NFSA
The Voice of the Fire Sprinkler Industry

Tuesday e-Tech Alert

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# Best Questions of December 2010

We have selected the following questions as the "Best of December 2010" answered by the engineering staff as part of the NFSA's EOD member assistance program:

**Question 1 – ESFR Obstructions**

Is there any portion of 2007 NFPA 13 that directs us on how to address obstructions outside a storage area where the ceiling system throughout a building is ESFR? The building is using an automated pick system called KIVA that has low shelf units that are transported by robotic pedestals throughout a large area of the building. Associated with this system are some conveyors and open grate mezzanines. The ESFR system is maxed out and we cannot add the flow of one additional K-14 sprinkler without it putting the system demand over the available supply by about 5 psi. If the occupancy/use of the area is classified as storage, even though the area where the conveyor or a mezzanine in reality is more like handling, can we add pendent QR sprinklers of the same temperature rating as the ESFR beneath conveyors and elevated equipment platforms without storage beneath them, without having to pick up these "additional" sprinklers in the ESFR calculation?

**Answer:** Whenever any kind of sprinkler is used under an obstruction, you need to know for sure that the sprinkler can handle whatever fire might occur under the obstruction. When ESFR sprinklers are used at the ceiling, you automatically know that an ESFR sprinkler can handle the situation under an obstruction. We can't recommend replacing the ESFR sprinkler under the obstruction with a QR without knowing if the QR sprinkler would be able to properly address the hazard. Even if you did replace the ESFR sprinkler under the obstruction with some other kind of sprinkler, it may not eliminate the sprinkler demand from the design. The rule in NFPA 13 came from the FM standard. The old FM standard allowed the sprinkler under the obstruction to be a K-11.2 standard spray sprinkler, but still required up to two sprinklers to be added to the design area.

An option might be to use ESFR sprinklers under the obstruction and speak with the AHJ about the new FM standards. FM no longer requires two ESFR sprinklers to be added to the design when ESFR sprinklers are added under obstructions. The only reason the rule is in NFPA 13 is because FM raised the concern years ago about extra sprinklers being needed, but FM no longer sees this as necessary. It is likely that the NFPA will remove the requirement as well. An AHJ might accept the new FM rules as equivalent provided all provisions of that standard are met.

**Question 2 – Soldered Copper Tube for ESFR Syste**ms

Section 6.5.4 in the 2007 edition of NFPA 13 addresses soldered and brazed joints in copper piping systems. The handbook commentary for this section goes on to say that 6.5.4 restricts the use of soldered joints to conditions under which the system piping is filled with water and in which the heat of a fire will not reach a magnitude that can compromise the integrity of the joint. It does allow soldered joints in these conditions:

Section 6.5.4.3 allows soldered joints for exposed piping systems in light hazard occupancies where sprinkler temperatures are either ordinary or intermediate.

Section 6.5.4.4 allows soldered joints for wet pipe systems above ceilings in light and ordinary hazard group I occupancies, regardless of the sprinkler temperature ratings.

Our specific ESFR occupancy involves artifact storage in mobile cabinets that requires some larger pipe sizes, including 4 and 6-inch mains. In these larger sizes brazing is not really practical due to the high heat required, and grooved joints are not allowed per the specification for pipe of 3 inch and smaller diameter.

Our research has found that:

- This section of NFPA 13 (6.5.4) has remained unchanged at least as far back as the 1991 edition.
- The latest edition of the Copper Tube Handbook published by the Copper Development Association shows that 95/5 solder melts at 450 degrees F (Figure 7 on page 38).
- The latest edition of the Copper Tube Handbook published by the Copper Development Association shows that 95/5 solder is rated for Service Temperatures up to 200 degrees F @ pressures well above the sprinkler maximum of 175 psi (table 4a page 28).
- EPDM gaskets used in the copper grooved couplings are rated for a maximum temperature of 250 degrees F.
- ESFR sprinklers in exposed and ceilinged areas are rated for 165 degrees F.
- Water boils @ 212 degrees F and in a fire condition with activated ESFR sprinklers would flow at a rate that would mitigate the temperature inside the pipe.

Based on the above, would solder joints be allowed in an ESFR occupancy (both exposed and ceilinged) since they would not be the weakest link in the system?

