

Number 146

May 5, 2009

Editor – *Russell P. Fleming, P.E.*

## Best Questions of April 2009

We have selected the following questions as the “Best of April 2009” answered by the engineering staff as part of the NFSA’s “Expert of the Day” member assistance program:

### Question 1 – Tyco Issues Statement on Allied ABF® II and CPVC Pipe

In your March 3, 2009 issue (No, 141) you provided an update on the CPVC compatibility issue with regard to antimicrobial coatings on steel sprinkler pipe. Is there anything new this month?

**Answer:** Yes. Tyco, the parent of Allied Tube and Conduit, issued a release relative to Allied’s ABF® II steel pipe coating on April 30, 2009, the opening day of the NFSA Annual Seminar and Exhibition. This allowed discussion at workshops on the topic the following day. In summary, the release explains that in a small number of cases, components of the coating in combination with high levels of mechanical stress may contribute to environmental stress cracking of downstream CPVC piping. As a conservative approach while its investigation continues, Tyco is recommending that ABF II coated steel pipe not be used in new systems containing CPVC. (Note: Please refer to the full text of the release, which is being provided as an attachment to this issue of *e-TechAlert*.)

### Question 2 - Distance from FDC to Hydrant

Is there a maximum distance a fire department connection can be located from a fire hydrant?

**Answer:** No. The distance from an FDC to a hydrant, like the distance between hydrants, is usually related to the amount of hose that a fire department carries on its trucks, which can vary from one department to the next. While the International Fire Code does not have specific hydrant location requirements, Section 903.3.7 of that document states: “The location of fire department connections shall be approved by the fire code official.” NFPA 24 simply requires that the locations need to be acceptable to the AHJ.

### Question 3 – Ceiling Pockets and Residential Sprinklers

Is it correct to assume that the ceiling pocket rule of NFPA 13 Section 8.8.7 (2007 edition), that allows nonsprinklered ceiling pockets under some circumstances, also applies to residential sprinklers?

**Answer:** No, you can’t use the ceiling pocket rules of Section 8.8 with residential sprinklers. Residential sprinklers are held to a higher standard of performance than other sprinkler sprinklers, at least for the first 10 minutes of operation. Residential sprinklers are tested for their ability to maintain survivable conditions in the room of fire origin. A large ceiling pocket might delay sprinkler response to the point where conditions in the room of origin might not meet the test criteria. However, you are allowed to use the ceiling pocket rules of Section 8.5.7. Since this is a subsection of Section 8.5, it applies to all sprinklers, including residential sprinklers. This rule allows sprinklers to be omitted from skylights “and similar ceiling pockets” that do not exceed 32 sq ft in plan view area. So, for these very small pockets, sprinklers can be omitted from rooms protected with residential sprinklers in accordance with NFPA 13.

Both NFPA 13R and NFPA 13D allow sprinklers to be omitted from pockets up to 100 cubic feet in area. This was done without fire testing but was considered acceptable to the committee based on the different levels of protection that are the goals and objectives of those standards.

#### **Question 4 – Restraint of Drops in Earthquake Areas**

Here in California there is a great deal of interest in the rules for restraint of drops from branch lines. Has any language been added in the standard requiring restraint on sprinkler drops? Is any language on sprinkler drop restraints coming in the next edition of NFPA 13? Are you aware of any language on restraining drops being added as part of the California adoption of NFPA 13?

**Answer:** Currently, there is no specific statement on the restraint of drops. Although some movement may occur during an earthquake, drops have the benefit of gravity working in their favor. In other words, gravitational forces will help to keep/restore the proper location of sprinkler drops after earthquake motion. As the 2010 edition of NFPA 13 is being prepared, there is a section being added to clarify that drops do not specifically require restraints. The Committee also discussed the use of restraint on armovers. However, a specific length where the requirement should be added could not be agreed upon, so no language is being added on that issue. We should caution that if extremely long drops in conjunction with a ceiling or on armovers it may be wise to provide restraint or additional support so as not to produce damaging moments, but this is highly subjective. We have not heard of any additional requirements being added as part of the California adoption.

