FIRE PROTECTION
Engineering
4TH QUARTER 2014
Issue No. 64

ROUNDTABLE OF FIRE PROTECTION ENGINEERS WHO WORK IN THE FIRE SERVICE

Preplanning

Fire Modeling for the Fire Research, Fire Protection, and Fire Service Communities

Effectiveness and Reliability of Fire Protection Systems

PO Box 12901 Overland Park KS 66282-2921
CHANGE SERVICE REQUESTED
PRSRT STD
U.S. Postage
PAID
Penton
Media, Inc

THE OFFICIAL MAGAZINE OF SFPE SFPE

One thing to remember.

When you join the global leader in fire protection engineering and security consulting, you'll use your talents to save lives and protect property. Whether you're a recent engineering graduate or a seasoned consultant, you'll have the unique opportunity to show your "A" game while also challenging yourself. You're one of the best. Become one of us, let everyone see it.

Go to **rjainc.com/careers** or call **Karen Klima** at **312.879.7220** to put your career on the technical fast track.

Your talent will shine.

do you have the fire in your belly?

rjainc.com/careers

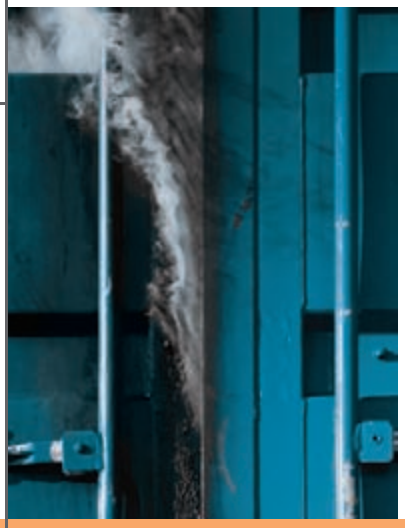
RJA®
ROLF JENSEN & ASSOCIATES, INC.
GLOBAL FIRE PROTECTION CONSULTANTS

CONTENTS

Departments

Features

4TH QUARTER 2014



FIRE PROTECTION Engineering

Online versions of all articles can be accessed at **magazine.sfpe.org**.

SFPE

Sign up for SFPE Fire Protection Engineering Emerging Trends at *magazine.sfpe.org*

Invitation to Submit Articles:
For information on article submission to *Fire Protection Engineering*, go to *magazine.sfpe.org*.

Subscription and address change correspondence should be sent to *Fire Protection Engineering*, Penton, 9800 Metcalf Ave., Overland Park, KS 66212 USA. Phone: 913.967.1670. Fax: 913.514.7148. Email: sonja.cheadle@penton.com

Copyright© 2014, SFPE. All rights reserved.

ON THE COVER: Eugene, Oregon, USA – November 3, 2011: Various fire departments from Eugene, Lane County, and other nearby emergency services.

From the TECHNICAL DIRECTOR

So Long

Fire Protection Engineering magazine was first published in 1998. The first issue was simply called the "premier issue" because we were not yet ready to commit to a regular publication schedule. The second issue was published in spring, 1999, and the magazine has been a quarterly ever since.

The magazine was launched in response to widespread dissatisfaction among SFPE members with SFPE's periodicals. During a series of regional meetings that were conducted in 1997 and 1998 to gauge member satisfaction, a common refrain was that SFPE published two periodicals (the *Bulletin* and the *Journal of Fire Protection Engineering*), and most members read neither of them.

Members were hungry for a publication that provided information that they could use in their day-to-day work. The SFPE board of directors decided to launch a magazine, with a goal of simply breaking even financially. The magazine would contain practice-oriented articles and provide information that fire protection engineers could use in their daily practice. To avoid creating another Bulletin, the magazine would avoid "member news"; instead this type of information would be published in a separate newsletter.

SFPE's executive director at the time, Kathleen Almand, handled matters associated with publishing the magazine. Having recently been hired as the technical director, the content was delegated to me. An editorial advisory board was created to identify editorial themes, potential articles and authors, and review the articles prior to publication. We hired a freelancer, Bob James, to handle matters that were outside of our skill sets.

I was assigned the role of "Technical Editor" for the new magazine. As a relatively young fire protection engineer, I knew nothing about being the editor for a magazine. I simply decided to publish articles that I would like to read – a principle that has guided me for the last 17 years. Having previously written articles for other magazines, I was upset when an editor badgered me for graphics to include with an article that I had written. So, another guiding principle was that I would never shake-down an author for images. We would use images that were voluntarily provided, and if we felt additional graphics were needed, we would find them on our own.

Following the first year of publication, we partnered with Penton Media. When we launched the magazine, we didn't think that we could afford a turnkey publisher like Penton, but we were pleasantly surprised by their offer when we approached them. In addition to handling publication of the print magazine, Penton has always ensured that the magazine reflected the state of the art in publishing and presentation. They proposed a website where the magazine's content would be archived, and they proposed deploying articles exclusively online to generate traffic to the website. More recently, Penton has assisted us with creating a jobs board and sponsored webinar program.

While we outsourced publishing duties, we have always maintained strict editorial control. *Fire Protection Engineering* magazine quickly developed a loyal following, and we were unwilling to do anything that could damage that. I continued as the Technical Editor and, while some names have changed, the Editorial Advisory Board remained in place.

An artifact of the loyal readership of *Fire Protection Engineering* magazine was that we became popular with advertisers. Advertisers wanted to reach our readers, and they found that our magazine was a very efficient way to get their messages in front of people who influence buying decisions of their products. We quickly surpassed the SFPE board of director's goal of breaking even, and the magazine and ancillary products now serve as a reliable source of non-dues revenue for the association.

This will be my last issue as the technical editor. I have no doubt that the magazine will continue to be a valuable resource for readers and advertisers alike.

Morgan J. Hurley, P.E., FSFPE
Technical Director
Society of Fire Protection Engineers

Fire Protection Engineering welcomes letters to the editor. Please send correspondence to *engineering@sfpe.org* or by mail to *Fire Protection Engineering*, 7315 Wisconsin Ave., Ste. 620E, Bethesda, MD 20814.

PEACE OF MIND JUST DROPPED IN!

NO LEAKS

EASY TO INSTALL

SEISMICALLY QUALIFIED

TRUST THE ORIGINAL

Find your "Peace of Mind" – choose the industry original FlexHead flexible fire protection system. Not only is it easy to install, but FlexHead offers a fully welded product guaranteed not to leak plus it is the only product that is UL Listed, FM approved and seismically qualified. Remember to "trust the original" when it comes to your next commercial, industrial, cleanroom and institutional application.

Cost Comparison

[atkore] [AtkoreIntl] [AtkoreInternational]

FLEXHEAD® INDUSTRIES

A PART OF atkore INTERNATIONAL

flexhead.com

©2014 Atkore International, Inc. All rights reserved.

VIEWPOINT > A Successful Partnership Between the Fire Service and Fire Protection Engineers

By Chief George Healy

The Fire Department of the City of New York (FDNY) has a long history of working with fire protection engineers, one that has ramped up significantly in the past decade and paid great dividends in improving the health and safety of our members.

In the early part of 2006, the FDNY experienced several challenging fires in high rise fireproof residential buildings. These fires were similar to several incidents that, in the past, had claimed the lives of firefighters and civilians. One fire in particular nearly claimed the lives of several firefighters, and multiple members went to the hospital with burns.

This fire occurred in a building that 10 years earlier was the scene of a line of duty death of a member from the FDNY. With this near miss incident, interest was renewed in developing tactics that would better protect both firefighters and civilians. In this effort, the FDNY requested the assistance of the National Institute of Standards and Technology (NIST). This request was answered by Dan Madrzykowski and Steve Kerber, fire protection engineers in the Firefighting Technology Group of NIST.

Fortunately, NIST was in the process of planning a series of tests for the spring of 2006 with the Toledo Fire Department; the focus of these tests was using positive pressure fans for stairwell pressurization and smoke control in high rise buildings. The concept was for a fire department to deploy portable fans to pressurize stairwells in high-rise buildings, allowing the fire units to limit smoke contamination of the stairwells and upper floors. A question that lingered was whether the portable fans would still be effective with increased pressures from actual fires. NIST validated the results from Toledo in December of 2006 in a series of live burns in a 17-story high-rise building in Chicago.

The fire service now began to request that the fire protection engineers study other tactics that possibly could provide an additional level of safety for firefighters and make for a more efficient operation. Of particular interest was the need for better understanding the effects that wind had on fire dynamics in high-rise buildings due to FDNY's past experience with the negative effects that wind had on these fires.

With this newly formed partnership proving so valuable, the FDNY was able to secure a high-rise on Governors Island to test alternate strategies to combat wind driven fires. With the support of NIST and funding through the Department of Homeland Security and the Assistance to Firefighters grants, testing was conducted in February of 2008.

New tools such as wind control devices, high-rise nozzles and PPV fans were tested for their usefulness and ability to control these fires. A wealth of knowledge was gained through this testing, and the FDNY changed its tactics, trained and equipped line units and is better prepared today to fight fires in high-rise buildings. In the last several years, the FDNY has utilized these tactics in at least 20 serious high-rise fires with very positive results and has not experienced any serious firefighter injuries at these incidents.

This history that I have discussed is just the tip of the iceberg. The testing continues today with NIST and Underwriters Laboratories' Firefighter Safety Research Institute. The importance of the partnership between the fire service and fire protection engineers cannot be overstated. The fire service today has knowledge of fire dynamics like never before. Testing allows the fire service to validate tactics and make changes to better provide safety. Changes in the fire service today are not based purely on personal observation and judgment; they are based on the testing that proves and validates their effectiveness.

Since the start of this partnership, the FDNY can show a reduction of traumatic injuries to its members from changing fire conditions. The fire ground is constantly evolving with changes to building construction and fuels that fill our homes. The fire service will continue to benefit from this ability to see how the these changes influence the fire and how we can deploy tactics and resources to combat the modern fire.

The fire service community owes a debt of gratitude to the dedication and support of fire protection engineers like Dan Madrzykowski and Steve Kerber. There continues to be requests from the fire service for better understanding of fire and means to control it; in the future, additional testing will further enhance our safety and effectiveness.

Chief George Healy is with the New York City Fire Department.

DEFINING INNOVATION *since* 1919

FIRELOCK™ FIRE-PAC SERIES 745
Dry, Deluge, Preaction
Compact,
Simplified Solutions

victaulicfire.com

8314 REV A 08/2014

Victaulic and all other trademarks used herein are trademarks or registered trademarks of Victaulic Company, and/or its affiliated entities, in the U.S. and/or other countries. The terms "Patented" or "Patent Pending" refer to design or utility patents or patent applications for articles and/or methods of use in the United States and/or other countries.

© 2014 VICTAULIC COMPANY. ALL RIGHTS RESERVED.

Victaulic®

DiNenno Prize to Recognize Contributions to Fire Safety

In honor of the late Philip J. DiNenno, the National Fire Protection Association (NFPA) and Hughes Associates have established the DiNenno Prize.

In addition to honoring his memory, the DiNenno Prize will encourage and recognize significant technical developments that have an impact on public safety, including building, fire, and electrical safety. A prize committee will consider nominations submitted from around the world.

"Phil will be remembered as one of the most outstanding leaders that NFPA has ever had," said NFPA President Jim Shannon. "He was an extraordinarily effective advocate for fire safety and the most respected person in fire protection engineering of his generation. NFPA is honored to join with Hughes Associates to establish the DiNenno Prize."

DiNenno served in many leadership roles in the Society of Fire Protection Engineering (SFPE), including president, and was awarded the Guise Medal, SFPE's highest honor. He was the founding editor of the SFPE Fire Protection Engineering Handbook and provided leadership to NFPA within technical committees, as chair of the Standards Council, and as a member of the Board of Directors. He was a pioneer in the use of computer fire modeling and played a significant role in the development of non-ozone depleting fire suppression technologies, working with industry, NFPA, U.S. EPA, the World Bank, and the United Nations.

For more information, go to *www.nfpa.org/dinenno*

New Public Service Announcements Promote Campus Fire Safety

Through a new initiative sponsored by FM Global, students from the University of Maryland's Department of Fire Protection (FPE) have produced and made available a series of public service announcement (PSA) videos to educate students about fire safety in residential living environments. The videos contain student interviews and narratives. The format is designed to engage students in thinking about the problem and educate them about common misconceptions.

The three PSAs, covering fire prevention, fire response, and fire technology, are available for use on any campus free of charge. To distribute, visit FPE's YouTube channel, choose a video, and click "share."

For more information, go to *www.fpe.umd.edu*

SFPE Corporate 100 Partner Program

The SFPE Corporate 100 Partner Program was founded in 1976 to strengthen the relationship between industry and the fire protection engineering community. Membership in the Corporate 100 Partner Program recognizes those who support the objectives of SFPE and have a genuine concern for the safety of life and property from fire.

BENEFACTORS

Aon Fire Protection Engineering
Arup Fire
FM Global
Honeywell Fire Safety
Koffel Associates, Inc.
NEMA – National Electrical Manufacturers Association
Poole Fire Protection, Inc.
Rolf Jensen & Associates, Inc.
Siemens Building Technologies, Inc.
SimplexGrinnell
Telgian Corporation
Tyco Fire and Building Products, Inc.
Underwriters Laboratories, Inc.
Xtralis

PATRONS

Bosch Security System
Code Consultants, Inc.
Gentex Corporation
Harrington Group, Inc.
International Fire Safety Consulting
JBA Consulting Engineers
Mircom Group of Companies
National Fire Protection Association
The Protection Engineering Group
The Reliable Automatic Sprinkler Company
S.S. Dannaway & Associates Inc.
Swiss Re

MEMBERS

AGF Manufacturing, Inc.
Automatic Fire Alarm Association
Chemetron Fire Systems
HSB Professional Loss Control
James W. Nolan, Emeritus
Liberty Mutual Property
Lubrizol Advanced Materials, Inc.
Micropack Detection Inc.
National Fire Sprinkler Association
ORR Fire Protection
Osho Ingenieria
Phoenix Fire Systems
Professional Loss Control
The Protectowire Co., Inc.
Randal Brown & Associates, Ltd.
Stat-X (by Fireaway)
Terp Consulting
The University of Maryland Online Master's Degree Program
XL Global Asset Protection Services

SMALL BUSINESS MEMBERS

Allan A. Kozich & Associates
Antal & Associates
Bourgeois & Associates, Inc.
Delta Q Fire & Explosion Consultants, Inc.
Efectis North America
FireLink, LLC
FIREPRO Incorporated
Fire Suppression Systems Association
Fisher Engineering, Inc.
Flexhead
Foster Engineering
Futrell Fire Consult and Design, Inc.
Grainger Consulting, Inc.
J.M. Cholin and Associates
Jaeger & Associates, LLC
Keltron Corporation
LeGrand Engineering, Inc.
Rollinger Engineering, Inc.
SDI Fire
Seneca Fire Engineering, LLC
Slicer & Associates, LLC
The Code Consortium
Thunderhead Engineering
Tom Christman
WPI – Distance Learning Program
Willseal, LLC

SNIFF IT: With a very early warning smoke detector

FireNET VAPOR®

When a fire strikes, very early warning high-sensitivity aspirating smoke detection is the only solution for protecting personnel and property. FireNET Vapor® actively samples the air for the smallest particles of smoke to detect fire at the earliest stage while reducing the occurrence of nuisance alarms.

FireNET Vapor® provides reliable detection in a wide range of demanding environments including, but not limited to, IT facilities, coal mines, clean rooms, airports, correctional facilities and residences. Available in multiple configurations to suit your needs.

SNUFF IT: With a clean and fast suppression system

FireNET XTINGUISH™

This UL Listed, environmentally-friendly aerosol extinguishes fire by breaking the chemical chain reaction of the fire, without oxygen depletion. Quick design, easy installation, and minimal maintenance make FireNET Xtinguish™ ideal for your total-flooding extinguishing applications. Available in multiple configurations to suit your needs. FireNET Xtinguish™ is a "green" product and carries an EPA SNAP listing.

UL LISTED

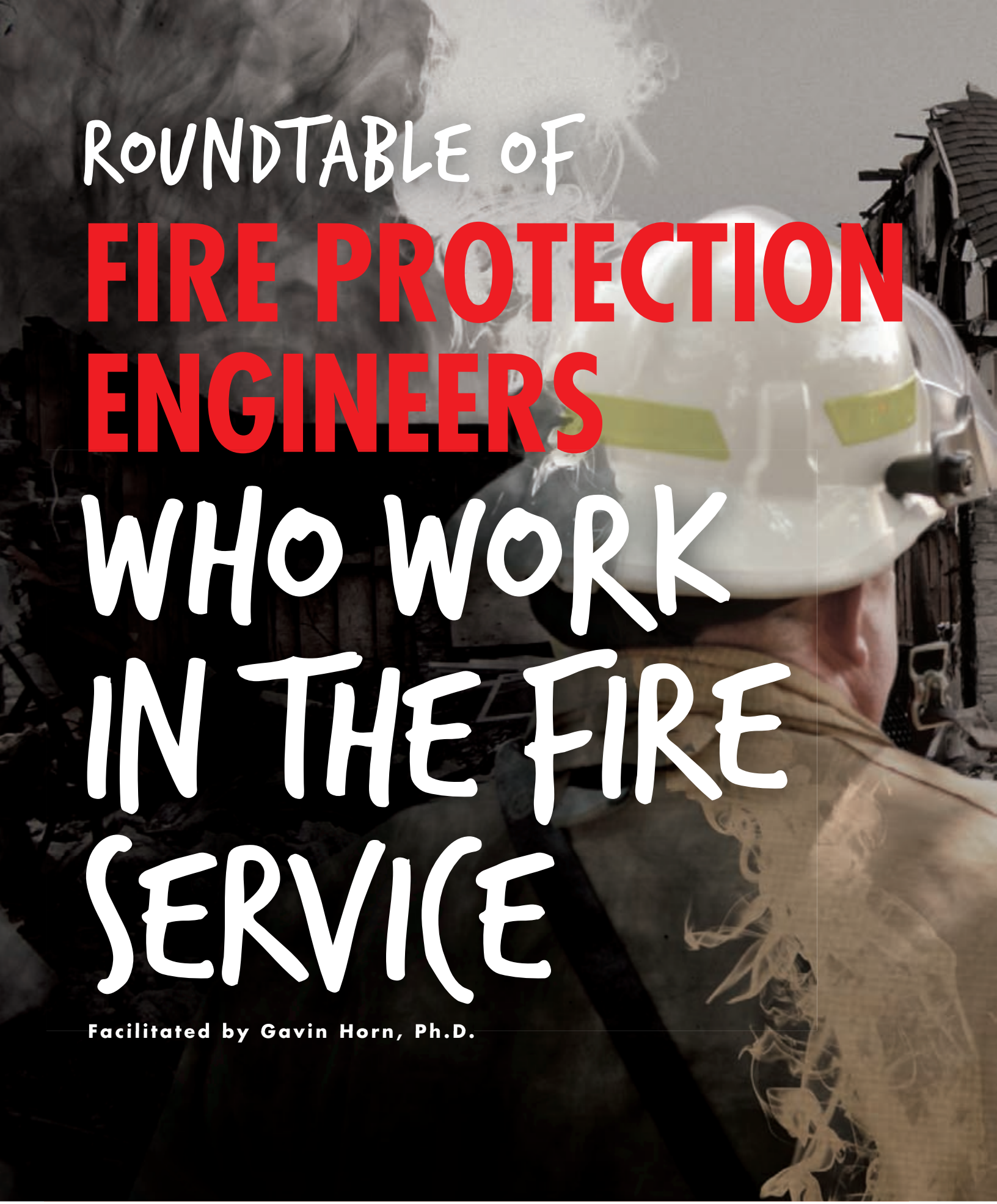
Please check our website for more listing information.

