NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
January 8, 2008
Number 104

Best Questions of December 2007

We have selected the following questions as the "best of December 2007" answered by the engineering staff as part of the NFSA's EOD member assistance program:

Question 1 – Flow for Sprinklers Under Gratings

If a building is equipped with grated mezzanines, is it a requirement that all levels of sprinklers within the remote area be calculated? In other words, say a building is equipped with three levels of grated mezzanines. Would all sprinklers within the remote area under all levels of grated mezzanines be required to be calculated? We recently have had a number of AHJ's require such a calculation. Why would sprinklers under a grated mezzanine be any different than sprinklers under ductwork or other obstructions that are not required to be calculated?

Answer: The answer depends on the situation. The following are the variations from the 2007 edition of NFPA 13. Similar rules apply to previous editions:

- If ESFR sprinklers are used at the ceiling, then section 22.4.4.6.4 requires two sprinklers to be added from under any obstruction, including grating.
- If sprinklers are installed under grating to comply with the bin-box or shelf storage rules of 14.5, then section 14.5(2) states that the sprinklers under the grated walkways do not need to be added to the ceiling demand, but they need to be calculated separately and the water supply needs to be capable of handling their demand. Usually the flow demand to these sprinklers is lower than the flow demand for the ceiling sprinklers, but the pressure demand is greater, so you need to make sure that the water supply can handle the walkway sprinklers on their own.
- If sprinklers are installed under a grating in a rack storage situation such that they are considered in-rack sprinklers (the walkway is just a wide flue space), then the rules for in-rack sprinklers need to be followed in chapters 16 and 17 and the correct number of in-rack sprinklers need to be added to the ceiling sprinkler demand.
- If sprinklers are installed under a grating just because the grating is an obstruction to ceiling sprinklers, then section 22.4.4.6.3 states that the sprinklers under the obstruction are not required to be calculated with the sprinklers at the ceiling. Each level of sprinklers is required to be calculated separately and the water supply needs to satisfy the single most demanding level of sprinklers. Section 22.4.4.6.5 repeats this concept.

We recognize that a few AHJ's cite section 22.4.4.5.5 as requiring multiple levels of sprinklers to be added together when the obstruction is open, such as grated flooring, but this is not the original intent of this section. This section was written to cover the situation where one set of pipe fed sprinklers in multiple areas. The most frequently occurring situation that this section applies to is when sprinklers are installed below a ceiling and the same branch lines feed sprinklers above the

ceiling in a concealed space. If there are sufficient openings in the ceiling, the branch lines need to be sized to handle the water delivery to many sprinklers.

But the situation described above does not apply to the situation under grated floors. The same branch lines do not feed the sprinkler at the ceiling and the sprinklers under the grated floors. During a fire, the sprinklers under the grated floors will only open if the fire is close to being directly under the sprinkler (a fire plume only extends horizontally about 20% of the distance that it rises vertically). So, if the fire is under a sprinkler under the grating, it will likely open the sprinkler, in which case the ceiling sprinklers will not open. If the fire is not under the sprinkler under the grates, then it will not likely open the sprinkler and the ceiling sprinklers will eventually open. For fires that start under grates in just the right location to have the potential for opening both ceiling and "under grate" sprinklers, the design area (1500 sq ft or 2000 sq ft depending on whether the situation is storage or not) should be sufficient to handle the problem. If you calculate the worse case (usually the ceiling sprinklers), then the few sprinklers under the walkway that open will likely keep the full number of calculated sprinklers at the ceiling from opening.

