

# FIRE PROTECTION Engineering

1<sup>ST</sup> QUARTER 2012

Issue No. 53

## A Roundtable Discussion on the **EDUCATION** OF FIRE PROTECTION ENGINEERS

**New Model Curriculum for Fire Protection Engineering**

**Cal Poly Introduces a New Graduate FPE Program**

**What's Up With Mandatory Continuing Professional Competency?**



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# FIRE PROTECTION Engineering



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From the **TECHNICAL DIRECTOR**

## Women in Fire Protection Engineering

Even with the current downturn in the global economy, the demand for fire protection engineers continues to outpace the supply. Anecdotal evidence suggests that the only change for recent graduates with degrees in fire protection engineering is that where five years ago they had 5-7 job offers in their choice of geographic area, they now may need to consider moving when they accept a job.

On January 16, 2003, the SFPE conducted a "summit" to identify strategies for increasing the size of the qualified fire protection engineering workforce. This "summit" was attended by leaders in the public and private sectors, as well as student and faculty representatives from universities in the United States.

One of the top five strategies identified for recruiting into the fire protection engineering profession was to target efforts towards women. According to a study conducted as part of the process for establishing the content for the principles and practice of fire protection engineering examination,<sup>1</sup> less than 10% of practicing fire protection engineers are women. Increasing the number of women who choose fire protection engineering as a profession could have a significant impact on the total number of people who enter the field.

The low number of women is not unique to fire protection engineering: in the broader field of engineering, women account for 20% of engineering graduates. What's more alarming than this low number is that women only comprise 11% of the engineering workforce.<sup>2</sup> Therefore, almost half of all women engineers leave the field after graduating with an engineering degree. So, the engineering profession faces two challenges that must be overcome to increase the number of women engineers: recruit more women into academic programs, and keep those that choose engineering as a profession.

One reason that women do not choose engineering as a career is that they feel that engineering does not provide them an opportunity to help people through their work.<sup>3</sup> Women are more likely than men to seek careers where they can help people, and many women perceive that engineering does not offer that opportunity.

Only one in four women who left the field stated that they did so to focus on raising a family.<sup>2</sup> The other reasons cited include:

- Nearly half identified working conditions, too frequent travel, lack of advancement potential, or low salary.
- One-in-three stated a dislike of the workplace climate, supervisor, or the office culture.

Of the women who have chosen to remain in the engineering workforce, many identified key supportive people within their organization, such as supervisors or co-workers. Conversely, women engineers who felt that they were treated in a condescending or patronizing manner, or were belittled or undermined by their supervisors or coworkers were more likely to leave their employers, and the engineering profession altogether.<sup>2</sup>

The work of fire protection engineers directly contributes towards making the built environment safer for people, which is consistent with the desire of many women for careers where they can help people.<sup>3</sup> And, a career in fire protection engineering pays well.

So, what can fire protection engineers do to make fire protection engineering a more attractive career choice for women? One relatively simple thing would be to highlight how fire protection engineers make the world a safer place when speaking with young women who might consider a career in math, science or engineering. Indeed, "fire protection engineers use science to make our world safe from fire" is one of the "messages" that SFPE has developed to help raise awareness of the profession.<sup>4</sup>

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

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

### Correction

We regret that we did not credit Charles Fox of Statewide Fire Protection for three images that appeared in the article entitled "The Monte Carlo Exterior Façade Fire" in the 4th Quarter, 2011 issue. These images appeared on pages 22 (left image), 23 (lower image) and 32.



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By David Lucht, P.E., FSFPE

The original idea for the Worcester Polytechnic Institute master's degree fire protection engineering program evolved from the bottom up. It all started among undergraduate students in non-fire majors.

In 1970, the entire undergraduate curriculum was revamped into a hands-on, project-based approach to engineering education. The keystone was the junior project. Known as the Interactive Qualifying Project or "IQP", this junior year effort became a degree requirement for all undergraduate students. Equivalent to three courses of academic credit, it had to be taken very seriously.