714-522-2246
sales@hochiki.com
www.hochiki.com

HOCHIKI
america corporation

7051 Village Drive, Suite 100
Buena Park, CA 90621-2268 USA

Please see our website to locate the Regional Sales Manager nearest you.
http://www.hochikiamerica.com/contact_us.php



Roundtable of Fire Protection Engineers Who Work in the Fire Service

Facilitated by Gavin Horn, Ph.D.

The fire protection engineering profession has been closely linked with the uniformed fire service from its very inception. The mutually supportive and beneficial relationship has led fire departments around the world to hire and directly incorporate fire protection engineers (FPEs) into their staff to support the department's mission.

These broad ranging duties have included providing a critical link between the fire departments and authorities having jurisdiction (AHJs), reviewing and evaluating plans, conducting inspections, leading post-fire investigations, and supporting public education needs.

FPEs are also critical resources for firefighters by providing scientific insight into standard operating procedures (SOPs), incident debriefs or tactic/strategy discussions and training.

As fire service budgets become tighter, the broad expertise provided by FPEs can help the department provide a comprehensive life safety strategy for their jurisdiction, potentially opening new business and funding opportunities.

The SFPE Fire Service Committee is committed to working with fire departments and fire protection engineers to promote their mutually supportive missions by providing information exchange and data sharing. For more information on this initiative, please see *www.sfpe.org*.

The Society of Fire Protection Engineers conducted a "roundtable" discussion with FPEs that work with fire departments around the globe, including a broad cross section of departments, varying in size and complexity, with FPEs working in one-person teams to departments that have 10 or more FPEs on staff. The purpose of the roundtable was to provide a glimpse into the lives and activities of FPEs within the fire service, the opportunities and challenges that they face, and their vision of the future.

> UPPSALA FIRE DEPARTMENT IS RESPONSIBLE FOR RESCUE SERVICES AND APREVENTION WORK IN THE UPPSALA, ÖSTHAMMAR AND TIERP MUNICIPALITIES.
>
> – ARNEVALL

The participants in the roundtable include:

- Gavin Horn, Ph.D., Facilitator, Illinois Fire Service Institute
- Scott Adams – Park City (UT), USA
- Peter Arnevall – Uppsala, Sweden
- John Bryan – Baltimore County (MD), USA
- Tony Caro – Denver (CO), USA
- Ed Claridge – New Zealand
- Andrew Milliken – Stafford County (VA), USA

For additional content, please visit *magazine.sfpe.org*.

Horn: Please describe your fire department.

Adams: The Park City Fire Service District (PCFSD) is located approximately 50 km east of metropolitan Salt Lake City, Utah. The PCFSD serves an area of 280 square kilometers consisting of residential, commercial, and wildland zones. The PCFSD employs 79 full-time and 2 part-time firefighter/EMTs and 11 administrative personnel. It also employs and manages a paid-call ambulance transport service of 21 personnel for a neighboring 1,300 square kilometer rural community known as North Summit.

Arnevall: Uppsala Fire Department is responsible for rescue services and prevention work in the Uppsala, Östhammar and Tierp municipalities. We have 5 full time fire stations and 12 part time stations, with a total of about 130 full time employees and 350 volunteer firefighters.

Bryan: The Baltimore County Fire Department covers an area of 1,600 square kimometers and serves more than 800,000 citizens, with 25 career stations and over 1,000 paid personnel. In addition, the community is served by 33 fully volunteer fire companies with over 2,000 volunteer fire fighters/EMS personnel. These personnel respond to over 114,000 incidents annually. The response area is very diverse, including heavy and light industrial, urban areas, small towns, suburban neighborhoods and farmland.

Caro: We comprise a medium sized department with 970 members staffing 35 fire stations. The fire prevention division conducts all fire code related functions and is comprised of approximately 50 personnel structured into five primary sections as follows: engineering, operational, administrative, hi rise, institutions and hazmat. All division personnel come from within the ranks, with the exception of the FPEs and administrative assistants.

Claridge: The New Zealand Fire Service (NZFS) is New Zealand's national fire service. It was established under the Fire Service Act in 1975 and has jurisdiction over the entire country. The NZFS is predominantly an urban fire and rescue service with responsibility for firefighting in urban fire districts. The NZFS comprises of approximately 1,700 professional career firefighters, 8,300 volunteer firefighters 450 support staff and 80 communication center staff. It is spread geographically throughout the whole of New Zealand, divided into five fire regions with 450 fire stations.

Milliken: The Stafford County Fire and Rescue Department is a team of 350 career and volunteer personnel providing all-hazard emergency services to nearly 135,000 residents within a 717 square kilometer area. Stafford County is one of the fastest growing communities in Virginia and the Washington, D.C. metro area.

Horn: Describe the history of FPEs within your fire department.

Bryan: Martin J. Hanna, P.E., was the first fire protection engineer hired by the Baltimore County Fire Department in the early 1970s. Jay was a former Washington D.C.

ZURN WILKINS

ZW4104SSG

350ASTDABFG

One Choice. One Zurn.

ZW209FP

Innovative fire protection solutions to ensure code compliance.

Zurn Wilkins fire protection products provide the contractor with complete fire protection solutions. Our technologically advanced backflow prevention products, automatic control valves, and pressure reducing fire sprinkler control valves ensure consistent test results and deliver Zurn Wilkins industry leading lowest life-cycle costs. Choose Zurn to ensure compliance to fire sprinkler code requirements and first-pass annual testing.

The ZW209FP Fire Protection Pressure Reducing Valve is designed for Fire Suppression Systems to reduce high inlet pressures to a safe and stable outlet pressure. The pilot assembly reacts quickly to the increase of upstream pressure to prevent damage to system piping, valves, and sprinklers while maintaining positive pressure on fire pumps.

zurn.com
1.855.ONE.ZURN

Find us in MasterSpec

> "When Salt Lake City received the 2002 Olympic Winter bid, major changes were headed for the Park City area. This would include the addition of high-rise hotels, temporary structures for spectators and Olympic venues, in addition to meeting the major changes that would take place in the Park City community as they hosted the world."
>
> – Adams

firefighter who attended and graduated from the U. of Md. school of fire protection engineering. Ted Tochterman was hired in September 1974 to replace Jay Hanna. In July 1978, Baltimore County added a second fire protection engineer, which was myself. Currently Baltimore County has a chief fire protection engineer and two other fire protection engineer positions.

Arnevall: Fire protection engineers have been a part of the organization since the 1960s. Back in the early days, the FPE program was a two year government funded program. Since the "new" FPE program started at Lund University in 1986, Uppsala Fire Department has had 7-16 FPEs employed full time, from both the "old" and the "new" program.

Adams: When Salt Lake City received the 2002 Olympic Winter bid, major changes were headed for the Park City area. This would include the addition of high-rise hotels, temporary structures for spectators and Olympic venues, in addition to meeting the major changes that would take place in the Park City community as they hosted the world. It was decided at that time to recruit and hire an FPE to address the challenges and assist with the master planning for the fire protection and life safety needs for the public and district.

Claridge: Dr Paula Beever was appointed the principal fire engineer for the NZFS in 1998, eventually providing leadership to a team of 12 fire engineers located around the country. The establishment of a national fire engineering unit occurred in 2005, which included the NZFS design review unit (DRU). The DRU is one specific function of the engineering unit and was established in response to the 2004 Building Act, which required alternative and performance-based fire engineering designs to be submitted to the NZFS for review.

Caro: The department hired its first FPE in the mid 1980s (an Illinois Institute of Technology graduate). Since that time, the department has evolved, and it currently has six FPE positions, with two being from an FPE background, one electrical engineer and three structural/civil engineers.

Milliken: Fire protection engineering was incorporated into the department's life safety branch in 2007 in response to the rapid growth within the community as well as the need to be more proactively involved in fire protection systems and community development services.

Horn: What role do FPEs currently fill within your fire department?

Milliken: As a relatively small agency in a rapidly growing community, my role as the fire protection engineer is integrated into the department's fire marshal's office. I am one of five multi-discipline deputy fire marshals who are responsible for a wide variety of life safety, fire protection, hazardous materials and investigative services.

As the engineering expert to the chief deputy fire marshal and county fire chief, my role within the department's command staff provides a strong and consistent voice in the community's growth process. I also provide rapid, on scene access to technical expertise regarding a wide variety of hazards within the new and existing built environment.

This technical expertise extends not only to the divisions within the fire

7+(/($'(5 1
)5(3527(&7,21
(1*,1((5,1*
(GXFDWLRQ 7UDLQLQJ &5HVHDUFK

21/,1(*5$'8$7(&352*5$06
$'9$1&('(1*,1((5,1* &0'('8)5(

> THE FIRE PROTECTION ENGINEER ROLES ARE PRIMARILY PLAN REVIEW FOR FIRE AND BUILDING CODE COMPLIANCE AS WELL AS REVIEW OF AUTOMATIC SPRINKLER SYSTEM PERMITS.
>
> – BRYAN

department, but also to other county agencies, including the building official, department of planning, etc. It also extends further to building owners and their architects, engineers and design professionals to help foster a fire service perspective in the earliest part of design and development.

Claridge: Fire engineers within the NZFS provide a variety of roles. These include provision of technical advice on building designs, supporting fire engineering and performance-based design though the fire engineering brief process, providing technical advice and support to fire risk management officers, supporting fire investigations and major fire incidents, and undertaking research. NZFS FPEs also take a proactive role in influencing changes to standards and legislation in New Zealand.

Bryan: The fire protection engineer roles are primarily plan review for fire and building code compliance as well as review of automatic sprinkler system permits. Other functions include assisting fire marshals with difficult code or technical problems, code training and meeting with design professionals. The chief fire protection engineer assists in writing the state and county fire prevention codes, building code adopting ordinances, and updating the county's five year emergency management plan.

The chief engineer is available 24/7 for emergency responses for fire dispatch, emergency management as well as public works. Emergency calls include structural issues, damage assessment, and carbon monoxide alarms. Non-emergency calls include designing and providing construction management for buried water storage tanks for rural fire fighting. I worked on the Insurance Services Office Municipal Grading Schedule update, and the department went from ISO Class 9 to ISO Class 6 in rural areas with a fire station within five road miles (8 km) of a structure.

Arnevall: Generally in Sweden, the FPEs within fire departments work on a wide range of tasks. So, we have a wide range of roles, including head of the fire department, leading roles in the organizations, experts in the prevention department, and development of methods and tactics, and even being in charge at rescue operations. We provide the theoretical and analytical side to an otherwise experience-based organization.

Caro: FPEs work on a variety of tasks. They spend the majority of their time conducting plan reviews and permitting process tasks. Other duties include bringing existing buildings into compliance, assisting city attorneys with prosecution tasks, and regulatory program and code development. Time is spent on emergency response, acceptance testing of overly complex fire protection/life safety systems, association involvement, fire inspector/firefighter training, and conducting research.

Adams: The PCFSD has only one FPE, who serves as the assistant fire chief and district fire marshal. As the FPE and district fire marshal (FM), I oversee all enforcement of fire and life safety requirements for existing and new commercial, educational, industrial, institutional, and residential facilities. I assist with the review and approval of special events. I perform detailed reviews and inspections, and I witness acceptance tests for all fire sprinkler systems, fire alarm systems, specialized engineered fire protection and detection systems, smoke control systems and detailed water supply analyses. I provide interpretations on fire and building code questions for design professionals, I perform detailed fire and life safety drawing reviews, and I provide consultations and exiting analysis reviews for all new and renovation projects. I am also actively involved in the model building and fire code development process, both on a local and national level.

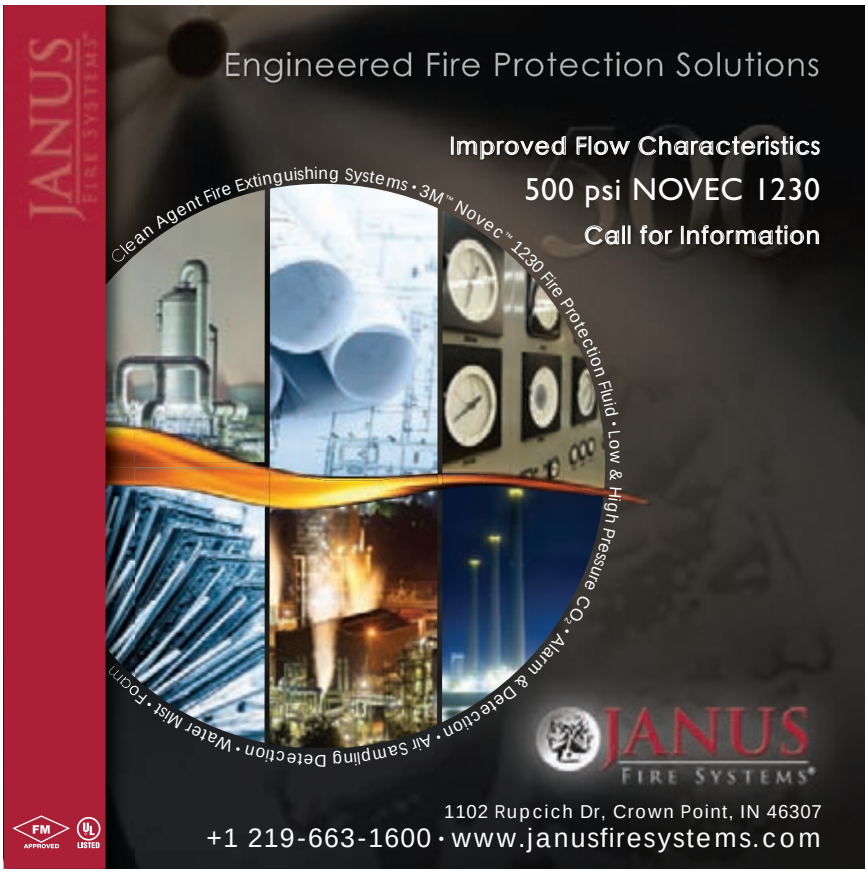
> FPEs are involved in every aspect of hazard identification and mitigation, review and permitting, and directing fire inspectors to verify permitted designs are properly implemented and functionally tested.
> – Caro

Horn: Describe a specific project where FPEs assisted your department.

Claridge: FPEs within the NZFS become involved in a wide range of projects. Just a few of the significant projects on which they were involved include: working towards a new NZ standard for home sprinkler systems; fire investigation related projects, including involvement in live fires and house burns; development of the NZ firefighting water code of practice, and collection of operational data.

Caro: An existing hospital is undergoing an approximate 1 million square foot (90,000 m^2) highrise expansion. FPEs are involved in every aspect of hazard identification and mitigation, review and permitting, and directing fire inspectors to verify permitted designs are properly implemented and functionally tested. FPEs will direct all applicable smoke control system testing. In addition, FPEs see that all required operational permits are requested and secured.

Adams: The major benefit that I have been able to bring to PCFSD as an FPE is that I am better able to communicate and consult with design professionals on fire and building code requirements, and bring the education, expertise and background needed to review and approve the design of fire and life safety systems. By applying my education, knowledge and experience, I have been able to assist with major construction projects located in mountainous areas and major Olympic venues. I have assisted with the master fire protection planning for a community and resort town in the wildland urban interface.



> FROM SECURITY-LADEN GOVERNMENT BUILDINGS TO THE LOCAL HOSPITAL AND HEALTHCARE FACILITIES, THE COMPLEX AND INTERCONNECTED SEQUENCE OF OPERATIONS FOR BUILDING SYSTEMS ARE CONSTANTLY EVOLVING.
> – MILLIKEN

Milliken: One specific and key role of fire protection engineering in Stafford County has been coordination of integrated fire protection and building system commissioning. From security-laden government buildings to the local hospital and healthcare facilities, the complex and interconnected sequence of operations for building systems are constantly evolving. Having a fire protection engineer to coordinate these systems provides a comprehensive, yet local fire service perspective to the installation, modification and overall synchronization of life safety system operations.

Bryan: Specific projects include updating the five-year Emergency Management Plan, writing the building code adopting ordinance, and designing and undertaking construction management for buried 30,000 gallon (140 m^3) fiberglass water storage tanks for rural firefighting.

Arnevall: We have participated in building and egress safety inspections, risk and hazardous materials analyses and commanding rescue operations. In our department, FPEs have been appointed as the fire chief.

Horn: Considering the great work underway by fire protection engineers at NIST, UL, ATF and others, do fire protection engineers in your department provide insight into standard operating procedures (SOPs), incident debriefs or tactic/strategy discussions and training?

Arnevall: Since we lead rescue operations on a daily basis, we participate in debriefings and tactics/strategy discussions continuously. We also participate when we create new standard operations procedures. Hence, it's natural that we bring new findings and the latest research that we find externally to discussions and decision making.

Claridge: As well as assisting in fire investigations and providing support to NZFS fire investigators, fire engineers within the NZFS become involved in large fires and those of special interest where something out of the ordinary has occurred. Depending on the incident, fire engineers provide advice and support on building performance which can influence future SOP development and firefighting tactics.