**Answer:** The rules are not specific to any size of pipe, but apply evenly to all sizes of pipe. Soldering of pipe to protect any hazard greater than Ordinary Hazard Group 1 is not permitted. The argument about the solder not being the weak link is not convincing, since fires can reach temperatures of well over 1500°F. If the solder joint ends up half-way between sprinklers and a fire occurs directly under the soldered joint, the joint might be heated to 400 degrees faster than the sprinkler 5 ft away could be heated to 165 degrees. It all depends on where the heat goes.

The AHJ is certainly allowed to accept a variance to the standard given special conditions. In this case, with a limited number of options for joining the pipe, the AHJ may be convinced that an exception is warranted. Perhaps if the joints are kept close to the sprinklers so that the sprinkler will open before the joint reaches a temperature where it could come un-soldered, the AHJ might be convinced that would be enough to ensure proper performance.

**Question 3 – Room Design Method Based on Deep Beams**

I am working on a retrofit fire sprinkler system. The building has 4 ft deep wood beams every 25 feet. Do these large wood beams create draft stops such that my design area would only be on one side of the beam, or would the area of design go on both sides of the beams?

**Answer:** You can't stop at the beam. The design area is based on the branch lines and cross mains. You have to determine the design area ignoring walls, partitions, beams or draftstops.

**Question 4 – Protecting Unfinished Basements in 13R Occupancies**

I am reviewing fire sprinkler plans for a 13R system in a new 4-unit condominium building. Each unit has its own private basement which can be accessed from within the dwelling unit only. The basements are unfinished (exposed 2x10 wood joists) and are shown to be protected with residential fire sprinklers with exposed steel piping. Can residential sprinklers be installed in areas without "flat, smooth, horizontal ceilings"? NFPA 13R appears to only address these areas when located outside the dwelling unit. Since these are private basements, I would believe them to be considered inside the dwelling unit. The area of each unit's basement is 1,350 sf.

I believe protecting unfinished basements with residential sprinklers is addressed in 13D, but not 13R. Could you please comment on what the correct design criteria should be? It would seem excessive to require a density/area method approach.

**Answer:** The issue is expressly covered in NFPA 13D where the user is simply told to place the residential sprinklers below the exposed joists such that a ceiling could be added later. The issue is not expressly covered in NFPA 13R.

If the area is within the dwelling units, residential sprinklers are permitted under NFPA 13R. There is no restriction on the use of residential sprinklers under exposed wood joists. The problem is in determining a design area. It would be up to the designer and the AHJ to determine if the 4-sprinkler design was acceptable.

If the area is considered outside the dwelling units, quick response sprinklers could be used in accordance with NFPA 13 (which would include up to five sprinklers instead of the four for residential, so it is not much of a penalty). Residential sprinklers could be used if the area is determined to be “similar to residential.”

**Question 5 – Air vs. Water for Pressure Testing**

We are doing a project in an occupied building and have been requested to test the system with air at 70 to 90 psi for 2 hours. In NFPA 13 the test certificate indicates pneumatic tests are conducted at 40 psi while and hydrostatic tests shall be at not less than 200 psi. Ever since I’ve been in the fire sprinkler business I have always heard not to exceed 40 psi when testing with air. I know that when air is expelled from an object it will cause movement and I am sure if water is flowing out at a specific pressure it too can cause movement. So maybe the correct terminology is not pressure. I have typically heard air pressure vs. water pressure is at a ratio of 4 to 1 or 3 to 1 but after researching the internet most authorities state pressure is pressure. I would welcome your response as I want to comply with the owner’s request unless it is considered an unsafe practice.

**Answer:** While “pressure is pressure,” the effect of that pressure can be different when the pressure is generated by a different source. The key difference is in the compressibility of air vs. water. Air undergoes a substantial volume change when compressed, while water does not. If the pressure confinement is suddenly eliminated, as through the failure of a section of piping or a fitting, both the air and water go back to their pre-pressurized volumes. For water this is negligible, but for air the considerable expansion can result in projectile movement of loose and damaged parts of the system, essentially creating shrapnel. It is for this reason that NFPA 13 limits air pressure tests to a maximum of 40 psi.

