NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
July 4, 2006

Best Questions of June 2006

We have selected the following questions as the “best of June 2006” answered by the NFSA Engineering staff:

Question 1 – Indoor Miniature Golf Course Housing

Does a small house to be installed on an indoor miniature golf course qualify as extra hazard based on "manufactured home or modular building assembly" listed in the annex?

Answer: Probably not, but the appropriate protection criteria in accordance with NFPA 13 would depend on the size of the “small house,” the contents, and whether it is independently sprinklered. A solid roof on a house-type structure within a sprinklered building is definitely an obstruction to the ceiling sprinklers and, if nothing else, can be considered under the rule that requires sprinklers below obstructions over 4 ft in width. If the interior of the house is not accessible then it can be considered in accordance with the rules governing combustible concealed spaces. The extra hazard classification would be considered an extreme approach. The description of the extra hazard Group 2 classification in Section 5.4.2 references "...occupancies where shielding of combustibles is extensive." This is the case with manufactured housing assembly, where the manufactured houses are built inside another building. Even in cases where the manufactured houses will eventually be sprinklered it is not considered practical to install sprinklers in the houses during the construction process.

Question 2 – Multiple Vertical Turbine Pumps

I have multiple vertical pumps taking suction from a common underground concrete tank. Questions are 1) Is there a minimum distance the pumps must be apart? and 2) Is there a minimum distance the pumps must be from the tank walls?

Answer: There are some guidelines for your situation provided by the Hydraulics Institute, which also recommends that you contact the pump manufacturer for their guidelines. As an example, if the pumps have flow up to 3000 gpm, they recommend at least 34 inches between the turbine shafts but a minimum of 4 times the diameter of the hole in the tank for the shaft. The shafts should be no closer than 17 inches to the sidewalls of the tank. These are very general guidelines that should be reaffirmed by the pump manufacturer.

NFPA 20 recommends using this information in A.7.2.2.2, where it states, "The Hydraulics Institute Standards for Centrifugal, Rotary and Reciprocating Pumps recommends sump dimensions for flows 11,355 L/min (3000 gpm) and larger. The design of sumps for pumps with discharge capacities less than 11,355 L/min (3000 gpm) should be guided by the same general principles shown in the Hydraulics Institute Standards for Centrifugal, Rotary and Reciprocating Pumps."

Question 3 – Pitching of Deluge Systems

Is there anything within NFPA 13 that requires pitching of piping in a deluge system? I have a deluge system where the bulk main is run in a ceiling space (not subject to freezing) before it goes up onto the roof. Does this pipe have to be pitched? Space is very limited, and I would like to run it in the joist space wrapping around two I-beams.

Answer: Unlike all dry systems, and all preaction systems beginning with the next (2007) edition of NFPA 13, there is no rule that the piping for a deluge system needs to be pitched. Section 8.15.2.4.1 states that the piping must be capable of being drained, but this can be accomplished without having to pitch the pipe, mainly through the use of open sprinklers installed at low points.

Question 4 – Effective Height of Sprinklers

A sprinkler system is being provided for a large building in which movie sets are built. The building is 70 ft high but all technical data seems to only go to 60ft. What do you recommend?

Answer: There is no height limit to the effectiveness of fire sprinklers, which is why the subject is not specifically addressed in NFPA 13. There have been a number of research projects done on this subject in buildings as high as 100 ft from the floor to the ceiling, all of which have concluded that there is an advantage to including sprinklers. Some work has demonstrated that the necessary design area tends to increase as the ceiling height increases. This is why FM Global sometimes requires a design area of 5000 sq ft when the distance from the floor to the ceiling exceeds 50 ft. A summary of the information on high ceiling areas can be found in several past NFSA Sprinkler Quarterly articles. The articles are titled, “High on Sprinklers”, “High on Sprinklers Part 2” and “Still High on Sprinklers.” If you don’t keep your back issues of Sprinkler Quarterly, they will be available to NFSA members for download from the www.nfsa.org website later this summer, or can be purchased through the NFSA engineering department library.