#### **Question 5 – Sprinklers under Balconies for NFPA 13R over Driveways**

I have an NFPA 13R (2007 edition) apartment building with balconies and patios that are being sprinklered per the IBC 903.3.1.2.1 requirement. The AHJ is asking for sprinkler protection under 2nd floor balconies that overhang in front of garage doors. Basically, they overhang driveways. This area is not required by NFPA 13R to be sprinklered and it is my understanding that the IBC patio/balcony requirement is not intended to apply to this area either. Am I right?

**Answer:** The IBC requires the sidewalls under the balcony. The IBC does not usually require the sprinklers above the balcony in an NFPA 13R occupancy. The concern on the part of the IBC membership is for occupants on the balcony or using the balcony for egress. They believe that this application would prevent a fire below from endangering the balcony. The NFPA committees have not required such protection in these cases.

#### **Question 6 - Earthquake Braces for Short Runs of Mains**

Section 9.3.5.11.3 of NFPA 13 allows the loads for sections of mains less than 12 ft in length to be included with the loads on adjacent runs of pipe. Does this mean that braces must be attached to any run of main longer than 12 ft?

**Answer:** Not necessarily. Section 9.3.5.3.6 allows lateral braces for one run of pipe to act as longitudinal braces for an adjacent run of pipe provided they are located within 2 ft of the centerline of the piping adjacent piping, and Section 9.3.5.4.2 provides the opposite allowance. So, theoretically, a section of main with a length up to the approximate brace spacing limits of Table 9.3.5.3.2(a) or (b) could be supported through adjacent piping runs provided the braces are located within 2 ft of both ends.

#### **Question 7 - Residential Sprinklers in an Attic Space Used for Storage**

We are currently bidding a four-story (basement, 1, 2, 3, and attic) sorority house. The attic space is finished and they now use it for storing boxes, paper, desks, etc. No storage over 12 ft or anything like that. Our question is whether this space can be designed and protected with residential sprinklers. My thought is that it would have to be a light or ordinary hazard spacing and calculation.

**Answer:** First, we have assumed that this building is being protected using NFPA 13R. As such, the answer to your question is “no.” Section 6.7.7.2 in NFPA 13R (2007 edition) discusses areas outside the dwelling unit. Section 6.7.7.2.1 states,

“Sprinklers outside the dwelling units shall be quick-response, and selection shall be based on the requirements of NFPA 13 except where permitted by 6.7.2.2.” Your scenario does not meet the exceptions. Therefore, the attic needs to be protected with quick response sprinklers per NFPA 13 spacing and calculation information.

### **Question 8 - Exterior Wall as a Fire Division for Stairway Sprinklers**

In an NFPA 13 system, do I have to sprinkler the first floor of a stairway in a building that has a basement and three floors, where the stairway serves only one fire division on each floor, but where the entrance from the outside is located on the first floor? In other words, is the outside of the building considered a different fire division?

**Answer:** You have asked if the exterior of the building should be considered a fire division for the purposes of applying Section 8.15.3.3 in NFPA 13, 2007 edition.

The answer is “no.” Section 8.15.3.3 is intended to apply to stairwells that have two doors where each door opens to a different space. The separation between those spaces would be required to have some type of fire resistance rating. The goal is to prevent the fire from traveling through the stairwell to reach the other space as depicted in Figure A.8.15.3.3(a). The sprinklers would stop the fire from spreading if both doors of the stairwell were left or blocked open. In general, NFPA 13 does not plan for fires starting outside of the building.

### **Question 9 – Adding Pull Stations when Upgrading Alarms for 13R Systems**

I am a local inspector. We recently had a number of three-story modular apartment buildings (9 living units) built in town and equipped with 13R sprinkler systems. The owner has decided to have the flow switch and the tamper switches monitored only off site. I have read on the NFSA web site in the FAQ section that this setup would be considered a “fire alarm system” therefore requiring a manual pull box as per NFPA 72 6.8.5.1.2. My question is this: since the owner was not originally required to have any off-site monitoring, would they now have to meet the requirements of a “system”, since they have gone above and beyond the original requirements?

