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Engineering
FALL 2007
Issue No. 36

Energy and New Fire Protection Challenges

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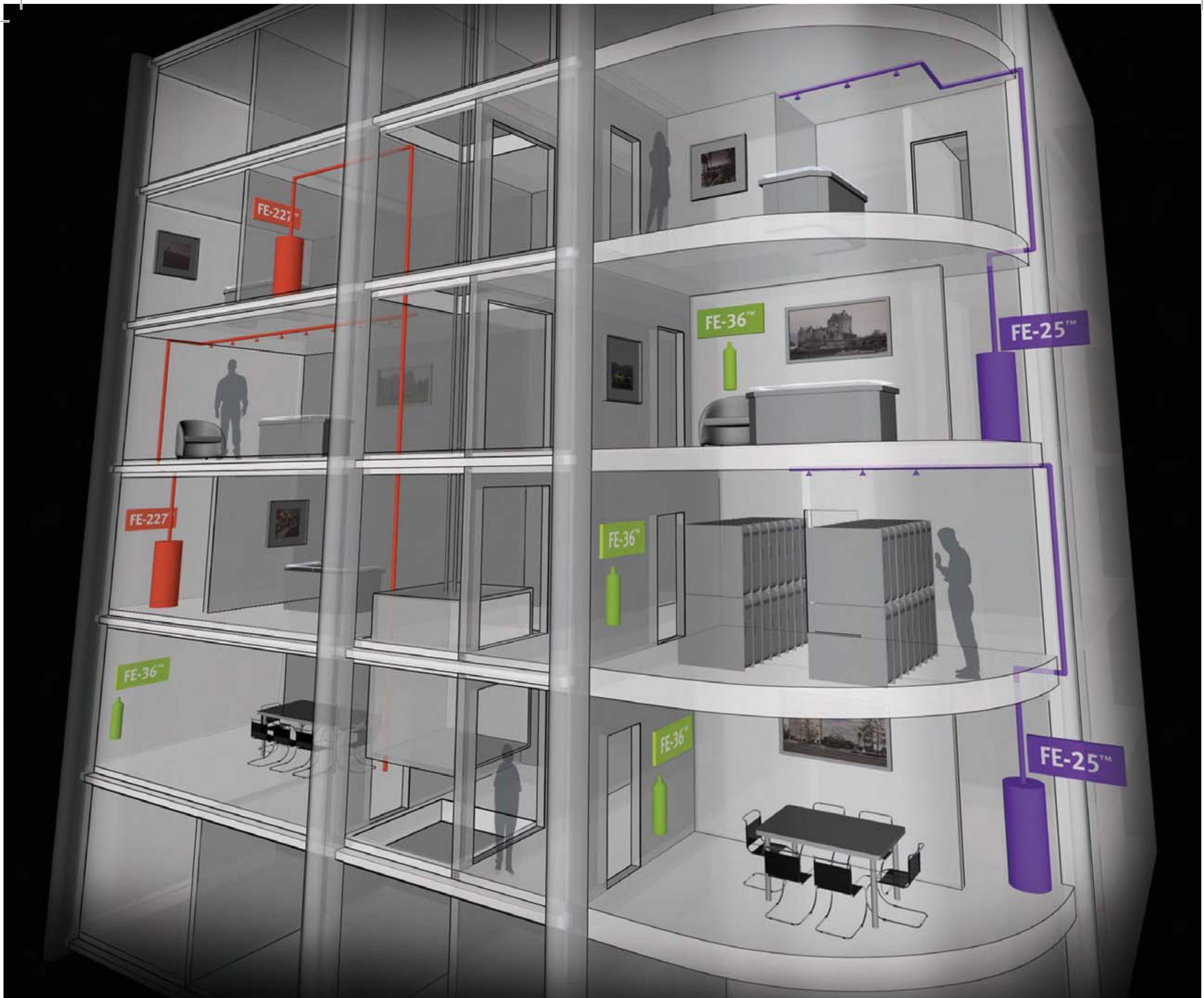
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From the TECHNICAL DIRECTOR

Obtaining U.S. Professional Licensure by non-U.S. Residents

Occasionally, engineers who are not residents of the United States wish to obtain licensure as a professional engineer in the United States. They may wish to become licensed in the United States because there are no similar credentials in their home country or because they wish to offer engineering services in the United States. Licensure as a professional engineer is required to offer engineering services directly to the public in the United States.

Unlike many countries, there is not a single license to practice in the United States. Professional licensure is regulated on a state-by-state basis, so an engineer must become licensed in each state or territory in which he or she wishes to practice. If the reason that the non-U.S. resident desires to obtain a P.E. license is because there is no similar credential in his or her country and he or she only wishes to demonstrate engineering competence, then the engineer can simply become licensed in any U.S. state or territory.

If engineers wish to offer engineering services in the United States, then they must become licensed in every state or territory in which they wish to practice. Once an engineer becomes licensed in one state or territory, it is typically relatively easy to become licensed in other states or territories since it is not necessary to retake any of the required exams.

Whatever the reason that an engineer wishes to become licensed in the United States, the licensure process is similar in most states and territories. Because each U.S. state and territory is autonomous, small differences do exist. However, requirements typically entail four parts: (1) graduation from a college or university that is accredited by the Accreditation Board for Engineering and Technology, (2) successful completion of the fundamentals of engineering examination, (3) experience as an engineer and (4) successful completion of a principles and practices of engineering examination. In some cases, engineers with a doctorate degree would be exempted from having to successfully complete the fundamentals of engineering examination.

The Accreditation Board for Engineering and Technology accredits colleges and universities in the United States. Those with a degree from a college or university that is located outside the United States may have to have their education transcripts evaluated by the Center for Professional Engineering Education Services to determine if the applicant's education is sufficient for licensure.

The preceding is required of both U.S. residents and non-residents. For some non-U.S. resident engineers, one of the challenges may be coming to a U.S. state or territory to take the required examination(s). However, it may be possible to take these exams outside of the United States.

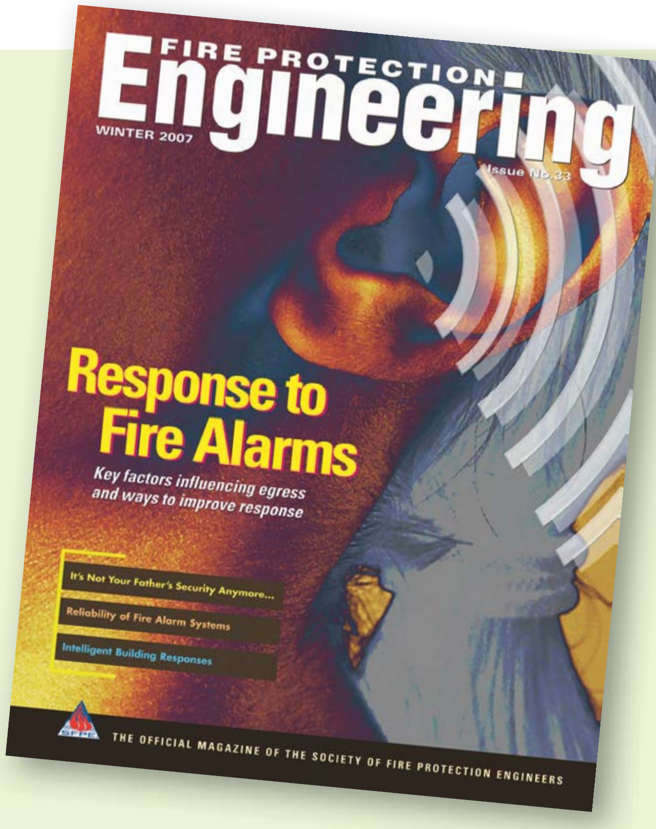
Up until 2005, the state of Oregon offered licensure examinations in Japan. Many states offer the exams at many sites, and Japan was considered one of Oregon's "sites." However, beginning in 2006, the National Council of Examiners for Engineering and Surveying, the association of licensing boards in the United States, began offering licensure exams in Japan. The exams in Japan may only be taken by Japanese residents, so this solution is of little help to residents of other countries.

The National Council of Examiners for Engineering and Surveying has a process in place for bringing licensure examinations to other countries; however, at this time, Japan is the only country other than the United States where licensure exams may be taken.

The Society of Fire Protection Engineers works closely with the National Council of Examiners for Engineering and Surveying (NCEES). Since only licensing boards have a vote within NCEES, SFPE has limited influence on matters such as international practice. Several SFPE members who reside outside of the United States have expressed interest in obtaining U.S. professional engineering licenses. While SFPE may not be able to strongly influence NCEES policies, SFPE can make sure that NCEES is aware of the concerns of non-U.S.-based members, and that members who reside outside of the United States understand what is necessary to become licensed in the United States. This article is part of those efforts.

Morgan J. Hurley, P.E.
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., #620E, Bethesda, MD 20814.



Dear Editor,

I am writing in my capacity as the President of the New Zealand Chapter of the Society of Fire Protection Engineers with respect to the letter from Mr. Simon Davis, representing the New Zealand Fire Service, that was published in the Winter 2007 edition of the *Fire Protection Engineering* magazine.

The engineering profession in New Zealand recognises that fire engineering is a new discipline, which does not yet have the experience, wisdom and research that many other engineering disciplines enjoy.

The Institution of Professional Engineers New Zealand (IPENZ) commissioned a task force to examine the role of fire engineers and the place of fire engineering in the design and construction of buildings.

The task force was set up because of concern that "fire engineering" was being practised by persons who were not adequately qualified or experienced to do so, and that this had resulted in the perceived standards of the profession being compromised.

Martin Feeney and I represented SFPE (NZ Chapter) on the task force. The final report from the task force is due to be released shortly, and it is proposed to present the report to interested parties at seminars in the major centres. The taskforce and IPENZ are confident that the report will have a positive influence in:

a) helping the industry understand fire engineering,

b) defining the different areas of expertise; and

c) providing a clearer understanding of the qualifications required by a fire engineer to practise fire engineering within the construction industry.

Simon is a member of the task force, so he is fully aware of the findings of the task force, hence it is surprising and unfortunate that he penned the letter.

I trust this letter provides you with a better understanding of the professionalism of New Zealand fire engineers and their commitment to providing engineering excellence. There is always room for improvement, and in this regard, we will continue to strive and provide assistance.

Yours sincerely,
Richard Brand
President, SFPE NZ Chapter

The engineering profession in New Zealand recognises that fire engineering is a new discipline, which does not yet have the experience, wisdom and research that many other engineering disciplines enjoy.

The impact on fire protection practices from building energy efficiency changes

By John H. Suzukida, P.E.

What does building energy efficiency have to do with fire protection? This article will focus on those trends in new or updated buildings to identify their potential impact on fire protection practices.

Energy-related trends include:

- Electricity will likely be the primary source of energy use in buildings for heating and cooling because there will be less fossil fuel (natural gas/propane or oil) burning on site. A possible exception could be the use of hydrogen or fuel cells.
- Windows that open will be used more often.
- Increased "zoning" and turning off heating/ventilation/air conditioning (HVAC) will be used in areas which are not being used.
- There will be better air filtration and indoor air quality.
- The term "zero energy" is likely to spread as each building will be challenged with generating and/or recovering more of its own energy.
- Solar, wind, skylights, window shading or "smart windows" which control the amount of sun and heat admitted will be used more frequently.
- Large, central, district heating and cooling may be more widely used in densely populated areas with distributed hot water or steam and chilled water.
- Use of on-site recovered and stored "gray waters" or other choices such as sea water, may be more common as fresh water becomes scarcer.

One indicator of the future in buildings is to look outside the United States since, generally, energy has cost more for a longer period of time in other countries. That higher cost has driven behavior and design due to its impact on the bottom line. For example, gasoline costs in Europe and Asia were historically three to four times higher than in the United States, so it's no wonder cars in those countries tend to be smaller. Similarly, high energy costs influenced building architecture to include things such as opening windows or shading to reflect sunlight. Building occupants outside the United States are more likely to be accustomed to warmer temperatures in summer and cooler ones in winter—by several degrees.

Not surprisingly, HVAC systems evolved differently in the United States than in most other countries. Throughout Asia and Europe, many large commercial buildings use zoned systems which do not depend on ducts to distribute heating and cooling air. Instead, smaller systems that can be turned on and off are used only when the space is occupied. That is quite a cultural shift from the United States, where every room is expected to be comfortable at all times, in homes and anywhere else. Those expectations have led to the development of large central systems instead of the smaller zoned systems.

More tightly regulated emission of greenhouse gases are likely to reduce burning natural gas or oil at each building for HVAC purposes. That could result in:

1. District heating and cooling growth. This is a system where hot water or steam for heating and chilled water for cooling are generated in one location and piped to numerous buildings, eliminating the need for HVAC systems in each building. District systems are used most often where the buildings are located close together.
2. Electricity becoming the default form of energy use in buildings. It may be obtained from a combination of sources, depending on conditions which vary through the day or time of year, such as solar or wind. Solar could be in the form of collectors which heat water or photovoltaic cells that convert sunlight into electricity and may be incorporated into roofing materials or other cladding, even glass. Electricity may be generated in the form of small on-site windmills. Storage of electricity is a large technological challenge (e.g., battery limitations in electric cars); instead, it's likely that any electricity generated on site will be augmented by power from the existing electrical grid. In the event excess electricity is generated on site, it can be sold back to the utility for a credit.

The term "zero energy" refers to a building with a net zero use of energy; sometimes it uses energy generated elsewhere, sometimes it generates excessive energy that is sold back to the electric utility – but on the whole it does not use more energy than is generated.

In the future, access to clean water may be equally as challenging as energy efficiency. In Hong Kong, it is very common to have the toilets supplied with sea water instead of fresh water. The blue-green color is an immediate indicator that something is different!

Collecting rainwater or using gray water for other uses in the building are possibilities which could result in on-site water storage, with positive fire protection implications. Other possible effects may be more buildings using opening windows.

As buildings become more energy-efficient, it's likely that some of the concepts above will be used, and their impact on fire protection will need to be evaluated and incorporated into future practices.

John H. Suzukida, P.E., is with Lanex Consulting, LLC.

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FLASHPOINTS > Fire Protection Industry News

NFPA Report Finds More Fires But Fewer Deaths in the U.S. in 2006

Fire departments in the United States responded to an estimated 1.6 million fires during 2006. These fires caused 3,245 civilian deaths and 16,400 injuries, according to a National Fire Protection Association (NFPA) report released on September 10, 2007. The number of fires increased slightly by about 3% from 2005 to 2006, while fire deaths fell 12% and fire injuries were down by 8%.

The total number of people that died from fires in 2006 (excluding firefighters) was the lowest since NFPA began collecting this data in 1977 and 4% lower than the previous low of 3,380 in 2002. The number of fire deaths varies from year to year, with most of the variation in fire deaths occurring in communities with populations under 10,000.

NFPA's study, *Fire Loss in the United States During 2006*, offers a detailed account of fire loss for the previous year and an analysis over time based on new information.

For more information, go to www.nfpa.org.

Home Fire Sprinkler Coalition Develops Public Education Kit and Children's Education Program

As part of its ongoing efforts to provide materials and tools to educate the public on the benefits of residential fire sprinklers, the Home Fire Sprinkler Coalition (HFSC) recently released a new Public Education Kit – available free to fire service and public educators nationwide – and an interactive, educational Web site (www.SprinklerSmarts.org).

The Public Education Kit contains all of HFSC's educational and presentation material, including:

- A CD containing customizable presentations;
- Public relations tools and program materials;
- A DVD that features videos for consumers (*Protect What You Value Most*), builders (*Built for Life*) and people living in homes protected with sprinklers (*Living with Sprinklers*); and
- New educational brochures for real estate and insurance professionals.

