Solving Industry Challenges with Innovative Technologies See a Need, Fill a Need

Mark Fessenden
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Mark Fessenden - Johnson Controls

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Topics of Discussion

- Freeze Protection...Finally a Listed Antifreeze!
- Breaking ESFR K14 Barriers...New Protection Schemes that Use Electronically Actuated Sprinklers
- Solving Issues Associated with Acoustic Damage in Data Center Protection
- Protecting Combustible Exterior Wall Systems with Remotely Controlled Monitor Nozzle
Liquid Freeze Protection (LFP)
Protection of Piping Against Freezing
(13:19, 16.4.1)

If systems cannot be maintained at or above 40°F (4°C)

Options for Protecting Piping Against Freezing

- Listed Antifreeze
- Insulation
- Listed, Supervised Heat-trace
- Dry Pipe or Preaction System
- PE Verified Heat-loss Calculations
### Addressing a Life Safety Concern

#### Serious Incidents Involving Antifreeze

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
</table>
| 1997  | Bethel, ME     | - Flash fire caused by vapors of propylene glycol-water solution interacting with natural gas fired heaters  
- Fire extinguished when plain water discharged  
- Occupants treated for smoke inhalation and thermal skin burns |
| 2002  | Monmouth, NJ   | - A kitchen fire activated a sprinkler system containing glycerin-based antifreeze, which ignited the flames and caused an explosion  
- Tenant fatality |
| 2006  | Denver, CO     | - Lit matches activated a sprinkler system containing polypropylene glycol  
- One child and one adult suffered second- and third-degree burns |
| 2009  | Truckee, CA    | - A kitchen fire activated a sprinkler system containing glycerin-based antifreeze, which ignited the flames and caused an explosion  
- Tenant fatality |
| 2010  | Herriman, UT   | - Lit matches activated a sprinkler system containing polypropylene glycol  
- One child and one adult suffered second- and third-degree burns |

Antifreeze Combustibility

Details

Testing and Heat Release Rates
Residential pendent, concealed and sidewall sprinklers
K-factors between 3.1 and 7.4 tested
Solutions of glycerin and propylene glycol were tested
  Glycerin — from 50% – 70% concentration by volume
  Propylene Glycol — from 40% – 60% concentration by volume

Findings

Large-scale ignition was found to occur in various situations
50% glycerin & 40% propylene glycol w/ HRR of 3.0 MW
55% glycerin & 45% propylene glycol w/ HRR of 1.4 MW
>55% glycerin & >45% propylene glycol w/ HRR of <0.5 MW

Results

<table>
<thead>
<tr>
<th>Antifreeze Mixture</th>
<th>Freezing Point</th>
<th>Density at 68°F</th>
<th>Energy Released</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>32 °F</td>
<td>0.998 kg/l</td>
<td>357 MJ</td>
</tr>
<tr>
<td>Glycerin</td>
<td>-22 °F</td>
<td>1.146 kg/l</td>
<td>596 MJ</td>
</tr>
<tr>
<td>Propylene Glycol</td>
<td>-22 °F</td>
<td>1.062 kg/l</td>
<td>629 MJ</td>
</tr>
</tbody>
</table>

Fig. 2 – HRR v Time for water and 50% water/glycol
Fig. 3 – Water test at 4.5 min.
Fig. 3 – 50% Water/Glycol test at 4.5 min.
60% Propylene Glycol

Fire Protection Research Foundation
Antifreeze Solutions in Home Fire Sprinkler Systems Phase II

Test A1 - 6" Wide Heptane Pan
K3.1 Sprinkler
60% Propylene Glycol Antifreeze Solution
## Current Antifreeze Rules
– NFPA 13, 13R & 13D, 25

<table>
<thead>
<tr>
<th>NFPA 13 (13:19, 8.6.2)</th>
<th>Propylene Glycol</th>
<th>Glycerin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shall Be Listed for Use in Sprinkler Systems</td>
<td>Shall Be Listed for Use in Sprinkler Systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NFPA 25 installed prior 9/30/2012 (25:17, 5.3.3.4.1)</th>
<th>Premixed Non-listed 30% by Volume Until 9/30/2022</th>
<th>Premixed Non-listed 38% by Volume Until 9/30/2022</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Premixed Non-listed Between 30% and 40% with a Deterministic Risk Assessment</td>
<td>Premixed Non-listed Between 38% and 50% with a Deterministic Risk Assessment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NFPA 25 installed after 9/30/2012 (25:17, 5.3.3.4)</th>
<th>Listed Antifreeze</th>
<th>Listed Antifreeze</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed Antifreeze</td>
<td>Listed Antifreeze</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NFPA 13R (13R:19, 5.4.2)</th>
<th>Follow NFPA 13</th>
<th>Follow NFPA 13</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NFPA 13D (13D:19, 9.2.2)</th>
<th>Listed or 38% When Deemed Acceptable by AHJ</th>
<th>Listed or 48% When Deemed Acceptable by AHJ</th>
</tr>
</thead>
</table>