You should be aware that I sent the same question to NFPA and received a quite different answer. NFPA 72 (2002), the standard that would apply to the installation of a flow switch, section 6.2.3.1 addresses “nonrequired (voluntary) systems” and states that the systems installed “shall” meet the requirements of that code. Section 6.8.5.1.2 states “for fire alarm systems employing automatic fire detectors or water flow detection devices, at least one fire alarm box shall be provided to initiate a fire alarm signal”. And since the water flow switch is the only initiating device that has been installed to detect the flow of water, it can not be considered to be a supplementary feature of the required system functions.

**Answer:** You have referenced NFPA 13R, which requires that the sprinkler system be locally monitored. You note that the system is being monitored off site, which is generally considered to be more reliable, since it involves a constantly attended location. However, when voluntary upgrades such as this are done on a system, they do not pull in additional requirements for the building. This system would still comply with NFPA 13R (under which it was installed) but would not invoke other items such as manual pull stations from NFPA 72 simply because the alarm monitoring was upgraded.

We have reviewed the sections you quoted from NFPA 72 and believe the intent is not being conveyed correctly. The 2007 edition of NFPA 72 indicates that the language has been modified, but the annex clearly tells the intent. Section A.6.2.3 states: “Nonrequired fire alarm features ... are fire alarm systems or components that are not required by the building or fire codes and are installed voluntarily by a building owner to meet site-specific fire safety objectives ... Nonrequired components must be operationally compatible in harmony with other required components and shall not be detrimental to the overall system performance. It is for this reason that 6.2.3.1 mandates that nonrequired (voluntary) systems and components meet the applicable installation, testing, and maintenance requirements of this Code. It is not the intent of the Code to have the installation of nonrequired (voluntary) systems or components trigger a requirement for the installation of additional fire alarm components or features in the building...”

The meaning in NFPA 72 is that the off-site monitoring of the NFPA 13R system would have to comply with the NFPA 72 requirements, but no additional features, such as pull stations, would be required to be added due to the upgrade.

## Question 10 – Deflector Distance in Tight Storage Areas

A tenant locker area at a loft project has a floor to deck distance of only 7 ft 5 inches and the cages are constructed of 2x4 lumber covered with chicken wire. There will be no cap to prevent tenants from storing up to the deck itself. They will keep the top of the door down to clear any sprinkler pipe and lights. How do you lay out sprinklers for proper coverage when you can't keep storage levels down 18 inches from sprinkler deflectors?

**Answer:** Assuming you are using NFPA 13 with spray sprinklers, Section 8.6.6 in the 2007 contains the requirement to maintain 18 inches between the pendent/upright sprinklers and the top of any storage. The annex discusses storage along the walls. Although shelving is specifically referenced in the annex, the concept could still be applied to these types of storage units where tenants may pile boxes high (within 18 inches of the sprinkler deflector) along the perimeter. In this type of scenario, it may be appropriate to put a sprinkler in each storage space. Depending on the width of each storage space it may be necessary to prevent cold soldering with lintels or baffles. If the above option does not work, then the only other option is to make the owner aware of the need to enforce the 18 inches of clearance with their tenants.

## Question 11 – Joint Options for Joint Treatment

Section 6.5.1.3 of NFPA 13 mentions the use of either tape or compound for threaded joints, but not both. Is this correct? Why?

**Answer:** Section 6.5.1.3 is simply trying to say that you only apply the tape or compound to the male threads. That means that you do not apply the tape or compound to the female threads. Applying the tape or compound to both the male and female threads puts too much material in the fitting. There are some situations where contractors use both tape and compound, and there is no prohibition against this in the NFPA standards. However some prohibitions against the practice appear in the listing limitations of special listed piping products, so the manufacturer's instructions need to be checked carefully. For example, the manufacturers of CPVC pipe and fittings prohibit the combined use of tape and compound in their listing literature. Since the literature is a part of the listing, it becomes a requirement. The prohibition is referenced in the annex to the standards. For example, Section A.5.1.1.1 in NFPA 13R states:

A.5.1.1.1 Compatible thread sealant or Teflon tape can be used in a CPVC sprinkler head adapter. However, a combination of the two cannot be used together. The manufacturer of the sprinkler head adapter has listed installation instructions that must be followed for each sprinkler head adapter used.

The reason that the CPVC manufacturers do not allow both tape and compound is that they take up space inside the fitting, which could cause too much stress in the fitting and lead to a crack or leak.