Children are the main audience for the Sprinkler Smarts animated Web site, which features fun characters and interactive games. Fire safety officials can use worksheets offered on the Web site as well as other downloadable material in collaboration with the presentations and games. These materials help children understand fire safety and prevention as well as identify fire sprinklers and their benefits through an entertaining form of education.

For more information, go to www.HomeFireSprinkler.org.

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FIRE PROTECTION ENGINEERING ENERGY AND NEW FIRE PROTECTION CHALLENGES

By Carl F. Baldassarra, P.E., FSFPE

This article is a "roundtable" discussion of energy-related fire protection engineering challenges and solutions. The focus is on emerging alternative energy sources and new technical challenges facing fire protection engineers, regulatory authorities, owners and consumers. The virtual roundtable is a result of interviews of various experts representing a cross-section of industry practitioners and regulators in the field and a compilation of their responses.

The panel includes:

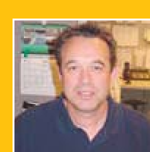
Carl F. Baldassarra, P.E., FSFPE, *President*, Schirmer Engineering Corporation

Lynne Kilpatrick, Seattle Fire Department

John Alderman, P.E., *Managing Director*, Risk, Reliability and Safety Engineering

Thomas P. Mueller, *Vice President*, Hayden and Company

Robert P. Benedetti, *Principal Flammable Liquids Engineer*, National Fire Protection Association



Carl Rivkin, *Principal Chemical Engineer*, National Fire Protection Association

QUESTIONS

Have the recent increases in the cost of petroleum products led to additional investment in protection of these assets, e.g. additional interest in process safety, protection systems, etc.?

Alderman:
There has not been a direct correlation for either increasing or decreasing levels of protection for existing facilities. However, for the last couple of years and into the foreseeable future, both process safety management and fire protection will increase because of new projects and the expansion of refineries and chemical facilities.

Benedetti:
The petrochemical industry has always paid close attention to health and safety issues, environmental protection, fire protection and loss prevention. Admittedly, accidents do occur. Recent additional investments in the petrochemical sector in safety and loss-prevention programs are probably responses to impending or proposed rules under the aegis of the U.S. Department of Homeland Security (DHS) and to the occurrence of unfortunate accidents, such as the BP–Texas City incident. I think the petrochemical industry, by and large, takes the risks that are inherent in high-hazard operations seriously and has done a good job implementing prevention and protection programs.

Kilpatrick:
Over the last few years, some local bulk petroleum facilities have made minor improvements in their fire protection systems and associated product pipeline systems. It's difficult to know, though, whether the improvements were made in response to increases in the cost of petroleum products or for some other reason.

Mueller:
I think that, in part because of the tremendous demand for energy and specifically petroleum products, there has indeed been an increased emphasis and investment by producers for fire protection equipment, systems and process controls to minimize fires, and economic inventory and production losses.

What kinds of additional safety analyses or protection systems are being installed at processing and storage facilities?

Alderman:
We are seeing more companies conduct either fire hazard assessments or full risk assessments to determine the need for protection systems. More companies recognize the benefit of prevention versus protection, hence, more systems are being installed to prevent or minimize releases of hazardous material.

Benedetti:
The focus appears to be on security and vulnerability assessment of existing and planned facilities, in response to DHS rulemaking.

Kilpatrick:
Improvements have been made to existing foam fire protection systems protecting bulk tanks, and piping systems that serve storage facilities have been upgraded.

Mueller:
The critical manufacturing processes include systems monitoring pressure and temperature to integrated process control systems that allow operators to observe significant changes and avoid equipment failure or atmospheric releases that can result in fires or explosions. In addition, emergency system-isolation systems are being designed into the process to help minimize catastrophic failures.

> Once a company integrates the process controls, earmarking the additional dollars for fire protection systems and equipment is still too often a difficult process, especially in industry.
>
> *– Mueller*

Do you find that fire protection engineering services are typically provided by a fire protection engineer or another member of the design team?

Alderman:
The large companies have fire protection engineers perform the work. For smaller companies and for engineering contractors, fire protection is typically being performed by others.

Benedetti:
Loss-prevention programs of any type, whether fire protection, explosion prevention, protection for runaway reactions and process upsets, are generally the responsibility of an engineer or other technical specialist with expertise in the subject area.

Kilpatrick:
The design team generally provides the fire protection engineering services, and occasionally, they hire additional fire protection engineers to consult on the project.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Mueller:

Once a company integrates the process controls, earmarking the additional dollars for fire protection systems and equipment is still too often a difficult process, especially in industry. It is improving, but certainly not to a point that generally involves a specialist in fire protection or specific fire protection engineering consulting firms. More often, the implementation of fire protection systems and equipment is executed by other design team members, not by specialists in the fire protection field.

Have you seen an increase in performance-based design solutions for these emerging issues?

> *NFPA 30* does not mandate particular means of fire protection. It leaves the decision to provide protection to the designer, based on a fire hazard analysis.
>
> *– Benedetti*

Alderman:

Many energy-related companies have developed their own standards that exceed the local fire and building codes. As such, they have developed a form of performance-based design based upon the fire hazard present.

Benedetti:

Working with such a broad-based code as *NFPA 30, Flammable and Combustible Liquids Code*, almost any application of the code ends up being performance-based. The design of protection for chemical processes inevitably is tailored to process conditions, the hazards of the process, and the hazards of the materials in the process. Generally, the same holds true for bulk storage, although features such as normal and emergency venting of storage tanks are based on proven specification criteria developed many years ago. *NFPA 30* does provide specification-oriented fire protection design criteria for warehouse storage of containers and intermediate bulk containers of flammable and combustible liquids, but these criteria are based on evaluation of full-scale fire tests that mimic actual, as-used storage arrays. The designer always has the option of choosing a performance-based design under the "equivalency" concept inherent in NFPA codes and standards. This is particularly true where no specific protection criteria exist for the intended storage conditions. This is also true of bulk storage in tanks. For storage tanks, *NFPA 30* takes a passive approach to protection based on proper design of the tank itself; appropriate emergency venting; separation from important buildings, adjacent properties, and public roads; spill control; and overfill prevention. *NFPA 30* does not mandate any particular means of fire protection. It leaves the decision of whether or not to provide protection – and, if so, what type – to the designer, based on a fire hazard analysis.

Kilpatrick:

Yes. In general, the fire code does not address process safety and control to the degree that is necessary for industrial facilities. For that reason and because of the length of time it takes to develop and adopt fire code regulations at the national level that pertain to these emerging fuels, performance-based design solutions are generally submitted and often encouraged. As a jurisdiction, we find ourselves relying more and more on industry standards in addition to the fire code when we review these plans. We have recently begun requesting third-party technical reviews to evaluate process safety and protection systems of submitted designs.

Mueller:

For many industrial locations and hazards, there is inconsistency in the methodology and type of fire protection systems implemented. NFPA standards can serve as very valid guidelines, but the crossover from commercial to industrial fire protection identifies shortcomings, resulting in open design solutions. For the petroleum industry, for example, industry guidelines, best practices, and current manufacturer/end-user technology and applications, sometimes driven by cost, are the major factors of design solutions.

What do you see as the most challenging aspect of hydrogen as a motor vehicle fuel?

Kilpatrick:

Hydrogen-fueled vehicles and hydrogen fueling stations have not yet appeared in Seattle. However, I think the most challenging aspect of hydrogen is the ability to ensure that the level of safety of hydrogen internal combustion engines and fuel-cell-powered vehicles is comparable to that of other vehicles. Because of the high pressure of onboard storage systems, ensuring the integrity of the containment cylinder and the associated pressure relief valves is of utmost concern. The fire service is very concerned about responding to car fires and extricating persons from motor vehicle incidents involving fuels under pressure. Though not hydrogen-fueled, a car fire incident recently occurred in Seattle where a high-pressure fuel tank exploded. The tank was propelled hundreds of feet into the air and metal car parts showered the area like shrapnel. Had the vehicle involved trapped occupants or if firefighters had approached minutes earlier, certainly injuries or fatalities would have resulted.

Mueller:
To the best of my knowledge, providing the supply to meet the potential demand is the most immediate challenge. Nearly every bit of hydrogen that is being produced by the petroleum industry is being self-consumed in their own hydrogen desulphurization units to provide cleaner gasoline and diesel fuel products to comply with federal guidelines on cleaner-burning fuels. Many refineries are building new hydrogen units across the United States such that they can comply and keep up with the growing demand for refined products. Otherwise, I understand that the market is too small to attract the large oil companies right now. Only about a dozen states have hydrogen fueling stations, and only California has more than a handful. Even if big oil companies are slow to add hydrogen to their product line, industrial gas suppliers could step in.

Rivkin:
Producing large quantities of hydrogen using renewable energy sources is a real challenge.

What new technologies are being employed to meet this challenge?

Kilpatrick:
It is my understanding that alternative storage systems, such as the use of metal hydrides that act like a sponge to store large amounts of hydrogen, are being researched that could help minimize the need for such high-pressure systems.

Mueller:
Some hydrogen is produced at refineries whereby it is cracked-off in the distillation process, and then it must be ultimately transported by tanker truck. Nearly all hydrogen is made from natural gas, which is abundant in North America. Fuel-cell vehicles are electric-powered. The electricity is generated by a fuel cell in the car. The fuel cell mixes hydrogen and oxygen in a process that produces electricity and emits water. Hydrogen fuel-cell vehicles are seen as a long-term solution to U.S. dependence on oil. Honda reportedly has a 2008 model that will get the mileage equivalent to 68 miles per gallon (29 liters/km) in the federal city/highway combined-driving cycle. Hydrogen with the same amount of energy as a gallon (3.8 liters) of gasoline sells for $3 to $6, but because fuel-cell cars are much more efficient, the cost per mile is much less than with gasoline.

> The fire service is concerned that vehicles powered by compressed gas fuels be more readily identifiable to firefighters responding to motor vehicle accidents where decals or the bumper-marking systems currently employed are not adequate.
>
> *– Kilpatrick*

Rivkin:
Wind turbines appear to be the fastest-growing new technology to produce electricity and potentially to produce hydrogen.

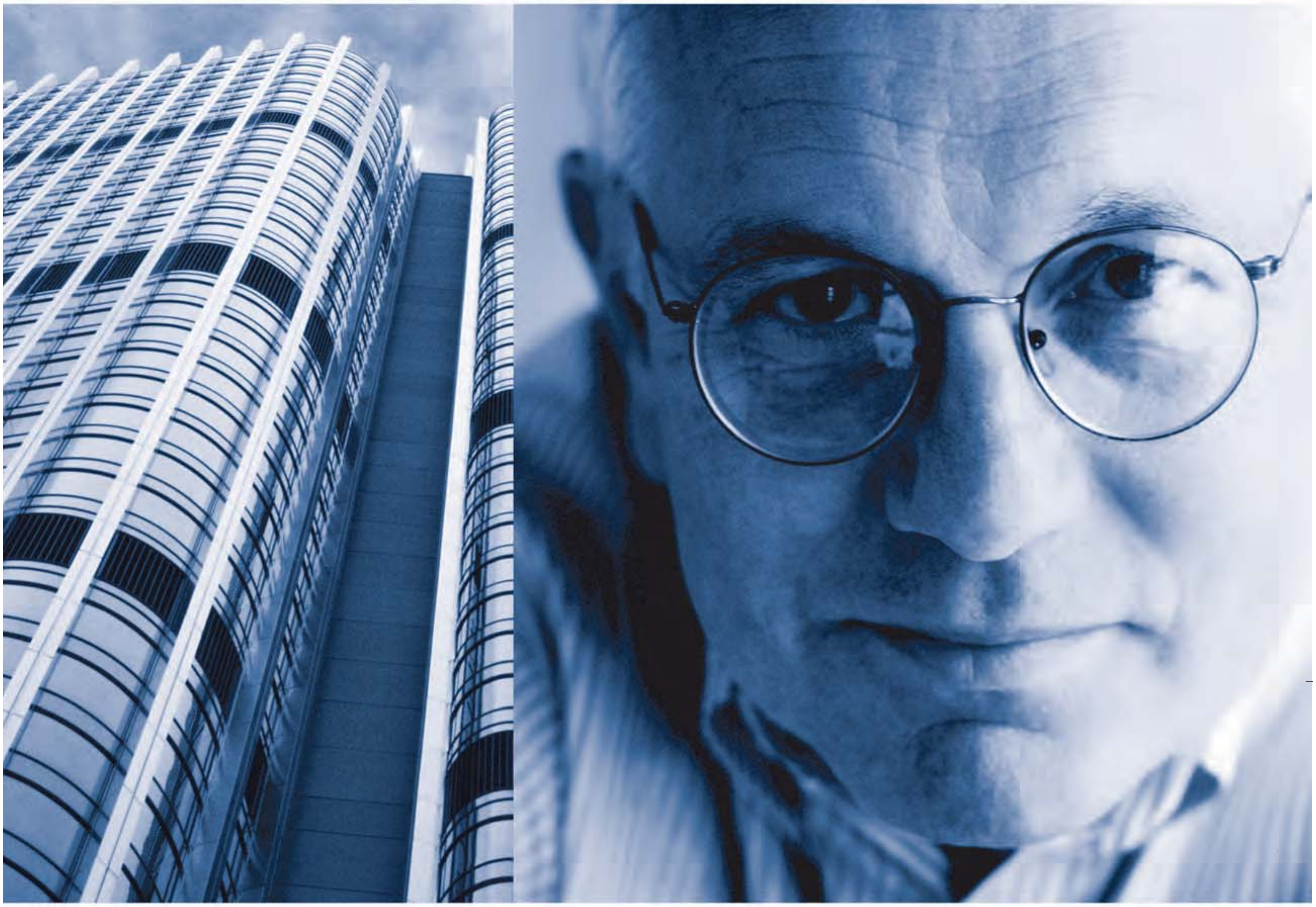
Do you believe that current codes and standards are adequate? If not, what needs to be done?

Kilpatrick:
No. Even though there has been and continues to be a considerable amount of research to establish a unique set of requirements for hydrogen, I do not believe that the current codes and standards are fully developed and adequately address all the safety concerns. The codes and standards development organizations, the Department of Energy, the National Hydrogen Association, the Society of Automotive Engineers and other stakeholders should continue to actively pursue development of a safe set of standards for hydrogen. The fire service is concerned that vehicles powered by compressed gas fuels be more readily identifiable to firefighters responding to motor vehicle accidents where decals or the bumper-marking systems currently employed are not adequate. Car parts containing markings are easily separated or mangled in a vehicle accident.

Rivkin:
NFPA is developing a comprehensive hydrogen safety code that will extract portions of several existing NFPA documents and fill gaps. Potential gaps are integrating hydrogen-dispensing equipment into existing fueling facilities, maintenance work on hydrogen equipment and hydrogen generators.

Is there an area where additional research or testing needs to be conducted? If so, please describe.

Kilpatrick:
Because hydrogen is odorless, is easily ignitable and the flame is nearly invisible in daylight, some on-board system to effectively detect leaking hydrogen should be considered.



Mueller:

One of the biggest challenges for the future is meeting the supply and distribution of hydrogen to the retail fueling service stations.

Rivkin:

Additional research is needed in the behavior of hydrogen mixtures, explosion characteristics in partially confined spaces and sensing technology to name the few. There are likely many other areas that require research.

What do you see as the most challenging aspect of Ethanol/E-85 as a motor vehicle fuel?

Alderman:

Storage and transportation. The pipeline system within the United States is not capable of transporting ethanol because it is water-soluble. This means there will be many more storage facilities located closer to distribution points.

Benedetti:

There are two challenging aspects of ethanol as a motor fuel. First, the possible lack of understanding that fire-fighting techniques and fire-fighting agents can be different for ethanol-based fuels. For example, alcohol-resistant fire-fighting foams should be used for motor fuels with ethanol concentrations above 10% to 15% and would be considered mandatory for high EtOH concentration fuels or neat ethanol. Also, there is a general lack of understanding of the hazards of flammable/combustible liquids among some organizations that are entering this business.