**New listed solutions NOT required to be Glycerin- or Glycol-based, as long as they pass UL 2901**
UL 2901 Test Protocol for Antifreeze

- **Performance**
  - General
  - Characterization Tests
  - High Ambient Temperature Stability
  - Temperature Cycling Stability
  - Electrical Conductivity
  - Corrosion Rate
  - Pit Depth Corrosion
  - Exposure to Elastomeric Materials
  - Stress Corrosion
  - Impact of Galvanic Action
  - Compatibility with Polymeric Materials
  - Toxicity
  - **Exposure to Fire**
  - **Fire Fighting Effectiveness**
  - Viscosity at Temperature Limitations
  - Resistance to Leakage

Test protocol recently finalized by UL, in development since 2011
Tyco LFP™ Antifreeze

Certified for use in residential, commercial and storage applications*

**Benefits**
- Cost-effective
- Easy installation & maintenance
- Helps meet NFPA 13, 13R, 13D & 25
- UL Certified

**Features**
- 5-gal. pail
- 30-gal. drum
- Non-toxic
- Compatible with most system materials
- Minimum use temperature -10°F (-23.3°C)

*Not listed for extra hazard occupancies, flammable liquid protection or systems using ESFR Sprinklers*
### Technical Details

**Tyco LFP™ Antifreeze**  
Pre-mixed antifreeze solution

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Liquid, colorless</td>
</tr>
<tr>
<td>Minimum Use Temperature</td>
<td>-10°F (-23.3°C)</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>1.3960 – 1.3995</td>
</tr>
<tr>
<td>pH</td>
<td>7 – 8</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.122 – 1.129</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>1000 – 1400 microsiemens/cm</td>
</tr>
<tr>
<td>Compatible Piping</td>
<td>CPVC, PEX, steel, brass, stainless steel, black steel, copper, cast iron, fusion bonded epoxy coated materials</td>
</tr>
<tr>
<td>Compatible Materials</td>
<td>EPDM natural rubber, SBR, BUNA-N elastomeric materials</td>
</tr>
</tbody>
</table>

See Tech Data Sheet TFP1680 for full details
Installation and Maintenance Overview

**Installation Instructions**

**New Systems**
- Ensure system is air-tight
- Perform pressure test to 200 psi to ensure no leakages
- Test LFP™ Antifreeze using a refractometer and/or hydrometer to demonstrate compliance to property ranges
- Fill system with LFP™ Antifreeze
- Perform pressure test to 200 psi to ensure no leakages

**Existing Systems**
- Flush branch lines and mains to avoid contamination
- Perform pressure test to 200 psi to ensure no leakages
- Test LFP™ Antifreeze using a refractometer and/or hydrometer to demonstrate compliance to property ranges
- Fill system with LFP™ Antifreeze
- Perform pressure test to 200 psi to ensure no leakages
- Test the system again to verify solution is not diluted

**Maintenance Instructions**

**Fluid Test**

- Use a hydrometer or refractometer to test fluid annually, prior to cold weather
  - Annual calibration of test equipment is required
  - See TFP1680 for suggested tools

The acceptable property ranges of LFP™ Antifreeze are:

<table>
<thead>
<tr>
<th>Concentration of LFP Antifreeze %</th>
<th>Specific Gravity at Approximately 77°F (25°C)</th>
<th>Refractive Index at 77°F (25°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1.122 – 1.129</td>
<td>1.396 – 1.3995</td>
</tr>
</tbody>
</table>

*Automatic sprinkler antifreeze systems to be inspected, tested and maintained by a qualified inspection, testing and maintenance service.
**Tyco LFP™ Antifreeze**

