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FUSIBLE LINK

APRIL 2016

President's Message…

The April meeting is soon upon us and we have a great speaker and topic coming up. Jeff Kochelek, CEO of Engineered Corrosion Solutions, will be discussing the science of corrosion in automatic sprinkler piping specifically with regard to the role oxygen plays in corrosion reaction in wet systems and steel pipe. Information to be presented is vital to understanding the concepts of corrosion formation and prevention. Don't miss it. In March John Druker as usual gave a great briefing on the updates to the NJ Fire Codes. The Chapter's Speakers program is geared to provide the latest in Fire Prevention and Protection Engineering as a service to our members and the associated industries in the field. Let's share this knowledge. Bring along a guest, peer or co-worker to the next meeting. Let's spread the word and keep everyone informed and up to date.

See you in April.

Rich Reitberger
President

Items for your information

- The Jim Goerl Golf outing is set at the New York Country Club for June 6th and is being coordinated by Eric Greenwald of the NY Metro chapter.
- Congratulations to the latest scholarship recipients - Tyler Lambert, Rachael Marino, Dimitrious Savva, Jessica Tiles, and Eric Wasserman.

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Chapter Meeting Minutes
March 7, 2016

President Rich Reitberger convened the meeting at 6:01 PM at the Hanover Manor in East Hanover, NJ with the customary salute to the flag and attendee introduction.

A motion was made by Ed Armm to approve the February meeting minutes and the members voted to approve.

Nate Gorey presented the February Treasurer's report to the group. John Antola, Jr. made motion to approve and was approved by the members.

The annual symposium will be held on May 4th at the Hanover Manor starting at 8 AM. The registration is now open. Please go to the website http://www.njsfpe.org/ to register.

Rich discussed how the Scholarship fund is being transitioned into a 501c3 Education and scholarship foundation. As a 501c3, the foundation will be able to contribute in more ways than scholarships; such as funding educational objectives. It will take a couple of months to set up and more information is to follow.

The annual meeting will be June 20th and will be an extended menu.

About the speaker;

John Drucker - Assistant Construction Official, Fire Protection Subcode Official, Building, Electrical and Fire Inspector and Fire Investigator with the Borough of Red Bank, NJ. Serve in both Uniform Construction and Uniform Fire Code roles. Work with both New and Existing Construction including High Rises, significant Assembly Uses, Medical including a Hospital and considerable single and multi-family Residential. As well as an administrative role, function as plan reviewer and field inspector.

John presented an all-encompassing code update as New Jersey prepares to adopt the 2015 International Codes with New Jersey Amendments on March 21, 2016. The presentation covered a brief review of the significant changes in the building, residential and mechanical codes, the 2014 NEC Electrical Sub-code, and the 2013 NFPA-72 Reference Standard, including, but not limited to, fire alarm, access control, low voltage systems, pathway survivability, supervising station monitoring, voice evacuation and mass notification based on the proposed NJ Code Adoption.

Some highlighted changes include;

- Horizontal building separation for pedestal buildings have been changed. Previously the building beneath the horizontal separation was limited to 1 story. This is no longer a limited to one story as long as there is a 3 hour horizontal separation. However, there is a limit for the height from grade when using 13R systems as to not exceed 60 ft. above grade.
- There are much stricter requirements for windowless basements as the code is pushing for them to be suppressed for new construction.
- Means of egress can be narrowed with a credited voice systems and sprinklers.
- IBC now aligns with the NEC on requiring abandoned wiring to be removed.
- Fire Evacuations and safety Plans are critical and should be considered with the architect prior to the design of the building. The plan should be submitted with the Means of Egress review.
- Open mall buildings with perimeters are now treated like a covered mall. Eg. Jersey shore premium outlets.

Rich Reitberger called the meeting to a close at 8:38 PM.

Coffee Break Training - Fire Protection Series

Inspection Techniques: Understanding Emergency and Standby Power Levels

No. FP-2014-19 May 13, 2014

Learning Objective: The student will be able to explain the difference between emergency and standby Level 1 and Level 2 power supply systems.

When emergency or standby power systems are required by the model fire codes, they refer to National Fire Protection Association (NFPA) 110, *Standard for Emergency and Standby Power Systems* for design and installation guides for emergency power supply systems (EPSS).[1]

NFPA 110 recognizes two levels of classification: critical to life and safety (Level 1) or less critical (Level 2). Level 1 systems generally are employed where critical life safety systems are employed, such as for emergency lighting.