Kilpatrick:

Currently the primary challenge associated with ethanol is the recent discovery that the fueling-system components, such as seals and hoses, may deteriorate as a result of the corrosive nature of the alcohol.

Editor's note: In October 2006 Underwriters' Laboratories (UL) announced it suspended authorization for manufacturers to use its listing marks on components for fuel-dispensing devices that provide for fuel mixtures with greater than 15% alcohol, such as ethanol. While no reported safety issues have been reported to them, their research indicated that high concentrations of ethanol or other alcohols may result in the degradation of certain fuel-dispensing components, adversely affecting the ability of the equipment to contain the fuel. As of this date, UL has never listed a dispenser for E85 use.

Mueller:

This is a complicated subject because it has major implications to the U.S. oil (energy) industry, U.S. auto industry and consumer. The oil industry is the largest consumer of ethanol in the United States. Ethanol is purchased as an additive and is blended with gasoline to provide a cleaner-burning fuel. By doing so, both the oil industry and auto industry meet federal guidelines for use of renewable fuels as well as meet government smog-reduction rules.

The U.S. oil industry is also driving up the demand for ethanol because of the growing demand for gasoline. The oil industry controls the downstream distribution of gasoline products from the refinery to the retail service station. So the demand for ethanol is certainly growing, hence the surge in ethanol plant production across the United States. The U.S. oil industry does not produce E-85. Ethanol is typically blended into gasoline at 10% ethanol and 90% gasoline. E-85 is 85% ethanol and 15% gasoline. As I understand it, approximately 1% of all U.S. retail service stations provide E-85 to the consumer. Meanwhile, nearly 50% of all gasoline sold in the United States contains some percentage of ethanol.

The U.S. auto industry has been building "flex-fuel" vehicles for several years, but not in large numbers. To my knowledge only about 5% of the total autos in the United States can burn E-85 fuel. The domestic automakers have a goal of producing up to 2 million "flex-fuel" vehicles per year by 2010, and produce 50% of their U.S. production capable of burning E-85 by 2012.

For the consumer, the retail price of E-85 at the pump is traditionally less than unleaded gasoline; however, the mileage per gallon is approximately 25% less as compared to fuel economy for gasoline. So on an annual basis, the consumer will pay more money for E-85. The commercial preference for the consumer, if it is strictly based on economics, will be to favor gasoline. For the gasoline retailer, the investment to distribute E-85 is an additional expense. The average cost for new tanks, pumps, etc., to distribute the product is approximately $200,000 per facility. So, there are many challenges to introducing E-85 into the distribution retail fuels market.

What new technologies are being employed to meet this challenge?

Benedetti:

Studies are now being conducted to determine the capabilities of currently available foam fire-fighting agents for use on fires involving high concentration EtOH fuels and neat EtOH. These studies are also aimed at determining whether specific fire-fighting tactics are needed. It should be understood that selection of fire-fighting agents and proper fire-fighting tactics for flammable or combustible liquids (with the exception of containers in warehouses) are beyond the scope of *NFPA 30*.

Kilpatrick:
UL is currently conducting tests and research to resolve the compatibility problem of equipment.

Mueller:
There is a tremendous push in the United States to construct ethanol plants. Once again, the largest consumer is the oil industry, and they are largely responsible for driving the demand as well as the cost up.

Do you believe that current codes and standards are adequate?

Alderman:
Yes.

Benedetti:
I believe that *NFPA 30, Flammable and Combustible Liquids Code*, is more than adequate to address an ethanol production facility. *NFPA 30* necessarily addresses process operations broadly. A basic premise of *NFPA 30* is that a fire hazard review must be conducted to identify fire and explosion hazards and to ensure that corresponding fire prevention, fire control and emergency action plans are implemented. The hazards of bulk storage of ethanol and ethanol-containing motor fuels are no different than that of any other flammable liquid. The requirements in *NFPA 30* are well established, well understood, and appropriate. All that is left is proper application of the provisions of the Code by a knowledgeable engineer or designer. I should point out that the larger facilities will probably come under federal rules for process safety management and for the prevention of release of hazardous chemicals.

> Bio-diesel does not present nearly the challenges that other alternative fuels do. It has a high flash-point, low volatility, and, therefore, presents less of a fire hazard than other motor fuels.
>
> *– Kilpatrick*

Kilpatrick:
Except for the compatibility issue, I believe the current codes and standards adequately address ethanol.

Mueller:
I don't think so. Industry research and testing will raise awareness and drive new standards. I think that appropriate codes and standards will follow, but it is difficult for these to keep pace with technology and industry. The ethanol industry as a whole would benefit from more standards and fire protection practices to protect processing, storage and loading facilities.

Is there an area where additional research or testing needs to be conducted? If so, please describe.

Kilpatrick:
Again, UL is actively conducting research and testing to ensure effective safety requirements are developed.

Mueller:
Probably more follow-up work associated with the Ethanol Emergency Response Coalition and accelerated flammable liquids training for municipal firefighters, especially in communities where the ethanol plants are being constructed.

What do you see as the most challenging aspect of bio-fuels as motor vehicle fuels?

Alderman:
The local Authority Having Jurisdiction (AHJ) may not understand the technology and hazards, or lack of hazards. Bio-fuels facilities pose fewer fire and explosion hazards than refineries or other processing facilities.

Benedetti:
As with EtOH, the challenging aspects of other bio-fuels are (1) the possibility that fire-fighting tactics used for hydrocarbon fuels might not be appropriate for bio-diesel fuel, although personally I don't think this will be the case; (2) the same general lack of understanding of the hazards of flammable/combustible liquids among some organizations that are entering this business; and (3) there is some indication that individual entrepreneurs entering this new business might not have an understanding of the hazards of the process or its raw materials and by-products.

Kilpatrick:
Bio-diesel does not present nearly the challenges that other alternative fuels do since it's more similar to traditional fuels. It has a high flash-point, low volatility and, therefore, presents less of a fire hazard than other motor fuels. The most challenging aspect of bio-diesel right now seems to be that there are few controls in the code for the purest form of bio-diesel (B100), a class IIIB liquid, when it is used as a motor vehicle fuel or inside as a generator fuel. The fire service also has concerns that "home-brew" operations

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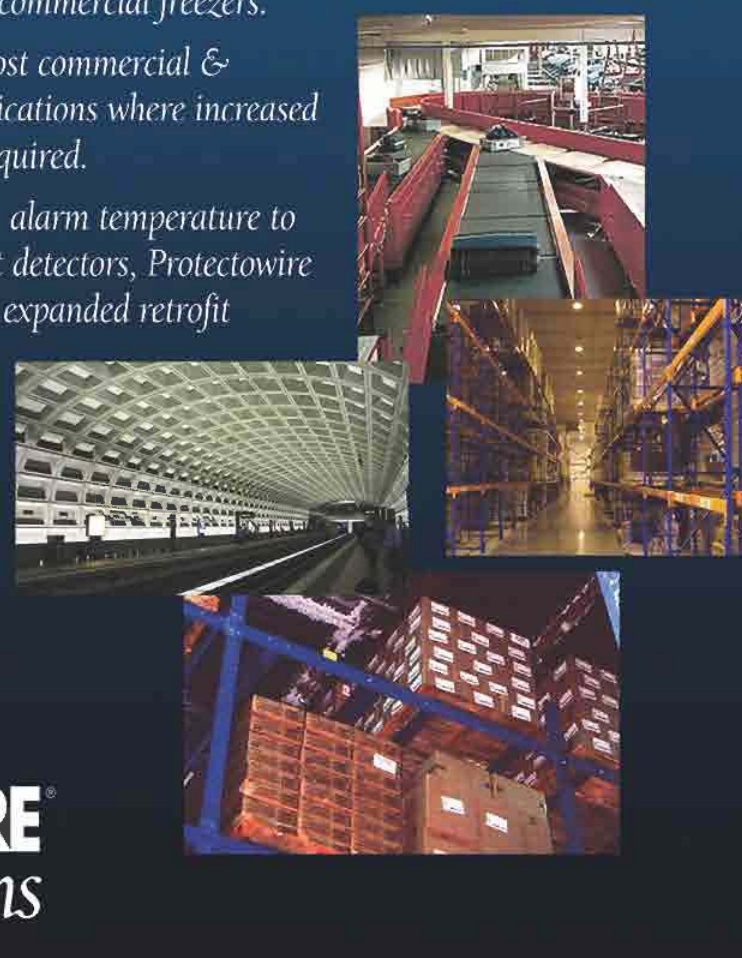

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What new technologies are being employed to meet this challenge?

Kilpatrick:

New technologies are not really needed to address the challenge, but the codes should be revised to acknowledge that Class IIIB liquids are being used as motor fuels.

Do you believe that current codes and standards are adequate? If not, what needs to be done?

Alderman:

Yes, I believe current codes and standards are adequate.

Benedetti:

Yes. As stated above for ethanol, *NFPA 30* would be the appropriate code to use. If the provisions of *NFPA 30*, including its requirement for a fire hazard analysis, are properly applied, then the result should be a safe operation. As stated above, federal rules will likely apply to larger facilities.

Kilpatrick:

No. In my jurisdiction, B100 is the most prevalent bio-diesel being used, and it is being used as both a motor vehicle fuel and as a fuel for generators. It is my opinion that when the current codes were developed, we did not contemplate the use of Class IIIB combustible liquids as motor fuels, and therefore, many of the prudent practice requirements that appear in the codes do not apply to fueling of B100. Code change proposals should be submitted to address the use of bio-diesel motor vehicle fueling operations as well as when used as a generator fuel inside buildings.

Is there an area where additional research or testing needs to be conducted? If so, please describe.

Kilpatrick:

I am not aware of any additional research or testing that needs to be conducted on the use of bio-diesel as a motor vehicle fuel.

Atif Qureshi of the Fire Protection International Consortium contributed to this article.


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Risk Asses

sment

in the Oil and Gas Energy Industry

By John A. Alderman, P.E., and William Fink

Many companies have standards for fire protection and many states and municipalities have building and fire codes that they follow. However, these standards and codes have typically been "prescriptive" in nature and required that fire protection be provided, regardless of the frequency or severity of the potential hazard. Fire protection in the energy production industry generally consists of fireproofing, water or deluge systems, foam systems and fire detection and alarm systems.

The fire protection community is slowly using performance based criteria in determining appropriate fire protection. "Performance-based" applications to code compliance have been adopted across the United States. In the energy production sector, risk assessment is used and the latest modeling programs are used to assess the hazards of fires and explosions. Based on the results of these studies, the fire protection engineer and owner can then determine the appropriate fire protection required for the hazard.

This paper addresses the use of risk assessment techniques for fire protection in the energy production industry.

Hazard Analysis Methods
❑ Checklist
❑ HAZID
❑ What-if?
❑ HAZOP
❑ FMEA

Table 1. Hazard Analysis Methods

IS MORE BETTER?

In the Piper Alpha incident in 1989, 168 people lost their lives as a result of an explosion and resulting fire in an offshore platform. Would more fire protection have helped in that incident? Figure 1 is a storage tank fire and is another example of the need for fire protection. There are many other incidents where the question of adequate detection and mitigation could have reduced the impact of the incident.

HOW MUCH IS TOO MUCH?

There has always been debate about the amount of fire protection that is necessary in the energy-production industry. Inadequate or improper protection can lead to potential loss of life and property, resulting in reduced production and possible environmental impact. Overprotection can lead to increased cost, false alarms or trips of systems and increased maintenance. More importantly, overprotection can lead to a false sense of security by management that the facility is completely safe. So what is the correct level of fire protection?

THE USE OF RISK ASSESSMENT

Figure 1. Storage Tank Fire

Risk assessment is a process where the results of a risk analysis are used to make decisions, either through a risk ranking of hazard reduction strategies or through comparison to target risk levels and cost-benefit analysis. Risk is often referred to as the product of the consequences of the potential hazard times the probability of occurrence of scenarios. Risk assessment techniques can be used to determine the amount of fire protection required for a given hazard by conducting an analysis or calculations to define the fire protection required to mitigate the hazards. The process consists of a series of steps as illustrated in Figure 2. Each step in the risk assessment process is discussed in the following sections.

HAZARD ANALYSIS

The first step in any risk assessment is to conduct a hazard analysis. The hazard analysis techniques used to identify potential hazards in the process and facility are shown in Table 1. Typical facilities where hazard analyses are performed include refineries, storage terminals, gas plants, platforms, floating production/storage and offloading floating storage and offloading, or any combination of these. However, this approach can be used for Liquified Natural Gas facilities, gas turbine generator stations, power plants or practically any type of energy-production facility.

The outcome of a hazard analysis is a list of potential fire hazards that may occur on the facility. A partial list could include jet fire, pool fire, explo-

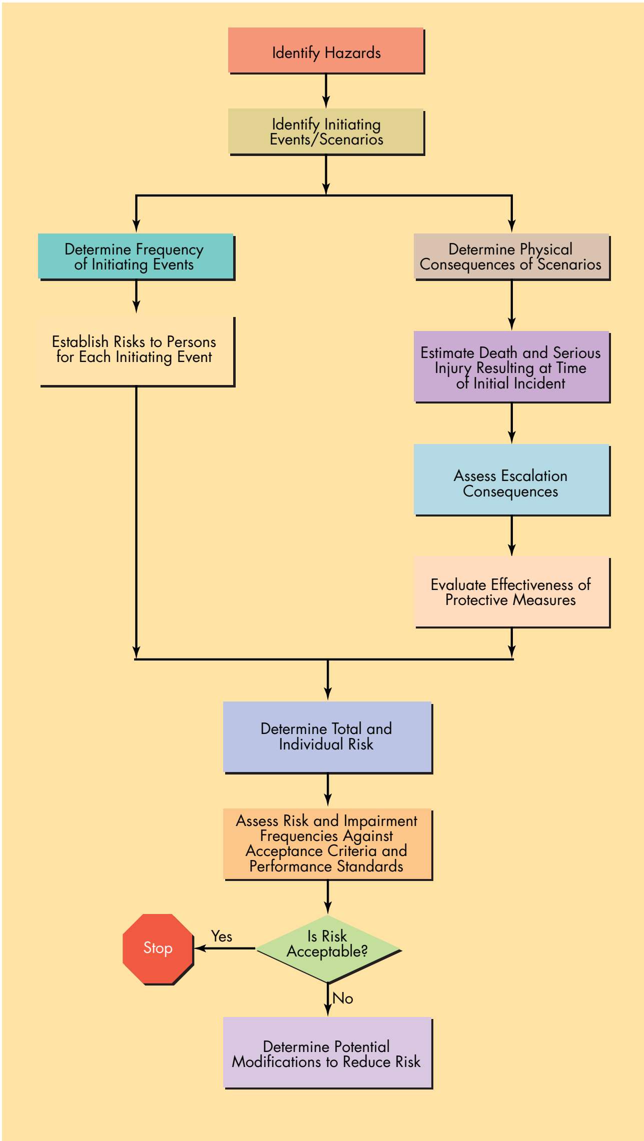


Figure 2. Risk Assessment Process

sion, electrical fire or building fire. The list would also include the corresponding location where each could occur. These hazards can then be turned into scenarios for further analysis. A common mistake is to list just the hazards, whereas a scenario is a series of events that need to occur to create a hazard.

CONSEQUENCE ANALYSIS

Consequence analysis is the process used to determine the impact or magnitude of the scenarios. For example, one scenario could be a pump seal failure in the light-ends handling area of a facility that results in a vapor cloud forming with an explosion if ignited. In assessing the consequences, there are two very important questions that must be addressed:

- **What is the range in size of the events that can occur?**
- **What is the impact of the event?**

In assessing the impact, one would normally take into account the radiant heat, blast overpressure and/or toxic effects on any occupied buildings, evacuation routes, escape equipment and process equipment that could be involved in escalation. Toxic effects may include the products of combustion from fires such as smoke, carbon monoxide or hydrogen sulfide contained in the material.