Milliken: As fire protection engineers in the fire service, we should be the ambassadors of this work to help our crews connect the technical with the tactical as it applies to the local community and fire environment. Although we do push these great resources to our personnel and have some input with both local and regional SOP development, training beyond our recruit academy is an area that fire protection engineering could offer greater emphasis and support in the future.

Adams: Yes, we do provide input. We are part of the command staff at any major working fire or incident to provide assistance as needed, and in particular with the operation of the specialized fire and life safety systems in our major high-rise buildings. We are also able to provide our expertise in the review of SOPs to verify that all safety measures are considered. We provide bi-annual training to suppression crews on the operation of the specialized fire and life safety systems, assist crews with pre-planning target hazards, and instruct new candidates at the fire recruit academy.

Bryan: FPEs in Baltimore County provide training on such subjects as codes, water supply, etc.

Your system design is not

COMPLETE

without corrosion control.

Potter Nitrogen Generators

Corrosion can cause an otherwise healthy system to deteriorate and completely fail within a short amount of time. By filling your system with clean, dry nitrogen, the oxygen corrosion process can be controlled. Our nitrogen generators are pre-engineered and specifically designed for use in fire sprinkler systems.

Complete your system—protect it from corrosion.

Learn more at: www.PotterNitrogen.com

POTTER | CORROSION SOLUTIONS
The Symbol of Protection

Caro: Historically, direct involvement has been limited. Officers that have left fire prevention and returned to the operations division had new knowledge and understanding of building construction and the associated fire protection/life safety systems. Occasionally, station officers have requested field visits to provide training.

Horn: How do you envision the role of the FPE within the fire service advancing in future years?

Bryan: I see the FPE in the fire service playing a much larger role due to the complexity of the built environment, presence of performance based code alternatives, as well as a cost effective alternative to using uniform fire fighters. Uniform fire fighters have a large amount of training and certifications that they must obtain and maintain, often at the expense of learning codes in detail and applying those skills in the plan review process. Many uniform personnel rotate out of these positions in a few years just when they become proficient in the correct application of codes.

Milliken: In much the same way the advanced life support or hazardous material services have been increasingly incorporated into the fire services over the past decades, it's not unreasonable to suggest that the demand for in-house, advanced technical expertise regarding the rapidly evolving fire protection and built environment will continue to spread throughout the fire service. Whether it's greater involvement in development services, department training, or emergency response, incorporating staff fire protection engineers to help fill these gaps will likely no longer be only a luxury only for larger departments.

> "FPEs within the NZFS are intimately linked with New Zealand's performance-based building code and the provision of advice on building design and firefighting needs."
> – Claridge

Claridge: FPEs within the NZFS are intimately linked with New Zealand's performance-based building code and the provision of advice on building design and firefighting needs. Supporting performance-based building codes requires technical knowledge combined with the application of fire science and engineering principles. While there remains a performance-based building code, there will always be a need for the fire service to be represented within the building design process. Fire service FPEs are necessary to influence the built environment and provide the necessary link between legislation, standards, lessons learned from incidents and research into operational firefighting.

Adams: I see the FPE becoming more involved in the management team of the fire department. In see the FPE bringing that missing piece of the puzzle to the team, in that they will be able to bridge the gap between tradition and new technology, by applying their skills to evaluate and research different challenges or difficulties the fire department may encounter – both from a tactical and a managerial application and approach.

Arnevall: I think we have to continue working on a lot of different tasks and be wide in our field of expertise. But, I also think that the fire departments are going to employ a wider range of expertise, from building engineers and lawyers to HR personnel, since the complexity and vulnerability of today's society is growing at a rapid rate.

Caro: FPEs will play a more integral part in bridging the gap between the fire service's knowledge of codes and systems and their intended use on the emergency fireground.

For additional, exclusive online content, see *magazine.sfpe.org*.

It's **Intelligent**, you say?

Why yes, it is intelligent.

FAAST Fire Alarm Aspiration Sensing Technology® from System Sensor integrates directly to major fire alarm control panels without the need for any additional hardware or software – just like any other detection device on the loop. This unique capability greatly simplifies installation and fire systems management while reducing cost and complexity. FAAST can also be seamlessly integrated to building management systems via Modbus/TCP protocol, available standard on all models.

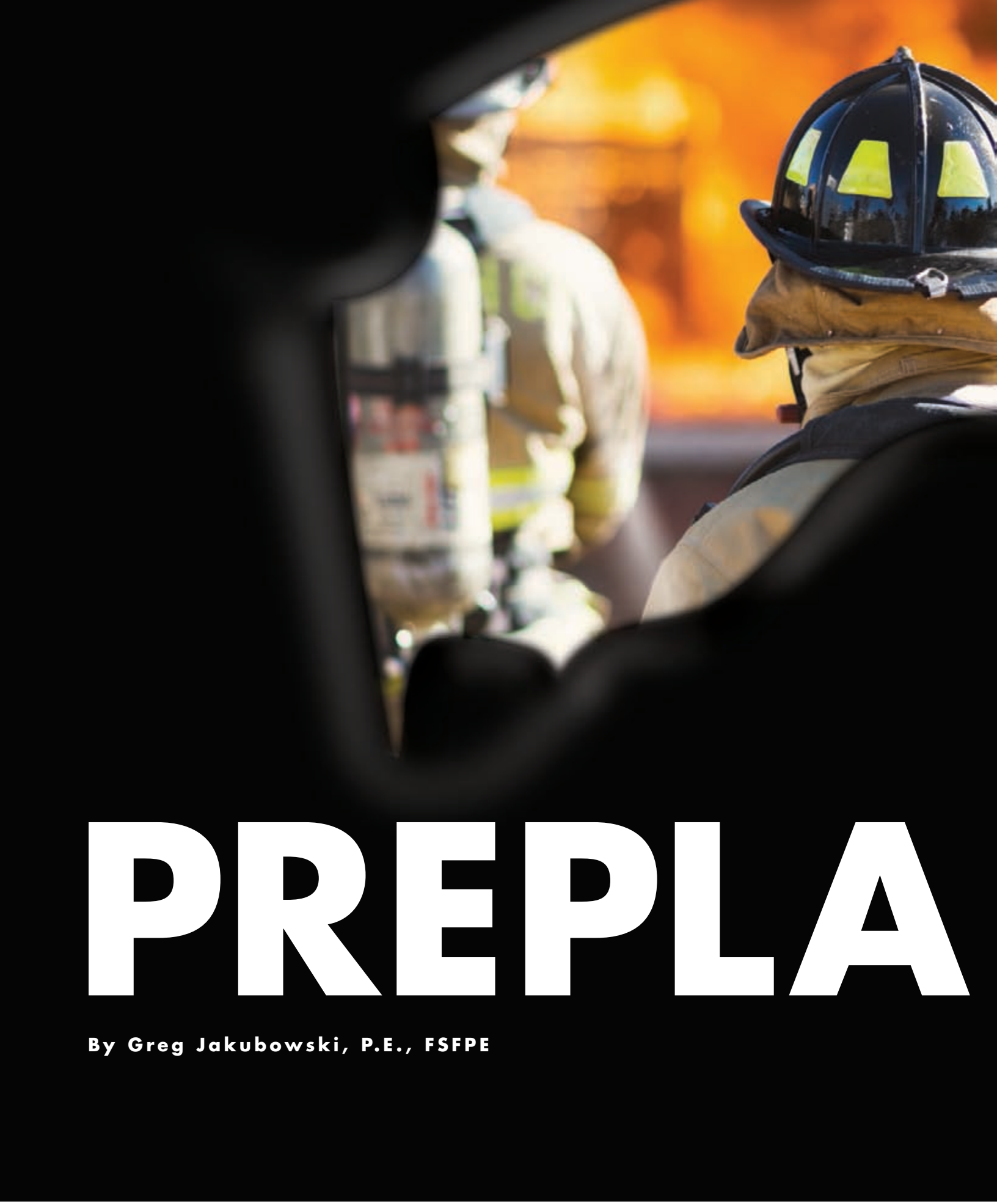
FAAST is the intelligent choice for any environment that needs highly accurate, system-connected Very Early Warning Fire Detection.

Learn more at systemsensor.com/**faast**.

SYSTEM SENSOR®

©2014 System Sensor. All Rights Reserved.

FAAST
FIRE ALARM ASPIRATION SENSING TECHNOLOGY®



PREPLA

By Greg Jakubowski, P.E., FSFPE

NNING

Firefighters are often trained in generalizations. Because of the constant variety of threats they face, they are often trained to fight fires in a general sense, and they learn about building construction and features in a general sense. They receive training and instruction manuals on their equipment – but rarely do they have a "user's manual" specifically designed for emergency response to the buildings in which they are expected to work.

They may get some sort of walkthrough training on the building and its fire protection features and equipment, but they are often expected to document or perhaps just

remember the building functions and performance in a fire or other emergency situation.

Things were simpler when building construction and fire protection features typically followed prescriptive codes and firefighting tactics could be standardized. As the performance-based design concept has grown in popularity, and building design and fire protection features have become more tailored to the specific building, there are increasing expectations on fire department performance when responding to these buildings. Even prescriptively designed buildings can present challenges to firefighters, such as pressure vessels that may relieve upon exposure to the heat from a fire, or doors that may have alternative locking mechanisms. Firefighters also have concerns that lightweight construction elements may be subject to early collapse.

Engineers are designing structures, stadiums, transportation facilities, and a host of other venues, using sophisticated tools that allow them to more finely tune the fire protection and safety features of a building to its specific construction and occupancy. Some firefighters and building officials understand those sophisticated tools, but some do not.

SIZE-UP

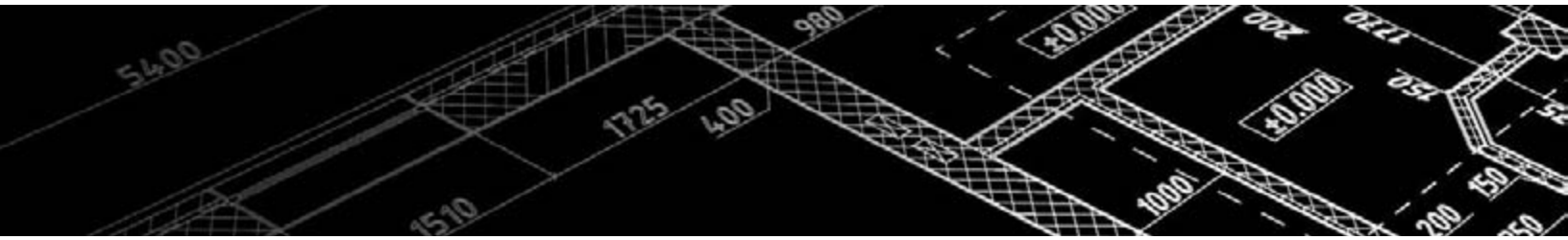
Firefighters are taught to "size up" the building or facility where an emergency is occurring based upon any prior knowledge they may have, and their observations of the building when they pull up to an emergency. This look may be skewed depending upon if it is day or night or if smoke or something else limits their full view of the building. They may

make general assumptions about the building and its construction based upon this assessment, and these assumptions directly translate into fire attack tactics.

If they have little or no pre-incident knowledge of the facility, they are at a disadvantage when they develop their tactics. Buildings with unusual features are not just limited to city environments; even in the suburbs, small medical office buildings can hold sophisticated medical equipment that uses gamma radiation requiring concrete shielding walls and doors – with a building exterior that looks like any other office building.

> There are many obstacles to effective preplanning, which can include a lack of interest by both the emergency responders and the building owner, and limited technical knowledge in completing the preplans themselves.

The gap in knowledge of a facility and its protection/safety features may, at the least, result in one or more of these features being ignored or used incorrectly, potentially



7+(+$66®)$0,/<

2)

),5(3527(&7,21(1*,1((5,1*62)7 : $5(

7KH+$66)DPLOL RI)LUH3URWHFWLRQ HQJLQHHULQJ VRFLHWLHV FRQWDFWXV UHYLHZLQJ DXWRPDWLF &RQGRPLQLXPV DQG HGXFDWLRQDO LQVWLWXWLRQV ZKR GHVLJQ DQG]H WWW HWWP DW RUUHYLHZ IILH FRQWRO\ WWP V IRUFRP P HUFLDO LQGXVWUDO DQG UHVLGHQWDO SURSHUWLHV LQ DFFRUGDQFHZ LWK 1)3$ VWDQGDUGV 7KH+$66 IDP LO FDQ VDYH\ RX WP HDQG P RQH DVLW KDVIRUWRXVDQGVRI RWHUVLQ RYHU FRXQWLHVLQFH

+$66 7KH OHDGHULQ FRP SXWHU VRIWDUH IRU WKH GHVLJQ DQG DQDOVLV RI VSULQNOHU V\ WWP V *1RZ LQFOXGHV +$66 +286(DQG -2%&267 (67,0$725 LQ DGGLWRQ WR ' DU\ : HVEDFK +DPPHU 6\ WWP 9ROXPH *UDGHQWDQGPDQ RWKHUKHSIXOXWLOLWLHV $YDLODEOHLQ(QJOLVK (QJOLVK DQG0 HWUF XQLW DQG6SDQLVK 0 HWUF XQLW YHUVLRQV

&226$ &RP SXWHU VRIWDUH IRUFDOXODWLQJ WKR SKDVH LORZ IRUKLJK SUHVXUH DQG ORZ SUHVXUH&2 V\ WWP VLQ(QJOLVK RUP HWUF XQLW *1RZ LQFOXGHV -2%&267 (67,0$725 IRUTXLFN&2 V\ WWP LQWHUDFWLRQ FRWWFDOXOXOWLRQV

+$66+286( )DWDOFFXUDWHZ D WKFDOXOXOWHGHQWDO\SULQNOHUV\ WWP VLQ DFFRUGDQFHZ LWK 1)3$ ' DQG 5

-2%&267(67,0$725 4XLFN GHYHORSV\SULQNOHUV\ WWP FRWWFWWP DW IURP GLUHFWGDWDHQW RUTXLFN JHQHUDWG JUG RUWHHV\ WWP V

+56 6\VWHPV,QF

6RXWKVLGH6TXDUH 3HWHUVEXUJ71

(PDL KDVV#KUVV\VWHPV FRP

ID[ZZZ KUVV\VWHPV FRP

leading to a more damaging fire than what might have occurred if that gap did not exist. If no or ineffective preplanning is done, the responding personnel will have little to no knowledge of the building's protection features and they will not have been properly prepared to use those features properly.

For example, one common fire service generalization is that if a building is sprinklered, the sprinkler system will handle a fire, making their efforts in that building easy. Many firefighters may not be aware that different densities are needed for different heights of storage, and be unable to differentiate between different commodity classifications when viewed in the field. There are many communities where code enforcement and inspections are limited, or even non-existent, which then limits the oversight to verify that the installed protection will work properly when it is needed.

EFFECTIVE PREPLANNING

There are many obstacles to effective preplanning, which can include a lack of interest by both the emergency responders and the building owner, and limited technical knowledge in completing the preplans. This is where fire protection engineers can help.

A firefighter's world changes regularly. Companies may be out-of-service due to staffing issues, training, or on another emergency. It is not unusual in city departments for companies to respond to 10 or more runs per day. Even if resources are adequate and available, traffic

> Essentially, the fire service can become the de facto historian of buildings in their response areas, and the facility managers might find the fire service preplan information quite useful as well.

jams and severe weather events can impede the provision of rapid service.

Severe storms can topple trees and power lines, completely blocking roads that provide access to various buildings. EMS responses and training can be a major focus of a fire department due to the demands of providing that service effectively, but this can limit the time available to study buildings and the protection features, provided in them along with how those features work.

Not only does custom building design present new challenges, but building operation and management concepts have changed over the years as well. No longer does a facility manager stay with one building for the life of that building. This responsibility is often contracted to a third party, and these facility managers often deal with multiple buildings across a wide area. It

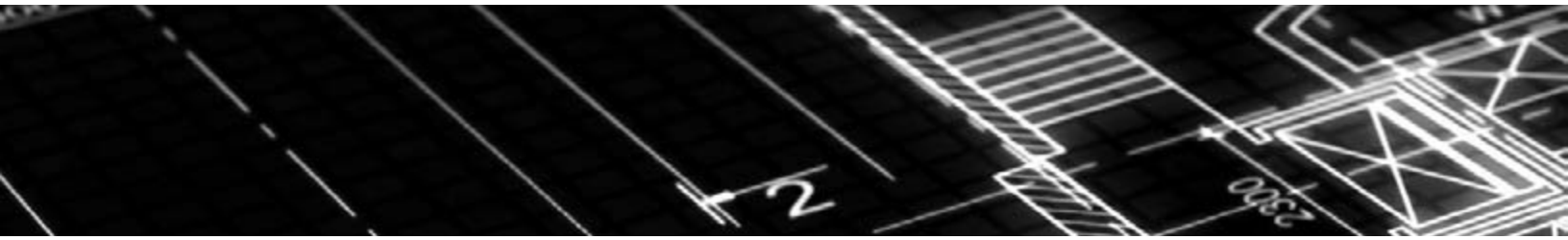
Now meet more specs

The new FM approved
Fireloop™ quake-ready expansion joint
for fire sprinkler systems.

Metraflex for pipes in motion | Fire Protection Division

www.Metrafire.com
1-855-Firelup • 1-855-347-3587

© 2014 The Metraflex Company



Fire Suppression Rating Schedule Requirements

The ISO *Fire Suppression Rating Schedule*[4] (FSRS) has the following requirement – *The fire department should make building familiarization and pre-incident planning tours of each commercial, industrial, institutional, and other similar building at least annually. Records of the inspections (whether in electronic or other formats) should include complete and up-to-date notes and sketches, which must be available to the responding incident commander.*

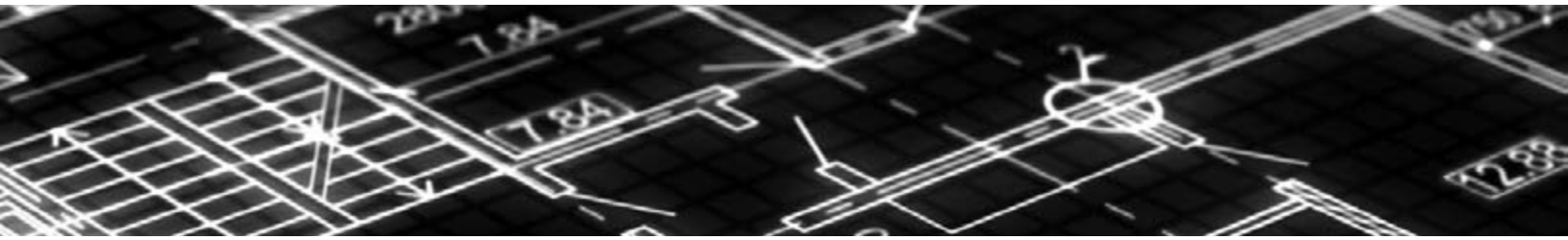
Building familiarization and pre-incident planning should be in accordance with the general criteria of NFPA 1620, Standard for Pre-Incident Planning.

