uses the term "corrosion resistant" to apply to types of pipe like copper, brass, stainless steel or copper-nickel. Each of these types of pipe resists the typical chemical reaction that occurs when steel is exposed to water and oxygen. Galvanized steel is not on this list because it is still subjected to the chemical reaction that occurs between the steel, oxygen and water, but the galvanization process slows the corrosion down. Galvanized pipe is not corrosion resistant, but it is slower to corrode.

Section 8.4.7.2.1 of NFPA 13 only applies to systems with large drop sprinklers. Since these systems use large branch lines, they would tend to be too expensive to install with "corrosion resistant pipe". However, if you really wanted to use corrosion resistant pipe on a system with large drop sprinklers, you could do so using the "alternate arrangements" clause in Chapter 1 or the "meets or exceeds" clause in Chapter 6. Section 8.3.4.3 was written for attic systems that would use much smaller branch lines than large drop systems, so the Committee recognized that the alternative of corrosion resistant pipe would be attractive in some cases.

Question 12 – Adjacent Skylights with Wall Separations

We have a condominium project, and on the top floor of the project the condos have skylights in them. We omitted sprinkler protection in the skylights per (2007 edition) NFPA 13 Section 8.5.7. The skylights are less than 32 sq ft in area, and they are less than 10 ft horizontally to other skylights, but all are separated by rated walls. We feel that the rated wall acts as the separation required by the 10 ft of distance. Is there an interpretation on this that can validate omitting the sprinklers within the skylights? Coverage is maintained by sprinklers around the skylights such that the floor area below is protected.

Answer: The intent of Section 8.5.7 is to only require the 10 ft separation between skylights in the same compartment. The concern is for the hot gasses from a fire filling one well created by the indentation of a skylight and then spilling under and filling the next well prior to activating a sprinkler in the room to control the fire. If a wall is located between the wells, there is no chance that the hot gasses will spread from one well to the next before opening sprinklers.

Sign Up for 2nd Half 2008 "Technical Tuesday" Online Seminars

The NFSA has announced the following schedule of online technical seminars for the second half of the year:

Date	Topic	Instructor
July 8	**Review of the Attic Rules**	**Cecil Bilbo, Jr.**
July 29	**Fire Pump Sensing Lines, By-Passes and Jockey Pumps**	**Kenneth E. Isman, P.E.**
Aug 19	**Non-metallic Sprinkler Piping**	**Victoria B. Valentine, P.E.**
Sept 9	**Explosion Prevention and Suppression Systems**	**Russell P. Fleming, P.E.**
Sept 23	**Really Tall Buildings**	**Kevin J. Kelly, P.E.**
Oct 7	**Testing of Fire Pumps**	**Kenneth E. Isman, P.E.**
Oct 28	**Ethanol Plant Protection**	**Jeff Hugo**
Nov 18	**Aerosols – NFPA 30B**	**Kevin J. Kelly, P.E.**
Dec 2	**NFPA 3, Commissioning**	**Cecil Bilbo, Jr.**
Dec 16	**Sprinkler Systems and HVAC Equipment**	**Russell P. Fleming, P.E.**

As in the past, a 30% discount is available when signing up for all ten seminars in the series. Information and registration for this seminar series is available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133.

Upcoming NFSA "Technical Tuesday" Seminar – July 8th

Topic: Review of the Attic Rules
Instructor: Cecil Bilbo, Jr., CET, NFSA Director of Technical Services
Date: July 8, 2008

In the 2002 edition of NFPA 13, the rules for spacing sprinklers in combustible concealed spaces became more restrictive. Some minor adjustments to those rules were made for the 2007 edition. This seminar will cover the portion of these requirements known as the "Attic Rules". These rules bring up many questions when applying the standard to actual scenarios. The Committee's intent for systems installed in attic-type scenarios will be discussed. Construction types, spacing, location, position and calculation methods will also be covered for these applications.

Upcoming NFSA "Business Thursday" Seminar – July 17th

Topic: Fire Sprinklers are "Green"
Instructor: Dominick Kasmauskas, NFSA Northeast Regional Manager
Date: July 17, 2008

Fire sprinklers have been "Green" and inherently helping to preserve our environment for over 130 years, yet they receive no credits for Architects to obtain in the LEED (Leadership in Energy and Environmental Design) program. This presentation will give you an overview about the US Green Building Council, LEED Credits, and bullet points to use when discussing with others why Fire Sprinklers are inherently Green and have been saving our environment from "green house" and toxic gases plus conserving both water and energy through direct and indirect manners. Save your building, save our environment!

Information and registration for the above "Technical Tuesday" and "Business Thursday" seminars are available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133.

Additional NFSA training opportunities include…

NFSA Two-Week Technician Training Classes

August 4-15, 2008	Providence, RI
October 13-24, 2008	Chicago, IL
November 10-21, 2008	Houston, TX

For more information, contact Nicole Sprague using Sprague@nfsa.org or by calling 845-878-4200 ext. 149.

In-Class Training Seminars

The NFSA training department also offers in-class training on a variety of subjects at locations across the country. Here are some upcoming seminars:

July 15	Rogers, AR	Pumps for Fire Protection
July 16	Rogers, AR	Fire Pump Layout & Sizing (a.m.)
July 16	Rogers, AR	CPVC Piping (p.m.)
July 17	Rogers, AR	Residential Homes to High-Rise
July 28	Miami Beach, FL	Pumps for Fire Protection
Aug 26	Freeport, ME	Basic Seismic Protection (a.m.)
Aug 26	Freeport, ME	Advanced Seismic Protection (p.m.)
Aug 27	Freeport, ME	Sprinklers for Dwellings
Aug 28	Freeport, ME	CPVC Piping (a.m.)
Aug 28	Freeport, ME	Commissioning & Acceptance Testing (p.m.)
Sept 9	Anchorage, AK	Plan Review Policies & Procedures
Sept 10	Anchorage, AK	Inspection, Testing & Maintenance
Sept 11	Anchorage, AK	Basic Seismic Protection (a.m.)
Sept 11	Anchorage, AK	Advanced Seismic Protection (p.m.)
Sept 23	Hillsboro, OR	Plan Review Policies & Procedures
Sept 24	Hillsboro, OR	Commissioning & Acceptance Testing (a.m.)
Sept 24	Hillsboro, OR	CPVC Piping (p.m.)
Sept 25	Hillsboro, OR	Sprinklers for Dwellings

For more information on these seminars, or to register, please visit www.nfsa.org or call Dawn Fitzmaurice at 845-878-4207 or email seminars@nfsa.org.

About the National Fire Sprinkler Association

Established in 1905, the National Fire Sprinkler Association (NFSA) is the voice of the fire sprinkler industry. NFSA leads the drive to get life-saving and property protecting fire sprinklers into all buildings; provides support and resources for its members – fire sprinkler contractors, manufacturers and suppliers; and educates authorities having jurisdiction on fire protection issues. Headquartered in Patterson, N.Y., NFSA has regional operations offices throughout the country. www.nfsa.org.