## Question 12 – ESFR Sprinklers for Bin Box Storage

We have a project where the specifier has called for ESFR protection in a warehouse. The roof deck is at 32 ft. In one area of the warehouse, there will be bin box storage on wire shelves (at least 50% open) with 4 ft wide grated walkways in between at two levels: 9 ft and 18 ft. The top of storage will be at 25 ft 10 inches. The bins are plastic, and we have determined the commodity to be Group A plastic. Can we even use ESFR sprinklers for protecting this area? Do we have to sprinker under the walkways if they do not exceed 4 ft in width? If so, would we have to use ESFR sprinklers below the walkways, including two additional sprinklers in the design area? Are there other options like CMSA sprinklers?

**Answer:** No. There are no criteria contained in NFPA 13 for ESFR protection of bin box storage of Group A plastics. Since ESFR sprinklers are designed for fire suppression, they are often subject to more limitations to ensure they meet their intended goal. You also asked if there are any CMSA (Control Mode Specific Application) sprinklers listed for this arrangement, but we are not aware of any. Even control mode density/area (standard spray) sprinklers are not provided with protection criteria for bin box storage exceeding 25 ft. In general, your arrangement is outside the standardized protection provided in NFPA 13.

Unfortunately, there are times when scenarios arise that have not been addressed by the standards and codes. One option may be to work with the insurance company for the project and incorporate their recommendations. Another option would be to lower the storage height to a maximum of 25 ft and then use control mode density/area sprinkler protection. It may also be

possible to have a fire protection engineer analyze the scenario to develop protection criteria that would satisfy the owner's goals while meeting the concerns of local code authorities.

## Upcoming "Technical Tuesday" Online Seminar – May 12th

*Note: This seminar was originally scheduled for April 7<sup>th</sup>, but was switched with "Frequently Asked Questions – Part 4" due to an instructor scheduling conflict.*

**Topic: Older Systems and Components**

**Instructor: Russell P. Fleming, P.E., NFSA Executive Vice President**

**Date: May 12, 2009**

Older systems and components are often encountered when dealing with additions and renovations of existing buildings. In many cases the components, designs and installation techniques would not be allowed for a new installation under today's rules. This seminar will review the official positions of codes, standards, and listings relative to what can be kept in use and what must or should be replaced. This seminar will also address the various fire sprinkler product recall and voluntary replacement programs that have taken place over the years, discuss their status, and review obligations when encountering those products still in service.

## Upcoming "Business Thursday" Online Seminar – May 21st

**Topic: CPVC Update**

**Instructor: Chris Gaut, NFSA Regional Manager – Central**

**Date: May 21, 2009**

With the large quantity of CPVC pipe being used throughout the country and with the increased need for plastic pipe installation because of future residential sprinkler usage, issues regarding CPVC pipe arise. This presentation will discuss how the industry has taken a proactive step, involving contractors, suppliers and manufacturers and other stakeholders to address the issues.

Additional training opportunities available through the NFSA engineering department include...

## Two-Week Layout Technician Training

September 14-25, 2009

Baltimore, MD

October 12-23, 2009

Phoenix, AZ

## Inspection and Testing for the Sprinkler Industry

June 16-18, 2009

Leominster, MA

## Advanced Technician Training

June 23-25, 2009

Denver, CO

For more information on the above classes, contact Nicole Sprague using [Sprague@nfsa.org](mailto: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:

|   |                      |              |
|---|----------------------|--------------|
| Sprinklers for Dwellings                        | McFarland, WI        | May 6        |
| CPVC Piping Installation Requirements (1/2 Day) | McFarland, WI        | May 7        |
| Foam Water Sprinkler Systems (1/2 Day)          | McFarland, WI        | May 7        |
| Inspection, Testing & Maintenance               | McFarland, WI        | May 8        |
| CPVC Piping Installation Requirements (1/2 Day) | Lincoln, NE          | May 12       |
| Commissioning & Acceptance Testing (1/2 Day)    | Lincoln, NE          | May 12       |
| Inspection, Testing & Maintenance               | Lincoln, NE          | May 13       |
| NFPA 13 Update 2007                             | Lincoln, NE          | May 14       |
| Hydraulics for Fire Protection                  | Colorado Springs, CO | May 19       |
| Inspection, Testing & Maintenance               | Colorado Springs, CO | May 20       |
| Sprinklers for Dwellings                        | Colorado Springs, CO | May 21       |
| NFPA 13 Overview & Intro to Plan Review         | Anaheim, CA          | May 26-27    |
| Plan Review Policies & Procedures               | Anaheim, CA          | May 28       |
| NFPA 13 Overview & Intro to Plan Review         | Branson, MO          | June 2-3     |
| Inspection, Testing & Maintenance               | Branson, MO          | June 4       |
| Introduction to Sprinkler Systems (1/2 Day)     | Hillsboro, OR        | June 15      |
| Sprinkler Protection for General Storage        | Hillsboro, OR        | June 16      |
| Hydraulics for Fire Protection                  | Hillsboro, OR        | June 17      |
| Basic Seismic (1/2 Day)                         | Hillsboro, OR        | June 18      |
| Advanced Seismic (1/2 Day)                      | Hillsboro, OR        | June 18      |
| Residential Homes to High Rise                  | Albany, NY           | June 23      |
| Introduction to Sprinkler Systems (1/2 Day)     | Albany, NY           | June 24      |
| Commissioning & Acceptance Testing (1/2 Day)    | Albany, NY           | June 24      |
| Sprinkler Protection for Special Storage        | Albany, NY           | June 25      |
| Hydraulics for Fire Protection                  | New Lenox, IL        | July 7       |
| NFPA 13 Overview & Intro to Plan Review         | New Lenox, IL        | July 8-9     |
| Commissioning and Acceptance Testing (1/2 Day)  | Apple Valley, CA     | July 28      |
| CPVC Piping Installation Requirements (1/2 Day) | Apple Valley, CA     | July 28      |
| Inspection, Testing & Maintenance               | Apple Valley, CA     | July 29      |
| Sprinkler Protection for Rack Storage           | Apple Valley, CA     | July 30      |
| NFPA 13 Overview & Intro to Plan Review         | Kahului, HI          | August 12-13 |
| Inspection, Testing & Maintenance               | Kahului, HI          | August 14    |
| NFPA 13 Overview & Intro to Plan Review         | Brighton, MI         | August 19-20 |
| Sprinklers for Dwellings                        | Brighton, MI         | August 21    |
| NFPA 13 Update 2007                             | Aurora, IL           | August 26    |
| NFPA 13 Overview & Intro to Plan Review         | Aurora, IL           | August 27-28 |
| Introduction to Sprinkler Systems (1/2 Day)     | Alexandria, MN       | September 8  |
| NFPA 13, 13R, 13D 2002 Update (1/2 Day)         | Alexandria, MN       | September 8  |
| Plan Review Policies and Procedures             | Alexandria, MN       | September 9  |
| Inspection, Testing & Maintenance               | Alexandria, MN       | September 10 |
| NFPA 13 Overview & Intro to Plan Review         | Anaheim, CA          | Sept. 22     |
| Hydraulics for Fire Protection                  | Anaheim, CA          | Sept. 23     |
| Underground Piping (1/2 Day)                    | Anaheim, CA          | Sept 24      |
| Basic Seismic (1/2 Day)                         | Anaheim, CA          | Sept 24      |
| Inspection, Testing & Maintenance               | Concord, NH          | October 13   |
| Residential Sprinklers Homes to High-Rise       | Concord, NH          | October 14   |
| Sprinklers for Dwellings                        | Concord, NH          | October 15   |
| Underground Piping (1/2 Day)                    | Woodland, CA         | Oct 20       |
| Commissioning & Acceptance Testing (1/2 Day)    | Woodland, CA         | Oct 20       |
| Sprinkler Protection for Special Storage        | Woodland, CA         | Oct 21       |

These seminars qualify for continuing education as required by NICET.