Effective pre-incident planning of these buildings can secure ISO FSRS points, therefore having a positive effect on the insurance rating and insurance rates for an entire community.

is difficult to expect them to know about every intricacy of every building they cover.

During evenings and weekends, the experience and knowledge level of those facility managers may further deteriorate from that which is available during normal working hours. Buildings also may change ownership, which may cause a change in the facility manager, thus losing the institutional knowledge that is so critical when an emergency occurs. Essentially, the fire service can become the de facto historian of buildings in their response areas, and the facility managers might find the fire service preplan information quite useful as well.

From a design engineer's perspective – will that valuable work during the design phase be for naught when something happens in that building years later? Will someone really know the intent of how that building was designed



to perform when the emergency occurs? Preplans can prepare firefighters for success.

REQUIREMENTS

There are a variety of code requirements for preplanning. The *International Fire Code*[1] (in Chapter 33 – "Fire Safety During Construction and Demolition") places the responsibility for fire prevention on the owner, and the owner is required to designate a fire prevention program superintendent who is responsible for developing and maintaining a preplan in cooperation with the fire chief. There also are various requirements for fire safety and evacuation plans for a variety of occupancies outlined in Chapter 4 of the *International Fire Code*.

These plans have several required items, almost all of which are included in a pre-fire plan that meets the requirements of NFPA 1620[2]. NFPA 1[3] – also requires pre-fire planning during construction, alteration, or demolition. There also are requirements for emergency plans for a variety of occupancies outlined in NFPA 1. NFPA 1620 encourages cooperation in preplanning between building owners, occupants, designers, insurers, and firefighters.

Besides preplans for buildings, other facilities and occupancies can be preplanned successfully. Confined spaces are a key interest to OSHA; the openings and access information can be preplanned, listed and provided for emergency responders. Rail, vehicle, and other types of tunnels

with limited access and ventilation also can be preplanned. The rail lines and highways – particularly interchanges – can be preplanned, even accessing cameras and other tools to help provide intelligence for responders. Cameras in schools and other buildings can similarly be embedded into electronic preplans. NFPA 1620 provides a standard for the data that is needed for an effective preplan.

Once a preplan is developed, there are many schools of thought on how to disseminate it. Many find hard copy preplans to be reliable and effective under most conditions. However, these copies are only as accurate as the last time they were updated, copied, and disseminated. PDF or similar electronic systems also require an effective dissemination plan.

A cloud-based system allows changes to be made at almost any time. Cloud-based preplans also can be shared with users located almost anywhere – essentially everyone that might need to access the information will have it when needed. However, this requires each user to have a working connection to the cloud system.

An additional concern is change management in the preplans – i.e., who is authorized to make changes. It is important to balance the need to make the preplans as current as possible with the technical accuracy of the plans – making sure that changes are done correctly.

Preplans are most effective when they are used to train personnel before incidents occur. Facility managers can take them in the field

SIEMENS

Small and medium-sized buildings are getting a voice of their own.

With Cerberus PRO Intelligent Voice Communication everyone can benefit from premium life safety.

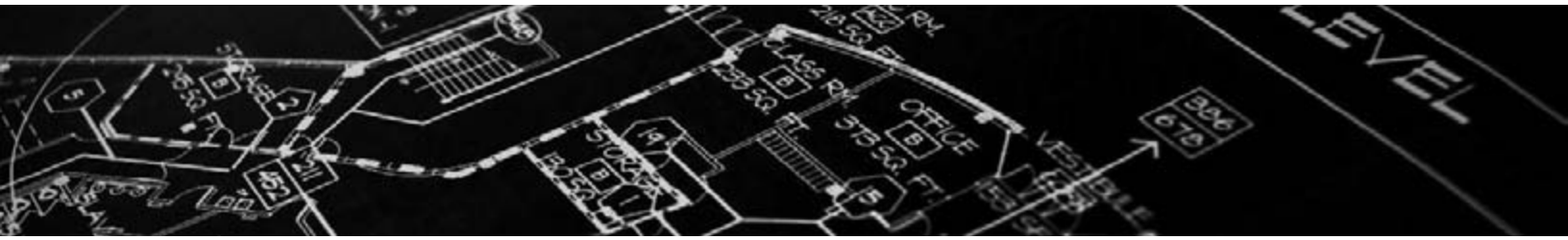
When it comes to protection, the safety you provide shouldn't be limited by your building's size or budget. With Cerberus® PRO Intelligent Voice Communication, we've put premium safety features within reach of any building, regardless of size.

Comprehensive, cost-effective and compact, Cerberus PRO is more than a voice enabled fire system. In a single enclosure, it offers fast, reliable detection, complete operator control and intelligent communications for fire, mass notification, and other emergency and non-emergency uses.

Cerberus PRO delivers to small and mid-sized buildings technology once reserved only for high-end facilities. This includes our industry-leading intelligibility, the ability to localize emergency and non-emergency messages to different parts of your building, and remote diagnostics for time- and cost-saving maintenance. It's a perfect fit for schools, retail, churches, banquet halls and low-rise hotels, apartments and offices – anywhere people gather.

A Siemens Solution Partner in your area can support your facility or your next project.

www.usa.siemens.com/CPIVC



and validate the information, and verify that shutoffs are correctly identified and located, and verify that any changes that may have occurred are addressed. Firefighters can take the preplans, and using different available apps, conduct simulations of various incidents and discuss options for handling those incidents. If they have handled the incident before, even virtually, it will make it easier when they are faced with it in real-time.

FUTURE OF PREPLANS

Preplans should be available to initial arriving company officers, as well as to incident commanders and planning chiefs at the command post immediately when needed. Preplans, when linked to wearable personnel tracking devices, will allow identification of the locations of firefighters operating in the buildings right at the command post or for the operations chief or safety officer. This concept is under development and may be available in the near future.

In the not-too-distant future, preplans may be provided in displays in the masks of firefighters – allowing them to identify where they are in the building, and what hazards, exits, or other concerns are around them. At some point, fire modeling of buildings that determine how long the environment is tenable in a fire situation could be tied to building sensors and alarms that will enable fire officers to more effectively predict how long firefighters can safely operate in buildings. In all of these cases, fire protection engineers can be a huge asset to firefighters by helping to develop and maintain preplans, as well as the tools necessary to facilitate these concepts.

Gregory Jakubowski is with Fire Planning Associates, Inc.

References:

1 *International Fire Code*, International Code Council, Washington, DC, 2012.

2 NFPA 1620, *Standard for Pre-Incident Planning*, National Fire Protection Association, Quincy, MA, 2010.

3 NFPA 1, Fire Code, National Fire Protection Association, Quincy, MA, 2012.

4 *Fire Suppression Rating Schedule*, Insurance Services Office, Jersey City, NJ, 2013.

BOOST YOUR HYDRANT AND FIRE SPRINKLER WATER PRESSURE

Darley has provided the Firefighting community with trusted and reliable pumps for over 100 years. You can trust Darley to bring the same level of quality to high volume water pressure products with the Self Testing Hydrant Booster System and 13D Fire Sprinkler Pump System.

- The ONLY patented Self Testing 13D Fire Sprinkler Pump System
- The ONLY patented Self Testing Hydrant Booster System
- Solves pressure problems on any budget
- Engineered and wholesale lines available

Darley

Contact Darley | 1.800.4.DARLEY
www.firesprinklerpumps.com
pumpsales@darley.com
TRUSTED WORLDWIDE SINCE 1908

FIRE SPRINKLER PUMPS by Darley

Congratulations! SFPE has a long tradition of recognizing individuals and organizations for their outstanding achievements in support of the fire protection engineering profession and the Society. Since 1973, SFPE has recognized achievements for a broad range of fire protection engineering activities to elevate the general quality of fire protection practice, establish a standard of excellence against which all fire protection engineers can measure performance, and inform the public of the breadth and value of their contributions.

The 2014 award recipients will be honored October 11, 2014, at the Hilton Long Beach, in conjunction with the SFPE Conference & Expo in Long Beach, California. Learn more about SFPE award programs, submission information, deadlines and past award recipients at www.sfpe.org.

SFPE
Engineering A Fire Safe World

SFPE'S 2014 HONORS & AWARDS

2014 FELLOWS


Robert P. Benedetti, FSFPE


Douglas J. Carpenter, FSFPE


Tom Christman, FSFPE


John A. Frank, FSFPE


April Leyla Hammond, FSFPE


J. Gordon Routley, FSFPE


David T. Sheppard, FSFPE

ARTHUR B. GUISE MEDAL
Endowed by R. Keith Guise
Professor Ai Sekizawa, Dr. Eng.

FIRE PROTECTION PERSON OF THE YEAR
Tonya L. Hoover

HAROLD E. NELSON SERVICE AWARD
William Webb, P.E., FSFPE

ROLF H. JENSEN AWARD FOR OUTSTANDING COMMITTEE SERVICE
Endowed by Rolf Jensen and Associates
Ann Jeffers, Ph.D.

JOHN L. BRYAN MENTORING AWARD
William Koffel, P.E., FSFPE

D. PETER LUND AWARD
Michael Strömgren

JOHN J. AHERN PRESIDENT'S AWARD
Jeffrey M. Shapiro, P.E., FSFPE

DAVID A. LUCHT LAMP OF KNOWLEDGE AWARD
Underwriters Laboratories

HAT'S OFF AWARD
Ralph Foster, III, P.E.
Jamie Patterson
Stan Maciaszek, P.E., FSFPE
Martin Nilsson
Fredrik Nystedt
Nils Olsson
Daniel Rosberg
Ulf Wickström, FSFPE

SFPE FOUNDATION HONORS

JACK BONO ENGINEERING COMMUNICATIONS AWARD
Endowed by Underwriters Laboratories


William C-K Wong, LEED AP


Professor Nicholas A. Dembsey, Ph.D, P.E., FSFPE


Jarrod Alston, P.E.


Christopher W. Lautenberger, Ph.D., P.E.

CHIEF DONALD J. BURNS MEMORIAL RESEARCH GRANT
Endowed by Bentley Systems

Andre W. Marshall, Ph.D., and
Rosalie Wills (student)
University of Maryland

STUDENT SCHOLAR AWARD
Alistair Bartlett, University of Edinburgh

SFPE Foundation

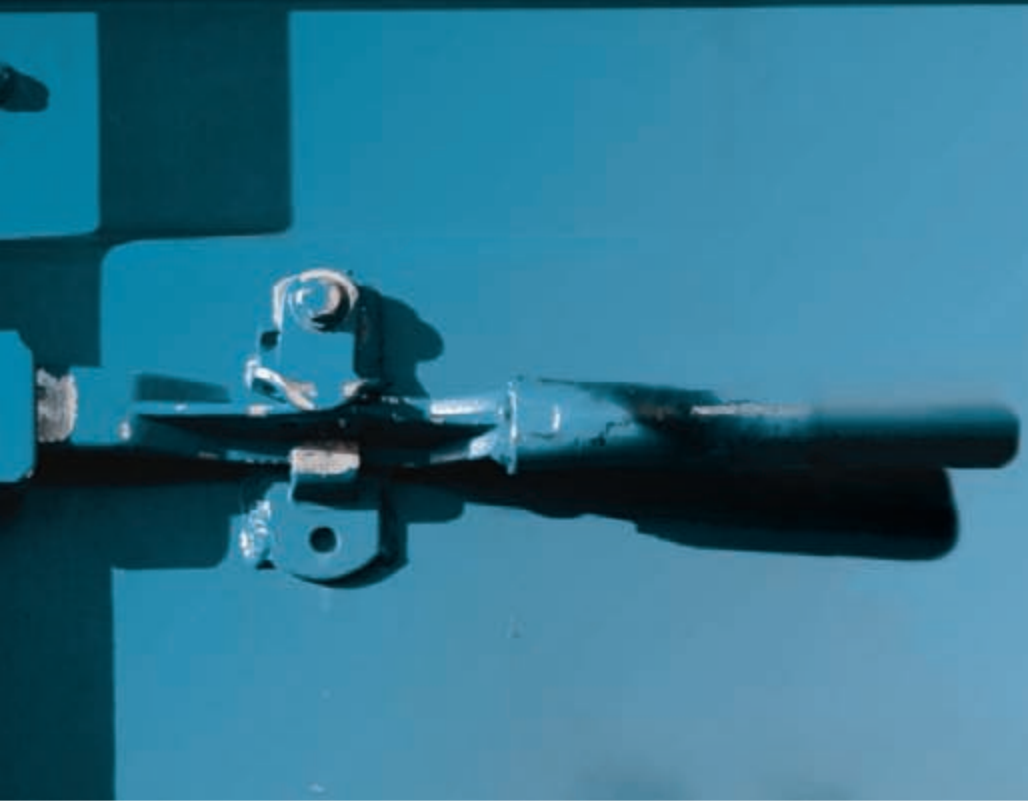
SFPE CHAPTER EXCELLENCE AWARDS

GOLD			SILVER		BRONZE
Austin/San Antonio	New England	St. Lawrence	British Columbia	Northern California-Nevada	Carolinas
Chicago	New York Metropolitan	Tennessee Valley	Japan	Rocky Mountain	New York Empire
Greater Atlanta	Philadelphia-Delaware Valley	The Central Savannah River	Mid-South	Sweden	People's Republic of China
Hawaii	Saudi Arabia		New Jersey	Taiwan	Southern Ontario

FIRE MODELING

FOR THE FIRE RESEARCH, FIRE PROTECTION, AND FIRE SERVICE COMMUNITIES

By Kevin McGrattan, Ph.D., Randall McDermott, Ph.D., Glenn Forney, Ph.D., Kristopher Overholt, Ph.D., Craig Weinschenk, Ph.D. and Jason Floyd, Ph.D.



The Fire Dynamics Simulator (FDS), first publicly released in 2000, has recently undergone its fifth major revision. Since its first release, FDS has been applied in three major areas: basic research in fire dynamics, performance-based design, and forensic reconstructions of actual fires.

As its applications widen in scope, there is a need to develop new capabilities, while at the same time to verify and validate new and existing algorithms. This is a difficult task because the variety of applicable scenarios is vast and growing.

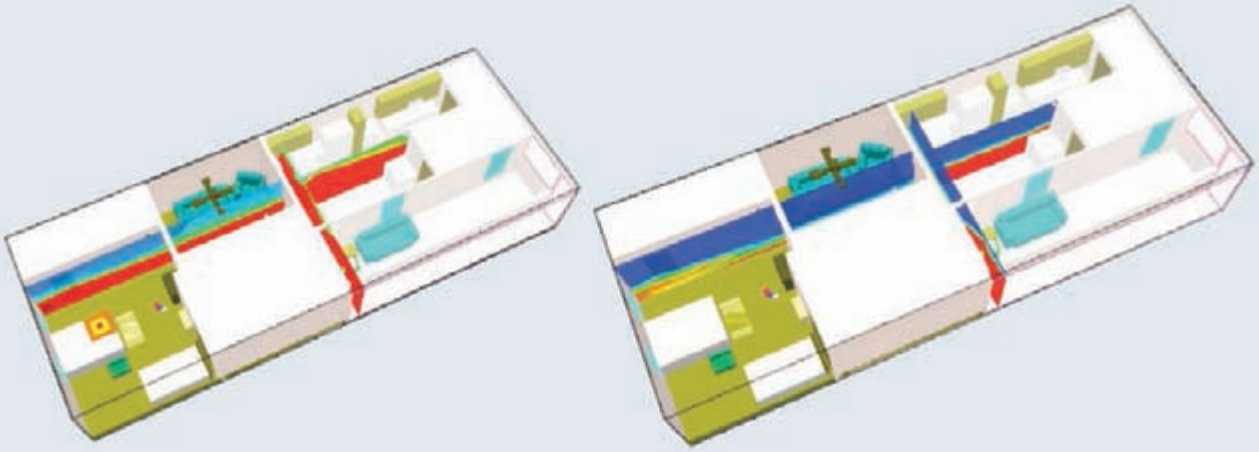


Figure 1: Smokeview snapshots of two simulations of a house fire that were intended to assess the consistency of eyewitness accounts. *Courtesy: Hughes Associates*

Take, for example, the images shown in Figure 1 through Figure 3. Figure 1 shows a few snapshots of a simulation of a house fire that were used to assess the consistency of eyewitness accounts. Figure 2 provides an example of how FDS was used to complement field experiments, which were designed to study the impact of crew size, alarm assignments, and vertical response modes on occupant survivability, firefighter safety, and property protection for high-rise fire scenarios.[1] Safety concerns prevented live fires during the experiments, so FDS was used to simulate potential thermal and toxic hazards representative of fires in a high-rise office building.

Figure 3 shows a simulation of the dispersion of toxic gases in the atmosphere. This model includes a portion of the FDR Drive along the East River in New York City where there were concerns about the accumulation of carbon monoxide from a partially enclosed roadway that was part of planned new construction.