Question 5 – Porches of NFPA 13 Occupancies Below NFPA 13R Occupancies

A Type III, group R2 building will be used primarily for short-term rental units, i.e. hotel occupancy. However, the first floor will be subdivided for retail space. There is a combustible wraparound porch on the first level that is approximately 8 ft wide. NFPA 13R will be used for the hotel, with NFPA 13 design criteria applied to the first floor. Is sprinkler protection required for the porch area?

Answer: Yes, unless the Authority Having Jurisdiction (building official) considers the retail space to be accessory to the hotel occupancy. If the full building is considered an NFPA 13R occupancy, then sprinklers would not be required for the porch even if some parts of the first floor are used for retail as described within the scope of NFPA 13R and protected using NFPA 13 criteria. However, the applicable building code may consider the situation at hand to represent a residential occupancy over top of a retail occupancy, in which case all provisions of NFPA 13 would be required for the first floor occupancy, including the requirement that the porch be protected with sprinklers in accordance with Section 8.14.7, Exterior Roofs or Canopies.

Question 6 – Wardrobes, Cabinets and Trophy Cases

From past NFSA communications we are aware that sprinklers are generally not required in wardrobe style cabinets and other items of furniture. What about the case of school cabinets, with

bulkheads deep enough that the spray pattern would not physically reach the rear of the cabinet although the spacing of the ceiling heads would allow coverage if the bulkheads did not interfere? Is there is any information on this situation besides the annex of 13?

Answer: You are correct that it is not customary for sprinklers to be located inside furniture. NFPA 13 (2002 edition) addresses the situation of storage spaces built along a wall topped by a bulkhead in Section A.8.14.8.2, stating "Portable wardrobe units mounted to the wall do not require sprinklers to be installed in them. Although the units are attached to the finished structure, this standard views those units as pieces of furniture rather than as part of the structure; thus, sprinklers are not required." It is important, however, that the sprinklers are located to cover all of the floor space, including that which is occupied by the cabinets. Similar language was added to the body of the text for the 2007 edition of NFPA 13, in proposal 13-191 (Log #535), which was unanimously accepted. It should also be noted that it is not required to get water to every square inch of floor space. NFPA 13 states in Section 8.5.5.1 that "sprinklers shall be located so as to minimize obstructions to discharge."

Question 7 – Fire Flow Requirements

We are working on a project that covers 127 acres, including 6 large buildings and support buildings. The area is supplied by a water storage tank and fire pump serving private fire service mains and hydrants as well as sprinkler systems. Can requirements for fire hydrant flows be found in the fire code, building code, or NFPA standards?

Answer: There is no single standard or code to use for the calculation of fire hydrants. The idea is to provide enough flow to handle the hazard near the hydrants. This flow is typically called the “fire flow.”

Calculating fire flow is extremely complex. The overall hazards must be defined. The possibilities include fighting fires in sprinklered buildings near the hydrants, fighting fires in nonsprinklered buildings near the hydrants, fighting fires in vehicles near the hydrants, and fighting fires in wildland areas near the hydrants. If the focus is narrowed to buildings, there is still a need consider both sprinklered and nonsprinklered (if there are any) buildings. For the situation with nonsprinklered buildings, water is needed for fire fighting within the building plus additional water to keep the fire from spreading to adjacent buildings (called exposure protection).

For nonsprinklered buildings, there are a number of different formulas and tables that are used to determine fire flow. The most common are the Insurance Services Office (ISO) formula and the International Fire Code table. Both of these options vary the needed fire flow depending on the type of construction of the building, the size of the building and the location of potential exposures. Values can range from 500 gpm to 10,000 gpm. NFPA 1142 - *Standard on Water supplies for Suburban and Rural Firefighting* also contains a calculation approach based on building occupancy, construction type and exposure hazards. Hydrant spacing is also an issue. For example, NFPA 1142 recommends that the full fire flow should be available from hydrants within 1000 ft of the building being protected, with up to 1000 gpm allowed from each hydrant (with pumper outlets) within 300 ft, up to 670 gpm from each hydrant within 301 to 600 ft, and up to 250 gpm from each hydrant within 601 to 1000 ft from the building.