Question 2 – Classification for Plastics Processing

We recently got into a discussion with an insurance carrier involving the protection of a manufacturing plant that carries out plastic extrusion of composite outdoor decking and railing products. The composite is combined wood sawdust and PVC powder. Fortunately, PVC powder is only a Group C plastic (Class III commodity) and really doesn't present any issues as far as storage goes. There is agreement on finished goods as well - using the 2007 edition of NFPA 13, the insurance carrier cites Table 13.2.1 as requiring that "10-ft high on-floor storage of cartoned solid plastic commodities" would be an extra hazard (Group 1) occupancy. However, the insurance representative takes exception to our classification of the extrusion manufacturing as ordinary hazard Group 2 per annex section A.11.2.1. The insurance representative claims the reference to injection molding in this section as OH2 is an error added to NFPA 13 in the 2002 edition, and that the extrusion process should be Extra Hazard Group 2 as "plastics processing" is described in A.5.4.2. We have been trying to determine the difference and came across the following:

> "In the extruding process, plastic is melted by an electric heat element while being moved through a die using a right angle electric motor screw gear. As for a moulding plastic process, this may involve a thermo set plastic (i.e. fry pan handles, distributor caps, etc). In this process, the plastic is poured into an electrically heated mould/die which may be rotated or have pressure added to ensure the plastic reaches all parts of the mould/die. Once again, no hydraulic fluids are used. Please keep in mind that thermo set plastic can be classified as a Group C plastic and uses less plasticizer thus having a lower burn rate when compared to Group A plastics".

Is it reasonable that if the extruders are actually plastic injection molding machines then the process needs to be protected by an extra hazard system?

Answer: This is one of the situations where hazard classifications may need to be performed by a knowledgeable Professional Engineer in consultation with the building owner. There are many different types of plastics manufacturing, and they fall into different hazard classifications based on the process used, the quantity of plastics and the methods used to form or mold the plastics. In some operations, the primary exposure is a large metal machine. Plastic pellets are fed into a

closed hopper and the machine has no plastics on its exterior. A fire in the space would not be expected to spread to the plastics or involve the plastics. This type of processing can be protected as OH-2. However, storage of the pellets and the finished product need to be handled as plastics storage.

Other types of plastics processing involve the cutting or molding of exposed plastics with waste falling to the floor or exposed bins. A fire in this space is more likely to involve the plastics and deserves to be treated as extra hazard. Depending on the amount of plastics and the obstructions to ceiling sprinklers caused by machines, the hazard could be EH-2.

The wording of NFPA 13-2007 does appear to contain a conflict between A.5.4.2 and A.11.2.1 on the subject of plastic processing operations. A.5.4.2 says that "plastic processing" would be an extra hazard Group 2 occupancy and it has said this since the 1991 edition. However, the third sentence in A.11.2.1 says: "The [plastic] injection molding operation should be considered an ordinary hazard (Group 2) occupancy."
(Not to confuse the issue, but in the 2002 edition, a typo led to the term "plaster injection molding").

Not all plastics and not all moulding process are equally hazardous, so there may be times when "plastic processing" could be considered extra hazard, but not all of them should be. It is difficult to consider the hazard of working with plastics as being in the same category as other EH2 occupancies such as flammable liquids spraying, solvent cleaning, etc. Also note that in A.5.3.2 a "resin application area" is given as an example of OH2, whereas NFPA 33 (as cited in NFPA 13 Section 21.4) demands a minimum of OH2 but calls for EH2 for spray application of combustible and flammable resins.

Question 3 – Protection of Idle Wood Pallets

I have a question regarding protection for idle wood pallets from an existing wet system, a 1957 pipe schedule sprinkler layout in a 21-ft high flat wood roofed building with wood purlins framed into wood laminated beams. Table 12.1.9.1.2(a) in the 2002 edition of NFPA 13 stipulates the minimum use of K-8 sprinklers for 6 ft of pallet storage with a density of 0.20 gpm over 2,000 sq ft. In the 2007 edition, section 12.12.1.2(5) appears to allow the use of high temperature K-5.6 sprinklers protecting 6 ft stacks with either 8 ft of clear space or 25 ft of commodity between each set of four stacks. When using Table 12.12.1.2(a) the control mode protection of 6 ft stacks of wood pallet using high temperature K-8 sprinklers does not stipulate the storage arrangement. Is it the same as the K-5.6 protection or can the storage be maximized to continuous 6 ft stacks for the available floor space?