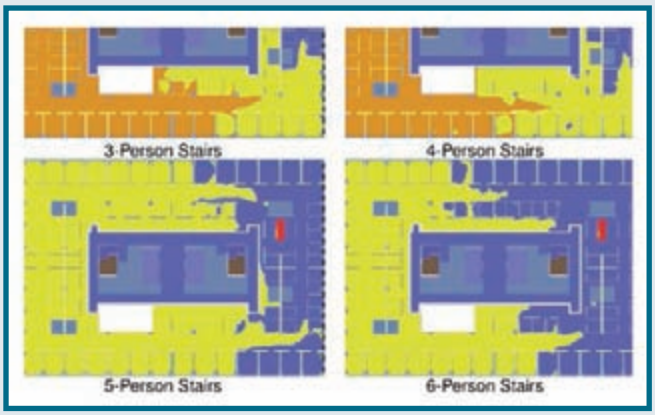


Figure 2: Predicted fractional effective dose contours on the high-rise fire floor. Higher values represent more toxic environments.[1]

These three examples highlight very different applications, with length scales varying from tens to thousands of meters and physical phenomena ranging from millimeter-scale pyrolysis of common household materials to kilometer-scale atmospheric boundary layer phenomena. Applications such as these have driven the development of FDS since its first release; this article reviews some of the major changes in the most recent version.

IMPROVEMENTS IN FDS 6

Many of the improvements in FDS 6 are not immediately obvious. Most of the input parameters remain the same, as does the overall look and feel of the graphics program Smokeview. However, some very important changes have been made to improve the basic flow solver, in particular how the governing equations are approximated on the numerical grid and how the sub grid-scale turbulence is represented. In addition, algorithms have been added to Smokeview for solving the fractional effective dose equation in a slice plane (contours in Figure 2) and the radiative transport equation for visible light (volume rendered smoke and fire in Figure 4).

The flow model in FDS is essentially a set of partial differential equations known as the Navier-Stokes equations. These equations cannot be solved exactly. Instead, the partial derivatives are written in approximate form as finite differences; the accuracy of the approximation is determined by the size of the numerical grid.

There are many different ways to write the finite difference terms; versions 1 through 5 of FDS used a simple central difference scheme that was reasonably fast and accurate. It did have one drawback, however, for regions where temperatures would change rapidly; for example, at the edge of the fire, the numerical scheme would allow

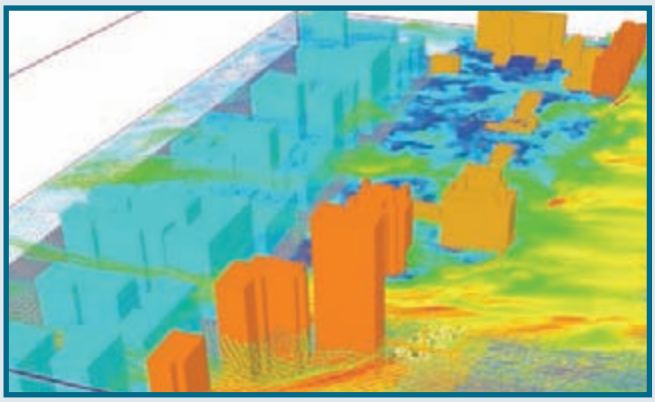


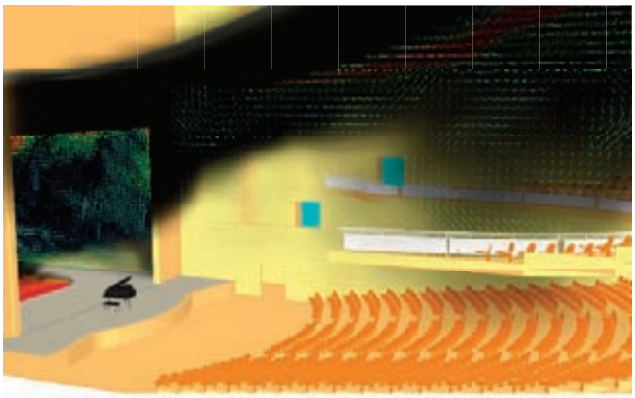
Figure 3: Smokeview snapshot showing the wind field over a proposed semi-enclosed roadway along the east side of Manhattan. *Courtesy: Hughes Associates*

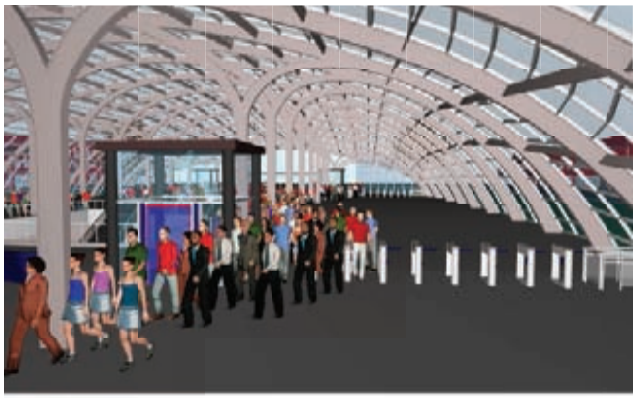
the temperature, density, and species concentrations to oscillate above and below their ambient values. This was, of course, simply a numerical artifact related to the fact that the finite difference scheme is only an approximation; however, it was nevertheless noticeable and could sometimes lead to spurious results, especially when the numerical grid was relatively coarse.

To correct this problem, a more sophisticated finite difference scheme was implemented that removes the spurious oscillations. This scheme is more costly in terms of CPU time, but it was decided that the improvement in accuracy was more important than speed, especially because the steady increase in computer speed will soon make up the difference.

The second major change to the flow solver is the turbulence model. FDS uses a technique known as large-eddy simulation (LES) to represent the fluid motion that is too fine to resolve on the numerical grid. This technique has been around since the 1960s, when it was first developed for weather simulations.

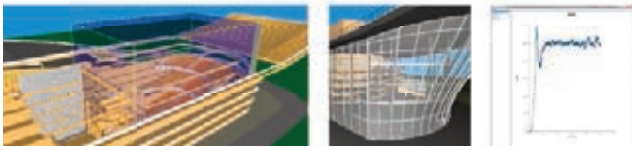
Since that time, a number of enhancements have been made to its treatment of sub grid-scale turbulence. FDS versions 1 through 5 used the original LES-turbulence model developed in 1963 by meteorologist Joseph Smagorinsky.[2] However, this technique proved to be overly dissipative, meaning that simulating realistic plume dynamics on a relatively coarse numerical grid was difficult. Several variations of the Smagorinsky approach were investigated, and a simplified form of the model of another meteorologist, James Deardorff,[3] was chosen on the basis that it is relatively cheap and performs well at both coarse and fine resolution.





Fire Dynamics and Smoke Control

Graphical User Interface for FDS
Import CAD and FDS Models
Easy Interactive Drawing Tools
High-Quality 3D Visualization



Agent-Based Evacuation Simulation

Continuous Occupant Movement
Import CAD and FDS Models
SFPE and Agent Simulation Modes
High-Quality 3D Visualization

Visit www.thunderheadeng.com to learn more about PyroSim and Pathfinder

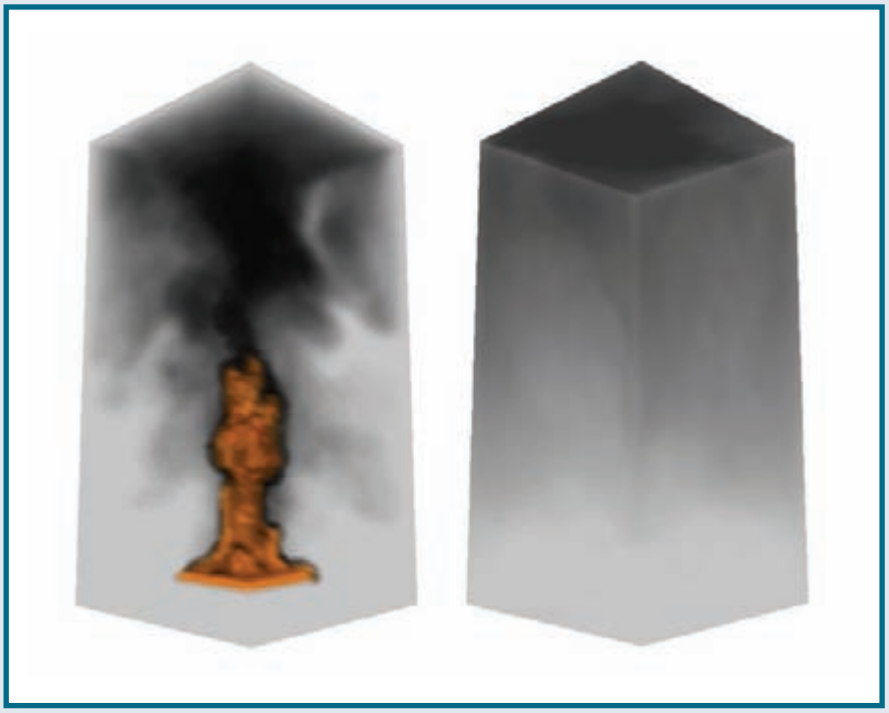


Figure 4: Simple demonstration of smoke deposition to wall and ceiling surfaces during (left) and after (right) fire exposure.

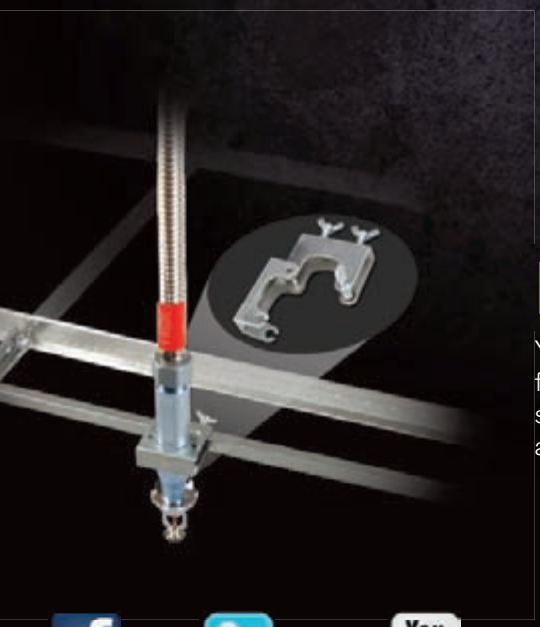
Other improvements in FDS 6 include:

Combustion: There is increased flexibility to define a detailed combustion scheme that goes beyond the simple "fuel meets air and burns" approach. For many typical fire applications, much of the new combustion machinery is not needed, and one can specify a predetermined design fire with little change from past versions. However, for topics such as CO production, under-ventilated fires, suppression, and soot formation and oxidation, the new chemistry and combustion framework will make it easier to explore alternative reaction schemes.

Radiation: FDS uses a set of subroutines called RadCal to calculate the absorption and emission properties of hot gas mixtures. One limitation of RadCal had been its use of methane as a surrogate for all fuel types. FDS 6 now includes the radiative absorption properties of fuel gases other than methane. These properties are based on measurements by Prof. Greg Jackson and students at the University of Maryland,[4] and the implementation in FDS was done by Vivien Lecoustre. This can improve the radiation calculations in detailed flame simulations or fuel-rich fires.

Ventilation: In previous versions of FDS, one could only specify pre-defined inlet and outlet flows for mechanical ventilation. To improve the ability of FDS to model buildings, a heating, ventilation, and air conditioning (HVAC) sub-model was added, based on the solver in MELCOR, a U.S. Nuclear Regulatory Commission code for analyzing containment buildings. This model treats an HVAC system as a collection of nodes and junctions. With the HVAC model, one can define the following components:

- Ducts with forward and reverse flow losses
- Nodes (e.g., tees, inlet and outlet vents, plenums) with flow direction dependent losses



FLEXIBILITY WHEN BUDGETS ARE TIGHT.

You don't have money to burn. Reduce install times and skilled labor costs while enabling faster time-to-occupancy with the SprinkFLEX flexible sprinkler system. Our fully assembled sprinkler drop installs without tools in a matter of minutes and introduces greater flexibility and speed into the build timeline. Call **800.463.1276** or visit **sprinkflex.com.**

SprinkFLEX®

A PART OF atkore INTERNATIONAL

[atkore] [AtkoreIntl] [AtkoreInternational]

©2014 Atkore International, Inc. All rights reserved.

- Fans with three options: constant flow, quadratic, and user-defined. The quadratic and user-defined options change the fan flow rate based on its inlet and outlet pressure. This, for example, would reduce the flow into a compartment with a growing fire.
- Dampers (currently only fully open or fully closed)
- Filters with the ability to define different removal efficiencies for different species as well as the impact of filter loading on the pressure drop across the filter
- Heating and cooling coils with either a fixed amount of heat exchange or an amount computed with a simple heat exchanger efficiency model

Soot Deposition: An accurate prediction of smoke concentration and smoke deposition to surfaces is important in various fire model applications, including visibility for human tenability studies and fire patterns for forensic reconstructions. Smoke that deposits to surfaces can reduce the gas-phase smoke concentration and affect visibility and detector activation time. The deposition of particulate matter also is important for predicting the dispersion characteristics of aerosol toxicants (e.g., ash, radionuclides, or other particulate matter). In FDS 6, soot and aerosols can accumulate on surfaces due to gravitational settling, thermophoretic deposition (where temperature gradients near walls push particles towards or away from walls), and turbulent flows near surfaces (where particles impact surfaces due to turbulent motion). Figure 4 is a simple example showing soot deposition to surfaces.

VERIFICATION AND VALIDATION (V&V)

In 2007, the U.S. Nuclear Regulatory Commission (NRC) and the Electric Power Research Institute

FABRI-LOCK

DRAFT CURTAIN SYSTEM

A Turn Key System for:

Smoke Containment
Draft Stopping
Sprinkler Separation
Heatbanking

LIGHTWEIGHT - COST EFFECTIVE
FAST PROFESSIONAL INSTALLATION
ACCEPTED BY ALL MAJOR BUILDING CODES

800-991-1352

www.smokeandfireprevention.com

(EPRI) published the results of a validation study of five different fire models commonly used by the commercial nuclear power industry.[5] The study was prompted by the NRC's adoption in 2004 of NFPA 805.[6]

In particular, NFPA 805 requires fire models to be verified and validated. The standard does not state explicitly what is meant by this. Guidance documents, such as the SFPE *Guidelines for Substantiating a Fire Model for a Given Application*,[7] and standards documents such as ASTM E 1355[8] and ISO 16730[9], all provide a basic framework for evaluating models. However, these documents do not have specific requirements as to how the model uncertainty is to be reported and how this information is to be used in a regulatory context. As a result, the NRC and EPRI took it upon themselves to develop a relatively simple framework for reporting and applying model uncertainty in day-to-day design analyses.

With the support of the NRC, FDS and the NIST zone model, CFAST, have adopted the basic framework of the NRC/EPRI V&V study. In addition, the way in which FDS is developed, tested, and released has greatly improved in recent years because of the boom in free and open source software development tools. Using a procedure that is commonly referred to as "continuous integration," an automated script runs hundreds of FDS test cases and regenerates all of the plots and figures for the FDS manuals each night. This greatly reduces the likelihood that new bugs will be created with each new routine.

Using a procedure that is commonly referred to as "continuous integration," an automated script runs hundreds of FDS test cases and regenerates all of the plots and figures for the FDS manuals each night.

FIRE SERVICE APPLICATIONS

Even before it was publicly released, the Fire Research Division at NIST has used FDS to provide insight into the development and thermal conditions of fires that have caused injuries or fatalities.[10,11,12,13,14,15,16] In addition, FDS has been used in firefighter staffing studies, firefighter training studies, and the impacts of various tactical operations such as ventilation or suppression operations. The overall objective of the use of fire models in

FIRETRACE®

AUTOMATIC FIRE SUPPRESSION SYSTEMS

Expect MORE from your fire suppression

MORE
PERFORMANCE

MORE
DESIGN FLEXIBILITY

MORE
SAVINGS

E4 total flooding systems are tested and approved by UL (Underwriters Laboratory).

UL LISTED

LEARN MORE AT: **www.firetrace.com/more**

FIRETRACE INTERNATIONAL - WORLD HEADQUARTERS
8435 N. 90th St., Suite 2, Scottsdale, AZ 85258, USA.
Tel: +1 480 607 1218 • Email: info@firetrace.com

FIRETRACE INTERNATIONAL LTD - EMEA OFFICE
Unit 11, IO Centre, Salbrook Road, Salfords, Surrey, RH1 5DY, UK.
Tel: +44 (0) 1293 780 390 • Email: info@firetrace.com

these studies is to improve firefighter safety and operational effectiveness. These applications are challenging to model because they incorporate advanced features such as the pyrolysis of real materials, under-ventilated combustion, and complex geometries. In fact, many current FDS development activities are driven by fire service applications, primarily because fire growth and spread are to be predicted, and not just specified as in most fire protection design applications. This demands a more thorough knowledge of material properties and complex fire physics.

Kevin McGrattan, Ph.D., Randall McDermott, Ph.D., Glenn Forney, Ph.D., Kristopher Overholt, Ph.D., and Craig Weinschenk, Ph.D., are with the National Institute of Standards and Technology. Jason Floyd, Ph.D., is with Hughes Associates, Inc.

References:

1 Averill, J., Moore-Merrel, L., Ranellone, R., Weinschenk, C., Taylor, N., Goldstein, R., Santos, R., Wissoker, D. and Notarianni, K. *Report on High-Rise Fireground Field Experiments*, NIST Technical Note 1797, National Institute of Standards and Technology, Gaithersburg, MD, 2013.

2 Smagorinsky, J. "General Circulation Experiments with the Primitive Equations. I. The Basic Experiment." *Monthly Weather Review*, 91(3): 99–164, March 1963.

3 Deardorff, J. "Numerical Investigation of Neutral and Unstable Planetary Boundary Layers." *Journal of Atmospheric Sciences*, 29: 91–115, 1972.

4 Wakatsuki, K., Jackson, G., Kim, J., Hamins, A., Nyden, M. and Fuss, S. "Determination of Planck Mean Absorption Coefficients for Hydrocarbon Fuels." *Combustion Science and Technology*, 180: 616–630, 2008.

5 Hill, K., Dreisbach, J., Joglar, F., Najafi, B., McGrattan, K., Peacock, R. and Hamins, A. *Verification and Validation of Selected Fire Models for Nuclear Power Plant Applications*, NUREG 1824, U.S. Nuclear Regulatory Commission, Washington, DC, 2007.

6 NFPA 805, Performance-Based Standard for *Fire Protection for Light-Water Reactor Electric Generating Plants*, National Fire Protection Association, Quincy, MA, 2001.

7 SFPE G.06, *Guidelines for Substantiating a Fire Model for a Given Application*, Society of Fire Protection Engineers, Bethesda, MD, 2011.