For sprinklered buildings, there are two approaches. NFPA 13 calls for inclusion of outside hose demand. This is the amount expected to be used at fire hydrants outside the building during a fire

inside the building. The maximum outside hose demand is 500 gpm and is added to the sprinkler demand at the closest hydrant to the building. The Insurance Services Office (ISO) agrees with NFPA 13 and states that, for the purposes of sizing water supplies to fully sprinklered buildings, the fire flow demand should be the sprinkler demand plus the outside hydrant (outside hose) demand.

The International Fire Code (IFC) disagrees with NFPA 13 and ISO. It has a table for needed fire flow that varies with building construction, size and exposures. There is a significant credit given to fully sprinklered properties, but the outside hose demand is generally more than the 500 gpm required by NFPA 13. You would need to consult the IFC for more details concerning the specific type of building.

Question 8 - Open Ceiling Grids

A compartment has open grid ceilings in it. This compartment is surrounded by gypsum board walls that go the deck. Do the walls have to be fire rated to qualify as adequate separation so that sprinklers could be eliminated from the non-combustible concealed spaces above adjacent ceiling?

Answer: No. Provided the density/area method is used for hydraulic calculation of the system, there are no requirements for fire rating of this barrier or partition. Section 11.1.2 of NFPA 13 states, "For buildings with two or more adjacent occupancies that are not physically separated by a barrier or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding occupancy shall extend 15 ft (4.6 m) beyond its perimeter." This section indicates that the barrier or partition separating two areas in an NFPA 13 occupancy hazard design need only be capable of delaying activation of sprinklers in an adjacent area. If that partition or barrier cannot perform this function, then the protection for one area must extend into the other. The only time that the partition must be rated is if this system has been designed using the "room design method" found in Section 11.2.3.3.

Question 9 - Relief of Excess Pressure Through Relief Valves to Atmosphere

An existing 21-story condominium has a 750 gpm, 150 psi diesel fire pump. The fire pump has a relief valve piped back to supply side of pump. The backflow preventer is within 20 feet of the supply side of the pump. When the pump is run every week, the system experiences pressures exceeding 175 psi. The problem is that the relief valve is trying to relieve the pressure but, because the backflow preventer is so close to the supply, the pressure is recycling through the pump. It has been proposed to reconfigure the piping to allow the relief valve to discharge into a properly sized drain, thus relieving the excessive pressures. Would this be acceptable?

Answer: This fire pump arrangement violates several sections of NFPA 20. The proposed fix continues to violate NFPA 20 and will result in an efficient system during pump operation, causing thousands of gallons of water to flow through the relief valve every week when the pump is tested. If the relief valve fails, then the system will be over-pressurized and could potentially blow apart.

The pump design and installation violates Sections 5.7.4.1 and 5.7.4.2 of the 2003 edition of NFPA 20. Section 5.7.4.1 has been in the standard for several cycles. Section 5.7.4.2 has always been implied by the standard, but since so many people chose to misinterpret it, the Committee decided to spell out the rules plainly in the 2003 edition. There is serious concern about the use of pressure relief valves to bring system pressure under control for the reasons described above.

The best solution would be to redesign the system with a different pump that does not cause so much pressure. This can be difficult given variable water supplies, but it can be accomplished with a break tank that brings the suction pressure down or a variable speed pump that slows the pump down to reduce the discharge pressure under low flow conditions. Both of these options result in better fire protection than the use of relief valves.

Question 10 – Manual Fill Pipes for NFPA 22 Tanks

A high-rise project has a 40,000 gallon concrete built-in fire protection water storage tank, which will serve as the primary water source for a standpipe system, and which will be supplied by a vertical turbine fire pump. A 4-inch manual fill pipe will be used to quickly fill the tank, with a 2-inch auto-fill valve, activated by a float, also piped to "top off" the tank as needed. To meet the intent of Section 13.4.1.3 of NFPA 22, is it necessary to automatically fill the tank within the 8-hour period, or can we rely on the use of the manual fill pipe initially and after a fire event?

One of the reasons we are asking is that Section 13.5.2.3 of NFPA 22 (2003 edition) requires an overflow at least one size larger than the fill line. If we meet the intent of Section 13.4.1.3 through the 4-inch manual fill pipe, then it would seem we need at least a 5-inch overflow. If we meet the intent of 13.4.1.3 through the 2-inch auto-fill valve, we would need to provide a 2½-inch overflow, but Section 13.5.1 requires the overflow to be at least 3 inches in diameter.