**Testing Requirements and Usage Limitations**

<table>
<thead>
<tr>
<th>Testing Requirements</th>
<th>Volume Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same installation/maintenance requirements as existing antifreezes per NFPA 13 and 25</td>
<td><strong>NFPA 13D</strong>&lt;br&gt;• No volume limitations&lt;br&gt;• Antifreeze may only be used in above-ground piping</td>
</tr>
<tr>
<td>It is recommended that automatic sprinkler antifreeze systems be inspected, tested and maintained by a qualified inspection, testing and maintenance service annually, prior to cold weather</td>
<td><strong>NFPA 13R</strong>&lt;br&gt;• No volume limitations&lt;br&gt;• Dwelling-only buildings are limited to above-ground use of antifreeze</td>
</tr>
<tr>
<td>Tools to use for testing antifreeze solution:&lt;br&gt;  - Digital refractometer&lt;br&gt;  - Hydrometer and thermometer in appropriate graduated cylinder</td>
<td><strong>NFPA 13R Mixed-Use Occupancies</strong>&lt;br&gt;• No volume limitations for system size in buildings containing only dwellings&lt;br&gt;• System size limitation of 40 gal. for sprinkler systems in non-dwelling buildings&lt;br&gt;• System size limitation of 40 gal. in mixed-use occupancies fed by a single sprinkler system&lt;br&gt;• If future building renovations result in occupancy classification changes, a fire sprinkler system evaluation must be performed to determine if any changes are required for the use of antifreeze&lt;br&gt;• Only above-ground piping may be filled with antifreeze</td>
</tr>
<tr>
<td></td>
<td><strong>NFPA 13</strong>&lt;br&gt;• Buildings with occupancy classifications of Light Hazard and Ordinary Hazard Group 1 and 2 are limited to a sprinkler system volume of 40 gal.&lt;br&gt;• Storage applications using non-ESFR sprinklers are limited to a sprinkler system volume of 40 gal.&lt;br&gt;• LFP™ antifreeze is not listed for use in protecting Extra Hazard occupancies, flammable liquids or use with ESFR sprinklers.</td>
</tr>
</tbody>
</table>
Electronic Activated Sprinkler Systems
Early Fire Protection Systems

Perforated Piping Systems - 1812  
Automatic Sprinkler Systems - 1874
100 years of progress in fire sprinkler design…
What are the Key Elements of an Effective Fire Protection Solution?
Control Mode Sprinklers

- Limiting the size of a fire by distribution of water so as to control the heat release rate and pre-wet adjacent combustibles, while controlling ceiling gas temperatures to avoid structural damage.
Suppression Sprinklers

- Vertical fire spread is reversed
- Sprinklers operate quickly, while heat release is small & reduce heat radiation
- High density water delivered direct to the base area of fire
- Fewer sprinklers operate, less water damage
- Design parameters much more critical
Required Delivered Density - RDD

- Required Delivered Density - the minimum amount of water needed to suppress a fire of a particular storage commodity
Actual Delivered Density - ADD

*Actual Delivered Density* – the rate water is actually deposited from operating sprinklers onto the horizontal surface of a burning combustible array.
Fire Plume Penetration

• A high challenge fire can have an upward draft equivalent to 30 – 35 mph (50 – 56 kph)
• Small droplets provide cooling while large droplets have sufficient mass to penetrate the fire plume
Distribution Pattern – ESFR Sprinklers

- ESFR sprinklers combine fast response with water delivery properties to provide a heavy, well distributed discharge pattern that ensures sufficient penetration of water to suppress the fire.
- Both of these criteria must be satisfied to achieve fire suppression.
Response Time Index - RTI

• **RTI** - measures the speed of response of the heat sensitive element

• Traditionally Fast Response Sprinklers have a thermal element with an RTI of 50 (meters-seconds)$^{1/2}$ or less. ESFR’s must have a thermal element with an RTI of 36 (meters-seconds)$^{1/2}$ or less

• Standard Response Sprinklers have a thermal element with an RTI of 80 (meters-seconds)$^{1/2}$ or more

<table>
<thead>
<tr>
<th>Material</th>
<th>RTI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strut</td>
<td>110 m-s$^{1/2}$</td>
</tr>
<tr>
<td>Glass Bulb (5mm)</td>
<td>105 m-s$^{1/2}$</td>
</tr>
<tr>
<td>Fusible Link</td>
<td>26 m-s$^{1/2}$</td>
</tr>
<tr>
<td>Glass Bulb (3mm)</td>
<td>36 m-s$^{1/2}$</td>
</tr>
<tr>
<td>Glass Bulb (2.5mm)</td>
<td>22 m-s$^{1/2}$</td>
</tr>
<tr>
<td>Heat Fin</td>
<td>26 m-s$^{1/2}$</td>
</tr>
</tbody>
</table>
Defining Detection