The goal of the IQP was to give each student an in-depth experience at the intersection of technology and society. Working in small, interdisciplinary teams, students would tackle problems of social significance. For example, three students in mechanical engineering, computer science and mathematics might work on innovative approaches to supplying safe drinking water to a remote African village. The team would do a literature review and project proposal before beginning. Then they would work with local community members to find solutions, ending with a comprehensive written report and public presentations – just like the "real world."

When the new curriculum was activated, the campus was suddenly filled with thousands of eager young minds searching for cool topics. And civil engineering professor Robert Fitzgerald ("Fitzie") was at the ready.

Through related work in building codes and civil defense preparedness, Fitzie had taken an interest in fire safety. Interacting with the Worcester Fire Department, he started advising IQPs on topics ranging from fire suppression, fire codes and communications to information systems and hazard assessments. As his project activities expanded, other faculty in a host of disciplines developed interest as well. Over 40 professors in traditional disciplines soon became involved in advising fire-related projects. Momentum had begun.

With time, the notion of starting a formal FPE master's degree program emerged. Fitzie worked with key faculty leaders, consulted with fire protection engineers in the industry and began formulating plans. Ultimately, WPI President Edmund Cranch authorized the hiring of a fire protection engineer to head a proposed new program. That's where I entered the picture.

I was then working as the Deputy Administrator of the United States Fire Administration. Previously I had worked as an insurance industry field engineer, fire test engineer at Ohio State University and as the Ohio State Fire Marshal. Unknown to me, Fitzie and colleagues had singled me out

as one having a breadth of experience favorable to what they thought was needed. I was approached and hired in 1978 to head the new master's degree program.

At the time, WPI was only able to commit enough resources to cover my salary for one day each week. I was then hired to work the other four days at Firepro Incorporated, a nearby consulting firm. Firepro's founder, Rexford Wilson, was a co-conspirator with Fitzie.

Developing a full-fledged degree program from scratch was a daunting task. We had no FPE faculty, no courses, no students, no laboratory space or university-level textbooks and almost no money. In fact, the degree program itself still had not been approved by the faculty at large.

In 1979 the university faculty voted to authorize the master of science fire protection engineering degree and approved nine course descriptions. Now we were "legal."

In the early years, area professionals were recruited to teach courses in the evenings. Students were mainly local practicing engineers who had day jobs.

With time, the program grew in size, enabling me to move to full-time status. By then, we were already enrolling full-time students, many of whom came from the WPI undergraduate program, inspired by the fire safety theme of so many IQPs. Eventually, distance learning technology enabled enrollment of off-campus students worldwide. Today, WPI reports a total of 293 students enrolled in the FPE program, including nine at the doctoral level.

Fundraising was a vital element of program startup. Gifts and grants from individuals, foundations and corporations made the difference – they contributed millions of dollars for scholarships and internships as well as course development and construction of a first-generation fire laboratory.

The centerpiece course, which we called "Fire Dynamics," was underwritten by a \$100,000 leadership gift from CIGNA Corporation. This project included writing of the landmark textbook *Introduction to Fire Dynamics* by CIGNA Visiting Professor Dougal Drysdale.

Fitzie and I retired in 2004. We, along with all the other faculty and staff, continue to draw satisfaction from knowing there are some 600 WPI graduates out there working at the intersection of technology and society and making today's world a safer place – very much in harmony with the IQP that played such a key role at the inception of the program.

*David A. Lucht is with Worcester Polytechnic Institute.*

For more details on the history of the WPI program, go to [www.wpi.edu/~fpehistory](http://www.wpi.edu/~fpehistory)



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

## Midwest University Launches FPE Graduate Program

The University of St. Thomas (UST), St. Paul, Minn., is launching a graduate program in Fire Protection Engineering. It has been more than 25 years since a university has offered such a program in the Midwest region.

The 30-credit master's program will be offered to students beginning in the Spring 2012 term. It will combine on-campus work at UST and distance learning with the nationally-recognized Department of Fire Protection Engineering at the University of Maryland.

"This has been a long, unmet need in the Midwest," says Paul Rivers, board member of the Society of Fire Protection Engineers and senior fire protection specialist at 3M. "It is exciting to see these two recognized educational institutions come together with a novel approach to meet industry needs. To have such expertise and talent locally available is essential. The future looks bright for Midwest companies looking to work with locally trained fire protection engineers."