Answer: The 4-inch manual fill pipe can be used as the method for filling the tank assuming it is arranged to be a bypass (with a normally closed indicating valve) routed around the check valve (located on the discharge pipe between the check valve and all other valves) and can fill the tank in 8 hours. If this pipe is used for filling than the overflow should be able to handle the flow during operating conditions per Section 13.5.1. The inlet is that the overflow pipe be at least one pipe size larger than the fill line per Section 13.5.2.3, which in this case will be one size larger than a 4-inch pipe.

Question 11 - Residential Sprinklers for Differing Ceiling Heights

If a residential pendent sprinkler is installed within it's listing of 4inches below the ceiling and correctly spaced away from walls, can the spray from this residential pendent installed in an 8 ft ceiling cover the floor area beneath an adjacent 9 ft ceiling?

Answer: No. If the fire were to start under the ceiling that is 9 feet high then there is a chance that the sprinkler may not operate early enough to control the fire. Although NFPA 13 contains ceiling pocket guidelines by which ceiling pockets up to 1000 cubic feet are acceptable, those rules only apply to standard spray and extended coverage sprinklers. A skylight exception in Section 8.5.7 of NFPA 13 (2002 edition) permits similar ceiling pockets up to 32 sq. ft to omit a sprinkler from the higher elevation and applies to all types of sprinklers. Therefore, if the higher ceiling area is limited to 32 square feet or less and the system is installed per NFPA 13, it is acceptable to cover that floor area without a sprinkler at the higher elevation.

It should be noted that if a residential sprinkler has a listing for distances up to 18 inches below the ceiling than this specific case would be acceptable as the sprinkler would be 4 inches below the 8 ft ceiling and 16 inches below the 9 ft ceiling. Both distances would comply with the listing and a sprinkler at the higher elevation could be omitted.

If the sprinkler is being installed in accordance with NFPA 13R or NFPA 13D, it should also be noted that the NFPA Committee has recently discussed the ceiling pocket concept in their preparation for the 2007 edition of the standards. Tentatively approved language will allow ceiling pockets up to 100 cubic feet with depth up to 12 inches. Also included are the other requirements similar to NFPA 13, such as unprotected pockets being at least 10 feet apart.

Question 12 – Obstructions for Light Fixtures in Ordinary Hazard

Light fixtures 2 ft by 4 ft in size are being installed in a small warehouse. Sprinklers are standard spray uprights in an ordinary hazard system. What parts of NFPA 13 address the placement of these fixtures such that won't obstruct the sprinkler spray? As planned, the sprinkler deflectors will be 15.25 inches above the lowest edge of the light fixtures.

Answer: Obstructions for standard spray sprinklers are in section 8.6.5 of NFPA 13 (2002 edition), which is the same as Section 5.6.5 of the 1999 edition. Two options are available: making sure that enough water gets under the object, or making sure that enough water gets to both sides of the object. There is no requirement to do both.

Section 8.6.5.1.2, known as the "beam rule" within the industry, is used to ensure that enough water gets under the object. According to the table that accompanies this figure, the sprinkler deflector must be at least 4.5 ft away from the closest edge of the light in fixture order to have the deflector 15.25 inches above the bottom of the light.

Sections 8.6.5.2.1.3 through 8.6.5.2.1.10, collectively known as the "three-times rule", are used to ensure that enough water is distributed on both sides of the obstructing object. This would require the sprinkler to be at least 24 inches from the closest edge of the light. Note that this distance is measured in a straight line from the sprinkler deflector to the closest edge of the light, so the distance is the plan view can be slightly less if there are elevation differences.

One consideration for ordinary hazard occupancies is that the "three-times" rule does not have any specific minimum dimension for distance when the obstructing object is not a structural member (see section 8.6.5.2.1.4). Since light fixtures are not structural members, this means that there is no minimum distance that you need to be away from a 2 ft by 4 ft light fixture in an ordinary hazard occupancy as long as the sprinkler is positioned in such a location that you can predict that water will get to both sides of the obstruction (in this case both over and under the obstruction). Caution is needed when using this variation of the "three-times" rule since the building has been as a "warehouse" and the rules for ordinary hazard may not be sufficient for dealing with the commodity being stored.