Level 2 systems are intended to supply power to so-called selected loads, where interruptions of the primary electrical supply could create hazards or hamper rescue or firefighting operations.

These diesel-powered generators provide an emergency power supply for a high-rise office building.

The following table compares some of the Level 1 and 2 applications.

Level 1	Level 2
Life safety illumination	Heating and refrigeration systems
Fire detection and alarm systems	Communications systems
Elevators	Ventilation and smoke removal systems
Fire pumps	Sewage disposal
Public safety communications systems	Lighting
Industrial processes where current interruption would produce serious life safety or health hazards	Industrial processes
Essential ventilating and smoke removal systems	

It is important to note that NFPA 110 does not specify where or what type of system is required; that is a function of the adopted building or fire code. NFPA 110 provides performance standards for the EPSS when the codes say one is required.

For additional information, consider enrolling in the National Fire Academy course "Fire Protection for the Built Environment" (R0135) at **http://apps.usfa.fema.gov/nfacourses/catalog/details/645.**

[1] Another standard, NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, exists for uninterruptible power supplies for rectifier plants or similar installations.

Dry Valve

Product Code: FireLock NXT Series 768N
Manufacturer: Victaulic Company

Victaulic, the world's leading manufacturer of mechanical pipe joining and fire protection systems, introduces the new FireLock NXT Series 768N Dry Valve. Re-engineered by listening to customer's needs, the new dry valve provides simplified set-up and maintenance for fire protection contractors and fitters while still maintaining the core features and benefits of the original technology.

Continuing with Victaulic's NXT dry valve key features and benefits including low air pressure, single set points, smaller compressors and pre-set pressure switches, the following updates were made to the new and improved design:

- Specifically engineered threads on the strainer cartridges for the air and priming manifolds make sure you never mix-up a strainer again.
- Trim divided by air (left) and water (right) lines, and brought to the sides to aide in accessibility.
- Clearly labeled manifolds reduce trim down to three manifold components – air, priming and alarm manifold, making it a simpler, lighter valve; including less components to install

In addition to the re-design, the new valve will also feature a QR code on the front of the valve, which will allow fitters to instantaneously access short videos on installation, set-up, and maintenance, complete installation instructions; and access to technical help with the push of a button.

The FireLock NXT Series 768N Dry Valve is available in sizes 1 ½ -8 inches/40-200mm with up to 300 psi/2068 kPa /21 Bar.

Highrise Fires involving ACM (Aluminum Composite Material) Facades **(The following article was taken from the March 2016 XL GAPS newsletter)**

The New Year's Eve celebrations in Dubai were overshadowed by a major highrise fire. At 64 stories high and 302 m tall, "The Address Hotel" houses a 200 room hotel and 600 residential units. The building was finished in 2008 and is the 19th tallest building in Dubai.

Top: CBS News YouTube video report of Dubai fire. Click to visit URL

The façade of the tower is covered with aluminum composite material (ACM) with a 3 mm thick polyethylene core and 0.5 mm aluminum facing on both sides. The ACM panels are fixed on metal studs to the outside wall of the building leaving a gap between the wall and the panels. ACM panels were introduced in the late 1950's and are available from a variety of manufactures. They are very popular with architects and building contractors since they are available in a wide range of finishes and colors and can easily be bent into shape.

Floodlights are located on a platform on the 14th floor to illuminate the outside of the building. Faulty wiring ignited the panels at the 14th floor and the fire rapidly spread up the entire height of the building.

The building was fully sprinklered and the sprinklers prevented the spread of the fire into the building. The purpose of a sprinkler system is to control and extinguish a fire inside the buildings and is designed for the operation of a certain number of sprinklers on the same floor. The number of sprinkler heads operating determines the size of the fire pump and the required size of the fire water tank. The fire that spread up the entire height of the building activated sprinkler heads on a multiple levels and as result the water supply was depleted in less than 30 minutes.

There was no significant horizontal spread of the flames along the width of façade, but the fire was beyond the reach of monitor nozzles located at ground level and eventually the fire self-extinguished once all combustible material was consumed

The material might be noncombustible under laboratory testing conditions but can be combustible in real life installations.

This fire was the recent one in a series of fires around the globe in highrise buildings with ACM facades. (See the sidebar.)