Answer: Each of the five options in Section 12.12.1.2 is independent, and their provisions should not be mixed. Option 1 refers the user to Table 12.12.1.2(a). None of the other options reference this table and once this table is used for the design criteria, none of the other rules in the other options apply to this table. Table 12.12.1.2(a) has more stringent sprinkler demand rules and therefore the pile separation rules of option 5 are not necessary. NFPA 13 was revised in the 2007 edition because fire tests have showed that the old rules were no longer sufficient due to changes that have been made in the way that wood pallets are assembled. The new rules, in section 12.12.1.2 of NFPA 13 give the user several options. One of the options (12.12.1.2(1)) is to protect idle wood pallets with high temperature K-8 sprinklers and a density of 0.2 gpm per sq ft over 2000 sq ft. This option is the first row of Table 12.12.1.2(a). The K-8 sprinklers in this table are

important because of the water droplet size that is produced as the water leaves the deflector of the sprinkler. Another option is to use section 12.12.1.2(5), which allows wood pallets to be protected the same way as any Ordinary Hazard Group 2 occupancy. This would allow a density of 0.2 over 1500 sq ft and would also allow the use of ordinary temperature K-5.6 sprinklers. However, there are some severe limitations on the arrangement of the wood pallets in order to make this scenario work. This situation was not directly fire tested, but was added to the standard by the committee as a practical matter since many Ordinary Hazard occupancies have a few wood pallets hanging around and the sprinkler system should not be penalized just because they are there.

Question 4 – Use of OS&Y Valves

I am writing to you with regard to our college's procedures used to test and inspect replacement main sprinkler water supply valves in accordance with NFPA 25 (1998 edition) and NFPA 13 (1999 edition). We replaced main sprinkler water supply valves in two buildings on campus. The procedure used to inspect and test these valves is detailed below:

-Main water supply valve is exercised by completely closing the valve.
-The inspectors test valve is opened
-Leakage is determined by the lack of flow
-Inspection and testing is appropriately documented.
-The valve is fully opened and chained in the open position.

Our local AHJ has requested that we provide additional documentation that the methodology used to test and inspect these valves is consistent with NFPA guidance. NFPA 13 (1999) 10-2.2.1 references hydrostatic testing of all piping and attached appurtenances conducted at 200 psig for 2 hours. Additionally, NFPA 13 (1999) specifically states that any modifications to an existing system of greater than 20 sprinklers require the modification to be isolated and tested under the same regimen.
The NFPA documents clearly state that components that cannot be isolated shall not require testing in excess of system working pressure. The main water supply valves located in the buildings cited by the AHJ are not able to be isolated and any installation of new valves to allow isolation would only subject those new devices to the same inspection and test requirements. How can we make sure our test procedures are appropriate and consistent with NFPA requirements?

Answer: It would appear that someone is being a bit overzealous in trying to enforce NFPA 13 and NFPA 25. There is no requirement in either standard to ever test the ability of a control valve to stop the flow of water in a pipe. The purpose of the hydrostatic test is to make sure that the components do not release water to the outside. The hydrostatic test at 200 psi is conducted when the system is new to ensure that the parts have been assembled in such a manner that water does not get out of the system. When new parts are installed on an old system, the hydrostatic test is still conducted for the same reason, but the pressure requirement changes. We do not want to subject old parts to the 200 psi pressure. Remember, these parts are generally only listed for a working pressure of 175 psi. To subject them to a pressure of 200 psi every time a part is replaced eats into the safety factor. For this reason, NFPA 13 clarifies that the 200 psi pressure is only to be applied if you can isolate the new parts. If you can't isolate what is new, the hydrostatic test needs to be performed at whatever system pressure is available. That should be enough to tell you that the parts were installed correctly and will not allow water out of the system. Also, if the clarifying language in more recent editions of NFPA 13 or NFPA 25 helps, but those editions have not been adopted yet locally, please remember that the new editions can still be used and

referenced. The old editions all state that alternate arrangements are allowed that meet the same level of safety as prescribed by the standard. The new editions are always considered to provide an equivalent (or better) level of safety. In fact, the new editions can essentially be seen as interpretations of the older editions. The new editions of the standard are the most recent official position of the NFPA, so they should not be ignored. They can be accepted as alternate arrangements to the older editions.