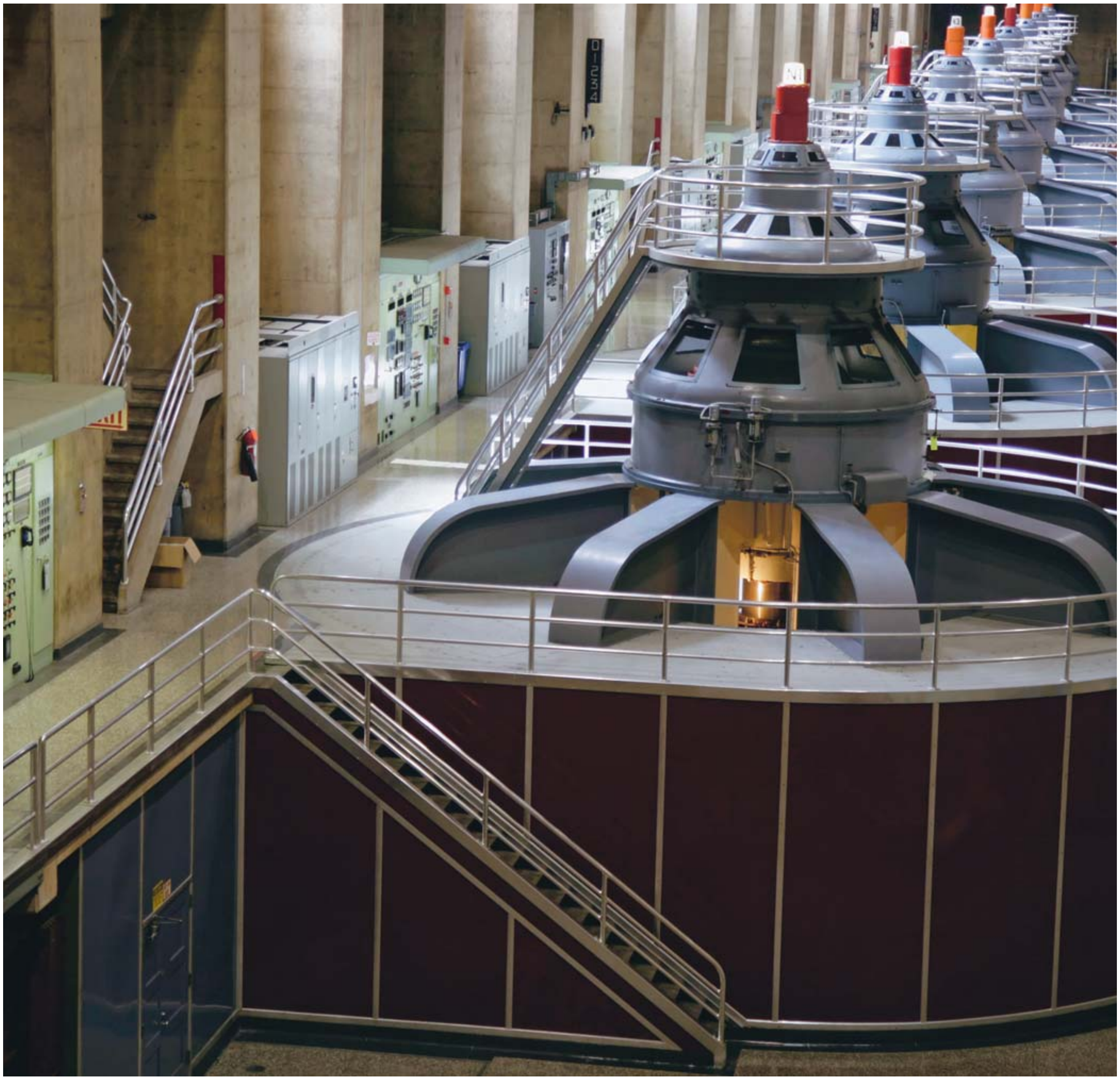
In performing any consequence analysis, analytical tools can be very useful in determining the consequences of a scenario. In most cases, each scenario will have a variety of conditions that need to be evaluated in the consequence analysis. This includes factors such as the size of the release, orientation of the release, temperature and pressure of the operation, and weather conditions (that will all vary). The impact of these variables on the results and the behavior of the release must be taken into consideration during the modeling.

A question that often arises during the consequence analysis is how sophisticated the program needs to be. Programs range from spreadsheets that use simple equations to computational fluid dynamics (CFD) modeling that can take days for a single scenario evaluation. The answer is that it depends on the complexity of the design, the time the analysis is being performed and the desired results. In the conceptual stage, simple models can be used, but as the design details increase, the complexity of the consequence analysis frequently also increases.

LIKELIHOOD DETERMINATION

If the installed fire protection would be based on only the consequence analysis, then the energy-production industry would be very well protected. In reality, though, the likelihood of the consequences must be taken into consideration. In determining the likelihood of the consequences, certain key information is required, such as the frequency of the initiating event, frequency of ignition, probability of escalation, likelihood that the weather will be favorable or not and other factors specific to the given scenario. In any likelihood determination, there are generally a large number of scenarios to be analyzed. This means that computer models may have to be used to ensure that the iterative process of evaluating each variable of each scenario is performed.

The experience level of the analyst is very important. The analyst will make many decisions in the analysis that can influence the outcome. In determining the likeli-



hood, it is very easy for the analyst to go to a previous report and select a frequency to use in the analysis or spend days looking for a value that does not exist. The source used and assumptions made need to be carefully documented.

RISK

The "risk" is the product of consequence and likelihood of each scenario. The risk for each scenario can be combined by specific areas or for the whole facility to obtain desired risk profiles. The risk is calculated using event and fault trees that take into account safety and mitigation systems. The main problem associated with any risk assessment is the appropriateness of the data used in the calculations.

RISK TOLERANCE

After the risk is calculated, the results must be compared to either governmental or company criteria to determine if the risk is tolerable. This means that the risk is at a level people are generally willing to accept. If it is, then additional fire protection is not required and the level of fire protection (mitigation) used in the risk calculation is adequate.

If the level of risk does not meet the "acceptable" risk criteria, then additional mitigation may be required. The options for reducing the risk are selected and the analysis recalculated to determine the impact on the risk. In some cases, the options provide significant risk reduction, whereas others have little impact on the risk.

One concept that is being used extensively is as low as reasonable practical (ALARP). Figure 3 shows the ALARP concept. This concept suggests that, at some point, the cost to mitigate a hazard is so high that it is no longer practical to implement the option. Cost-benefit analysis can be used to determine if ALARP has been achieved.

JET FIRE ANALYSIS EXAMPLE

In a jet fire assessment, the two important parameters are the flame dimensions and the calculation of the thermal radiation field around the flame. The convective heat transfer rate can be very high, leading to rapid failure of objects inside the flame envelope. Thermal radiation outside the flame envelope can also lead to equipment failure. In addition, there is the potential for fatalities and to block escape routes over a large fraction of the deck of a floating production/storage and offloading vessel. Below 37.5 kW/m^2, most equipment items, with the exception of load-bearing steel plates, will survive, while personnel fatalities are credible down to below 12.5 kW/m^2.[1]

There are many methods available to calculate flame lengths and thermal radiation contours for an ignited release of gas from a leak on process equipment. Most commercial consequence assessment codes, such as PHAST,[2] can be used to calculate thermal radiation contours for jet fires.

The example considers a release of lift gas, which is primarily methane, at 25 MPa and 60°C. The release occurs from a riser and is immediately ignited, resulting in a jet fire. The windspeed is 5 m/s.

For an assumed 10 kg/s release, the calculated hole size is 14.6 mm. Radiation contours calculated using PHAST are shown in Figure 4 for 37.5 kW/m^2, 12.5 kW/m^2 and 6.3 kW/m^2, where:

37.5 kW/m^2

The yellow inner contour is typically taken as the criterion for immediate fatality. At this level, the pain threshold is virtually instantaneous, and probit analysis gives a 50% probability of lethality in around 20 seconds. (Probit analysis provides a mathematical relationship between the magnitude of an effect [e.g., thermal radiation intensity], the duration of exposure and the proportion of an exposed population that might be affected by exposure to that effect.)

12.5 kW/m^2

The green contour is typically taken as the limiting radiation intensity for escape actions lasting a few seconds

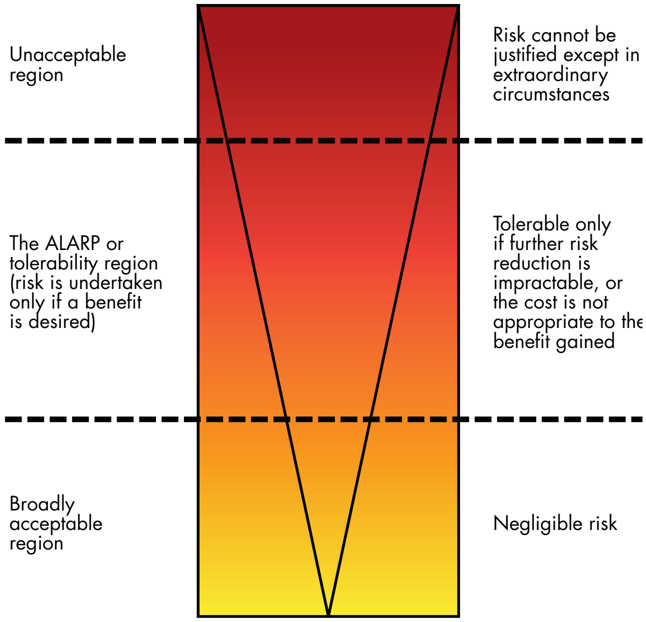


Figure 3. ALARP

(such as jumping into the sea). At this level, the pain threshold is reached in around four seconds and probit analysis predicts 50% lethality in around 80 seconds. Fifty percent fatalities would be expected for personnel in the zone between 37.5 kW/m^2 and 12.5 kW/m^3.

6.3 kW/m^2

The blue contour is typically taken as the limiting radiation intensity for escape actions lasting more than one minute. This is equivalent to the exposure level in for escape actions lasting up to one minute for personnel in appropriate clothing. Egress routes exposed to radiation intensities above this level are considered impaired.

Figure 4 shows that there is the potential for immediate fatalities from the event. The figure shows that the escape routes will be impaired for personnel aft of the release. Personnel at these locations need to go to alternative muster points and may become fatalities if the event escalates while they are at these alternative locations.

The likelihood of the scenario would be calculated based upon the probability of the release (pipe failure, gasket failure, etc.), the probability of ignition after the release occurs and the probability of blast overpressures being generated. Evaluation of the potential for fatalities of personnel trapped on escalation of the event would be considered as part of the risk analysis and would be dependent upon where the personnel are when the scenario would occur.

There is no discernable effect on

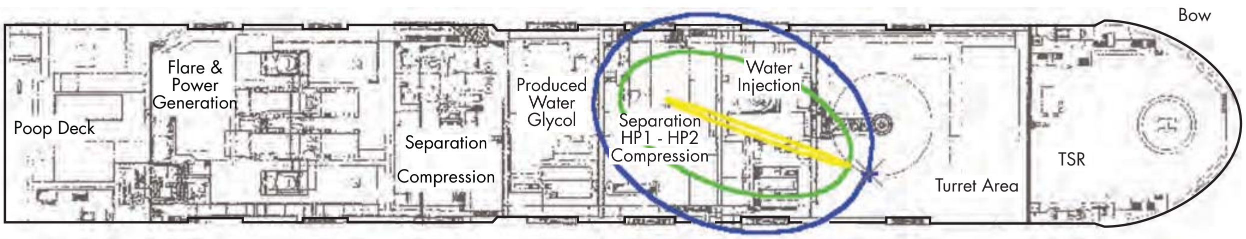


Figure 4. Jet Fire Release Example

the temporary safe refuge (TSR) for the release shown. However, if the release is directed towards the TSR, there will be direct flame impingement on the firewall in front of the TSR. An "A"-rated firewall will be penetrated in around 15 minutes with direct impingement of a jet flame. An "H"-rated firewall will survive over one hour in these conditions.[3] Thus the additional expense of an "H"-rated firewall is justified for this scenario.

There is also potential for escalation as unprotected process equipment, steel plate and beams will rupture or fail in under 10 minutes when directly exposed to jet flame. When exposed to a radiative flux of 37.5 kW/m^2 process equipment and steel beams under load will likely survive for 60 minutes.[3]

Using event trees, the frequency of the jet fire impacting the accommodations was estimated. The frequency of a leak was calculated as 1.40E-3, a probability of ignition of 0.3, weather direction toward the building of 15% for an overall frequency of 6.3E-5 events/year or once in 15,873 years.

Given the consequences of immediate fatalities with 10 personnel in the area in the unlikely event the fire occurs, the risk for this scenario is 10 x 6.3E-5 events per year which equals 6.3E-4 fatalities/year.

If the company's risk tolerance criteria is 1.0E-4, then the scenario fails this criteria and additional risk reduction is required.

John A. Alderman and William Fink are with RRS Engineering.

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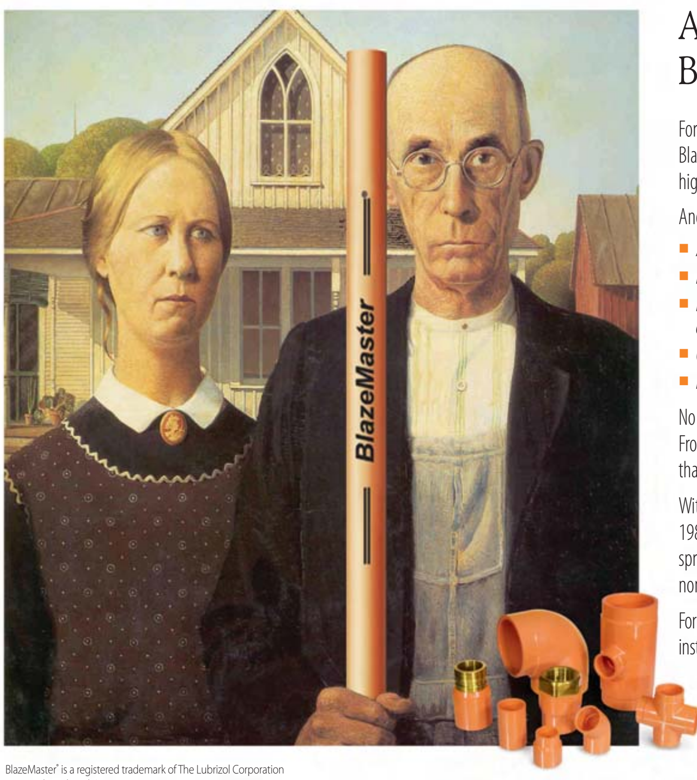

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Implementation of a Performance-Based Standard for Fire Protection of Nuclear Power Plants

By Harold T. Barrett, P.E.

INTRODUCTION

Nuclear energy currently provides approximately 20% of the electricity consumed in the United States. In order to operate a nuclear power plant, electric utility companies must effectively manage the risk due to fires in these generating plants.

Managing fire risk at a nuclear power plant is not simple for a variety of reasons. Electric generating plants, by nature, have many fire hazards that must be addressed. Nuclear plants have additional challenges unique to nuclear power. The plants themselves are complex and the designs diverse. Even after the nuclear chain reaction is terminated by shutting down the reactor, the radioactive fission products in the nuclear fuel continue to generate decay heat. The plants must be designed and operated so that the necessary systems will continue to function to remove that decay heat.