**Question 6 – Float Valves in Standpipe System Storage Tanks**

We have a question regarding NFPA 14 Figure A.7.1(c) titled Typical Multizone Systems. The schematic shows at the top a domestic water makeup connection going into the water storage tank and a fire

protection water connection with a float valve also filling the tank. Why do both valves that fill the tank look like float valves? If they are, which one works first? Or do they both fill at the same time? Or is the domestic makeup a manual valve and the fire protection connection automatic? Or should they be reversed, with automatic domestic fill and manual fill from the fire protection system?

**Answer:** First, you must recognize that the figure you are referring to is in the annex, not the body of the standard. Since it is in the annex, none of it is mandatory. You can set the equipment up any way that you want. If you want to make both valves automatic and have one valve open before the other, that is fine. If you want to have both valves open at the same time, that is acceptable as well (recognizing that it may cause a fire pump from a lower zone to start).

The second thing that you must realize is that with a multizone standpipe system you probably need to comply with NFPA 20 – *Standard for the Installation of Stationary Fire Pumps for Fire Protection.* In the most recent edition, NFPA 20 has special rules in Chapter 5 for buildings that are so tall that they are above the reach of the fire department apparatus. If your building falls into this category, you'll need two automatic fill valves on the tank and each one needs to be sized to provide the entire system demand. The domestic fill might not be sufficient for this task. There also needs to be a separate manual fill.

**Question 7 – Toggle Hangers in Lath and Plaster Ceilings for 2-inch Pipe**

We note that NFPA 13 allows the support of sprinkler pipe from lath and plaster ceiling sheathing through the use of toggle hangers rather than the support of the pipe directly from the structural members for pipes up to 1½ inch in nominal size as long as the hangers are not spaced more than 15 ft on center. Can 2-inch pipe be supported in the same manner as long as the hanger spacing is sufficiently reduced to make the load similar (or less than) the load of 1½- inch pipe supported at 15 ft intervals?

**Answer:** While there is no specific allowance for this in NFPA 13, there are also no specific restrictions that would prohibit an AHJ from considering this as an equivalency under Sections 1.5 and 1.6 of NFPA 13. However, we do note that while NFPA 13 prohibits the use of sprinkler pipe to hang other objects, the presence of exposed sprinkler pipe is a temptation to many building owners and it is a common problem for items to be hung from sprinkler piping that were unknown to the sprinkler contractor and not included in any load calculation. The larger the pipe, the more possibility there is for people to think they can hang something big and heavy from the sprinkler pipe.

**Question 8 – Multiple Adjacent Skylights in Separate Rooms**

We have a question regarding skylights. We know from Section 8.5.7 of NFPA 13 (2007 edition) that sprinklers can be eliminated from skylights not exceeding 32 sq ft that are separated from by at least 10 ft from any other skylight. If there are five adjoining rooms with skylights under 32 sq ft and the partitions between the rooms are full height, can sprinklers be eliminated from the skylights?

**Answer:** Yes. The intent of Section 8.5.7 is to have unprotected skylights separated from other unprotected skylights. This can either be accomplished by separating them 10 feet horizontally or by separating them by walls into individual compartments.

**Question 9 – Isolation Valves for Manual Dry Standpipes**

Are isolation valves are required for manual dry standpipes?

**Answer:** Yes. Section 6.3.2 of NFPA 14 (2010 edition) simply states: "Valves shall be provided to allow isolation of a standpipe without interrupting the supply to other standpipes from the same source of supply." The type of standpipe does not matter.

**Question 10 - Protection of Steam Turbine Generator Bearings**

The 2010 edition of NFPA 850 – *Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations* discusses the protection of turbine generator bearings in Section 7.7.4.2. This section states a design density of 0.25 gpm/sq ft over the protected area of all bearings. We have recently seen two different existing installations for the protection of steam turbine generator bearings. One installation consisted of two nozzles protecting each of the bearings and the other installation consisted of one nozzle protecting each of the bearings. My question is this: Is one nozzle at each bearing location acceptable as long as it is designed to provide 0.25 gpm/sq. ft. over the protected area?