ACM Panels: ACM panels were introduced in the late 1950's and are available from a variety of manufactures and come in various specifications: ordinary polyethylene core, fire retardant polyethylene core and noncombustible core which is achieved by adding mineral components to the polyethylene. Standard tests for determining the combustibility of materials are small scale laboratory type tests for ease and efficiency of testing. Laboratory type fire tests can only determine whether the material that is being tested is combustible or not. These tests cannot determine the combustibility of material that is treated with fire retardant chemicals. The material might be noncombustible under laboratory testing conditions but can be combustible in real life installations. In real life the energy release of the ignition source can be much higher and overcome the fire retardant effect and the material will burn like ordinary combustible material.

In large scale fire tests the maximum size of the test probe is limited by the size of the testing equipment or the building in which the tests are taking place. NFPA 285 "Standard Fire Test Method for Evaluation of Fire Propagation characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components" is a large scale fire test and the size of the test probe is 4 m by 4.8 m.

Fires involving ACM panels are normally started by localized high energy ignition sources on the exterior side of the façade. Typical ignition sources are electrical sparks from faulty electric installations or burning combustible material which is stored on balconies of residential units. The ignition can take place anywhere along the entire height of the building and the fire will spread up vertically due to the **Chimney Effect** created by the gap between the panel and the outside wall of the building wall. Falling burning debris will ignite combustible material on lower levels and spread the fire downwards. The entire height of the façade will be engulfed in flames in a matter of a few minutes.

Due to the height of the building the fire department is unable to reach upper floors with hose streams and falling debris is endangering to fire crews. Also the first priority of the fire department in such a scenario is to ensure that all occupants leave a burning building safely and to rescue any occupants which are trapped or otherwise hindered to leave the building. The issue of combustible ACM panels is primarily related to multi-story buildings which of course have a large number of occupants. The evacuation of the large number of occupants, especially in residential buildings with occupants from all age groups, ties up a large portion of the resources of the fire department.

So unless the core of the ACM panel is noncombustible and the ACM panel is classified as "noncombustible", there is always the chance for such a fire. In Dubai alone there are more than 900 buildings with a height over 23 m and the large majority of them are covered with combustible ACM panels.

Reducing Your Risk

Replacing all combustible ACM panels on a high-rise building with non-combustible ACM panels is the only option to eliminate the potential for such a fire. Alternative and more practical and more cost efficient solutions are currently being investigated and include the partial replacement of combustible panels with noncombustible panels to create firebreaks along the height of the building and the installation of sprinklers at various levels of the building.

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Recent Fires Involving ACM

Lacrosse Docklands, Melbourne, Australia, 2014
- 23 story residential building
- Fire started on balcony on 8th floor by a cigarette butt disposed in a plastic container

Torch Tower Dubai, 2015
- 79 story residential building
- Fire started in 52nd floor, falling debris ignited combustible material on lower level floors and fire rapidly spread up the entire height of the façade

Mermoz Tower, Roubaix, France, 2012
- 18 Story residential building
- Fire started on 2nd floor
- Fire spread to the top of the building within a few minutes

Al Tayer Tower, Sharjah, 2012
- 40 story residential building containing 6 carpark levels
- Fire started on 1st floor balcony
- Fire cause: discharged cigarette

Saif Belhassa Building, Dubai, 2012
- 13 story residential building
- Fire started on 4th floor

Tamweel Tower, Dubai, 2012
- 34 story residential building
- Fire started at roof level
- Fire spread down the exterior of the building

Wooshin Golden Suites, Busan, South Korea, 2010
- 42 story residential building
- Fire started on the 4th floor
- Fire cause: faulty electric socket

Fortune Tower, Jumeira Lake Towers Development, Dubai, 2007
- 34 story residential building under construction

Water Club Tower, Atlantic City, USA, 2007
- 41 story building under construction
- Fire started on 3rd floor

For more details about these fires including photos please see: http://www.skyscrapercity.com/showthread.php?t=1801571

(The following article was taken from the March 2016 XL GAPS newsletter)

Renewable Energy – Photovoltaic Systems 2016 Update

At the end of 2014, the worldwide photovoltaic (PV) market had an installed capacity of 178 GW[1]. This is an increase of almost 40 GW over 2013. The largest share of newly installed capacity in 2014 comes from China followed by Japan and USA.

The UK has emerged as a new European leader. Germany is still the largest producer with 38.2 GW. Newcomers in 2014 are Chile and South Africa. Worldwide 2015 statistics are not yet available.