In order to operate the plants efficiently and economically, most plant functions are designed to be remotely controlled from a central control room. This results in a very high concentration of control cables (wires) in a relatively small area of the plant. When exposed to a fire, these con-

trol cables can fail, resulting in either the loss of a desired function or the occurrence of an undesired function. Maintaining control of the necessary systems needed to both control and cool the reactor is a difficult challenge during and following a fire.

NFPA 805[1] is a consensus standard developed to efficiently and effectively manage fire risk at nuclear power plants. The standard provides flexibility to a nuclear power plant licensee through implementation of a mix of both deterministic (rule-based) and performance-based methods to analyze and manage fires. The Nuclear Regulatory Commission has revised federal regulations to allow the voluntary adoption of *NFPA 805*.

BACKGROUND

On March 22, 1975, a fire occurred at the Brown's Ferry Nuclear Power Plant.[2] Maintenance workers in the cable spreading room were performing a leakage test of electrical penetration seals installed in the reactor building wall. The leakage test utilized a candle to observe air flow through the penetration seal. The seal material was polyurethane foam.

The candle flame ignited the foam, causing the fire to grow larger due to the air flow through the penetration seal leaks. The flame also ignited the insulation on the electrical cables that ran through the penetrations. The fire caused extensive damage to the electrical cables in the cable spreading room and the reactor building.

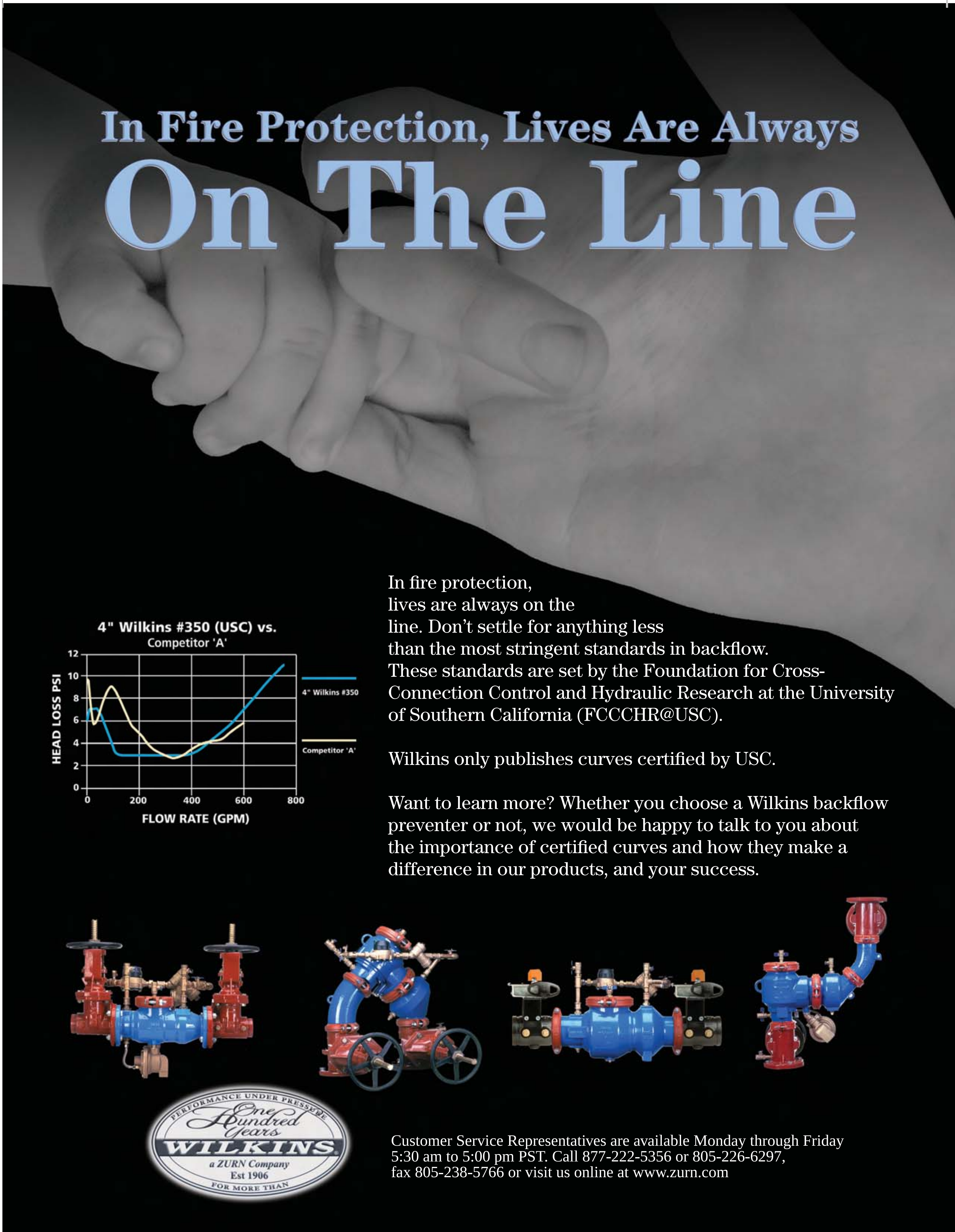
Fire damage to cables caused the functional loss of much of the equipment normally used to shut down the reactor and almost all of the equipment used to mitigate accidents. In addition, the fire caused de-energized wires to come into contact with other energized wires, resulting in numerous actuations of equipment that were not required or desired.

The investigation into this event identified deficiencies in both plant design and event mitigation procedures. Also, fire protection programs (FPPs) of that vintage did not adequately address maintaining safe shut down ability following a fire. In the later 1970s, the Nuclear Regulatory Commission (NRC) developed improved guidelines for FPPs to address the deficiencies identified at Brown's Ferry. The guidelines were published as a generic technical position in the *Standard Review Plan – NUREG 0800*,[3] Branch Technical Position (BTP) 9.5-14,[4] and the associated Appendix A.

In 1981, the NRC developed guidelines for addressing the impact fires can have on the ability to safely shut-down nuclear plants. These guidelines were made a requirement for all nuclear plants already operating through the publication of regulation *10CFR50.48*[5] and the technical requirements published in *10CFR50* Appendix R.[6]

For the past 25 years, the nuclear industry has struggled with addressing nuclear fire risk using prescriptive, deterministic regulations. Implementing FPPs in accordance with BTP 9.5-1 and Appendix R has proven to be both expensive and difficult. Appendix R has been a particularly challenging problem since the current generation of nuclear power plants was not originally designed to address the necessary separation and compartmentalization to meet the rule. Plants had to be modified to meet the Appendix R requirements. Due to the inflexibility of the Appendix R rule, approximately 900 exemptions were granted on a case-by-case basis.

Implementation of a performance-based, risk-Informed (PB/RI) fire protection program will allow nuclear plant licensees to quantify their fire risk, allowing them to focus on implementing measures that have the highest impact on nuclear safety while efficiently and economically managing that risk.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THE *NFPA 805* STANDARD

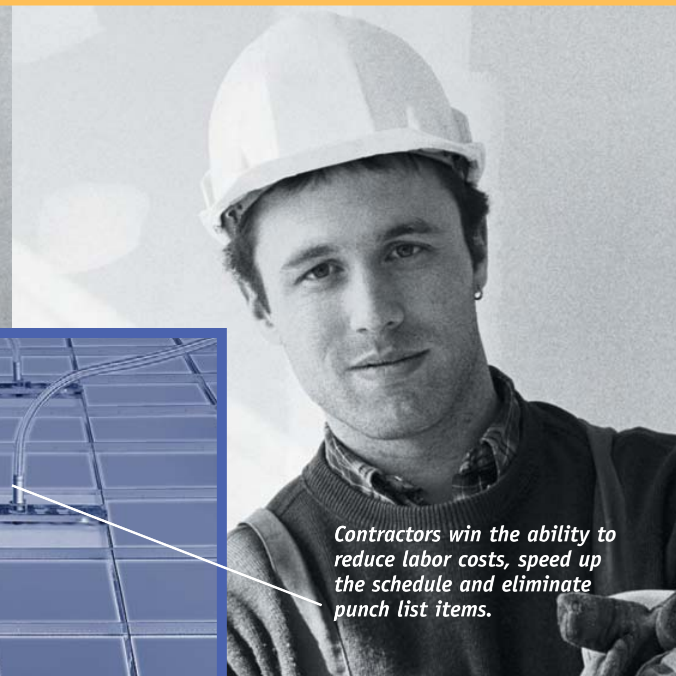
NFPA 805 has been written to provide an effective method to transition from the existing, deterministic, FPP licensing basis to a performance-based, risk-informed (PB/RI) licensing basis. During the transition to *NFPA 805*, the licensee is required to perform a comparison of their existing FPP against the criteria of *NFPA 805*. When the comparison determines that the FPP does not fully meet the *NFPA 805* requirements, the licensee is allowed to perform a performance-based assessment, using the goals, objectives and performance criteria provided in the standard. If the performance-based assessment determines that the goals, objectives and performance criteria can all be met, the condition will be allowed without further modifications or changes.

The regulatory framework used to implement *NFPA 805* is voluntary; licensees are not required to implement the new standard. However, the industry and the NRC have worked hard to make the transition to a PB/RI FPP in accordance with *NFPA 805* the best overall solution to address fire protection for commercial nuclear power plants. In order to encourage nuclear plant licensees to adopt *NFPA 805*, the NRC has authorized enforcement discretion during the transition period. This means that problems that are identified will not be considered violations, provided that they meet certain criteria and that they will be corrected as part of the transition. This serves to encourage licensees to identify and correct items of nonconformance as part of the *NFPA 805* transition.

NFPA 805 contains the following major sections:	
Chapter 1	Introduction
Chapter 2	Methodology
Chapter 3	Fundamental Fire Protection Program and Design Elements
Chapter 4	Determination of Fire Protection Systems and Features
Chapter 5	Fire Protection During Decommissioning and Permanent Shutdown
Chapter 6	Referenced Publications
Annex A	Explanatory Material

NFPA 805 also contains some new requirements that have not previously existed in NRC regulations. Fire risk must be controlled so that "adequate assurance" is provided that the fuel is maintained in a safe, stable condition in "any operational mode." In addition, radioactive releases must be managed such that releases to unrestricted areas must be maintained as low as reasonably achievable (ALARA) and below 10CFR20 limits.[8]

There are several new processes being implemented as part of the *NFPA 805* transition. The PB/RI methodologies available under *NFPA 805* necessitate the development and use of a state-of-the-art fire probabilistic risk assessment (PRA). The fire PRA is used in conjunction with the change evaluation process. This new process is very similar to the 10CFR50.59[9] self-approved change process for licensee-implemented changes. Change evaluations can be used to self-approve exemptions/deviations to the post-fire safe shutdown requirements. They can also be used to document and justify performance-based, risk-informed license amendment requests to the NRC on fire protection program fundamental program and design elements. A new feature being implemented as part of the change evaluation process is the requirement to consider fire risk, defense-in-depth and safety margins in each change evaluation.



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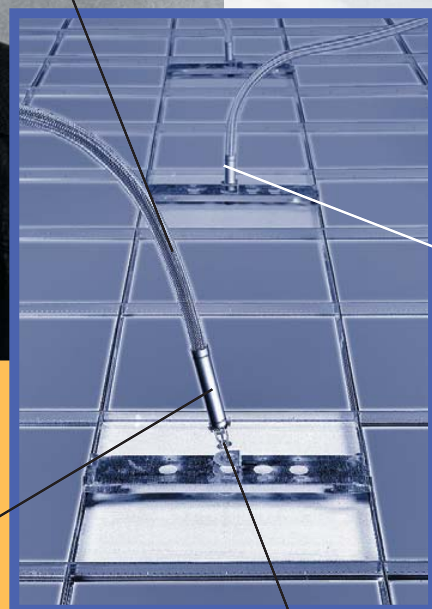

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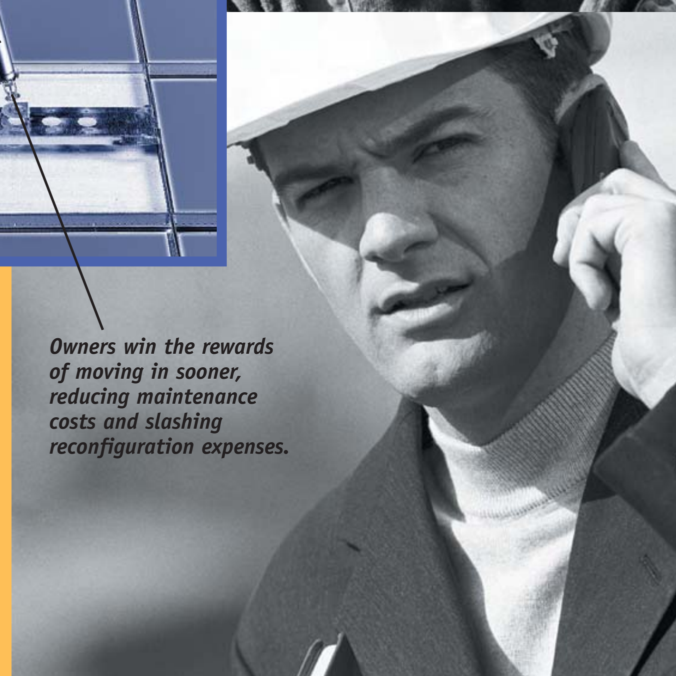

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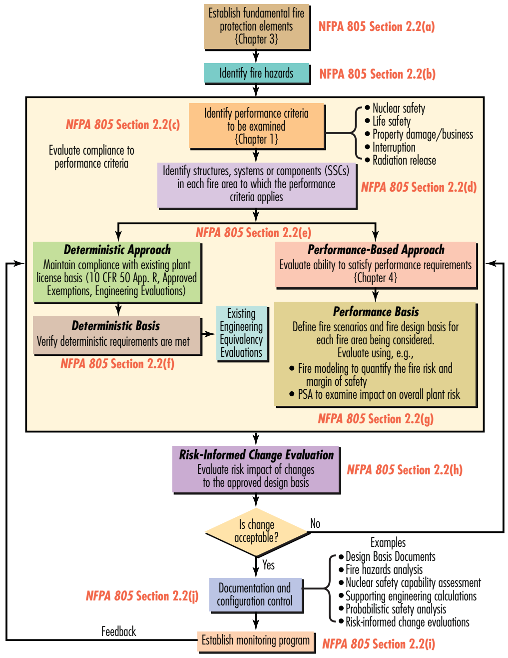

Figure 1. *NFPA 805* Methodology[7]

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IMPLEMENTATION GUIDANCE

The nuclear industry has invested significant resources in developing guidance documents to be used to implement *NFPA 805* transition. Nuclear Energy Institute (NEI) document NEI 04-02[7] has been developed to provide the information necessary to perform the transition process.

Transition using NEI 04-02 as guidance is broken down into three phases:

1. Preliminary assessment (initial cost benefit analysis, preliminary assessments, and submittal of the letter of intent to the NRC).
2. Analyses and license amendment request (LAR) (engineering analyses, including the fire PRA, change evaluations, non-power operations review and radio active release review up to and including submittal of the LAR to the NRC).
3. Transition completion (completion of program implementation).

Figure 2 provides a graphical presentation of the phases of transition.