Last Chance for "Technical Tuesday" & "Business Thursday" Online Series

Both of these new NFSA online seminar series start within the next week. As such, time is short to obtain the 30 percent discount that comes with registration for all ten seminars in each series. The "Technical Tuesday" seminars for the second half of 2006 focus on ten areas commonly leading to installation problems with sprinkler systems. Some of these are traditional problems of understanding the installation rules, while some relate to problem areas surfacing with regard to new technologies. Information and registration for these seminar series are available at www.nfsa.org.

Technical Tuesday Seminars

July 11	CPVC Piping Compatibility and Use
Aug. 1	Where Codes Override Installation Standards
Aug. 22	Sprinkler Obstructions
Sept. 12	Concealed Spaces
Sept. 26	Commissioning of Systems
Oct. 10	Draft Stops and Closely-Spaced Sprinklers
Oct. 24	Confusing Aspects of Storage Protection
Nov. 7	Emerging Issues for Residential Sprinkler Systems
Nov. 21	Protective Coatings for Piping
Dec. 12	Other Problem Areas/Frequently Asked Questions

Business Thursday Seminars

July 6	Safety and Risk Management
July 20	Contract Language Pitfalls
August 10	Change Orders
August 24	Insurance Programs: OCIPs and CCIPs
September 14	Pre-Job Planning
September 28	Mold Remediation
October 19	Project Scheduling
November 2	Prompt Pay and Retainage
November 16	Water Charges: Impact and Standby Fees
December 7	AHJ Relationships

A discount of 30 percent is available when signing up now for all ten seminars in the series. Information and registration for this seminar is available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-200 ext 133.

Upcoming NFSA Technical Tuesday Online Seminar

Topic: CPVC Piping Compatibility and Use
Instructor: Russell P. Fleming, P.E., NFSA Executive Vice President
Date: July 11, 2006

Although introduced as a special listed product, the CPVC piping system has become the industry standard for residential and similar applications. Some specific rules relating to CPVC pipe and fittings are now found within the NFPA standards. Special precautions must be taken with regard to hanging, testing, and other aspects of use. There are also newer concerns of compatibility with other products found in sprinkler systems that require attention to prevent system failures. The focus of this seminar will be on identifying and avoiding these compatibility problems.

Information and registration for this seminar is available at www.nfsa.org.

2006 Basic and Advanced Technician Training, NICET Inspection Seminars

The NFSA is the only organization that offers two-week basic technician training seminars, 3-day advanced technician training seminars, and NICET-oriented inspection and testing review seminars at various locations across the United States. The following dates and locations remain for the 2006 schedule:

2-week Basic Technician Training

August 14-25, 2006 – Seattle, WA
October 16-27, 2006 – Philadelphia, PA

3-day Advanced Technician Training

October 3-5, 2006 – Minneapolis, MN

3-day NICET Inspection and Testing Certification Review

July 11-13, 2006 – Edwards, CO
September 6-8, 2006 – Dallas, TX
November 14-16, 2006 – Anchorage, AK

For more information, contact Nicole Sprague using Sprague@nfsa.org

NFSA In-Class Training Opportunities

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

July 11-12	Providence, RI	NFPA 13 Overview & Intro to Plan Review
July 13	Providence, RI	Hydraulics for Fire Protection
July 18-19	Prescott Valley, AZ	NFPA 13 Overview & Intro to Plan Review
July 20	Prescott Valley, AZ	Inspection, Testing & Maintenance
July 18	Albuquerque, NM	Hydraulics for Fire Protection
July 19	Albuquerque, NM	Pumps for Fire Protection
July 20	Albuquerque, NM	Sprinkler Protection for General Storage
July 25	Centerville, OH	Sprinkler Protection for General Storage
July 26	Centerville, OH	Sprinkler Protection for Rack Storage
July 27	Centerville, OH	Sprinkler Protection for Special Storage

For more information or to register, visit www.nfsa.org or call 845-878-4207.

labor relations and other services to its membership. Headquartered in Patterson, New York, the National Fire Sprinkler Association has regional operations offices throughout the country.