This is an update of previous articles that were published 2011-2014. A new guideline "GAP.2.1.8 – Photovoltaic Systems" was published in January 2016. It Includes loss prevention updates on:

- Fire Hazards Standoff roof systems
- Building
- Components
- Hail
- PV Installations – Rapid Shutdown
- Commissioning and Maintenance

Fire Hazards Standoff roof systems

- In earlier articles we discussed that UL 1703 has been revised and includes now a complete new fire classification test which tests the PV module, mounting system and underlying roof as "a system". This change is effective since 2015.
- Traditionally roof systems and PV modules were tested completely independent. Parameters that influence the fire behavior are the roof slope, the panel slope in relation to roof slope, distance between roof and panel, and the setback of the panel versus roof edge. The tests were conducted between 2009 and 2013 and the final report can be downloaded at http://www.solarabcs.org/about/publications/reports/flammability-testing/pdfs/SolarABCs-36-2013-1.pdf
- GAPS recommend the use of listed assemblies with a Class A rating that have been tested to ASTM E108, UL 1703, or equivalent.
- In Europe there is no testing standard that evaluates the offset panel in conjunction with the roof cover system.
- This does not mean that the hazard is different as was shown by tests that were carried out in Germany and which were published in a 2015 issued TÜV Rheinland report[2].
- Do not install panels over roof assemblies that contain foam plastic insulation (polyethylene, polystyrene, poly-isocyanurate) below the roof covering system. Install a non-combustible material such as gypsum board, fiberglass or mineral wool insulation between the foam plastic insulation and roof cover.
- Do not install panels within 50 ft (15 m) of fire walls.
- The potential of debris accumulation at and underneath PV panels will largely depend on the angle to the roof and distance between the panels and the roof. The removal of debris should be part of the preventive maintenance program. In certain type of installations it might be beneficial to install a wire screen to prevent accumulation underneath the panels in the first place.
- Roof access should be in accordance with NFPA 1[3]. Details are also in GAP.2.1.8.
- Roof fires are one of the main concerns with roof mounted PV systems. They can go undetected for some considerable time and might be difficult to extinguish because of the shading effects by the panels.

Building

- When possible, mechanically fasten the arrays to the roof system. For fully adhered and ballasted roof system, using concrete paver blocks to secure the array is acceptable. Caution must be observed as not to overload the roof system with the additional ballast material.
- Install ballasted rigid systems on roofs with a roof slope of less than 2.4 degrees only. Remove all ballast material on the roof covering beneath the panel supports.
- Do not install systems on roof that have large stone or pea gravel ballast and that are subject to high winds.
- Arrange the PV panels as not to have any adverse effect on the roof draining systems.
- In areas prone to earthquakes, secure PV panels to the roof deck or framing. Ballasted systems should not be used.

Components

- New installations should use the latest versions of recognized standards for cables, cable connectors, junction boxes and inverters.
- Most of these standards are fairly new or have had a number of modifications in the last couple of years based on field experience.
- Install cables in noncombustible cable trays/ trunking or metal conduit offset of the roof system. Cables should not be directly laid on the roof. Run cabling as much as possible on the outside of building.
- Never run cabling over fire walls. Keep cables away from plastic illumination bands or skylights. If they have to be near the bands or skylights install them 6 ft (2 m) away and in non-combustible cable trays, trunking or use SWA steel wire armored cables.
- More details can be found in GAP.2.1.8

Hail

- In the worst case, the blocking of roof drains and additional temporary roof loads can cause roof collapse.
- Hail can potentially damage roofs/roof coverings and PV Panels.
- Hail impact on rigid PV panels is tested as part of the overall tests of the PV modules. The tests vary between the various main standards being used IEC 61215, EN 61215, UL 1703, or ANSI/FM 4478.
- Tests are either done with steel or ice balls. Important parameters are the steel or ice ball diameter and test velocity. The majority of the panels sold in Europe, use a standard 1 in. (25 mm) diameter ice ball and test velocity of 51 mph (23 m/s). UL listed panels are tested with steel balls which have an equivalent of 1 ½ in. (38 mm) ice balls.
- The size used will be mentioned in the test certificate delivered with the PV module.
- FM uses another rating system which is explained in more detail in GAP.2.1.8.
- If the photovoltaic system will be installed in an area that has more than a low hail hazard then look for panels that have been tested larger than 1 in. (25 mm) ice balls.