For more information, go to [www.bit.ly/Aj9f9Q](http://www.bit.ly/Aj9f9Q)

## Study Finds Failure Points in Firefighter Protective Equipment

In fire experiments conducted in uniformly furnished, but vacant Chicago-area townhouses, National Institute of Standards and Technology (NIST) researchers uncovered temperature and heat-flow conditions that can seriously damage facepiece lenses on standard firefighter breathing equipment, a potential contributing factor for first-responder fatalities and injuries.

The findings are detailed in a report entitled, "Fire Exposures of Fire Fighter Self-Contained Breathing Apparatus Facepiece Lenses." The research study was sponsored by the U.S. Fire Administration and Department of Homeland Security. The work is an important step toward improving what may be the most vulnerable component of a firefighter's protective gear in high-heat conditions: the facepiece lenses of the so-called self-contained breathing apparatus (SCBA).

The researchers tested five models of SCBA facepieces, each from a different manufacturer. In all cases of lens degradation, the damage was due to temperatures and heat fluxes that exceeded performance limits of polycarbonate, the lens material commonly used in SCBA for firefighters.

"Our results do not suggest, in any way, that lens failures are due to the manufacturers," explains Nelson Bryner, a co-author of the report. "All the lenses tested were consistent with requirements specified in standards."

In the United States, SCBA makers must submit their products for certification testing before they can be sold. Certification requires passing the "heat and flame test" specified in a standard by the National Fire Protection Association. Citing the conclusions of other researchers, the NIST team notes that this test is conducted at high temperatures, but "it does not capture the conditions of temperature, heat flux, and duration that a firefighter might experience."

"The next step," the NIST researchers write, "is to identify the exposure limit just before thermal degradation occurs. Data on the limits of the equipment would be valuable information for the fire service to help prevent further injuries and fatalities related to SCBA equipment failure."

To access the report, go to [www.tinyurl.com/83clprk](http://www.tinyurl.com/83clprk)

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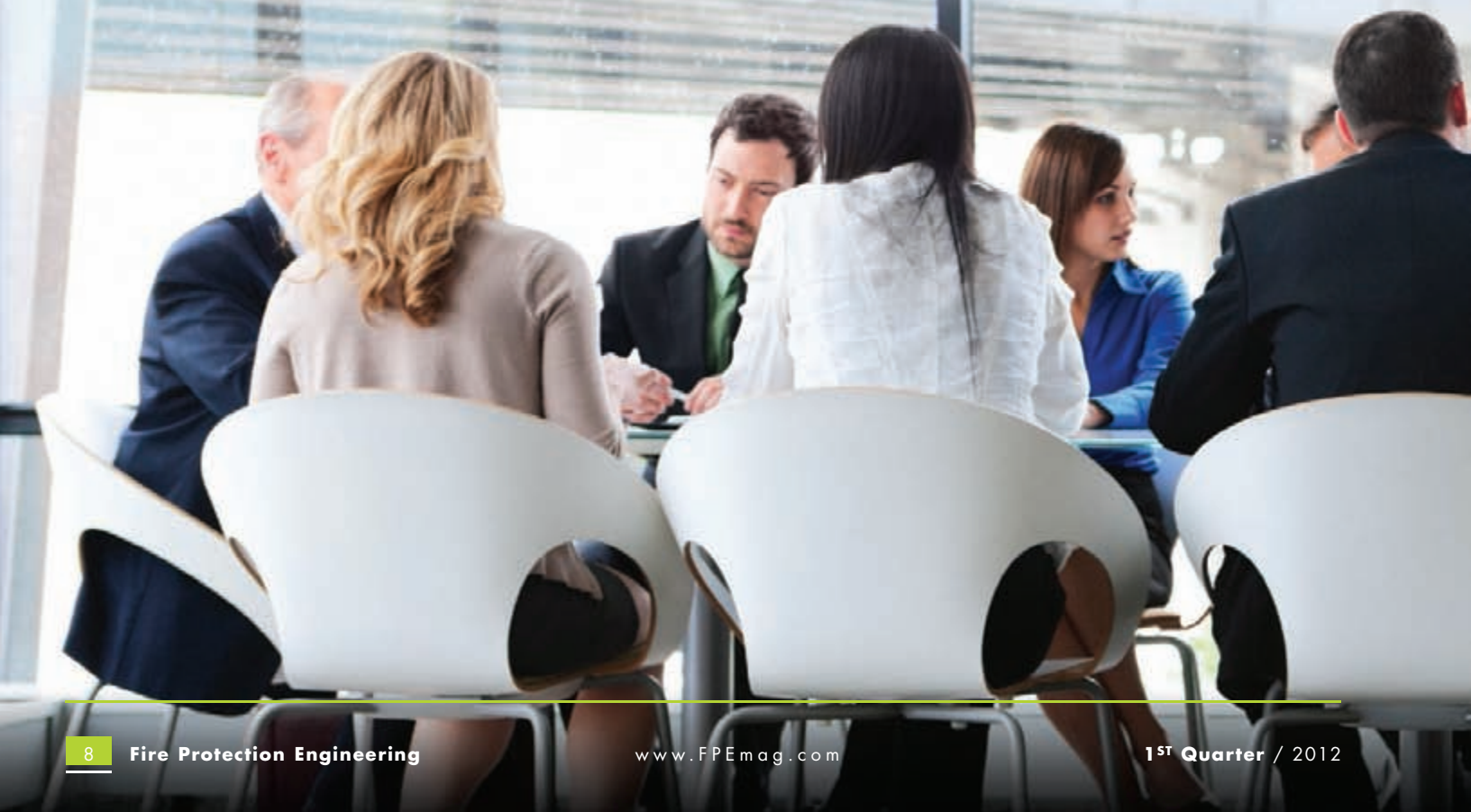