8 ASTM E 1355, *Standard Guide for Evaluating the Predictive Capabilities of Deterministic Fire Models*, American Society for Testing and Materials, West Conshohocken, PA, 2004.

9 ISO 16730, *Fire Safety Engineering – Assessment, Verification and Validation of Calculation Methods*, International Organization for Standardization (ISO), Geneva, Switzerland, 2008.

10 Madrzykowski, D. and Vettori, R. *Simulation of the Dynamics of the Fire at 3146 Cherry Road NE Washington D.C., May 30, 1999*, NISTIR 6510, National Institute of Standards and Technology, Gaithersburg, MD, 2000.

11 Madrzykowski, D., Forney, G. and Walton, W. *Simulation of the Dynamics of a Fire in a Two-Story Duplex – Iowa, December 22, 1999*, NISTIR 6854, National Institute of Standards and Technology, Gaithersburg, MD, 2002.

12 Vettori, R., Madrzykowski, D. and Walton, W. *Simulation of the Dynamics of a Fire in a One-Story Restaurant – Texas, February 14, 2000*, NISTIR 6923, National Institute of Standards and Technology, Gaithersburg, MD, 2002.

13 Madrzykowski, D. and Walton, W. *Cook County Administration Building Fire, 69 West Washington, Chicago, Illinois, October 17, 2003: Heat Release Rate Experiments and FDS Simulations*, NIST Special Publication SP-1021, National Institute of Standards and Technology, Gaithersburg, MD, 2004.

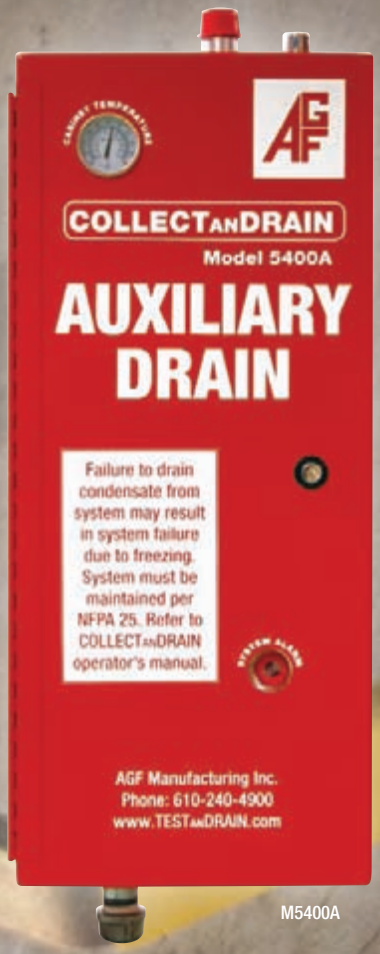
14 Grosshandler, W., Bryner, N., Madrzykowski, D. and Kuntz, K. *Report of the Technical Investigation of The Station Nightclub Fire*, NIST NCSTAR 2, National Institute of Standards and Technology, Gaithersburg, MD, 2005.

15 Bryner, N., Fuss, S., Klein, B. and Putorti, A. *Technical Study of the Sofa Super Store Fire, South Carolina, June 18, 2007*, NIST Special Publication 1118, National Institute of Standards and Technology, Gaithersburg, MD, 2011.

16 Barowy, A., Madrzykowski, D. *Simulation of the Dynamics of a Wind-Driven Fire in a Ranch-Style House, Texas*, NIST TN 1729, National Institute of Standards and Technology, Gaithersburg, MD, 2012.

Stop Replacing the Auxiliary Drains that Freeze and Break with Auxiliary Drains that Freeze and Break

The **COLLECTANDRAIN®** Model 5400A provides a temperature controlled environment for the sprinkler system auxiliary drain so freeze-ups are a thing of the past. This winter stop the cycle of replacing drains and install the only auxiliary drain with superior freeze protection.



M5400A

COLLECTANDRAIN™

M5300A M5100A M5200A

www.testandrain.com

*Actual photo of ice breaking the valve of an auxiliary drain taken in a parking garage during the winter of 2014.

EFFECTIVENESS AND RELIABILITY OF FIRE PROTECTION SYSTEMS

By James A. Milke, Ph.D., P.E., FSFPE

Performance based design analyses often involve a comparison of the contributions of a variety of fire protection systems to achieve specified design objectives. Fire protection systems can be divided into two categories: passive and active systems. Passive systems include fire-rated barriers and protection of openings in fire-rated barriers, while active systems include systems such as fire detectors and sprinklers.

An analysis of the contribution of a particular fire protection system to the achievement of specified objectives should include an assessment of the effectiveness and reliability of the proposed fire protection systems. For the purposes of this article, "reliability" is defined as the probability that a product or system will operate under designated operating conditions for a designated period of time or number of cycles. "Effectiveness" refers to the ability of a system to achieve desired objectives.

While reliability data for sprinkler systems has been included in NFPA analyses,[1] few compilations of reliability data are available in the open literature for other types of fire protection systems. This article provides an overview of the results of recent research that has been conducted to assemble such data from a variety of available sources.

Reliability data may be derived from fire incident statistics considering the entire fire protection system to be a single entity. Alternatively, the reliability of a system may be determined from an engineering analysis based on failure and repair rates of the components of the system, accounting for any redundancy in system components. For this article, the reliability data comes from considering the system to be one entity.

PROBLEM

False Fire Alarms?

STI-13420FR

SOLUTION

STI Universal Stopper® Helps Prevent False Alarms

This unique, polycarbonate cover helps stop false fire alarms around the world without restricting legitimate alarms.

Indoor/outdoor cover guards against accidental or intentional damage.

Safety Technology International, Inc.
www.sti-usa.com/fpe16
800-888-4784

STI 2014

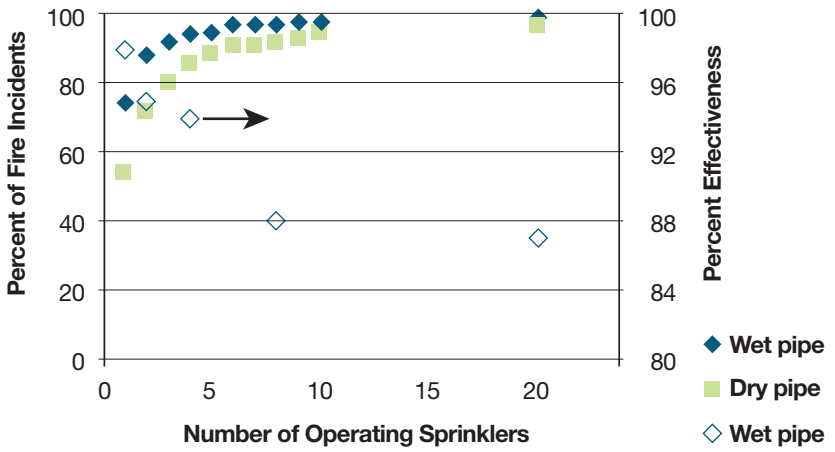


Figure 1: Effectiveness of Sprinklers in U.S. Fire Incidents[1]

Occupancy	Fire death rate* without auto extinguishing system	Fire death rate* with wet pipe sprinkler	Percent reduction
All public assembly	0.4	0.0	100%
Residential	7.4	1.2	84%
Store/Office	1.2	0.2	81%
Manufacturing	1.8	0.3	84%
Warehouse	1.2	2.0	-67%
Total	6.2	0.9	85%

** Fire death rate: civilian deaths/1000 fires*

Table 1: Fire Death Rates With and Without Sprinklers[1]

Reason for failure	All	Wet pipe	Dry pipe
System shut off	65%	61%	74%
Manual intervention defeated system	16%	19%	8%
Lack of maintenance	7%	8%	4%
System component damaged	7%	6%	10%
Inappropriate system for type of fire	5%	6%	3%
Total fires per year	738	564	130

Table 2: Reasons for Sprinkler Ineffectiveness[1]

Sources of information include expert opinion, NFIRS data, surveys by insurance companies, surveys by researchers, and in-depth fire incident analyses by selected sectors of the industry. This review will begin with a review of the effectiveness and reliability for two types of active systems – sprinklers and fire alarms, then proceed to passive systems.

ACTIVE SYSTEMS

Sprinkler Systems

The effectiveness of sprinkler systems in U.S. fire incidents is

summarized in Figure 1.[1] As indicated in the figure, when sprinklers operate in fire incidents, only one sprinkler operates in almost 70% of all fires and that one sprinkler is effective in 98% of the incidents. An interesting trend indicated in the figure is that the effectiveness of sprinklers declines with an increasing number of operating sprinklers.

The significant reduction in fire death rates in a wide variety of occupancies with sprinklers is presented in Table 1.[1] The fire death rate in sprinklered warehouses is likely an anomaly due to the small number of fire deaths that occur in warehouses and should not be used as justification to eliminate sprinklers from warehouses.

The reasons for sprinklers to be ineffective are indicated in Table 2.[1] As indicated in the table, the dominant cause for ineffectiveness is the system being turned off.

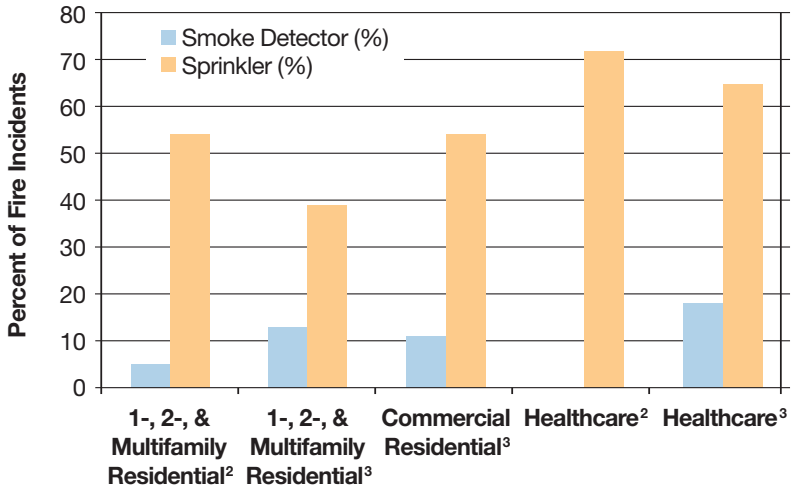


Figure 2: Fires "Too Small" for Smoke Detector and Sprinkler Operation[3]

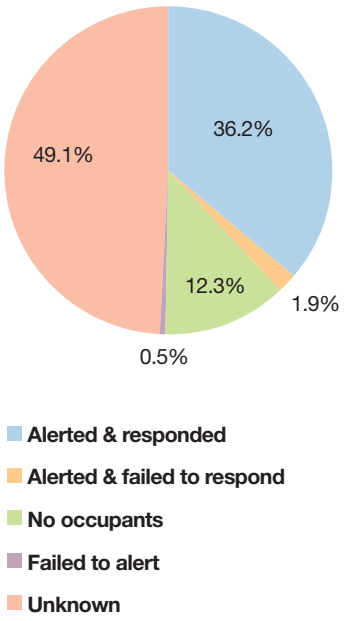


Figure 3: Response of Occupants to Audible Fire Alarms in Commercial Occupancies[4]

Fire Alarm Systems

Analyzing data from fire incidents that occurred from 2003-2006 in U.S. homes, Hall[2] determined fatal casualty rates in homes without operating smoke detectors to be 1.10 deaths per 100 reported fires compared to 0.52 deaths per 100 fire incidents with operating smoke detectors, a decrease of more than 50%. In a study by Milke, et al.,[3] the effectiveness of sprinklers and smoke detectors was assessed via an analysis of approximately 200,000 U.S. fire incidents that occurred from 2003 to 2007 in residential, commercial residential, and health-care facilities. The casualty rate (including both fatal and non-fatal casualties) was substantially less in residences with operating sprinklers (2.06 casualties per 100 fire incidents) than operating smoke detectors (3.17 casualties per 100 fire incidents).

An indication of the relative sensitivity of smoke detectors and sprinklers is provided in Figure 2. This indication is gleaned from the fires that were judged by the individual completing the fire incident form to be too small for the operation of sprinklers and smoke detectors. As indicated in the figure, with fewer fires judged to be "too small" for smoke detector operation than sprinklers, smoke detectors are characteristically more sensitive to early fire conditions than sprinklers.

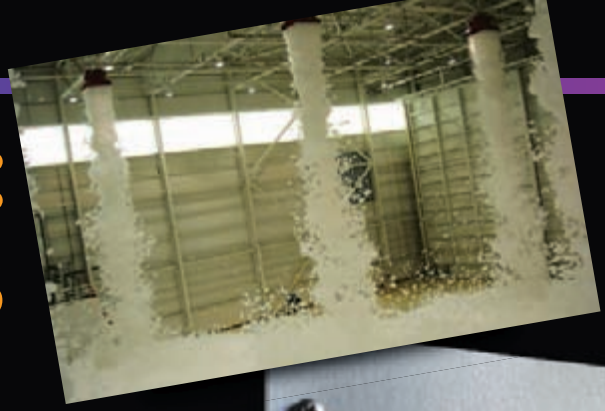
In a second study by Milke, et al.,[4] the response of individuals to the operation of smoke detectors in U.S. fire incidents in commercial occupancies is indicated in Figure 3. This study included 30,900 fire incidents that occurred from 2003-2010. As indicated in Figure 3, occupants responded in only 36% of the fire incidents where an audible alarm was produced as a result of an operating smoke detector. In the previous study by Milke et al.[3], involving residential occupancies, using the same categories as reflected in Figure 3, 83% of the occupants in residences responded to an audible alarm produced by an operating smoke alarm.

As indicated in Figure 3, occupants responded in only 36% of the fire incidents where an audible alarm was produced as a result of an operating smoke detector.

PASSIVE SYSTEMS

In a survey of experts in the 1980s as part of the Warrington Study in Australia, the reliability of fire-resistant-rated construction in commercial occupancies was estimated to be 70% (as compared to reliabilities of 95% for sprinklers and 75% for smoke detectors).[5] Rosenbaum conducted an analysis of data from U.S. fire incidents that occurred from 1989-1994 in commercial occupancies to compare the extent of thermal fire damage where different fire protection systems were installed. In his study, the extent of thermal damage was divided into three categories: fires that were limited

The Problem: False Alarms



The Solution: *The CTI™ System* from Protectowire

Protectowire's ***CTI System*** uses patented multi-criteria detection technology for the highest immunity to false alarms. CTI Linear Heat Detection Systems provide digital operation with short circuit fault identification and confirms the temperature at the alarm point to provide true Confirmed Temperature Initiation (CTI).

See the next great advance in heat detection at www.protectowire.com or contact your nearest Protectowire Distributor.

PROTECTOWIRE® FireSystems

The Protectowire Company, Inc.
60 Washington Street
Pembroke, MA 02359-1833 U.S.A.
781-826-3878; www.protectowire.com
An ISO 9001:2008 Registered Company

The CTI™ System . . .
New from
PROTECTOWIRE
the next great advance is here

See us at
SFPE Long Beach, CA
Tabletop #52.

Protection	Room	Floor	Structure
None	59%	4%	37%
Detection (D)	85%	4%	11%
Sprinklers (S)	89%	3%	8%
Fire-resistant-rated construction (FRRC)	77%	4%	19%
D+S	92%	2%	6%
D+FRRC	92%	3%	5%
S+FRRC	91%	3%	7%
All	95%	2%	3%

Fire death rate: civilian deaths/1000 fires

Table 3: Extent of Damage in U.S. Fire Incidents, 1989-1994[5]

to the room of fire origin, the floor of origin or multiple floors (i.e., the structure). The results of Rosenbaum's analysis are included in Table 3.

As indicated in Table 3, fires are limited to the room or floor of origin in 63% of all fire incidents where no protection is provided. In comparison, fires in buildings of fire-resistant-rated construction are limited to the room or floor of origin in 81% of all fire incidents, a difference of 18% over the baseline case consisting of buildings without any protection systems. In contrast, the proportion of fires limited to the room or floor of origin is 89% when only a detection system is installed and 92% when only a sprinkler system is installed.

Fire Doors

Photographs depicting the desired performance of a fire door are presented in Figure 4. These photographs were taken during the FEMA World Trade Center analysis during a tour of WTC 5. The office space adjacent to the door had a well-developed fire that consumed virtually all of the combustibles. As illustrated in the photographs, the inside of the stairwell is almost absent any effects of the severe fire that occurred on the other side of the door.

Reliability data for fire doors is available from four sources. FM Global examined 1,600 installations of fire doors.[6] Several types of fire doors were included in the survey, including rolling steel, horizontal sliding on inclined tracks, counter-weight closures or spring closures, vertical sliding and swinging doors.

On average, 82% operated properly, with rolling steel doors having the lowest reliability of 80% and vertical sliding doors having the greatest (93%). CIGNA Property and Casualty Loss Control staff evaluated the in-place performance of 805 fire doors. "41.1% of all doors had

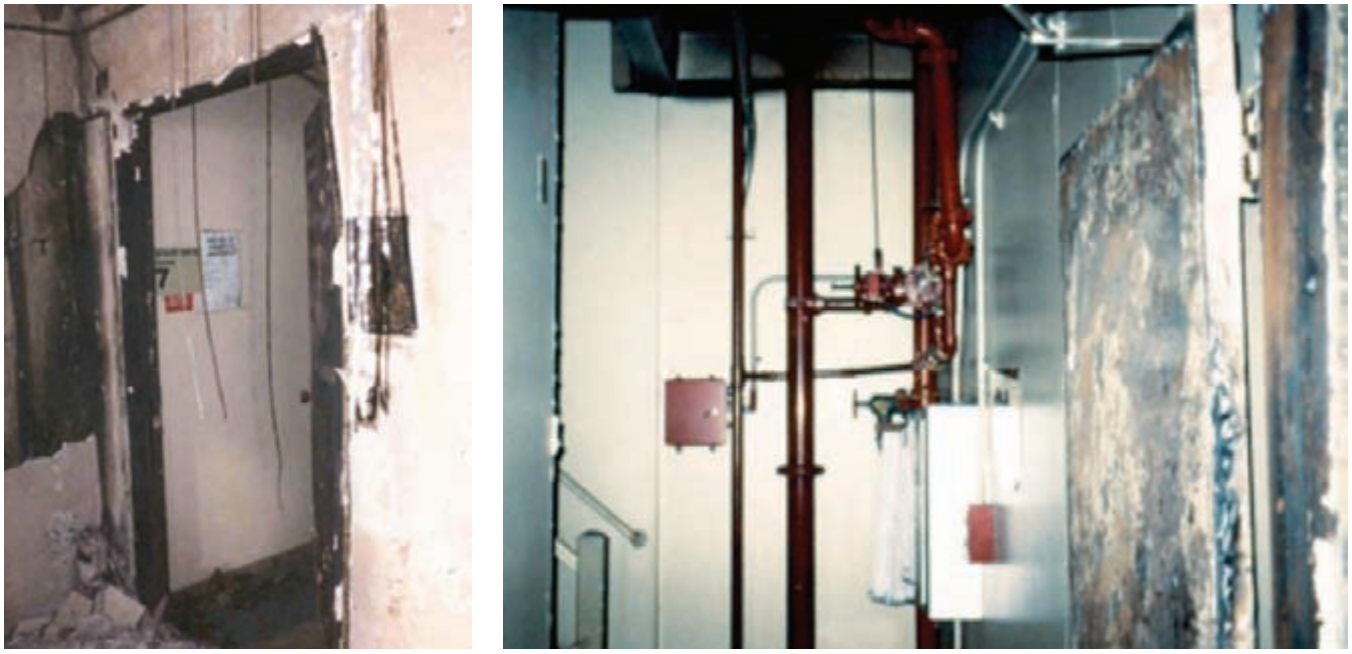


Figure 4: Fire Door Performance in WTC 5 during 9-11 (on left looking inside stairwell, on right viewed from inside stairwell)

VESDA® LASER QUANTUM

Very early warning smoke detection at point detector pricing

Out of box operation. Easy to maintain.