PV installations – Rapid Shutdown

- The 2014 Edition of the USA National Electrical Code (NEC) (NFPA 70) covers PV Systems in Article 690 and includes a number of new requirements. Paragraph 690.12 covers rapid shutdown of PV systems. The main objectives are:
- To quickly shutdown (10 seconds) PV system conductors: (1) inside a building and more than 5 ft (1.5 m) long and (2) outside a building and more than 10 ft (3m) from the PV array.
- Allow no more than 30 volts on shutdown conductors (generally considered touch-safe in a wet environment)
- A more detailed explanation can be found in an article "Rapid Shutdown of PV systems by B. Brook and J. Rogers" which can be found at http://iaeimagazine.org/magazine/2015/01/22/rapid-shutdown-of-pv-systems/
- Note that the above requirement does not necessarily accomplish that all the parts of the installation are below 30V. This can be seen from the "red" indicated circuits on some of the figures in the above cited article.
- There are proposals to include "PV module level" shutdown in the 2017 edition of the NEC code. There are however also a number of opponents. So the outcome is not yet clear and will depend on the final voting.
- Module level shutdown is also being looked at outside the US. There are some options available on the market but all of them have little track record at the present time.
- A suitable system should:
  - Be fail safe
  - Have double redundancy
  - Go to safe position also when one component fails
  - Go to a safe position when a control or signal cable gets damaged
  - Have possibility to test the system
  - Provide personal safety for intervention teams and fire fighters
- Also, the introduction of battery storage systems adds some layer of complexity to the shutdown process.

Commissioning and Maintenance

- Perform commissioning testing and inspecting and documentation of the entire system in accordance with EN 62446 or other applicable standard.
- Perform an infrared thermograph survey of the electrical components on an annual basis.
- Inspect wiring connections and terminations for corrosion and tightness on an annual basis. Replace or repair parts as needed.
- Test inverters on an annual basis per manufacturer's instructions.
- Perform a PV array insulation resistance test every three years. The resistance measured with the test voltage should not be less than the one specified in EN/IEC 62446
- Annually inspect the mechanical connections between panels and supports, concrete paver blocks if used, and sealing of roof penetrations as applicable for the installation. Tighten connections and repair/replace parts as needed.

Disposal of end of life or damaged panels

- Many countries treat PV panels as hazardous waste and they need to be disposed of in accordance with legal local requirements.
- The NFPA Research foundation published in February 2014 the "Commercial Roof-mounted Photovoltaic System Installation Best Practices Review and All Hazard Assessment" report. This is not an installation guide but it provides in depth information and is a good reading source.

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Footnotes

1 https://en.wikipedia.org/wiki/Solar_power_by_country
2 Leitfaden Brandrisiko in PV Anlagen (German only) http://www.ov-brandschutzhelfer.de/fileadmin/downloads_fe/Leitfaden_Brandrisiko_in_PV-Anlagen_V01.pdf
3 NFPA 1 – Fire Code, National Fire Protection Association
4 NFPA Research Foundation Report February 2014 http://www.nfpa.org/~/media/files/research/research%20foundation/research%20foundation%20reports/building%20and%20life%20safety/rfcommercialroofmountedphotovoltaicsysteminstallation.pdf

Internet links were checked on March 3, 2016

Rack Rate

As storage heights grow taller and the fire hazard of stored goods increases, research conducted by FM Global points to a cheaper, more effective method of in-rack storage protection

BY WESTON C. BAKER, JR.

WHEN WAREHOUSE MANAGERS ARE TOLD they need to install in-rack sprinklers, they usually react with trepidation and dismay. Who can blame them?

Although in-rack sprinklers have been successfully used to protect storage racks for more than five decades, protection guidelines have historically required the installation of a large number of sprinklers, making this type of protection very expensive compared to ceiling-level sprinklers. In addition, warehouse managers worry that in-rack sprinklers could cause water damage to stored products when accidentally struck by fork-lift trucks.

Given these drawbacks, it's easy to understand why facility managers might be reluctant to supplement their ceiling-level sprinklers with in-rack sprinklers.

As available warehouse space in certain parts of the world becomes scarcer, and as new material-handling equipment capable of reaching higher storage heights becomes available, warehouse facilities today are trending toward storage and ceiling heights that are much taller than ever before. Because the natural path for fire growth is vertical, as storage and ceiling heights increase, so will the fire hazard associated with this height increase.

In an effort to improve the protection of storage racks and lower the overall cost of fire protection, FM Global embarked on an in-rack sprinkler research project in 2011. Although we have previously conducted thousands of loss-prevention projects, this one was different. Our research division performed small-, intermediate-, and full-scale fire tests; unlike previous research programs, though, the testing was strategically coupled with computer modeling to help identify potential protection solutions. This approach demonstrated that by using larger orifice sprinklers and higher water flow rates, the number of in-rack sprinklers needed for an installation could be greatly reduced. This could lower the cost of an in-rack sprinkler installation by an estimated 40 percent, as well as reduce the likelihood of damage to sprinklers and stored products.