Question 5 – Capacity of Fire Department Connection Piping

I was hoping you could help me out with a question regarding the fire department connection. We know that the purpose of the fire department connection is to be a supplemental water supply, not *the* water supply. Where in NFPA would I find this definition? We are being questioned as to why we only used 4-inch pipe for the FDC connection as opposed to 6-inch pipe.

Answer: NFPA 13 has always considered the fire department connection (FDC) to be an auxiliary water supply that was never intended to be capable of meeting the entire demand of the system. While the standard never came out and said these specific words, it was clear from the way the document was written. For example, the sizing rules have always stipulated a maximum required pipe size of 4 inches, regardless of the size of the riser. Also, the connection requirement has always been for two 2-1/2 inch inlets, regardless of the flow demand of the system. Also, the water supply chapter only requires a single water supply (not the FDC). If the FDC was going to be considered as a water supply, then the water supply chapter would be requiring two water supplies instead of one.

The committee went a long way toward clearing this issue up in the 2007 edition. Section A.8.17.2.3 was added as follows, "The purpose of the fire department connection is to supplement the pressure to an automatic fire sprinkler system. It is not the intent to size the FDC piping based on system demand. For multiple system risers supplied by a manifold, the fire department connection need not be larger than that for an individual system."

Question 6 – Close-Spaced Sprinklers Around Open Stairways

I have an open stair that goes from a locker room located on the parking level of a police station up to the main level of the station. There are no fire walls that separate the locker room from the parking and none on the main level. The entire building is protected by one wet pipe system. Are closely spaced sprinklers required in this instance?

Answer: The committee has tried to clarify this in the 2007 edition of NFPA 13, stating that you do not need the draft stops or the closely spaced sprinklers in this type of situation. The draft stops and closely spaced sprinklers were always intended to substitute for a fire resistance rating of the floor ceiling assembly. For open stairs and escalator openings that penetrated the floor, creating a vertical opening, building officials were looking for some additional protection. But the situation that you have described does not include a rated floor ceiling assembly. Since the assembly is not required to be rated, and the open stair is allowed, there is no need to include additional protection above and beyond the normal sprinkler system.

Question 7 – Combined Dry Pipe Sprinkler and Standpipe Systems

We have an existing automatic dry standpipe in a building that requires 6 new heads on the third floor. The area to be protected is in a freezing condition. We have two choices. First, install a new dry riser in the basement and run a supply up to the third floor to protect the area. Second, feed the sprinklers off the automatic dry standpipe.

If we add a control value to the feed of the 6 head system, can we call this a combination system and rely on the automatic dry value solenoid of the standpipe to act as the tripping mechanism for the 6 head system? Do we need a pressure switch on this system since the standpipe is monitored and the system would be considered a limited-area system? I can't find anything in the book allowing or denying this configuration.

Answer: Although NFPA 14 allows the use of dry standpipes and does not preclude the use of a combined dry standpipe and sprinkler system, NFPA 13 has never allowed the combined system riser for other than wet pipe sprinkler systems. In the 2007 edition of NFPA 13 this is found as Section 8.17.5.2.1, which states that 2-1/2-inch hose connections for fire department use can be made to wet pipe sprinkler system risers. The Authority Having Jurisdiction can consider allowing the combined dry pipe system under the equivalency provisions of Section 1.5 of NFPA 13. Your subsequent questions regarding activation of the system would need to be addressed by the AHJ as part of this consideration.

Question 8 – Bathroom 15-minute Thermal Barriers

What constitutes a 15 minute thermal barrier? We have a project where the construction is non-combustible (steel studs, concrete ceiling, concrete floors) and the sheetrock does not extend behind the shower/tub unit. Would the single layer of sheetrock on the opposing side of the wall be considered a 15 minute thermal barrier?