- Laser-based absolute smoke detection
- Four VEWFD (Class A) sample holes
- 100m2 (1000 ft2) coverage
- Up to 2 x 9m (30ft) branched pipes
- Out of box operation
- Pre-alarm, Alarm, & Fault Relays
- Pre-alarm, Fire, Fault, Filter, & Power LEDs
- Monitored on-board filter
- Auto learning alarm thresholds
- Event logging

VESDA VLQ—The quickest time to total protection.

www.xtralis.com/VESDA-VLQ.

xtralis®
The sooner you know®

some type of physical or mechanical problem that would prevent them from operating properly during a fire event".[7] This results in a modest reliability of 58.9%.

Dusing, Buchanan and Elms[8] surveyed 91,909 installed fire doors in several occupancies. Of those doors, 12,349 (13.4%) were propped open. The problem was at its worse in institutional occupancies (39% of the doors were propped open) and least in assembly occupancies (only 5% of the doors were propped open). Scarff reported that fire doors were blocked open or had kick-down stops in 50 of the 275 hotels surveyed (18%) from June 1992 to June 1993.[9]

Fire Dampers

The performance of a fire damper is depicted in Figure 5 in WTC 5. This damper is near the location of the stairway door included in Figure 4. In this photograph, the damper has closed with the steel HVAC duct having collapsed away from the wall.

Through Penetration Seals

In a survey of large loss fires in the early 1970s, it was found that in 38% of all large loss fires (based on direct property damage of at least $250K), horizontal fire spread was attributed to non-fire stopped areas including floors and concealed spaces above and below floors and ceilings.[10] This was prior to the development of ASTM E814[11] (the first edition was in 1981) and may have been part of the motivation for development of the standard test method for through penetration firestop systems. Spruce[12] estimated that in buildings that were at least five years old, 95% of the openings in fire-rated barriers were inadequately protected (i.e., a reliability of only 5%).

The quality of any data highly depends on the input inserted onto inspection or incident forms. Further, while data from the U.S. National Fire Incident Reporting System is publically available, those from other sources is rarely reported openly. The availability of limited data or lack of quality data constrains the ability of engineers to make informed decisions on design options. This constraint can be withdrawn, but requires a concerted effort starting with those entering the information from inspections and fire incidents.

Figure 5: Fire Damper Performance in WTC 5

James A. Milke is with the University of Maryland.

References:

1 Hall, J., "U.S. Experience With Sprinklers," National Fire Protection Association, Quincy MA, 2011.

2 Hall, J. "US Experience with Sprinklers and Other Automatic Fire Extinguishing Equipment," National Fire Protection Association, Quincy MA, 2009.

3 Milke, J., Campanella, A., Childers, C., and Wright, B, "Performance of Smoke Detectors and Sprinklers in Residential and Health-Care Occupancies," Department of Fire Protection Engineering, University of Maryland, College Park, MD, 2010.

4 Milke, J., Hanson, R., and Mizrack, D. "Comparison of the Life Safety Performance of Smoke Detectors and Sprinklers in Commercial, Industrial and Education Institution Housing," Department of Fire Protection Engineering, University of Maryland, College Park, MD, 2013.

5 Rosenbaum, E., "Evaluation of Fire Safety Design Alternatives," MS Thesis, Department of Fire Protection Engineering, University of Maryland, College Park, MD, 1996.

6 "Can You Count on Your Fire Doors?" *Record,* Factory Mutual Research Corporation, July/August, 1991: pp. 12-15.

7 "Fire Doors, Friend or Foe?" CIGNA Property and Casualty Companies, CP-9N70, 1970.

8 Dusing, J., Buchanan, A. and Elms, D. "Fire Spread Analysis of Multi-compartment Buildings," Research Report 79112, Department of Civil Engineering, University of Canterbury, New Zealand, 1979.

9 Scarff, S. "Field Performance of Fire Protection Systems," Balanced Design Concepts Workshop, Richard W. Bukowski, ed., NISTIR 5264, National Institute of Standards and Technology, Gaithersburg, MD, 1993.

10 *Fire Protection Handbook,* National Fire Protection Association, Quincy, MA, 1974.

11 ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems,* ASTM International, West Conshohocken, PA, 2013.

12 Spruce, C. "In Praise of Passive Fire Protection," *Fire Prevention,* London Fire Protection Association, 32, 1994, p. 275.

Nothing is more important than the protection of life and property. At Tyco SimplexGrinnell, we deliver integrated life-safety solutions that encompass fire alarm, sprinkler, suppression, security, emergency communications and more. All complemented by eServices—an integrated suite of technology and service capabilities. That's how Tyco SimplexGrinnell is advancing safety and security for property managers, building owners and industry professionals.

Learn how we can help make your world safer at www.TycoSimplexGrinnell.com.

Safer. Smarter. Tyco.™

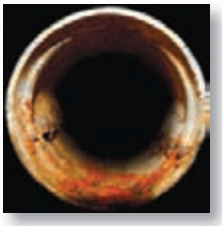
tyco SimplexGrinnell

CASE STUDY

POTTER ELECTRIC SIGNAL

POTTER ELECTRIC STUDIES EFFECTS OF USING NITROGEN GAS IN FIRE SUPPRESSION SYSTEMS

Internal corrosion of dry and pre-action fire suppression systems is a growing concern for the fire sprinkler industry. Corrosion in these systems causes failures resulting in property damage, production downtime, and increased maintenance costs. Additionally, corrosion impacts system hydraulics and reduces the efficiency of fire sprinkler system designs. Historically, dry and pre-action fire suppression systems have used compressed air as the supervisory gas to pressurize their piping. Compressed air, however, contains both oxygen and moisture causing the system piping to corrode. Nitrogen, acting as a supervisory gas in piping, is a well documented inhibitor of corrosion and has been implemented in industries such as gas and oil, pharmaceutical and the marine transit industry. Potter's Corrosion Solutions team performed a yearlong study analyzing the corrosion-inhibiting effects of 98% nitrogen gas when applied to both carbon steel and galvanized steel, in an environment simulating a dry pipe fire sprinkler system.



The conclusions are as follows:

1. The use of 98% nitrogen in lieu of compressed air as a supervisory gas reduces corrosion in both galvanized and black steel systems regardless of whether or not trapped water is present. The corrosion reduction potential ranges from 48% to 91% when compared to compressed air.
2. Using 98% nitrogen gas in lieu of compressed air increases the life expectancy of a dry or pre-action system on an average of 5.3 times.
3. The use of galvanized steel instead of black steel results in higher metal loss rates when compared in equivalent environments.
4. The use of 98% nitrogen gas in a relatively dry, black steel environment has the lowest corrosion rate overall.

For complete results, explanation of experimental procedures, and appendices, please visit *www.potternitrogen.com*.

POTTER
The Symbol of Protection

Potter Electric Signal Company
5757 Phantom Drive, Suite 125
St. Louis, MO 63042
www.potternitrogen.com

Invest in your career...

With an international standing that has attracted more than 4,000 members, 66 chapters and 13 student chapters around the world, SFPE advances the science and practice of fire protection engineering worldwide. Our strength and the future of the industry rely on the innovative thinking and active participation of professional fire protection engineers just like you. And, our members realize benefits they can't get anywhere else...

- ✔ Gain the credibility you need to advance your career.
- ✔ Build life-long alliances and share ideas and solutions with more than 4,000 industry peers and 66 chapters through SFPE's many networking opportunities throughout the year.
- ✔ Stay up to date on new developments and new opportunities through SFPE's monthly e-newsletter, web site postings, blog, and job board.
- ✔ Sharpen your expertise on technical topics through the quarterly peer reviewed *Fire Technology Journal*, *Fire Protection Engineering* Magazine, design guides, and other publications – as well as continuing education programs, symposia, and distance learning.
- ✔ Access smart opportunities and enjoy discounts on publications, educational events, and professional liability and group insurance programs
- ✔ Shape the future of fire protection engineering by contributing your time and expertise as a volunteer.

Join SFPE

MAIL to SFPE at 7315 Wisconsin Avenue, Suite 620E, Bethesda, MD 20814 or FAX to (301) 718-2242 or email Julie Gordon at jgordon@sfpe.org

SFPE Membership Application

❑ Yes! I would like to advance my career and help shape the future of fire protection engineering. Sign me up for a year of SFPE member benefits. I understand that the $215 annual membership fee entitles me to all of the benefits described above.

Method of Payment

❑ Enclosed is my check made payable to SFPE.

Please charge my ❑ American Express ❑ MasterCard ❑ Visa

Credit card number: _____ Expiration Date: _____

Signature: _____

Print Full Name: _____

Address: _____

City/Town: _____

State/Province: _____

Postal Code: _____

Country: _____

Referred by: _____

Company: _____

Phone Number: _____

E-mail: _____

Enjoy full benefits as an Affiliate Member just as soon as we receive your payment. Your welcome packet will include a detailed application for upgraded membership as an Associate or Professional Member, which is based on educational and practice accomplishments and entitles you to a certificate and special recognition.

visit www.sfpe.org

CASE STUDY

THE SOLBERG COMPANY

FIRE SPRINKLER PERFORMANCE UTILIZING SOLBERG® RE-HEALING™ FLOURINE-FREE FOAM

In today's industrial market sector, which utilizes firefighting foam, it has been stated repeatedly for several years that while fluorine-free foams may garner some level of market acceptance, this type of foam concentrate is not capable of achieving the same level of firefighting performance as their fluorinated counterparts.

SOLBERG® RE-HEALING™ RF3, a fluorosurfactant and fluoropolymer-free foam concentrate, has achieved an Underwriters Laboratories Listing as a 3% concentrate, as tested in accordance to UL 162 *Standard for Safety for Foam Equipment and Liquid Concentrates.*

UL 162 is the most difficult, stringent foam sprinkler test standard in the world, as the test protocol involves foam solution application from the test sprinkler for 5 minutes, followed by 5 minutes of water only discharge from the same sprinklers, as a test of the strength of the foam blanket. Any exposed fuel after the water application constitutes failure. After the water-only portion of the test and after a 10 minute foam drain period, the foam is tested for burn back resistance for a period of 5 minutes.

As the world's first fully fluorine-free foam concentrate, RE-HEALING RF3, 3% foam concentrate is UL Listed using standard sprinklers, at a minimum sprinkler pressure of 7.0 psi (0.5 Bar). The Listing Certification includes sprinklers with K-Factors of 5.6, 8.0, and 11.2 in upright and pendent styles. In addition to UL Certification, RE-HEALING RF3, 3% foam concentrate is also FM Approved, EN1568 Approved and ICAO Certified. For more information about Solberg and RE-HEALING foam, please contact us at *info@solbergfoam.com*.

UL162 Test Standard – 5 Minute Water Application

SOLBERG

The Solberg Company
1520 Brookfield Avenue
Green Bay, WI 54313
www.solbergfoam.com

The Features of a Fiberglass Storage Tank are Elemental.

Corrosion-Resistant 1 Cr					
Light-weight 3 Lw	Competitive Price 4 Cp			Water-tight 7 Wt	H-20 Load Rating 8 Lr
Double-Wall 9 Dw	Single-Wall 10 Sw	Design Flexibility 11 Fl	Low Maintenance 12 Lm	Above-ground 13 Ag	Under-ground 14 Ug

Xerxes Corporation fiberglass tanks, whether used in an underground or an aboveground application, are the ideal solution for storing water for fire protection. With a wide-range of tank models and capacities, and six manufacturing facilities, Xerxes has competitively priced storage tank options for *Fire Protection Engineering* readers' projects. Please visit our website to learn more about the many elemental features and benefits of a Xerxes tank.

952-887-1890
www.xerxes.com

XERXES®
a ZCL company

Leadership in Intelligent Building Solutions

Mircom Engineered Systems is the sales and service arm of the Mircom Group of Companies, with industry-leading support for Fire Protection Engineers.

As a solutions company, we are the ultimate partner. From design assistance, to the facilitation of conversations on international code and standard changes, we are eager to join forces with the Fire Protection Engineering community to collaborate on projects ranging from small buildings to the largest complexes.

After all – ***together, anything is possible!***

Mircom™
ENGINEERED SYSTEMS

905.660.4655
1.888.660.4655
mircomES.com

Contact us to learn how we can contribute to your team's next project!

Mircom™ Secutron™ MIRCOM™ GROUP OF COMPANIES

CASE STUDY

SONITECH NDT

INTERNAL PIPE OBSTRUCTION AND INTEGRITY EVALUATION: A NEW APPROACH

Even though pipe failure can be operationally crippling and potentially life threatening, there are no convenient or effective ways to accurately and comprehensively detect and map the severity of internal pipe integrity issues.

Soni Tech
Nondestructive Pipe Inspection

SoniTech NDT
PO Box 460366
Denver, CO 80246
www.SoniTechNDT.com

Mitigation techniques often seem ineffective, largely because of the blind shotgun approach to system repair. Steps taken are often misapplied due to insufficient knowledge, and therefore have less effective results. Imagine taking an aspirin as the cure for everything: headache, stomach flu, diabetes, cancer, etc. Sometimes it helps, but often not. Knowledge is the key. Unfortunately, today's most commonly used diagnostic methods are inefficient and ineffective, providing limited useful information.

Step into the 21st Century with SoniTech NDT's non-invasive Ultrasonic Localized Guided Wave (ULGW) inspection solution. Based on the longstanding principals of ultrasonic physics, ULGW is a proven technology to help make educated mitigation decisions by knowing the cause, location, and extent of corrosion issues – all with minimal to no risk to operations, facility assets, or service levels. The method is even recognized by the NFPA to satisfy the Internal Piping Condition and Obstruction Investigation requirement defined under chapter 14 of NFPA 25.

Very simply, a handheld scanner guides a harmless ultrasonic sound wave around the circumference of the pipe from the outside wall. Within seconds, conditions inside the pipe impact the sound wave, revealing internal pipe condition before leaks or other catastrophes occur.

Two technicians can quickly and accurately collect 100+ data points per day, which are then assessed and compiled into a detailed report. The ULGW report will map the location and severity of internal pipe integrity issues such as the effect of pitting, MIC, and other types of corrosion on the pipe wall, as well as the presence of unwanted air or water, giving you the knowledge necessary to make efficient and effective decisions.

WE KNOW FIRE PROTECTION

WE KNOW YOUR CUSTOMERS

WE KNOW HOW TO CREATE AND DELIVER CONTENT THAT PERFORMS

- BUILD BRAND AWARENESS
- ENGAGE POTENTIAL CUSTOMERS
- GENERATE QUALITY LEADS
- DRIVE TRAFFIC TO YOUR WEBSITE
- IMPROVE NATURAL SEARCH RANKINGS
- CREATE ENGAGING SOCIAL MEDIA CONTENT
- NURTURE LEADS TOWARDS A PURCHASE

Penton Marketing Services
WE KNOW YOUR CUSTOMERS
&
FIRE PROTECTION Engineering

PUSHING THE BOUNDARIES

10TH INTERNATIONAL CONFERENCE ON PERFORMANCE-BASED CODES AND FIRE SAFETY DESIGN METHODS

Join us this November for SFPE's 10th Annual International Conference

SHERATON MIRAGE RESORT
GOLD COAST, QUEENSLAND
AUSTRALIA

NOV 10-14 | 2014

Register online at www.sfpe.org before Friday, October 10, 2014 to receive discounted fee.

If you are interested in becoming an exhibitor or sponsor for this year's international conference, contact Melissa Franco at mfranco@sfpe.org.

SFPE
Engineering A Fire Safe World

ENGINEERS AUSTRALIA
SOCIETY OF FIRE SAFETY

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CASE STUDY

UNIFRAX

FYREWRAP® DPS INSULATION FOR DRYER DUCTS & PLENUMS

Unifrax FyreWrap® DPS Insulation is a high-temperature insulation blanket specifically designed, UL tested and certified to provide a single layer, one-hour-rated flexible enclosure around dryer exhaust ductwork and residential kitchen exhausts. It also provides code-compliant fire protection for combustible items, such as plastic pipes, by preventing flame propagation and smoke development in the plenum area.

FyreWrap DPS is a new and innovative product that provides a safe and cost effective means to achieve a 1-hour fire resistance-rated enclosure for routing dryer ductwork through fire resistance-rated wood truss/joist construction, as required by the International Building Code (IBC) for multi-unit wood structures, three stories or under having wall and floor/ceiling assemblies.

Unifrax FyreWrap Fire Protection Products offer solutions to a variety of passive fire protection applications when lightweight, thin materials are needed to prevent flame penetration and achieve a significant temperature drop. Materials are lightweight, easy to fabricate and capable of providing protection up to 2,300°F. The FyreWrap product family provides proven systems to meet international and local fire standards and code requirements in the commercial building, transportation and manufacturing industries.