The major bulk of the effort to transition to *NFPA 805* is spent in Phase 2 performing the many engineering analyses. Figure 3 is a

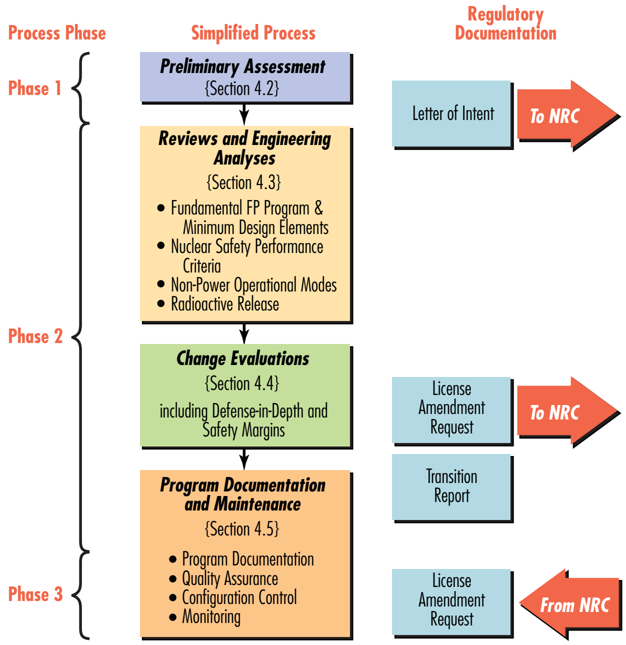

Figure 2. Phases in *NFPA 805* Transition[7]
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simplified diagram of the transition process.

These analyses begin with the transition of the existing FPP attributes to the *NFPA 805* criteria. This process is called "mapping" the existing attributes over to the new criteria. Mapping is most effectively documented in a table format. NEI 04-02 provides guideline tables to perform this part of the transition. The purpose of this mapping is to determine the existing state of compliance to the new *NFPA 805* requirements.

When an FPP attribute falls short of the *NFPA 805* requirement, the situation would be evaluated using a change evaluation. Based on the results of the change evaluation, if the risk of the situation is acceptably low, a licensee has the choice of justifying the deviation using PB/RI methods. If the risk is not acceptably low, the licensee has the choice of modifying the necessary systems, structures or components to comply with the *NFPA 805* requirement or requesting relief from the *NFPA 805* requirement from the NRC.

NEI 04-02 provides detailed guidance in how to perform and adequately document these change evaluations. Appendices I and J provide detailed checklists to be used to perform successive screening evaluations to determine what level of review (skill sets as well as actual personnel) is required to verify adequacy. Appendix D provides detailed guidance on how to perform and adequately document fire modeling when used as part of the *NFPA 805* transition process.

NEI 04-02 also provides detailed guidance to develop all the required licensing documentation, including templates for all submittals such as the letter of intent, the transition report and the license amendment request.

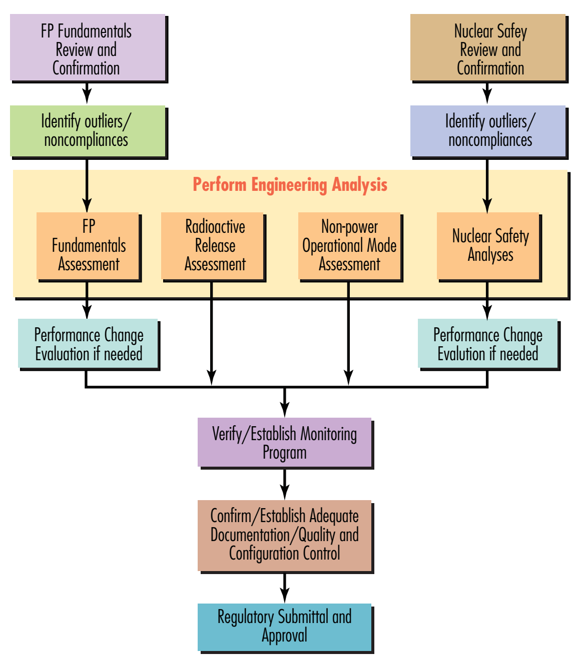

Figure 3. Transition Process[7]
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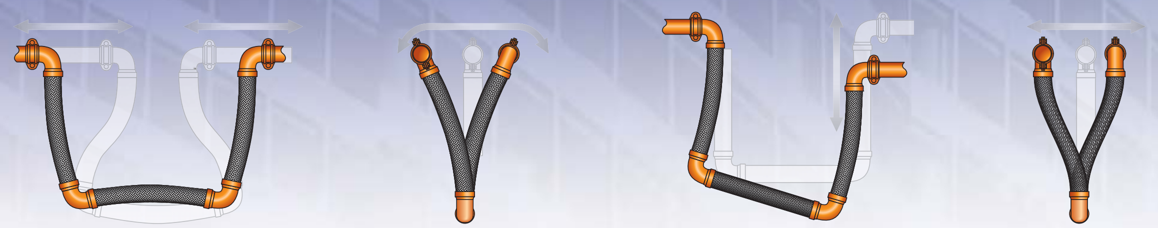

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Since *NFPA 805* is a PB/RI standard, a significant effort is being expended in developing a risk analysis for fires. A joint effort between industry experts and NRC researchers has resulted in guidance for the development of the fire PRA to support transition. A joint EPRI/NRC research document, *EPRI 1008239/NRC-RES NUREG/CR 6850,*[10] was developed to provide the detailed guidance necessary to develop a state-of-the-art fire PRA in support of *NFPA 805* transition. This guidance is currently being used to develop fire PRAs at all plants performing a transition to *NFPA 805*.

PILOT PROCESS

Since transition to *NFPA 805* has never been attempted, the participants in the transition process are implementing a pilot process. The purpose of the pilot process is three-fold: to prove the concept of the standard, to work out the details of how a licensee would go about performing the transition to *NFPA 805*, and to communicate the various lessons learned from the pilot process to the rest of the nuclear industry. The pilot process is also used to develop guidance for both the NRC technical review team and the regional inspectors monitoring and approving the transition.

Two nuclear sites have been designated pilot sites: Duke Energy's three-unit Oconee Nuclear Station in South Carolina and Progress Energy's single-unit Shearon Harris Nuclear Plant in North Carolina. (The transition process at both pilot facilities is currently in progress. Transition activities began in the summer of 2005, and both pilot sites anticipate submittal of the LAR in summer 2008.)

The pilot plant licensees have hosted numerous NRC pilot observation visits on approximately a quarterly basis. Each of these meetings have involved sharing of information from the pilot teams' progress, working with regulators to both familiarize and work out the details of the transition, and itemizing action items identified during the pilot process. At that time, it is expected that the pilot plants will submit their transition reports as well as their license amendment requests to officially transition to an *NFPA 805*-based FPP. Upon receipt of the analyses and license amendment requests, NRC staff will continue the pilot process through the utilization of newly developed standard review plan (SRP) guidance and subsequent approval of the LAR. The pilot process also includes development and piloting of the NRC inspection guidance on the pilot sites.

To date, a total of 42 nuclear power plants (4 pilots and 38 additional) have volunteered to transition to *NFPA 805*. These additional licensees are using the information gained from the pilot process to perform the transition to *NFPA 805* also. A staggered schedule is being utilized with submittal of analyses and license amendment requests ranging from mid-2008 to approximately 2016.

Harold T. Barrett is with the U.S. Nuclear Regulatory Commission. The views presented do not represent an official staff position of the Nuclear Regulatory Commission.

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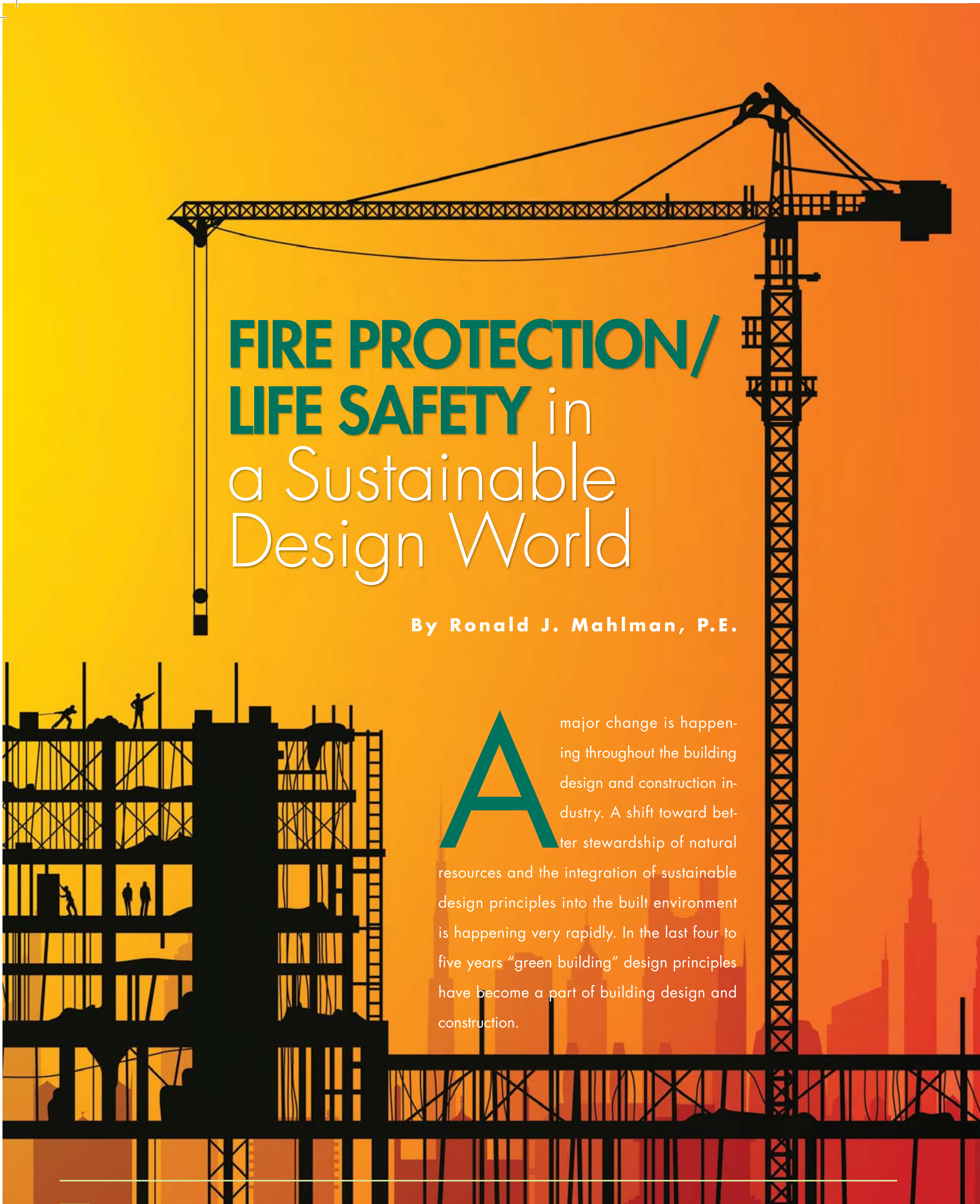
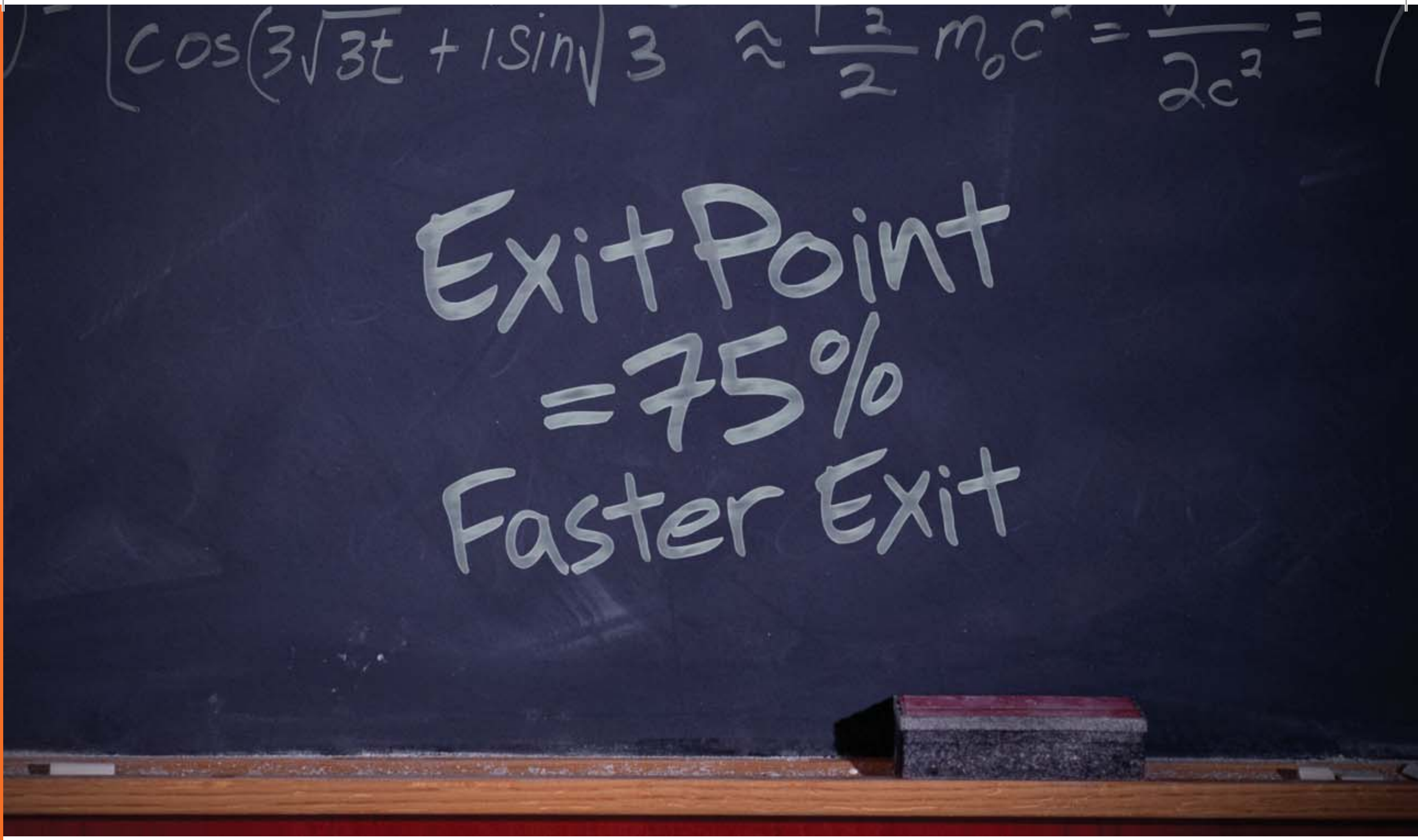


FIRE PROTECTION/ LIFE SAFETY in a Sustainable Design World

By Ronald J. Mahlman, P.E.

A major change is happening throughout the building design and construction industry. A shift toward better stewardship of natural resources and the integration of sustainable design principles into the built environment is happening very rapidly. In the last four to five years "green building" design principles have become a part of building design and construction.



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This article provides a broad-ranging discussion on how integration of "green," or sustainable, building design elements are often included into today's building design and construction projects, while at the same time recognizing the need for design teams to comply with building code and fire/life safety requirements.

Fire protection engineering may not be typically considered during a green building design process. However, there are several ways that a green building design may affect related fire protection systems or fire/life safety code requirements. Several examples include fire department access, issues associated with using reclaimed water to supply fire suppression systems, and the use of atria to provide natural light. Underfloor air-distribution systems also are employed in many sustainable design projects and often present building code compliance challenges. Additionally, there are aspects of fire protection engineering that may be utilized in an integrated green building approach to support sustainable design. Designing low-water (water mist or fog systems) or no-water consumption (dry chemical or clean agent) fire-suppression systems may be applicable in some design situations. Performance-based design approaches may also be used as a method to meet the intent of the applicable codes when unique green building design methods are employed.

Some of the questions to be addressed in this article are:

1. Which fire/life safety building code requirements most often come into conflict with application of innovative green building design elements and why?
2. How can a design team address these building fire/life safety concerns and satisfy local building and fire authorities while incorporating the desired sustainable design elements into the project?