- **Definition(s)**
  - **Spot-Type Detector:** A device in which the detecting element is concentrated at a particular location. Typical examples are bimetallic detectors, fusible alloy detectors, certain pneumatic rate-of-rise detectors, certain smoke detectors, and thermoelectric detectors.
  - **Rate-of-Rise Detector:** A device that responds when the temperature rises at a rate exceeding a predetermined value.
Automatic Sprinkler Activation
Sprinkler Activation & the Ceiling Jet

Sprinklers operate **where the heat is**, not the fire!
Ignition Location

Between Four

Between Two
Sprinkler Activation & Ceiling Jet

Quell™ Fire Sprinkler Test
"The Free Burn"

41C Sprinkler Building Storage Buck- Class III
delay
Single Head Distribution - 25.2 K-Factor Upright
6-Head Distribution - 25.2 K-Factor Upright
RDD, ADD, and RTI

- The smaller the fire, the less water is needed (= lower RDD)
- The larger the fire, the less water actually reaches it (= lower ADD)
- If the response is quick enough, early suppression can be achieved
Key Questions

- How do we deal with Exposed Expanded Plastics?
- How do we best address existing systems that have had a change in commodity?
Protection of Exposed Expanded Group A Plastics

Sprinkler Protection Criteria for Exposed Expanded Group A Plastics
Project Summary

Background
NFPA 13, Standard for the Installation of Sprinkler Systems, has limited information regarding protection criteria for Exposed Expanded Group A plastic commodity stored on racks. There is an important present need for protection criteria for this type of commodity, since it presents a significant fire hazard and is stored in many warehouse and retail buildings.

At the 2008 meeting of the Foundation’s Automatic Sprinkler Research Planning Council, this topic was identified as an area where additional research is needed to inform provisions of NFPA 13. At the Council’s 2011 meeting, the topic was identified at or near the top of the priority list of projects with a particular focus on results needed for the next edition of the Standard.

Although there is a broad range of criteria needed, the particular focus of this project was rack storage of this commodity with protection solutions which do not involve in rack sprinklers, to improve the flexibility of this storage protection configuration.

Previous testing by Viking Corporation in Europe showed successful performance with existing only K-16 sprinkler protection at 45-50 psi design pressure for 49 foot storage of actual mixed commodity (candles, foam slabs, cardboard boxes) in a non-standard rack configuration with vertical barriers interspersed in the rack at approximately 20 foot on center.

Research Objective
To develop cost effective sprinkler protection criteria for rack storage of exposed expanded Group A plastic commodity with a particular focus on ceiling only protection.
Protection of Exposed Expanded Group A Plastics
Protection of Exposed Expanded Group A Plastics

- **NFPA 13(2016):17.3.3.5**
  - Max. storage height 35 ft (11 m)
  - Max. ceiling height 40 ft (12 m)
  - Min. 8 ft (2.4 m) aisle
  - Sprinkler:
    - Intermediate Temperature
    - ESFR pendant sprinklers
    - Nominal 25.2 (360) K-factor
  - Design
    - 12 sprinklers @ 60 psi (4.1 bar)
    - 195 gpm/spk x 12 spk = 2342 gpm
    - Vertical Barriers

- **FM 8-9**
  - Max. storage height 35 ft (11 m)
  - Max. ceiling height 40 ft (12 m)
  - Min. 8 ft (2.4 m) aisle
  - Sprinkler:
    - ESFR pendant sprinklers
    - Nominal 25.2 (360) K-factor
  - Design
    - 20 sprinklers @ 75 psi (4.1 bar)
    - 218 gpm/spk x 20 spk = 4365 gpm
  - No Vertical Barriers
Specific Application

• NFPA 13 states:
  • “…Nothing in this standard is intended to restrict new technologies or alternate arrangements, provided the level of safety prescribed by this standard is not lowered…”
8.4.8 Special Sprinklers