Answer: No, the sheetrock on the other side cannot be considered the 15 minute barrier. The problem is the concealed space itself. If the fiberglass tub burns, the hot gasses will get into the concealed space and the heat could rise to ignite tub up on the next floor above. Some barrier is needed between the tub and the studs so that the hot gasses from a fire can't get into the concealed space. All building codes have tables of assumed fire resistance ratings for different materials. One of the materials that get a 15 minute rating is ½-inch gypsum board, i.e. sheetrock. There are many other types of materials that will work, including some plywood. But you need to have something between the tub and the studs in order to leave the sprinklers out of the bathrooms.

The other option is to sprinkler the bathrooms, which will improve the insurance discounts for the owner. The owner should check with their insurance company and see if the cost for the bathroom sprinklers is offset by the better insurance rate and/or the cost of the sheetrock behind the fixtures.

Question 9 – Ceiling Diffuser Directional Discharge

Is a ceiling diffuser in a typical acoustical tile ceiling considered to be a downward or horizontal discharge with regard to the temperature rating chart found in NFPA 13 (2002 edition) as Table 8.3.2.5(a)? Are the references to horizontal discharges in the column for intermediate rated sprinklers intended for diffusers mounted in walls or do they also apply to diffusers in ceilings with fins that can project airflow horizontally.

Answer: The term “horizontal discharge” when applied to a diffuser should be interpreted as “a diffuser that creates flow parallel to the ceiling.” This would obviously happen with a diffuser that is set into a wall to blow outward, away from the wall. This could also happen with a diffuser in the ceiling, but the fins would have to be bent in such a manner as to protrude down below the ceiling and redirect the flow parallel to the ceiling.

Many ceiling diffusers have fins that direct the air at a variety of angles around a room, but none of these angles is parallel to the ceiling. Most ceiling diffusers are downward discharge. Note that the terminology is not “vertical”. We do not expect downward discharging diffusers to blow only in the vertical direction. We expect that the flow will spread out away from the diffusers, but the heat does not usually affect sprinklers very close to the ceiling.

Ultimately, you need to look at the diffuser and how if is arranged. If it is directly blowing hot air on the sprinkler, Table 8.3.2.5(a) is irrelevant. Section 8.3.2.2 would require a higher temperature sprinkler if hot air at more than 100 degrees were blowing on a sprinkler. While Table 8.3.2.5(a) is a tool to help you evaluate where higher temperature sprinklers might be needed, it is section 8.3.2.2 that will override any other requirements and force to into a higher temperature sprinkler if the situation is such that hot air is blowing directly on a sprinkler.

Question 10 – Use of Barriers in Rack Storage

NFPA 13 (2007 edition) section A.16.1.9 indicates that a horizontal barrier is required if the ceiling is more than 10 ft higher than the maximum height of storage for Class I thru IV rack storage. Does this apply to all rack storage that has more than 10 feet clearance? What if you have a sloped roof? Would it apply only to the area where the distance to the roof is greater then 10 feet?

Answer: Annex note A.16.1.9 is intended to be an alternative to helping people comply with 12.1.3.4.1 in high clearance situations. For palletized and solid piled storage, we can just increase the ceiling density, pretending to have higher storage. But for in-rack situations, you can't just add to the ceiling sprinkler density to deal with potentially higher storage. So, the suggestion was made to give people an option to add a barrier and in-rack sprinklers.

The rule, new to the 2007 edition, should be clarified to tie to the 30 ft clearance issue in 12.1.3.4. None of the storage rules apply to any roof slope that exceeds 2 in 12, but if the roof slope is less than 2 in 12 and the high portion exceeded 10 ft clearance while the lower portion did not, we would agree that the concern would only be with the high portion and the barriers and in-rack sprinklers would only need to be installed where the clearance is over 10 ft.

Question 11 – Seismic Restraint for Armovers

Based on NFPA 13, 2002 edition, are branch line restraints required on 1-inch diameter armovers that are 1 to 2 ft in length?

Answer: No, based on the definitions of "branch line" and "arm-over." An arm-over, according to Section 3.5.9 in NFPA 13 (2007 edition), serves only one sprinkler. A branch line, per Section 3.5.1, "...supplies sprinklers..." which means that more than one sprinkler is served from the pipe. The restraint required in Section 9.3.6 is for branch lines. Although the 2007 edition of NFPA 13 is referenced, the intent for restraint is the same in previous editions of the standard.