**Answer:** You are correct that Section 7.7.4.2 of the 2010 edition of NFPA 850 recommends a density of 0.25 gpm/sq ft over the protected area of all bearings. Section 7.7.4.2 does indicate that this should be accomplished with an "...automatic closed-head sprinkler system utilizing directional nozzles." The term nozzles is plural which could indicate more than one nozzle, but the key would be proper coverage – it may well be that one nozzle is not able to fully protect the area in many cases due to the geometry of the arrangement. It is worth noting that in the statement of design objectives in NFPA 15 – *Water Spray Fixed Systems for Fire Protection*, Section 7.1.7 (2007 edition) states: "The design shall ensure that the nozzle spray patterns meet or overlap."

**Question 11 – Freeze Protection for Underground FDC Piping**

Does an underground FDC line have to be buried per the requirements of NFPA 13 Section 10.5 or can the cover be simply per the mechanical protection requirements of 10.4.3, 10.4.4, and 10.4.5? In other words, can the protection against freezing be ignored?

**Answer:** Common sense would dictate that unless there is a specific mechanism by which the underground pipe is automatically drained after it has been charged during use, then freeze protection must be provided.

**Question 12 – Sprinklers for Localized Combustibles in Concealed Spaces**

We have a project that is an existing 5-story wood structure. The residential units will have a new sheetrock envelope over the existing wood structure, as well as a new dropped non-combustible ceiling. The new interior walls surrounding the kitchen and closets are constructed of 2x4 studs that extend thru the new non-combustible ceiling but the sheetrock only extends six inches above the ceiling. Therefore, the wood studs are exposed in the concealed space. NFPA 13 (2002 edition) Section 8.14.1.5 (1) allows for localized protection of exposed combustibles. In other words a complete sprinklering of the concealed space is not required for localized or "limited" exposed combustibles. I believe we are interpreting this section correctly but would appreciate your comments, especially in regard to whether sprinkler protection would be required only on one side of the exposed combustibles.

**Answer:** Assuming that the wood studs for the partitions and their top plates are the only exposed combustibles in the space (meaning that if the wood studs were not there, the space would be permitted to be unsprinklered), NFPA 13 allows the installation of sprinklers to handle the localized combustibles, rather than providing sprinklers throughout the entire concealed space. As you pointed out in your question, Section 8.14.1.5(1) specifically applies to this situation. Section 8.14.1.5(1) was written specifically for combustible vertical partitions extending into a concealed space. If this section is going to be used to protect the localized combustible wood studs, a single row of sprinklers is permitted, meaning that the sprinklers will only be on one side of the studs. Spacing information is contained in Section 8.14.1.5(1) that keeps the sprinkler close enough to the wood members (within 6 ft) to control a fire. Also note that the sprinkler needs to be within 5 ft of the end of the partition.

## Upcoming NFSA "Technical Tuesday" Seminar – January 18th

***Topic: Antifreeze Systems***
***Instructor: Russell P. Fleming, P.E., NFSA Executive Vice President***
***Date: January 18, 2011***

Antifreeze systems generated more controversy than any other fire sprinkler topic during 2010. With the dust settled, this seminar will discuss the current requirements relative to both new and existing systems. It will explore design alternatives, including the status of dry residential sprinkler systems and new candidate antifreeze solutions. It will also address contractor obligations with regard to the evaluation of existing systems.

**To register or for more information, click HERE or contact Michael Repko at (845) 878-4207 or e-mail to seminars@nfsa.org.**

## Upcoming 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 2011:

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| Feb 1 | Poughkeepsie, NY | Sprinkler Protection for Special Storage |
| Feb 1 | Howland Township, OH | Inspection, Testing & Maintenance |
| Feb 2 | Poughkeepsie, NY | Sprinklers for Dwellings |
| Feb 2 | Howland Township, OH | Sprinkler Protection for General Storage |
| Feb 3 | Poughkeepsie, NY | Residential Sprinklers: Homes to High-Rise |
| Feb 3 | Howland Township, OH | Underground Piping (1/2 day a.m.) |
| Feb 3 | Howland Township, OH | Fire Pump Layout & Sizing (1/2 day p.m.) |

*These seminars qualify for continuing education as required by NICET, and meet mandatory Continuing Education Requirements for Businesses and Authorities Having Jurisdiction.*

**To register for these in-class seminars, click HERE. Or contact Michael Repko at (845) 878-4207 or e-mail to seminars@nfsa.org for more information.**

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***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.*