• 8.4.8.1* Special sprinklers that are intended for the protection of specific hazards or construction features shall be permitted where such devices have been evaluated and listed for performance under the following conditions:
  • (1) Fire tests related to the intended hazard
  • (2) Distribution of the spray pattern with respect to wetting of floors and walls
  • (3) Distribution of the spray pattern with respect to obstructions
  • (4) Evaluation of the thermal sensitivity of the sprinkler
  • (5) Performance under horizontal or sloped ceilings
  • (6) Area of design
  • (7) Allowable clearance to ceilings
What if a fire sprinkler system could think?
Components are Listed – Application is Performance Based Design


Technical Report
Underwriters Laboratories Inc.
Projects 4787366812, EX4998

for
Tyco Fire & Building Products
June 24, 2016
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Electronic Sprinkler System For Storage Applications
Smart Sprinkler Activation
Design Criteria

ELECTRONIC SPRINKLER SYSTEM UP TO AND INCLUDING EXPOSED AND EXPANDED GROUP A PLASTICS

GENERAL GUIDELINES:
When Tyco Electronic Sprinklers, paired with Simplex 4098 TrueAlarm Heat Sensors, are installed for the protection of high piled storage occupancies including single-, double-, palletized, and solid piled storage, up to and including exposed, expanded, Group A plastics commodities as defined by NFPA 13 (no open top containers or solid shelves), for ceiling only protection (no in-rack sprinklers), the installation criteria is as follows:

- a maximum coverage area of 100 ft² (9.3 m²) per sprinkler
- a minimum coverage area of 80 ft² (7.3 m²) per sprinkler
- a water supply duration of 60 minutes minimum is required

The sprinkler spacing criteria is:

- 12 ft (3.6 m) maximum for unobstructed and non-combustible obstructed construction
- 10 ft (3.0 m) maximum for combustible obstructed construction
- 8 ft (2.4 m) minimum for all construction

<table>
<thead>
<tr>
<th>CEILING HEIGHT ft (m)</th>
<th>STORAGE HEIGHT ft (m)</th>
<th>MINIMUM AISLE SPACING ft (m)</th>
<th>DESIGN PRESSURE psi (bar)</th>
<th>MINIMUM RECOMMENDED NO. OF SPRinklers</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 (10.7)</td>
<td>30 (9.1)</td>
<td>8 (2.4)</td>
<td>52 (3.6)</td>
<td>9 Sprinklers in 4-4-1 Arrangement: 4 on 2 most remote branch lines, 1 on next nearest branch line</td>
</tr>
</tbody>
</table>
Care & Maintenance

• Sprinkler Subsystem
  • Submit 10 samples or 1% of the total number of installed sprinklers, whichever is greater, to UL for testing 5 years after manufacturing, then again at 10 years and followed by annual testing after the 10th year.
  • Sampling can be from mock-installations not connected to the fire protection sprinkler system but are located in the same orientation and environment as the system sprinklers.

• Heat Sensor
  • Test the heat sensor releasing circuitry 5 years after manufacturing, then again at 10 years, followed by annual testing after the 10th year.
  • During testing, the releasing circuit must be loaded with a Metron or a simulator.
  • A minimum of 10 samples or 1% of the site install quantity, whichever is greater, must be tested by Tyco.
If the you can read this Click on the icon to choose a picture or Reset the slide.

To Reset: Right click on the slide thumbnail and select 'reset slide' or choose the 'Reset' button on the 'Home' ribbon (next to the font choice box).

Acoustic Damage in Data Centers
Typical Fire Protection in Data Centers

• Fire Systems are employed to reduce risk in Data Centers
• Building and Occupant Protection (Sprinklers)
• Prevent disruption in service levels and downtime (Clean Agent / Watermist)
• Protect customer image / reputation (Clean Agent / Watermist)
• Safeguard critical data (Clean Agent / Watermist)
Data Center Fire Suppression in the News

- **September 2016**: Large Bank in Romania shut due to Fire System Drill

- **October 2017**: Microsoft Azure outage caused by Fire System

- **April 2018**: Nasdaq's Nordic Data Center Shut Down

  - How loud are suppression systems?
  - How sensitive are HDD to noise?
  - And how do we lower this risk?
Decibel (dB) Scale

Source: www.epd.gov.hk
Sound Propagation Model

- Source-Path-Receiver Paradigm
- All sound travels from the source to the receiver through various paths
- The sound observed by the receiver has changed as compared to when it left the source
HDD Study

- 12 different models of enterprise HDDs selected to represent those entered in Data Centres
  - All drives were 3.5” form with SATA interface
  - Drive capacities range from 320 GB to 10 TB
  - Drive rotational speeds: 7200 RPM
  - Manufactured Date Ranges: 2009 to 2016