Question 12 –Ventilation Shutdown for ESFR Sprinklers

We have been requested to provide a linear wire detection system to provide air conditioning and vent shutdown for a building with 320,000 sq. ft. of manufacturing and warehousing with ESFR sprinklers. The architect requesting this says it is an NFPA requirement to allow proper activation and prevent problems with the ESFR sprinklers due to the air velocities, and is concerned with discharge velocities over 5 fps. I did a search of the NFPA sections but did not see anything regarding this. Do you know of any specific requirement? They are standard roof top units, nothing unusual.

Answer: You are correct that NFPA 13 does not reference air conditioning or heating ventilation systems. For the sprinkler systems, the standard assumes that the velocities of the ventilation system will be negligible on the transport of smoke and hot gases to the sprinklers and water down to the fire. There are aspects of NFPA 13 that might be considered related, such as the rectangular area for hydraulic calculations, since the air movement could pull the fire in a more rectangular pattern. If a smoke control system is being installed there may be need for the ventilation to be shut down. There are three standards that may or may not have relevance to your scenario that deal with smoke control: NFPA 92A - *Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences*, NFPA 92B - *Standard for Smoke Management Systems in Malls, Atria, and Large Spaces*, and NFPA 204 - *Standard for Smoke and Heat Venting.*

January 17th "Business Thursday" Seminar Features CPVC Issues

Topic: CPVC Issues
Instructor: Top Myers, Myers Risk Services
Date: January 17, 2008

The upcoming "Business Thursday" seminar is more technical than usual. You may have heard recent rumblings involving the use of CPVC piping, and many contractors are wondering how they can best protect their companies against unexpected problems. Top Myers has been involved in a number of aspects of installation problems leading to potential litigation, and has been party to recent discussions among manufacturers, suppliers and contractors to cooperatively address the current issues.

Upcoming NFSA "Technical Tuesday" Seminar – January 29th

Topic: Wet Pipe Systems
Instructor: Victoria Valentine, P.E., NFSA Director of Product Standards
Date: January 29, 2008

Wet pipe sprinkler systems are the baseline type of sprinkler system. This seminar will review what makes a system a system. Common questions that arise such as how to define a system, how to define a riser and what are the functions of the system connections will also be addressed. Other items that will be included are system sizes, corrosion issues and pressure reducing valves.

Information and registration for the above seminars and both the "Technical Tuesday" and "Business Thursday" 2008 series are available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133 or email: dawn@nfsa.org.

Additional NFSA training opportunities include…

NFSA Two-Week Technician Training Classes

February 4-15, 2008 (waiting list only)	Centennial, CO
April 7-18, 2008	Orlando, FL
August 4-15, 2008	Providence, RI
October 13-24, 2008	Chicago, IL
November 10-21, 2008	Houston, TX

For more information, contact Nicole Sprague at 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 seminars scheduled for 2008:

Jan 21////Piperton, TN////Sprinklers for Dwellings
Jan 22////Piperton, TN////Inspection, Testing & Maintenance
Jan 23////Piperton, TN////Hydraulics for Fire Protection
Feb 19////Ft. Walton Beach, FL////Inspection, Testing & Maintenance
Feb 20////Ft. Walton Beach, FL////Sprinklers for Dwellings
Feb 21////Ft. Walton Beach, FL////Standpipe Systems (a.m)
Feb 21////Ft. Walton Beach, FL////Underground Piping (p.m.)
Mar 4////Murfreesboro, TN////Sprinklers for Dwellings
Mar 5////Murfreesboro, TN////Hydraulics for Fire Protection
Mar 6////Murfreesboro, TN////Residential Homes to High Rise
Mar 10////Winston-Salem, NC////Sprinklers for Dwellings
Mar 11////Winston-Salem, NC////Plan Review Policies & Procedures
Mar 12////Winston-Salem, NC////NFPA 13 Update 2002

For more information on these seminars, or to register, please visit www.nfsa.org or call Michael Repko 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.