The key for the design team is to recognize that all construction projects need to satisfy the building and fire code provisions.

PRESCRIPTIVE CODE COMPLIANCE PROCESS

Designers, builders, and other stakeholders and practitioners in the built environment face the challenge of providing sustainable design elements while at the same time meeting model building and fire code requirements.

Sustainable design building elements, materials or methods of construction may face questions and concerns from local building and fire authorities during the permit process. Design teams often must demonstrate to local authorities how these innovative sustainable design elements comply with the prescribed code requirements or comply with the intent of the code provisions.

At this point in the project development, designers are often confronted with the challenge of answering the following questions:

1. What sustainable design elements can be shown to be in strict compliance with the prescribed code provisions?
2. Which sustainable design elements may not meet the prescribed code provisions and will need to be demonstrated to be equivalent?

The key for the design team at this point is to recognize that all construction projects need to satisfy the building and fire code provisions. It is also key to understand that innovative approaches to building design elements need to be identified early in the project design. Creative, integrated prescriptive code compliance can be part of a sustainable design project as long as the design team begins to discuss these code compliance issues early in the design process.

This prescriptive code compliance design process requires an integrated, collaborative effort of all project design team members including the owner, the architect, Mechanical, Electrical and Plumbing Designers, the structural engineer, the fire protection engineer, the interior designer, the civil engineer and the landscape architect.

INTEGRATED DESIGN/CODE COMPLILANCE PROCESS

Unlike traditional design projects where each design team member often works independently to address their area of design responsibility, an integrated design process relies on combining the team member strengths to collaborate early in the design process to address the sustainable design elements on items such as water usage, energy usage, occupant comfort, public safety/health, and environmental impact. The intent is to answer how each of these elements can be incorporated into a comprehensive design solution for the building that meets the prescribed code requirements or can be shown to meet the intent of the code.

When the prescriptive code approach cannot handle a new/innovative design element, a performance-based design approach may be needed for certain sustainable design elements of the project. The performance-based design approach

builds upon the integrated design process to show local authorities and other stakeholders that the design element complies with the intent of the code provisions, fulfills its intended purpose, and is shown to be at least equivalent in quality, strength, fire resistance and safety.

Therefore, the performance-based design approach again requires the "blending" of design team disciplines. This integrated design process is critical for sustainable design projects and is often conducted in periodic "design charrete" meetings among the team members. In a design charrete, the collective expertise of the project team is brought together to identify areas of overlap and synergy among the various design disciplines to develop solutions to building efficiencies, including water usage, energy usage, occupant comfort, day lighting and environmental impact.

Each of these elements can have practical impacts on meeting code requirements to "bridge the gap" between the implementation of sustainable design elements and building/fire code requirements, code intent and fire-fighting tactics. Building official approval of these innovative materials, systems and assemblies that are often a part of "building green" is a critical part of the design process that is often overlooked.

The team needs to demonstrate that the proposed alternate approach meets the intent of the code by way of:

1. Supporting evidence of proposed design, method and/or materials.
2. Supporting data such as test reports to substantiate design alternate.
3. Address code basis of safeguarding public health and general welfare.

FIRE-SUPPRESSION SYSTEMS

Rainwater cisterns and reclaimed water are being used to supply not only irrigation systems, but also fire-sprinkler systems. Industrial sites often have nonpotable water supplies contributing to a fire-water supply system, but for the most part, residential and commercial urban developments have potable fire-water supplies. When reclaimed water interfaces with potable systems and is proposed as part of a fire-water supply system, backflow requirements need to be reviewed carefully. In addition, there may be sprinkler pipe drop requirements that need to be taken into account to protect sprinkler systems against sediment buildup in their pipes.

Finally, the pipe-corrosion potential needs to be evaluated. Microbiologically influenced corrosion (MIC) may be an issue with the use of reclaimed water supplies. Where present, MIC can reduce a sprinkler pipe's life and require chemical treatment to remediate. It may not make sense to use reclaimed water as part of a fire-suppression system if chemicals must be added to the system or if a premature failure of the sprinkler system could occur because of poor water quality.

Water-mist systems have been used in green building designs as an element of fire suppression. In some cases, water-mist use is not the result of a desire to conserve water but of working with the available water supply, especially in adaptive-reuse buildings.

Water mist can be used to deal with issues associated with an available water supply's inability to support pressure and flow for new sprinkler systems. For example, an old high-rise warehouse was converted to mixed-use occupancy with residential and commercial components. Because parking was needed in the building, the owner proposed a multiple-level car-stacker system. The fire department indicated that a car stacker in the proposed configuration constituted "high-hazard occupancy." The available water supply could support a sprinkler system for the residential and commercial spaces, but there was insufficient flow and pressure for protection of a car-stacker system. As a result, a water-mist system was proposed for the stacker enclosure. This was accepted by the Authority Having Jurisdiction (AHJ) based on design and testing data provided by the equipment manufacturer.

NATURAL LIGHTING

A popular approach in sustainable design is the integration of natural light. Natural light may be brought to a building's interior through the use of skylights, light wells and atria. One common exterior application is a light court. These design elements may impose building, fire and life safety code issues if not coordinated with fire protection engineers during the early stages of design.

In building construction, a roof may be required to have a fire-resistance rating. If skylights are used in a roof's design, there may be building code requirements for the skylights to be protected or limited in size to maintain the fire-resistance rating of the roof assembly.

Light wells have unique building code requirements. A light well is a shaft located in an interior area of a building. Windows located in this shaft allow light to filter from the roof level to interior areas. A light well can be used to bring natural light through a building to lower levels. Even though a light well is typically surrounded by one building, codes may require that an assumed property line be created and that window-opening protection be provided, depending on building type, occupancy classification and separation distance (i.e., light well size).

The size and location of a light well can have significant code implications. In situations in which a building is located in close proximity to its property line and natural light is brought in from exterior light courts, building codes require the light courts to have specific dimensions, depending on the building's height and configuration. The size of light courts and the size, location and protection of window openings must be considered early in a design process.

In green buildings, atria are a common method of allowing natural light and air distribution, sometimes in conjunction with natural ventilation- to assist the air-distribution system in overcoming stack effect.

BUILDING AIR-HANDLING SYSTEMS

Underfloor air-distribution (UFAD) systems have become a common element in green building design. The concept is to use the area under a floor as a plenum space for supply air-distribution and the space above a ceiling as the return plenum in a noncombustible building. Several code issues may need to be addressed when a UFAD system is proposed. The area under a floor often is used for power and data cable distribution.

In a plenum space, a power cable needs to conform to electrical code requirements and must be installed within an electrical conduit/raceway enclosure, while a data cable that is not installed in conduit/raceway must be plenum-rated and also needs to comply with electrical code requirements. There can be issues regarding connections between power and data cables which are under and above a floor.

As a result, some jurisdictions require smoke detection beneath floors that contain power circuits or data cable. When smoke detectors are installed below floors, they need to be accessible for periodic maintenance and testing to comply with fire alarm code requirements. This in turn can be disruptive to building operations and daily functions of occupants when access to below-floor spaces is routinely needed in their workstations.

Some jurisdictions see this plenum space as being similar to a computer room's raised floor, which may require fire suppression, particularly when it is viewed as a space where data cable (not installed in conduit) can accumulate over the lifespan of the facility and may lead to an increased fire hazard. This yields problems for underfloor duct installations and fire stops under floors, which further disrupt airflow.

Some mechanical inspectors have fought the use of UFAD systems, viewing them as a possible violation of mechanical code restrictions against unducted heating air-distribution under floors. Regardless, when proposed, such systems need to be cleared with code authorities. If a system is allowed, any necessary special requirements must be established.

ATRIA

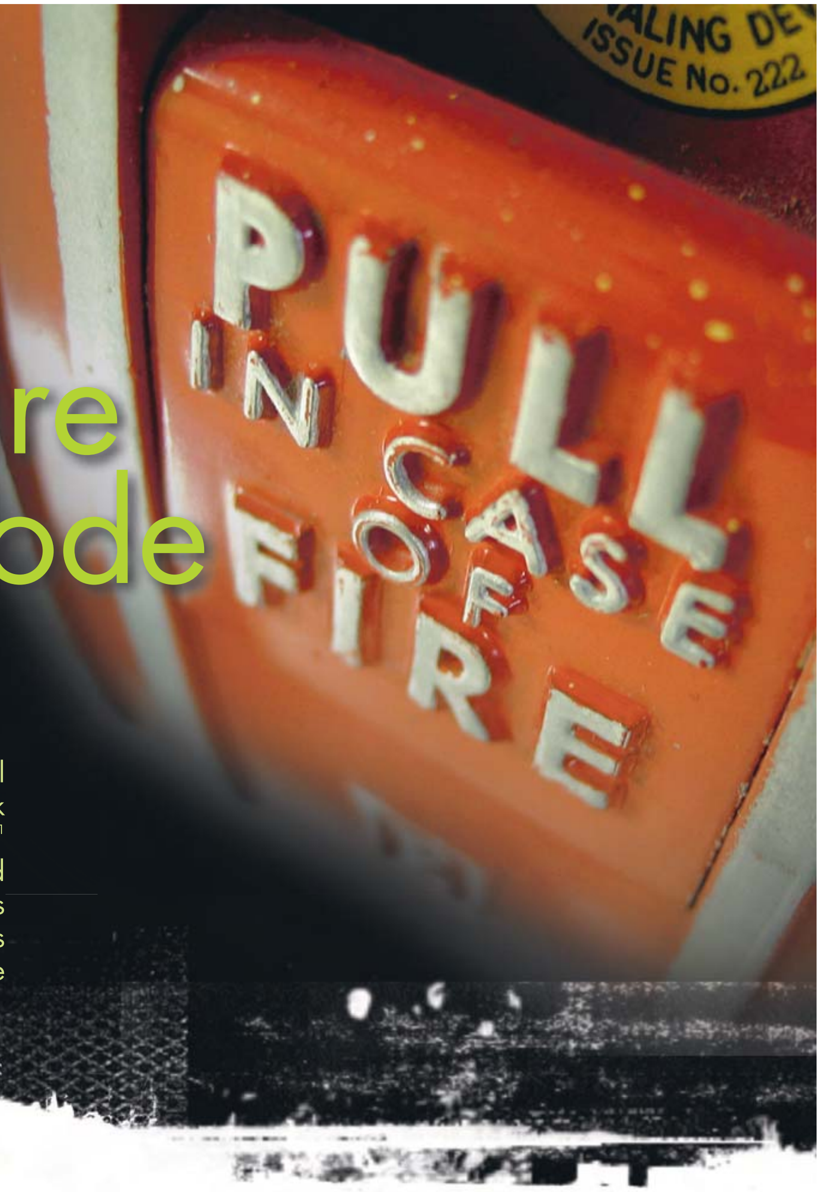
In green buildings, atria are a common method of allowing natural light and air-distribution, sometimes in conjunction with natural ventilation, to assist the air-distribution system in overcoming stack effect. Smoke-control is often required when an atrium is planned. Also, atria generally are required to be served by sprinkler systems that are separate from the remainder of the floors. Other fire-protection issues, such as an atrium's size and arrangement, including the location of walking surfaces and exit paths, need to be discussed early in a design process. These issues, in conjunction with design fire size, will affect a smoke-control ventilation system.

Supply and exhaust air requirements also need to be established. These determine the amount of equipment required and the size of the air shaft(s) serving a space. Supply air velocity is important in smoke-control systems, and it affects grille sizing and location. These issues are better determined early in a design process for space requirements and power consumption (normal and emergency) to be established for smoke-control system equipment.

Natural ventilation is sometimes used to supplement or provide supply air to an atrium, both normally and in smoke-control mode. In the event natural ventilation is used, the wind effect may need to be addressed, possibly by modeling, in the design of a smoke-control system. In some cases, natural ventilation and the stack effect may be suitable to ventilate an atrium normally and during a fire.

Natural ventilation designs require a performance-based design approach. In this approach, it is likely that fire and smoke computer modeling would be performed to prove the adequacy of an atrium's ventilation for a variety of fire scenarios. Mechanical exhaust capacity also can be modeled in an attempt to reduce the required exhaust quantity. Regardless, the general concept and approach to dealing with an atrium needs to be established early in a project and discussed with all of the stakeholders, including the Authority Having Jurisdiction.

Ronald J. Mahlman, P.E., is with Rolf Jensen & Associates.



It's Not Your Father's Fire Alarm Code Anymore

In fact, it's not just a fire alarm code. The National Fire Alarm Code has evolved since its roots back in the late 1800s and early 1900s. The 2007[1] edition has branched out to address risks and solutions for more than just fire. This article takes a look at that evolution. The next article in this series discusses how the evolution might continue in the next ten years.

Setting Standards for Excellence

It all seems to have started with the *General Rules and Requirements for the Installation of Wiring and Apparatus for Automatic Fire Alarms, Hatch Closers, Sprinkler Alarms, and Other Automatic Alarm Systems and Their Manual Auxiliaries*[2] published in 1899. That document had nine, 5" by 8" (130 mm by 200 mm) pages that included requirements for what are now called the protected premises and the supervising station. Those pages also included requirements for all inside and outside wiring. The 2007 edition of the *National Fire Alarm Code*® now has 272 8.5" by 11" (220 by 280 mm) pages, not including the text in *NFPA 1221*[3] and NEC 760,[4] which also had historical origins in the 1899 document.

In 1899, six-and-a-half pages of association minutes were devoted to discussing heat detector spacing versus sprinkler spacing and the fact both had something called "sensitivity" related to velocity, not just temperature. They discussed the fact that two devices that operate at the same temperature in a slowly heated liquid bath will operate at different times when subjected to flowing fire gases. The requirement for actually measuring and labeling heat detectors with this sensitivity number (RTI) finally will become effective in July 2008, 109 years later.

During the 1899 association meeting, representatives from New York, Philadelphia, Chicago and Boston argued that they should be allowed to have different rules:

"Mr. Wilmerding: In Philadelphia we have not found such spacing necessary, and I agree with Mr. Hexamer it largely depends upon the thermostat. If, in New England the thermostats require such a spacing, would it not be well for them to adopt such a spacing, but not ask us and New York City to adopt it."[5]

To accommodate the issue raised by Mr. Wilmerding, the code has evolved to require different spacing for different detector sensitivities. Back in 1899, thermostat spacing was based on the need to operate before a sprinkler. This was because that was how an alarm was transmitted to the nearest fire house. In cases where there was an alarm valve on the sprinkler system, close spacing of the heat detectors was not required.

In the current *Fire Alarm Code*, the listing test for heat detectors determines the spacing that will result in the particular model of heat detector operating before a standard temperature sprinkler operates when exposed to one specific flammable liquid fire and when both are installed on a 14'-9" (4.5 m) high ceiling. Is that test still relevant? Not really. However, it does provide one prescriptive solution for the spacing of detectors with different sensitivity ratings.

PRITCHETT'S ELECTRIC FIRE ALARM

It was not uncommon in the early 20th century to have initiating devices (thermostats, sprinkler waterflow switches and manual boxes) connected to a circuit that directly controlled bells connected in the fire house. There was one bell for each property. In another configuration, an automatic coded telegraph transmitter might be used on a city or privately owned telegraph circuit.

In 1911, the requirements for municipal alarm systems (transmission method and supervising station) were split off from the fire alarm document. Over the years, fire alarm systems evolved into several configurations:

- Systems with initiating devices that only sound an alarm in a building (protected premises fire alarm system);
- Systems directly connected to fire stations or dispatchers (remote supervising station fire alarm systems);
- Systems that used coded transmitters on a common signaling line circuit owned and originated at a municipal fire or emergency dispatch center (auxiliary fire alarm systems);
- Systems connected to commercial monitoring equipment, often using coded transmitters right in the initiating devices themselves (central station service); and
- Systems connected to commercial monitoring equipment all owned by the same person or entity, using either coded transmitters located in the initiating devices themselves or a direct switched connection (proprietary protective signaling system).