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These new in-rack sprinkler protection options are alternatives to existing guidelines rather than replacements for them, but they provide owners and designers with new possibilities for protecting buildings and goods that may be difficult, or impossible, to protect with ceiling-level sprinklers alone.

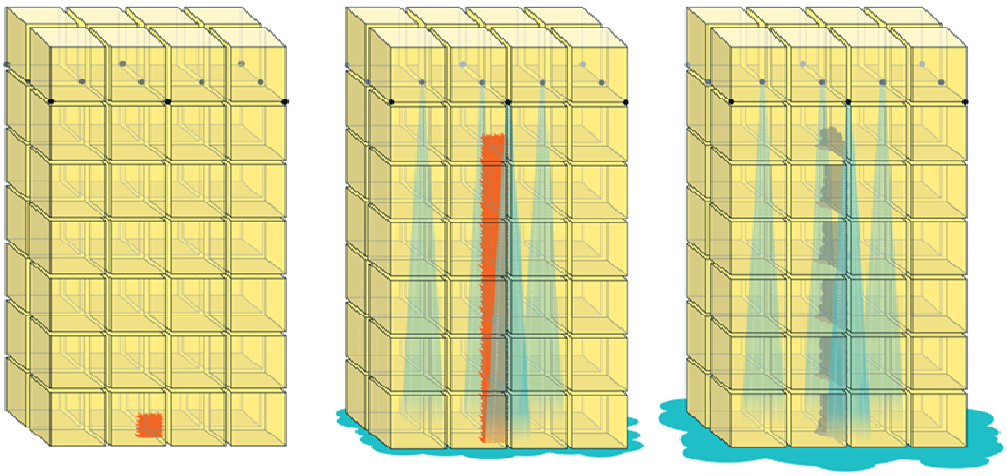
A new look at in-rack sprinkler potential

Since the invention of the first automatic sprinkler in 1874, scientific research and development efforts have improved ceiling-level sprinklers to the point where they can now protect storage under ceilings as high as 45 feet (13.8 meters). This has been achieved primarily due to improvements in the response time of the sprinklers, the size of the sprinkler orifice through which the water is discharged, and the design of the sprinkler deflector that directs the water flow downward toward the fire area. With future scientific research and development it is possible that ceiling heights can be further increased above 45 feet without requiring in-rack sprinklers. Even so, sprinkler manufacturers acknowledge that ceiling heights are quickly approaching the limit where ceiling-level sprinklers alone can be effective, necessitating the use of in-rack sprinklers.

Because of the potential drawbacks of in-rack sprinkler systems, sprinkler manufacturers have tried to find ways to produce ceiling-level sprinklers that can protect both higher storage and more hazardous commodities in open-frame storage racks without the need for in-rack sprinklers. While an abundance of scientific research and product testing has been conducted over the years to advance the performance of ceiling-level sprinklers, minimal work has occurred to advance sprinkler protection within storage racks. In-rack sprinklers are typically needed when the water penetration from ceiling-level sprinklers to the base of the storage array is impeded or requires a significant period of time, which is often the case for most high-storage configurations. Couple this with very fast vertical fire growth, and it's easy to understand the overwhelming challenge that high-storage configurations present to ceiling-level sprinklers.

CUTTING EDGE VS. CONVENTIONAL

How the FM Global system works compared to a traditional in-rack sprinkler system



The protection guidelines used for most in-rack sprinkler designs and installations were developed through a test program initiated in the late 1960s by NFPA's Rack Storage Fire Protection Committee for the purpose of providing design guidelines for NFPA. As a result of the sprinklers that were available on the market at the time, the test program used sprinklers that today are commonly installed for the protection of offices and other low-hazard occupancies. Very little advancement in the field of in-rack sprinkler protection has been made since this initial test program.

As a consequence, most in-rack sprinkler installations require a large number of sprinklers within the racks with relatively small horizontal and vertical spaces between them. A typical in-rack sprinkler arrangement for the protection of cartoned plastics would require that sprinklers be installed on an approximate 20-square-foot (1.9-square-meter) horizontal spacing every 15 feet (4.6 meters) vertically throughout the height of the storage rack. This not only drives up the cost of fire protection due to the amount of materials and labor required for the installation, but also increases the likelihood of a sprinkler being accidentally hit by something and discharging water onto stored items.