- Green = near 100% of baseline read/write
- Red = less than 50% of baseline read/write
- Black line indicates 50% read/write performance

<table>
<thead>
<tr>
<th>Brand</th>
<th>Memory Size</th>
<th>Helium filling?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8 TB</td>
<td>YES</td>
</tr>
<tr>
<td>B</td>
<td>320 GB</td>
<td>NO</td>
</tr>
<tr>
<td>B</td>
<td>2 TB</td>
<td>NO</td>
</tr>
<tr>
<td>B</td>
<td>1 TB</td>
<td>NO</td>
</tr>
<tr>
<td>C</td>
<td>500 GB</td>
<td>NO</td>
</tr>
<tr>
<td>C</td>
<td>500 GB</td>
<td>NO</td>
</tr>
<tr>
<td>D</td>
<td>6 TB</td>
<td>NO</td>
</tr>
<tr>
<td>D</td>
<td>6 TB</td>
<td>NO</td>
</tr>
<tr>
<td>D</td>
<td>10 TB</td>
<td>YES</td>
</tr>
<tr>
<td>E</td>
<td>6 TB</td>
<td>NO</td>
</tr>
<tr>
<td>E</td>
<td>6 TB</td>
<td>NO</td>
</tr>
<tr>
<td>E</td>
<td>10 TB</td>
<td>YES</td>
</tr>
</tbody>
</table>
Key Takeaways From HDD Study

- Observed noise performance variation across HDD models
- Some HDDs begin to have a reduction in read/write speeds while exposed to as low as 85 dBZ
  - New Helium Drives perform well at low frequencies
  - HDDs achieve 50% performance at 110 dBZ from 500Hz to 10K Hz
  - May want to consider lower than 110 dBZ target due to variation in HDDs
  - Data Centers should consider acoustics and take action to reduce the risk of HDD performance reduction due to noise
Inert Gas Suppression Noise

Exit Velocity: Supersonic
Exit Temperature: Below Freezing (but Dry)

Source: future facilities

Noise can exceed 130 dB
Acoustic Nozzle

Acoustic footprint of Gas Suppression system with Acoustic Nozzle

- Hard Drive 50% Performance Degradation
- Standard Nozzle
- iFLOW with Acoustic Nozzle
Remote Protection of Combustible Exterior Wall Systems
Worldwide Problem for Tall Buildings

- Increased number of fires spreading on high rise buildings
**Time is critical**

- Address Downtown Hotel, Dubai 1, January 2016 – 14 people injured

4 floors on fire

+ 80 seconds

20 floors on fire
Height, Accessibility and Response Time

Address Downtown Hotel, Dubai 1, January 2016 – 14 people injured

- Fire reported to start on 20th floor, at approx. 60 m (200 ft)
- Best equipped fire service can reach 60 m (200 ft)
- External fires difficult to fight from the inside
- What about response time?

Address Downtown Hotel, Dubai, January 2016
Rapid intervention at any height

1. **Speed**  ➔ *detect and deploy against incipient fires in seconds!*
   
   Fire service often takes minutes to respond and longer to become operational.

2. **Fight fires at any height**
   
   Fire service hose can reach ~60m (~200 ft)

3. **Large coverage area**
   
   At least 50 m wide by 60 m high (20 stories)

4. **Use a small amount of “agent”**
   
   Utilize typical NFPA 14 standpipe water supply – e.g. 2000 lpm (500 gpm)

5. **Minimize structural & architectural impact**
System Components

2 x Array IR Flame Detectors
installed outside of the building

Robotic Monitor & Extension Boom
concealed in the building

Deluge Valve with Remote Resetting Trim
to open and close the water supply to the monitor

PLC & Software
autonomously controls and positions the system

Graphical User Interface & Web Server (Optional)
allows control from PC and smartphones
Fully automatic fire detection and suppression

**Detect & Locate**
Autonomously detects and tracks the 3D location of up to 4 fires simultaneously, recalculating position 10 times per second

**Aim & Suppress**
*Within Seconds*, extends Boom and autonomously directs a high volume of water onto the fire.

**Remote Reset & Standby**
Goes into standby mode when flames are no longer detected.
2 x FV300 IR Array detectors

1 x Robotic Nozzle on extension beam
Full scale testing per SP test method 5483

1. Validate targeting performance
2. Validate suppression performance