For more information on FyreWrap DPS and our complete line of FyreWrap products, contact Unifrax at 716-768-6500 or *www.unifrax.com*.

Unifrax
600 Riverwalk Parkway, Suite 120
Tonawanda, NY 14150
www.unifrax.com

SFPE Job Board

SFPE AND *FIRE PROTECTION ENGINEERING* MAGAZINE ARE PLEASED TO OFFER AN ONLINE JOB BOARD FEATURING CAREER OPPORTUNITIES IN FIRE PROTECTION ENGINEERING.

jobs.sfpe.org is designed for communicating the availability of employment opportunities in the fire protection engineering market. This highly-targeted job board is ideal both for those seeking to fill positions and those looking for employment opportunities in fire protection engineering.

JOB CATEGORIES INCLUDE:

- CONSULTING
- GOVERNMENT
- INSURANCE
- RESEARCH & TESTING
- FIRE EQUIPMENT MANUFACTURING & INSTALLATION
- EDUCATION

The SFPE job board is promoted in each *Emerging Trends* newsletter, on the *magazine.sfpe.org* website, and through the SFPE LinkedIn group. Whether you're looking to make a career move, or you need to fill a fire protection engineer opening, *jobs.sfpe.org* is just a click away.

SFPE Corporate 100 partners receive a $100 discount off of each job post, and Corporate 100 job posts are featured at the top of the job listings. Please contact Carol Yachanin for your custom coupon code: carol.yachanin@penton.com.

INNOVATION MAKING A DIFFERENCE

Harrington Fire, your solution for high rise with smoke control and integrated voice

FireSpy HARRINGTON TRACKER

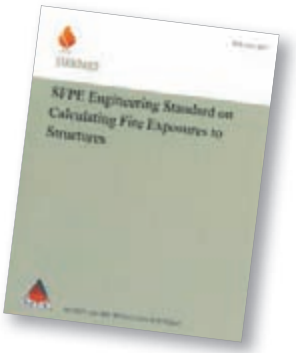
ASSEMBLED IN THE USA

Contact us at www.harringtonfire.com or 800-577-5758

IS YOUR BOOKSHELF UP-TO-DATE?

Visit www.sfpe.org/bookstore

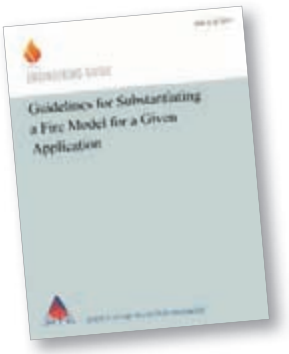
SFPE Engineering Standard on Calculating Fire Exposures to Structures



Performance-based design of structural fire resistance entails three steps: (1) determination of the fire exposure to the structure, (2) calculation of the thermal response of the structure to the fire exposure, and (3) production of the structural response. This standard provides methods for the first of these steps. It also addresses fully developed fire exposures, which include fully developed fires within an enclosure and localized fires that are not affected by an enclosure. Fires within an enclosure are considered to be spatially uniform, while local fire exposures are not. Topics covered in this standard include determining whether a fire exposure should be considered as a local fire or an enclosure fire, prediction of fire exposures within an enclosure, prediction of heat fluxes from local fires, and documentation of the analysis. An extensive commentary provides background and guidance for the requirements in the standard.

SFPE Member Price: $58 plus P&H
Non-Member Price: $161 plus P&H

Engineering Guide to Substantiating a Fire Model for a Given Application



The Engineering Guide to Substantiating a Fire Model for a Given Application provides a framework for determining and documenting the suitability of a fire model for use in a specific application. The framework in the guide is applicable to all types of fire models, ranging from algebraic calculations to zone or lumped parameter models to CFD or field models.

The guide addresses:

- Definition of the problem that is intended to be solved using modeling
- Selection of a candidate model
- Model verification and validation
- Uncertainty analysis

SFPE Member Price: $58 plus P&H
Non-Member Price: $161 plus P&H

SFPE Reference/Answer Manual for the P.E. Exam in FPE, 4th Edition

The new 4th Edition of SFPE's Principles and Practice of Engineering (PE) Examination in Fire Protection Engineering covers all of the technical subjects on the National Council of Examiners for Engineering and Surveying exam specification. The Reference Manual includes sample exercises on concepts that may be encountered in the PE exam. Also included are objectively scored timed sample problems that are equivalent to PE exam problems in length and difficulty. The answers to all of these exercises and problems are published in a companion answer manual.

SFPE Member Price: $204 plus P&H
Non-Member Price: $507 plus P&H

$ OORI VKHVH) 5 ((RQ GHP DQG
) LUH 3 URWFWRQ (QJ LQHHULQJ
KRVWVG Z HELQDUV DUH DYDLODEOH RQ GD\

) LUH DQG 1 XLVDQFH 3 HUUR DQFH RI %HDP ' HWFWRUV ±
$ 6 WXG\ &RQGXFWHG E\ (XJ KHV $ VVRFLDWHV

1) 3$ 6 WDQGDUG RQ $ HURVRO) LUH ([WQJ XLVKLQJ 6 \ VWHP V

9 LGHR) OPP HDQG 6 P RNH ' HWFWRQ %HQH¿ W DQG $ SSOFDWRQV

7 KH 5 RO RI 3 URGXFW 7HVWQJ &HUW¿ FDWRQ LQ) LUH 3 URWFWRQ

(YHU GD\ 8 VHDQG ([WDRUGLQDU 3 URWFWRQ²
8 VLQJ 7HFKQRORJ\ WR 0 D[LP L] H) LUH 6 \ VWHP) OH[LELOLW DQG 3 URWFWRQ

9 ,6 ,7

KWWS P DJ D] LQH VH RUJ Z HELQDU

RESOURCES

UPCOMING EVENTS

November 4, 2014
Certified Fire Protection Specialist (CFPS)
Presented in partnership with XL Gap Asset Protection Services, LLC
Online Course
Info: www.sfpe.org

November 10–14, 2014
10th International Conference on Performance-Based Codes and Fire Safety Design Methods
Gold Coast, QLD, AUS
Info: www.sfpe.org

November 20, 2014
Seminar on "Fire Protection with Water Mist"
Lund University
Lund, Sweden
Info: www.iwma.net

June 16–18, 2015
2nd European Symposium on Fire Safety Science
Nicosia, Cyprus
Info: safety@euc.ac.cy

June 22–25, 2015
NFPA Conference & Expo
Chicago, IL, USA
Info: www.nfpa.org

September 28–30, 2015
6th International Symposium Human Behaviour in Fire 2015
Cambridge, UK
Info: www.intersciencecomms.co.uk

November 8–13, 2015
SFPE Annual Meeting – Professional Development Conference & Exhibition
Philadelphia, PA, USA
Info: www.sfpe.org

BRAINTEASER [Problem / Solution]

Problem

A merchant can place 8 large boxes or 10 small boxes into a carton for shipping. In one shipment, the merchant sent a total of 104 boxes. If there are more large boxes than small boxes, and at least one carton of small boxes, how many cartons did the merchant ship?

Solution to Last Issue's Brainteaser

x is an integer, and $9 < x^2 < 99$. What is the largest possible value of x minus the smallest possible value of x?

18. The largest possible value of x is 9, and the smallest possible value of x is -9.

New Publications

2014 SFPE Compensation Survey

Do you want to know how your pay stacks up against that of your peers? The 2014 SFPE Fire Protection Engineering Compensation Survey is now available at the SFPE Online Store. Nine hundred engineers, from 35 countries, completed this survey, a 20% increase in participation over 2012. For the first time, participants were asked about their plans for retirement. This data can be used to gauge the expected job turnover due to retirements in the profession.

- **FREE to all SFPE members** *($49 for non-members).*
- **GET YOUR COPY** at the SFPE Bookstore by clicking **Shop SFPE** at **netforum.avectra.com/eWeb**.

SFPE To Launch Fire Safety Engineering Europe

SFPE to launch a new digital edition for European fire safety professionals, Fire Safety Engineering Europe, which will feature timely and relevant content regarding the practice of fire safety, methods and principles, technology developments, regional and international code updates, events and other topics of specific interest to this region. This publication is distributed to fire safety and other professionals involved in design and specification, product selection, approvals, ownership and purchasing, and shared via social media. Expert content is provided by fire safety engineers from the region, and will include news and educational and events listings for Europe.

- **FREE to all SFPE members**

SFPE

Engineering A Fire Safe World

SFPE ▲ 7315 WISCONSIN AVENUE, SUITE 620E ▲ BETHESDA, MD 20814 ▲ (301) 718-2910 ▲ FAX (301) 718-2242

LED Series Ceiling Notification Appliances

Eaton's Cooper Notification business has expanded its Wheelock Exceder LED Series to include ceiling models for horns, horn strobes, strobes, speakers, and speaker strobes. The Wheelock Exceder Series uses high-efficiency light emitting diodes (LEDs) as the strobe light source to help reduce costs in fire alarm and emergency communication systems. Available in small footprints with a frequency response range spanning 300 to 8,000 Hertz.

www.coopernotification.com
– Eaton

Rupture Discs with Inconel® 625

Fike has expanded its Atlas rupture disc product line to include Inconel 625 material of construction. The material will now be offered in sizes 1" (DN25), 1.5" (DN40), 2" (DN50), 3" (DN80), and 4" (DN100). Inconel 625 paired with Fike's G2 technology creates a rupture disc with outstanding corrosion resistance at a wide range of temperatures. Burst pressures range from 60-1500 psig.

www.fike.com
– Fike Corp.

Pipe Concealment

JG Innovations has added the ALumA-Fit™ Concealment System to its line of enclosure systems. The system is made from .030 aluminum and was designed to cover one or multiple exposed mechanicals. A non-obtrusive pipe enclosure, it is independent from any pipe or mechanical layout, and may be fabricated to the dimensions required right on the jobsite.

www.jgius.com
– JG Innovations, Inc.

Fire & Suppression System

Mircom's new FX-3500 Intelligent Fire Alarm & Suppression System includes intelligent fire alarm control units, which support Advanced Protocol (AP) as well as Classic Loop Interface Protocol (CLIP) devices. The FX-3500 control units are UL 864 Rev 9 and ULC S527-2011-Listed for fire control and releasing service. The series is recommended for both new and retrofit special-hazard, critical-infrastructure suppression, and special agent applications.

www.mircom.com
– The Mircom Group

Recessed Flush Dry Sprinkler

The Model VK482 "recessed flush" dry sprinkler has a 5.6 (81) K factor, and is cULus-Listed for both light and ordinary hazard occupancies. Its fusible element can be recessed up to .5-inch above the ceiling. Available in 165°F and 205°F temperature ratings. The VK482 provides an aesthetically pleasing alternative to a concealed dry sprinkler for protecting unheated areas in structures such as nursing homes, restaurants, schools, and freezers.

www.vikinggroupinc.com
– Viking Corp.

Intelligent Voice Communication

Siemens Intelligent Voice Communication systems deliver to small and mid-sized buildings technology once reserved only for high-end facilities. Available on both the Desigo® Fire Safety and Cerberus® PRO portfolios, these flexible, networkable fire panels leverage VoIP technology to deliver multiple unique messages simultaneously via high-quality digital voice. Customized messages reach specific areas at the same time.

www.usa.siemens.com
– Siemens

ENGINEERING GUIDE: FIRE SAFETY FOR VERY TALL BUILDINGS

This new guide, co-published by the International Code Council (ICC) and SFPE, identifies critical fire safety challenges unique to very tall buildings. *Engineering Guide: Fire Safety for Very Tall Buildings* examines how these special challenges can be addressed worldwide through an integrated performance-based design.

This engineering guide was written in response to an increase in the global design and construction of very tall buildings. Building codes in some countries may not contemplate all aspects of fire safety in very tall buildings—some of which approach a half mile, or 800 meters, in elevation. Buildings that are hundreds of meters tall pose challenges far different from those in average-sized tall buildings.

The guide emphasizes the importance of taking an integrated approach to the design of fire safety in tall buildings based on expected fire performance. This integrated approach looks beyond compliance with codes and standards, and considers how the height of the structure impacts fire safety and how various fire safety systems complement each other to achieve fire safety goals. These systems include smoke control, fire suppression, building evacuation, structural fire resistance and fire fighter access.

The *Engineering Guide: Fire Safety for Very Tall Buildings* recommends performing a fire risk analysis to determine how best to address the fire safety challenges unique to a specific building. Although fire hazards in very tall buildings are similar to those in shorter buildings, the consequences of a fire can be more severe given the large numbers of occupants, the inherent limitations in egress, and the sheer height of the structure. The risk analysis will identify which hazards should be addressed by the design, where the hazards may include accidental fires, fires following earthquakes, or terrorist threats.

Engineering Guide: Fire Safety for Very Tall Buildings is available for purchase in hardcopy

$49.95 for SFPE Members ($59.95 for non-members)

Engineering Guide: Fire Safety for Very Tall Buildings
MAIL to SFPE at 7315 Wisconsin Ave., Suite 620E, Bethesda, MD 20814 or FAX to 301-718-2242

- ❑ I am an SFPE member
  membership number _____
- ❑ I am not an SFPE member
- ❑ I am not an SFPE member, but would be interested in more information about the SFPE

Method of Payment

❑ Enclosed is my check made payable to SFPE

Please charge my ❑ American Express ❑ MasterCard ❑ VISA

Credit card number: _____ Expiration date: _____

Signature: _____

Print Full Name: _____

Address: _____

City/Town: _____

State/Province: _____ Postal Code: _____

Country: _____

Company: _____

Phone Number: _____ Email: _____

Sales Offices

HEADQUARTERS
Fire Protection Engineering
1300 East 9th Street
Cleveland, OH 44114-1503
216.931.9934
fax 913.514.6863

NEW JERSEY/ NEW YORK/ PENNSYLVANIA/ MARYLAND/DELAWARE
Bill Boyadjis
District Manager
P.O. Box 762
Morris Plains, NJ 07950
973.829.0648
fax 913.514.6380
bill.boyadjis@penton.com

REMAINING U.S./GLOBAL
Joe Dahlheimer
District Manager
745 Damon Drive
Medina, OH 44256
330.289.0269
fax 913.514.6481
joe.dahlheimer@penton.com

INSIDE SALES
Dave Kenney
1300 East 9th Street
Cleveland, OH 44114
216.931.9725
fax 913.514.6663
david.kenney@penton.com

GROUP PUBLISHER
Dan Ashenden
330 North Wabash Ave.
Chicago, IL 60611
312.840.8402
dan.ashenden@penton.com

FIRE PROTECTION Engineering

Index of Advertisers

SFPE Corporate 100 Partner Program

Corporate 100 members in red

FIRE PROTECTION Engineering

Fire Protection Engineering (ISSN 1524-900X) is published quarterly by the Society of Fire Protection Engineers (SFPE). The mission of *Fire Protection Engineering* is to advance the practice of fire protection engineering and to raise its visibility by providing information to fire protection engineers and allied professionals. The opinions and positions stated are the authors' and do not necessarily reflect those of SFPE.

Editorial Advisory Board

Carl F. Baldassarra, P.E., FSFPE

Don Bathurst, FSFPE

Luca Fiorentini
Tecsa

Russell P. Fleming, P.E., FSFPE
National Fire Sprinkler Association

Gavin Horn, Ph.D.
Illinois Fire Service Institute

Morgan J. Hurley, P.E., FSFPE
Society of Fire Protection Engineers

William E. Koffel, P.E., FSFPE
Koffel Associates

R. Thomas Long, Jr., P.E.
Exponent

Kurt Ruchala, P.E., FSFP,
Firepro

Warren G. Stocker, Jr., FSFPE
Safeway, Inc.

Personnel

Technical Editor
Morgan J. Hurley, P.E., FSFPE

Program Manager
Carol Yachanin, Penton Marketing Services

Art Director
Amy Black, Penton Marketing Services

Production Manager
Fran Vaughn, Penton Marketing Services

SFPE

Penton Marketing Services
WE KNOW YOUR CUSTOMERS

EXPERTLY ENGINEERING SAFETY FROM FIRE

KOFFEL ASSOCIATES
Fire Protection ENGINEERS®

We are your direct line to an expert.

$: $5' 6

□□□□□' HMJQ%XLOGO HUWV
$ZDUGTRUH HDOKFDUHTURP □
' HMJQ%XLOGQVWXMTRI □
$P HUFDTRUWKH DOMU□
5HHG1DWRQDO LOMV □
0HGLFDO&HQWU HMJQ□
%XLOG3URWFWW&DUN&RQ□
VWXFWRQDQG%DOORXU□
%HDWWDMP

7RNHQTURP 86$&(TRUWKH□
) W%HQQLQJ0DWQ$UP\ □
&RPPXQLW RVSLWDO□
5HSDFHP HQW3URWFWW□
7XQHU&RQVWXFWRQWDMP □

OUR SERVICES

CONSULTING
code consulting engineering analysis surveys

DESIGN & CONSTRUCTION ADMINISTRATION
systems design construction administration support

CODES & STANDARDS DEVELOPMENT
participation on code committees client advocacy

SEMINAR DEVELOPMENT & TRAINING
md/dc metro-area training national & worldwide training

PRODUCT TESTING & EVALUATION / REPRESENTATION
risk analysis product development support representation

LITIGATION SUPPORT
expert witness testimony case support research

Offices: Maryland / Massachusetts / Connecticut

410-750-2246 **www.koffel.com**




The True Clean Agent Suppressant — Nitrogen

CAFex By CHEMETRON Fire Systems™

CAFex™ Nitrogen clean agent systems are a great choice when protection requirements include high value assets, occupied spaces and zero tolerance for collateral damage that might result from other suppression solutions. Pure N_2 has no synthetic chemicals, agent blends or environmental concerns. No global warming or ozone depleting impact makes CAFex nitrogen the choice of users with the highest environmental standards. CAFex Nitrogen systems are…

- Safe for the environment
- Safe for people
- Won't damage property
- Economical to install
- Easy to service as replacement gas is readily available
- Backed by the Chemetron brand and a worldwide network of highly qualified distribution partners.
- Nitrogen is the only people safe, completely natural fire suppressant gas available.

www.chemetron.com

Predict. Prevent. Protect.

Chemetron and CAFex are trademarks of Kidde-Fenwal, Inc.