Additionally, even with all of those sprinklers installed, a fire in high-rack storage can still grow upward through a rack, opening both in-rack and ceiling-level sprinklers as it goes, making final extinguishment by the public fire service very challenging due to the height at which the fire is located above floor level. Ideally, a fire originating anywhere within a storage rack would be suppressed by the in-rack sprinklers, which would prevent the fire from growing vertically past the sprinklers, thus making it potentially easier for final extinguishment by the public fire service.

Finally, another important variable in protecting rack storage is the type of container used, which can have a significant impact on the sprinkler protection required for these spaces. Products that were once maintained within corrugated cardboard containers are now increasingly stored in plastic tote containers. While this trend may seem beneficial from the perspective of being able to reuse the containers more frequently, the fire hazard associated with the plastic containers greatly increases compared to cardboard containers. This is due to the higher heat release rate of plastic materials compared to cardboard, along with the benefit of water absorption that cardboard exhibits compared to the lack of water absorption by plastic materials. Closed containers that absorb water make it more challenging for fire to spread horizontally, which is a major factor in controlling a fire event by automatic sprinklers. With the concurrent trends toward higher storage and ceiling heights, as well as replacing cardboard containers with plastic totes, many warehouse facilities are no longer able to protect their storage in racks using a ceiling-only sprinkler system and must rely on supplementing the protection with in-rack sprinklers.

RUNNING THE NUMBERS

Independent cost estimates of old-style in-rack sprinkler systems vs. new

OLD		NEW	
Fire pump and tank	**$304,700**	**Fire pump and tank**	**$233,200**
Tank	$263,500	Tank	$192,000
Electric pump	$21,200	Electric pump	$21,200
Material and labor	$20,000	Material and labor	$20,000
Ceiling sprinkler	**$416,500**	**Ceiling sprinkler**	**$638,500**
Material	$264,000	Material	$471,000
Labor	$152,500	Labor	$167,500
In-rack sprinkler	**$2,849,000**	**In-rack sprinkler**	**$1,239,500**
Material	$1,339,000	Material	$726,500
Labor	$1,510,000	Labor	$513,000
TOTAL COST	**$3,570,200**	**TOTAL COST**	**$2,111,200**

Testing and optimized designs

To get a better understanding of the nature of fire growth within open-frame storage racks and the corresponding heat release rate at the time of in-rack sprinkler activation, we conducted several intermediate-scale tests using different test commodities. For each test, the response time of both standard-response and quick-response in-rack sprinklers, installed at different locations within the rack, helped us determine which factors most influenced the operation of the sprinklers and which factors caused a delay in operation.

Traditional in-rack sprinkler installations limit the storage height above the top level of sprinklers to 10 feet (3 meters), primarily due to the concern that fire growth within the storage rack will reach the top of the array and that the amount of heat from a fire may be too large for the ceiling sprinkler system to control. Research testing established that, when using the newly developed in-rack sprinkler system, the stored height of commodity above the top level of in-rack sprinklers can be much greater than previous restrictions.

The greater fire hazard of many stored goods makes it imperative for building owners to consider more effective methods of warehouse protection. Photograph: Getty Image

This was achieved by not only the type of in-rack sprinklers chosen and their discharge flow rates, but also by the location of the sprinklers horizontally within the footprint of the rack. The goal of the in-rack sprinkler horizontal arrangement was to prevent any fire spread above the in-rack sprinklers, which was achieved in all of the full-scale validation fire tests. By eliminating the ability of the fire to grow vertically above the in-rack sprinklers, the sprinklers essentially become a virtual floor on which the ceiling system can be designed. As a result, instead of limiting the storage height above the top in-rack sprinkler level, the new guidelines in DS 8-9 allow for storage above the top in-rack sprinkler level to be as high as 35 to 40 feet (10.7 to 12.2 meters), again depending on the commodity hazard being protected. This larger vertical distance above the top level of in-rack sprinklers greatly reduces the number of in-rack sprinklers required compared to traditional in-rack sprinkler arrangements.

A final factor to point out is that traditional in-rack sprinkler installations require that the water supply account for both the ceiling and in-rack sprinkler systems operating simultaneously, and also require them to be hydraulically balanced at their point of connection. This is because the existing in-rack sprinkler arrangements may allow the fire to grow to the top of storage and actuate not only in-rack sprinklers but ceiling sprinklers as well. The new in-rack sprinkler arrangements outlined in DS 8-9 prevented the fire from growing vertically past the in-rack sprinklers and thus never operated ceiling sprinklers. This performance is attributed to the timeliness of the in-rack sprinkler activations along with the amount of water that is discharged from them. As a result, instead of requiring the water supply to account for both the ceiling and in-rack sprinkler systems operating simultaneously, the new guidelines in DS 8-9 allow for the water supply to be sized based on the larger of the two system requirements, a feature that will help reduce the size of the water supply required for adequate protection.