To register or for more information, contact: Dawn Fitzmaurice at (845) 878-4207, E-Mail: [seminars@nfsa.org](mailto:seminars@nfsa.org)

---

*NFSA Tuesday eTechAlert is c. 2009 National Fire Sprinkler Association, and is distributed to NFSA members on Tuesdays for which no NFSA Technical Tuesday Online Seminar is scheduled. Statements and conclusions are based on the best judgment of the NFSA Engineering staff, and are not the official position of the NFPA or its technical committees or those of other organizations except as noted. Opinions expressed herein are not intended, and should not be relied upon, to provide professional consultation or services. Please send comments to Russell P. Fleming, P.E. [fleming@nfsa.org](mailto:fleming@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](http://www.nfsa.org).*

**You are receiving this message because you are subscribed to the NFSA email list. To remove yourself from this service and stop receiving email messages from NFSA, Please reply to this message with “remove” in the subject line.**



The Tyco logo is displayed in a white, lowercase, sans-serif font against a dark blue background.

*a vital part of your world*

**April 30, 2009**

**TYCO UPDATE  
ON ALLIED ABF<sup>®</sup> II STEEL COATED PIPE AND CPVC**

Since its introduction in 2004, Allied Tube & Conduit's ABF<sup>®</sup> II anti-microbial steel sprinkler pipe has been installed and successfully maintained in millions of feet of steel and CPVC applications. Recently, Allied and Tyco Fire Suppression & Building Products became aware of a small number of sites with environmental stress cracking (ESC) failures of CPVC pipe and fittings. Some customers have expressed concern that the ESC was caused by chemical components of the anti-microbial coating on the ABF II coated steel pipe. To put this into context, these instances of failure involve less than one tenth of one percent of the installed base in combined systems in the Americas.

ESC failures can occur in CPVC pipe and fittings when exposed to sufficient levels of stress and when an environmental stress cracking agent is present in sufficient concentration over a period of time. An ESC failure results in cracks in the wall of the pipe or fitting. These cracks typically result in weeping, dripping, and other small leaks from the fire sprinkler system.

In response to recent concerns, Tyco gathered a team of scientists and industry experts working in conjunction with Lubrizol and customers to investigate. Tyco's investigation has included an analysis of how the ABF II coating may be released and transported through the piping system, and how it may interact with other components of the system.

The initial findings of the investigation suggest that in some circumstances, components of the ABF II coating may wash from the interior of the steel pipe and transport to downstream CPVC pipe and fittings. In combination with ancillary products used in the system, such as cutting oils and lubricants, the ABF II coating components may collect at sufficient concentration and in some circumstances pose a potential risk to the CPVC pipe and fittings.

However, in the instances of CPVC failure investigated and not linked to poor quality CPVC pipe or fittings, unusually high mechanical stress has been present. Unusually high amounts of mechanical stress create an environment that makes CPVC pipe and fittings more susceptible to ESC. For example, some approved hangers have been found to put an excessive mechanical stress on the pipe. Tyco is continuing to analyze the causes and effects of mechanical stresses on the safety tolerances of CPVC pipe and fittings used in conjunction with ABF II coated steel pipe. Because steel-CPVC systems are installed using a variety of techniques and in a myriad of diverse environments, there are a large number of mechanical and chemical variables and combinations that a comprehensive investigation must include.



It is important to note that Tyco's analysis to date does not indicate an inherent risk associated solely with using ABF II coated steel pipe in combination with CPVC pipe and fittings. As a conservative approach while the investigation continues, Tyco recommends that ABF II coated steel pipe not be used in new systems containing CPVC. For these applications, Allied will continue to make uncoated steel pipe available. ABF II coated steel pipe should still be used in all-steel systems, where it provides industry-leading anti-microbial protection.

The overwhelming majority of installations of ABF II coated steel pipe with CPVC pipe and fittings have provided reliable service without incident for many years. Based on this experience and the initial findings, Tyco does not believe that previously installed systems are at an increased risk of ESC failure. For systems that are already installed or in the process of being installed, Tyco does not recommend removal of the CPVC or ABF II coated steel pipe.

For additional information or questions, visit [www.alliedtube-sprinkler.com/cpvc](http://www.alliedtube-sprinkler.com/cpvc) or contact Tyco at 1-888-890-2278 in the US, and at 1-708-339-1610 extension 7301 outside the US.

As a responsible leader in the fire sprinkler industry, Tyco is committed to the industry and its customers. Tyco will continue its investigation, testing, and analysis to enable it to provide the additional answers that it, the industry, and its customers seek. Thank you for your continued support.

###