> The period 1975 to 1985 was one of tremendous growth and development for the fire alarm industry and for the related standards. In 1975, it was realized that the basic standards for protected premises were not adequate for high-rise buildings.

Except for power supplies, initiating devices and notification appliances at the protected premises, the systems were generally quite a bit different – mostly in the amount and resolution of information, the manner in which that information was conveyed, and in the ownership of the transmission medium and the supervising station itself. So, it became expedient to have separate standards for each system configuration.

There was enough redundancy that it made sense to treat the protected premises virtually the same, regardless of if or how signals might be sent elsewhere. Off-premises signaling systems, composed of a transmission method and a supervising station facility, could be treated separately from the protected premises system. Thus, the *NFPA 72®* alphabet series was born – *NFPA 72 A – E*, plus *NFPA 71*.[6]

As technology advanced, the systems within buildings all started to have an additional common element – a control panel. Earlier, many systems had components at the protected premises that were on circuits powered and controlled by the off-site supervising station. In order to provide local alarms and control as well as the off-premises transmission, systems started using control panels. Manufacturers and consumers wanted some commonality in these controls, regardless of if, how or to whom alarms and other signals might be transmitted. Therefore, one model of panel would be manufactured with modules or features that allowed it to work with all or most of the available types of supervising station equipment.

Until the early 1960s, most fire alarm development was the result of commercial and insurance interests. Few homes had fire detection and alarm systems. In the 1960s, NFPA produced a manual on home alarm systems which later evolved into a standard, *NFPA 74*, separate from the other fire alarm standards.[7]

The period 1975 to 1985 was one of tremendous growth and development for the fire alarm industry and for the related standards. In 1975, it was realized that the basic standards for protected premises were not adequate for high-rise buildings. It took 10 years to develop *NFPA 72 F*[8] to address the needs of high-rise occupancies. Similarly, in 1976 a subcommittee was formed to develop guidelines for occupant notification. That became *NFPA 72 G*.[9] Again, the process took almost 10 years. Both documents were first approved during the 1984 NFPA

Fall Meeting. About the same time, testing methods and frequencies were compiled into *NFPA 72 H*;[10] these were approved during the 1983 fall meeting. Another significant major change came in 1984, as performance-based fire detection was added as Appendix C to *NFPA 72 E*.

Each of the different standards and guides continued to evolve. However, with so many different standards and guides, their use and enforcement were often confusing and difficult. Samuel Johnson is often quoted as having said, "The next best thing to knowing something is knowing where to find it."[11] So, to improve usability and correlation, all fire-detection and alarm signaling-system standards were reconsolidated in the late 1980s and early 1990s. That partial consolidation resulted in *NFPA 72 A* through *D* being combined into *NFPA 72* (no letter) in 1990 with a new name: *NFPA 72, Standard for the Installation, Maintenance, and Use of Protective Signaling Systems.*

In 1993, further consolidation took place. *NFPA 72 H*, which had been a guide for system testing, was incorporated into the code and revised and expanded. That resulted in the first comprehensive set of requirements for the inspection, testing and maintenance (ITM) of fire alarm systems. Given the number of changes since then, it's obvious that not everyone has agreed with the testing frequencies or the methods. However, most users agree that the chapter has made the enforcement of ITM easier and has resulted in improved maintenance, reduced false and nuisance alarms and an overall improvement in reliability.

In addition to adding *NFPA 72 H*, the 1993 edition of *NFPA 72* also incorporated *NFPA 71*, *NFPA 72 E* and *G*, and *NFPA 74*. The final recombination of those standards and guides in 1993 also brought about another name change: *NFPA 72®*, *The National Fire Alarm Code®*.

Since the recombination, the code committees and the general public have been focused on the evolution of the fire alarm code. With everything in one place, it is easier to focus core requirements and easier to see gaps in requirements. The chapters on initiating devices (formerly 72E) and notification appliances (formerly 72G) have expanded and incorporated many performance-based options, providing designers with flexibility to meet protection goals.

> A lot has changed since 1899 – not just fire alarm systems and standards. The world has changed, and the risks have changed.

A lot has changed since 1899 – not just fire alarm systems and standards. The world has changed, and the risks have changed. Signaling systems have design and installation costs and recurring lifecycle costs. In the case of fire alarm systems, they often are installed right along with other systems that have parallel purposes: security systems, energy management systems, paging systems, telephone systems, computer networks, cable television distribution, etc. Some efforts have been made to design and install combination systems to reduce overall cost – fire alarm and energy management or fire alarm and security, for example. However, the overall system complexity and the use of propworks have limited their use.

The overall direction of the signaling systems industry and market is towards systems that have multiple uses. The next article in this series will discuss some possible future changes to the NFPA signaling system standards and codes – changes to address risks other than just fire, and changes to allow and encourage systems to be used for purposes other than just fire-detection and alarm-signaling.

References

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2 *General Rules and Requirements for the Installation of Wiring and Apparatus for Automatic Fire Alarms, Hatch Closers, Sprinkler Alarms, and Other Automatic Alarm Systems and Their Manual Auxiliaries*, National Fire Protection Association, Transactions of the Third Annual Meeting, Boston, June 13 – 15, 1899.

3 *NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, National Fire Protection Association, Quincy, MA 2007.

4 *NFPA 70, National Electrical Code*, National Fire Protection Association, Quincy, MA 2005.

5 *Transaction of the Third Annual Meeting*, Boston, June 13 – 15, 1899, National Fire Protection Association, 1899.

6 *NFPA 72A, Standard for the Installation, Maintenance and Use of Local Protective Signaling Systems for Guard's Tour, Fire Alarm, and Supervisory Service,*

NFPA 72B, Standard for the Installation, Maintenance and Use of Auxiliary Protective Signaling Systems for Fire Alarm Service,

NFPA 72C, Standard for the Installation, Maintenance and Use of Remote Station Protective Signaling Systems,

NFPA 72D, Standard for the Installation, Maintenance and Use of Proprietary Protective Signaling Systems,

NFPA 72E, Standard on the Automatic Fire Detectors,

NFPA 71, Standard for the Installation, Maintenance and Use Signaling Systems for Central Station Service.

7 *NFPA 74M, Manual on Home Fire Alarm Systems (origin date unknown, prior to 1965), later evolved into NFPA 74, Standard for the Installation, Maintenance and Use of Household Fire Warning Equipment.*

8 *NFPA 72F, Standard for the Installation, Maintenance and Use of Emergency Voice/Alarm Communication Systems.*

9 *NFPA 72G, Guide for the Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems.*

10 *NFPA 72H, Guide for Testing Procedures for Local, Auxiliary, Remote Station and Proprietary Protective Signaling Systems.*

11 Often attributed to Samuel Johnson (1709 – 1784), though his actual quote is reported to have been: "Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it." Source: www.samueljohnson.com/apocryph.html#12 , 2007.

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7th International Conference on Performance-Based Codes and Fire Safety Design Methods

Langham Hotel, Auckland, New Zealand, April 16-18, 2008

Since the first conference on performance-based codes and fire safety design methods was held in 1996, many countries have developed, or are in the process of developing, performance-based codes and design methods. However, use of these approaches has generally been limited to high-end projects, and the percentage of projects where performance-based design is used varies among countries.

This conference will present the state-of-the-art in performance-based code approaches and engineering design methods. Papers will be presented on newly emerging technologies, as well as perspectives on approaches that have worked well and approaches that have not worked as well as originally desired. The conference will be held in New Zealand, which was one of the first countries to adopt a purely performance based Building Code. Over the last twelve years, this conference has earned a reputation among the fire protection engineering community as the preeminent event for information on the leading-edge technology in the areas of performance-based codes and engineering design methods.

See *www.SFPE.org* for a complete conference program and hotel and registration information.

Registration Fees

Advance registration fees

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- $950 US dollars for Non-Members Late registration fees (received after March 7, 2008)
- $925 US dollars for SFPE/CIB/SFS Members
- $1,050 US dollars for Non-Members

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RESOURCES >>>

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Info: e-Mail - lazarom@unican.es

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4th International Conference on Pedestrian and Evacuation Dynamics
University of Wuppertal, Germany
Info: www.ped2008.com

March 12-14, 2008
3rd International Symposium of Tunnel Safety and Security
Göteborg, Sweeden
Info: sp.se/fire/ISTSS2008

April 16-18, 2008
7th International Conference on Performance-Based Codes and Fire Safety Design Methods
Auckland, New Zealand
Info: www.sfpe.org

September 21-26, 2008
9th IAFSS Symposium
Karisruhe, Germany
Info: iafss.org/html/events.htm

November 2-3, 2008
2007 International Symposium on Elevator Evacuation During High-Rise Fires
Shanghai, China
www.isee-sh.org

May 28-30, 2008
5th International Conference – SiF
Singapore
www.ntu.edu.sg/cee/sif-08/index.html

BRAINTEASER > Problem/Solution

Problem

[Christine operates a lemonade stand on a hot summer day. She has developed a unique sales plan for her lemonade: instead of charging a fixed fee, customers must pay the amount that is in the cash drawer and then remove 40 cents. When the fourth customer shows up, he exclaims that there is not any money in the drawer. How much money was in the drawer when Christine opened for business? What is the minimum amount that Christine must have at the beginning so that she will not eventually go broke?]

Solution to Last Issue's Brainteaser

Texas Hold 'em is a poker game where players receive two cards face-down as their hand ("hole cards") and five community cards, which are dealt face-up. The community cards are available to all players. A player may use any five-card combination from among his or her hand and the community cards.

What is the probability of being dealt a pair of aces as the player's hand?

There are 52 cards in a deck, of which four are aces. The probability of being dealt one ace as the first hole card is 4/52. The probability of being dealt the second ace is 3/51. Therefore, the probability of being dealt a pair of aces as the hole cards is 12/2652.

CASE STUDY

VIKING ELECTRONIC SERVICES

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Developers Diversified Realty, the Ohio-based realty company which owns and manages over 800 retail properties in 45 states and Puerto Rico, needed to find a way to help emergency systems managers coordinate some of their work. Affordable Fire Solutions of Linwood, NJ, and Viking Electronic Services had the perfect solution.

Terry Lawn, the alarm sales manager for Affordable Fire Solutions, says the easiest way to work with Developers Diversified Realty was to give them access to their own systems. An authorized dealer for Viking Electronic Services, Lawn provided them access to their eLAN Fire Alarm Systems through eSP, the online maintenance and reporting tool that integrates with the eLAN Fire Alarm Systems.

"We manage over 40 fire alarm systems for them in Pennsylvania and New Jersey, and more are added or changed over time," says Lawn. There are multiple Authorities Having Jurisdiction, inspection schedules, system testing procedures, maintenance requirements, notification schedules, and more.

"So, we gave them eSP access," says Lawn. "Now, six directors check on the 40 systems, and they do it from Pennsylvania, New Jersey, Ohio, and North Carolina."

Through eSP, responsible parties can access system reports, system settings, perform remote programming and service, and other essential actions. Using only an Internet browser, they can securely work on their systems from anywhere, at any time.

The system access through eSP also saves Lawn's business time and bolsters Affordable Fire Solutions' reputation, as well, says Lawn.

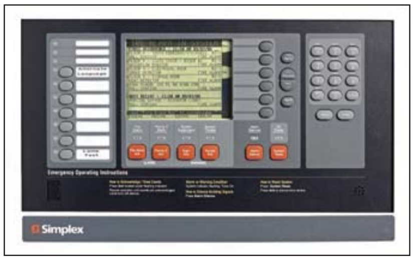
"With eSP access, such customers as Developers Diversified Realty see the work that we do for them on their systems, and they remain confident that we're on top of managing and meeting their needs."

If you're in the fire alarm business, learn how Viking Electronic Services can help you succeed by calling 800.274.9509, e-mailing info@vikingservnet.com, or visiting www.vikingservnet.com.

CASE STUDY

SIMPLEXGRINNELL

InfoAlarm™ Command Center Strengthens Response Capability of Simplex® 4100U Fire Alarm System



SimplexGrinnell has advanced the capabilities of its flagship Simplex 4100U fire alarm system with the introduction of the InfoAlarm™ Command Center – an expanded large-screen panel display and intuitive user interface that can help speed the response to emergencies.

Designed to facilitate quick, easy operation in emergency situations, the Simplex 4100U InfoAlarm Command Center enhances fire and life-safety protection by expanding the amount of information that can be displayed on the panel. The multiline display and the intuitive soft control keys enable system users, maintenance personnel, and first responders to access clear, easy-to-understand information that can identify the location, nature, and severity of an emergency or fire alarm system condition.

Fire protection and command operations can be further supported by placing remote, compact-sized InfoAlarm command centers in building entrances, lobbies, and other key locations.

"Today more than ever, access to information via the fire alarm system is critical in an emergency, whether it's a fire or other threatening situation," says John Haynes, director of Product Line Marketing at SimplexGrinnell. "That's why the Simplex 4100U InfoAlarm Command Center is such an important advancement. In simplest terms, it gives system operators and emergency responders more 'at-a-glance' information about an event, without having to scroll or push buttons. As a result, the response can be more rapid and accurate."

In addition to the extended information display, the InfoAlarm Command Center, one of the first products listed to meet the new UL 864 fire alarm equipment testing standard, gives the Simplex 4100U system added flexibility to meet application-specific customer requirements. Key features and benefits include:

- Easy, cost-effective upgrades
- Remote panel option
- "On the fly" instant-switch language selection
- Site map
- Watermark background
- Custom activity display choices

For more information, visit www.simplexgrinnell.com.

SimplexGrinnell LP
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www.simplexgrinnell.com

1

Vision Fire & Security is Now Xtralis

Vision Fire & Security (VFS) has changed its name to Xtralis. The company's product range encompasses air-sampling smoke detection systems (VESDA), video-based security systems and solutions (ADPRO), voice alarm systems (MILLBANK), fire control and management solutions (PROACTIV) and, through the acquisition of ASIM, security detectors, traffic detection, and traffic data acquisition systems. All current offices remain with the addition of Switzerland as head office for continental Europe.

www.xtralis.com
–Xtralis

2

Specification Writing Tool

The Intelli-Spec™ fire alarm system specification writing tool, now available on CD, enables specifiers to create, edit, and publish comprehensive specifications in Construction Specifications Institute (CSI) MasterFormat™, output as standard Microsoft or RTF documents. Intelli-Spec provides information on Gamewell-FCI's life safety products, including the new E3 Series™ emergency evacuation system and FocalPoint™ fire alarm monitoring workstation. Features include a cafeteria-style menu, making it easy to choose the features and hardware required for a particular project.

www.gamewell-fci.com
–Gamewell-FCI

3

Electric Submeters

Offering utility-grade metering accuracy, "Green Class" E-Mon D-Mon electric submeters offer a cost-effecitve way to benchmark and monitor energy usage trends and estimate CO2 emissions. Green meters are also ideal for measuring and verifying the on-going effectiveness of LEED, EPACT, renewable energy, demand-response, and other major energy-related initiatives that can positively impact a facility's bottom line, while also increasing environmental awareness within the using facility.

www.emon.com
–E-Mon, LLC

4

Quick Response Sprinklers

Victaulic's new V2744, K5.6 Quick Response sprinkler line features residential horizontal sidewall and recessed horizontal sidewall sprinklers that can be used in room sizes 12x12-ft. up to 16x20-ft. UL-approved, the sprinklers offer protection for design systems that require higher flow. The operating mechanism is a heat responsive, frangible glass bulb designed for prompt, precise operation. The V2744 is also listed for use in wet-pipe systems per NFPA 13D and 13R standards, under smooth, flat, horizontal ceilings.

www.victualic.com
–Victaulic

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