What these findings mean is that better in-rack sprinkler protection is now available at a significantly lower cost compared to traditional in-rack sprinkler arrangements. Although these design criteria are currently only available in FM Global's Data Sheet 8-9, efforts will be taken to incorporate them into codes and standards throughout the world, including NFPA 13, Installation of Sprinkler Systems, so that all warehouses where in-rack sprinkler protection is needed can take advantage of this important new information.

Weston C. baker, Jr. is an AVP, Sr. Engineering Technical Specialist, in the Engineering Standards division at FM Global. He is a member of the Installation and Discharge committees of NFPA 13. TOP PHOTOGRAPH: Getty Images

Employment Opportunities

ARUP is looking for a Senior Fire Consultant/Engineer - Tri State Region - offices in Edison and NYC

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- Develop fire strategies for projects across all markets
- Fire alarm design and construction administration support including reviewing shop drawings, submittals, RFIs and conducting field reports for large rail projects.
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- Developing client relationships and pursuing new business opportunities.
- Contributing to our research and development activities.

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Location: Hartford (Farmington)/New York City/Philadelphia (Blue Bell)

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- Bachelor's Degree in Engineering or Applied Science or equivalent
- PE license or CFPS certification a plus
- Strong oral and written communications skills
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- Strong interpersonal skills to communicate effectively with clients
- Expertise in development and analysis of property insurance industry loss estimates including MFL's, PML's and LE's.
- Strong advocacy skills in working with FM Global insured clients
- Self-motivated individual with successful ability to work in a team environment
- Microsoft Office and internet proficiency

Interest candidates should contact David A. Larson, SVP - Risk Services Practice Leader, Lockton Companies, 1185 Ave of the Americas, New York, NY 10036; E-mail: dlarson@lockton.com; Office: (646) 572-7367.

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MEETING NOTICE

Date: Monday, April 4, 2016

Place: Hanover Manor
16 Eagle Rock Avenue
East Hanover, NJ 07936

Price: $30.00

Time: Gathering starts at 5 PM, meeting starts at 6 PM

Topic: Managing corrosion in water-based sprinkler systems—the causes, the myths, and to how to assess

Speaker: Jeff Kochelek, CEO of Engineered Corrosion Solutions

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PLEASE COMPLETE AND RETURN WITH YOUR CHECK PAYABLE TO "SFPE NJ CHAPTER" TO:

Vicki Lynn Serafin
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Meeting Dates/Programs 2015-2016

May 4	**Seminar**
June 6	**James Goerl Golf Outing will be held at the New York Country Club in New Hempstead, NY**
June 20	**Annual Meeting—Use of Large Capacity Lithium Batteries in NYC Buildings**

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ADAAG http://www.access-board.gov/adaag/about/index.htm
AFAA National http://www.afaa.org/
AFSA http://www.firesprinkler.org/
ANSI http://web.ansi.org/
ASHRAE http://www.ashrae.org/
Campus-Firewatch http://www.campus-firewatch.com/
Coffee Break Training http://www.usfa.dhs.gov/nfa/coffee-break/
CPSC http://www.cpsc.gov/
CSAA http://www.csaaul.org/
Municipal Codes (E Codes) http://www.generalcode.com/Webcode2.html
FDNY http://nyc.gov/html/fdny/html/home2.shtml
FM Global http://www.fmglobal.com/
FSDANY http://www.fsdany.org/regs.htm
FSI http://www.firesprinklerinitiative.org/
FSSA http://www.fssa.net/
Fire Tech Productions—Nicet Training (FTP) http://www.firetech.com/
Home Fire Spklr Coalition http://www.homefiresprinkler.org/
HVAC Bld. Control Fire Safety http://www.iklimnet.com/hotelfires/hotelfiresmain.html
AFAA-NJ http://www.afaanj.org/
International Code Council - http://www.iccsafe.org/
International Code Council Residential Sprinkler Exam - http://www.iccsafe.org/news/nr/2009/0709_ResidentialSprinklerExam.pdf
The Joint Commission (JCAHO) - http://www.jointcommission.org/www.JointCommission.org/
Material safety data Sheets (MSDS-OSHA Site) - http://www.osha.gov/SLTC/hazardcommunications/index.html
National of Fire Equipment Distributors (NAFED) - http://www.nafed.org/index.cfm

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