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# A “ROUNDTABLE” DISCUSSION ON THE **EDUCATION** OF FIRE PROTECTION ENGINEERS

By Morgan Hurley, P.E., FSFPE





**T**oday, building designs have become more complex and highly detailed. Buildings are larger, have more unusual shapes, and contain a variety of hazards. Accordingly, the practice of fire protection engineering has been evolving at a rapid pace. Engineering tools are becoming more plentiful and more sophisticated, and the codes and standards that govern fire protection engineering design have grown more complicated.

The education programs that teach fire protection engineering have had to evolve to stay ahead of the profession. The Society of Fire Protection Engineers conducted a "roundtable" discussion of leading faculty from universities that offer degree programs in fire protection engineering. The purpose of the roundtable was to gain insight into the academic focus of the programs, the challenges that they face, and their vision of the future. The participants in the roundtable are listed in Table 1. This article is an

abbreviated version of the roundtable discussion. For the complete account, see <http://fpemag.com/articles/article.asp?i=539>.

**HURLEY:** What degree program(s) do you offer?

**NOTARIANNI:** WPI offers master of science and Ph.D. degrees. We also offer a five-year bachelor of science/master of science program for high school graduates. WPI graduates enter the FPE job market with two degrees—a B.S. in one of the traditional engineering disciplines, such as mechanical, civil, chemical, electrical or other engineering. We also offer a graduate certificate in fire protection engineering and an advanced certificate in fire protection engineering.

**HADJISOPHOCLEOUS:** Carleton University offers Ph.D. and masters programs in fire safety engineering. At the master's level, there are three options: master of applied science,

master of engineering with project and masters of engineering with coursework only.

**CHOW:** Hong Kong Polytechnic University offers a master of science in fire and safety engineering and master and doctorate degrees in fire science and engineering. We also offer undergraduate and graduate degrees in building services engineering and facilities management, where students may choose to take fire engineering courses. We plan to offer undergraduate degree programs in risk and safety assessment and in building energy technology and management soon.



Faculty	University
Karen Boyce, Ph.D.	University of Ulster, Northern Ireland (United Kingdom)
W.K. Chow, Ph.D., FSFPE	The Hong Kong Polytechnic University
Charles Fleischmann, Ph.D., P.E., FSFPE	University of Canterbury, Christchurch (New Zealand)
George Hadjisophocleous, Ph.D., P.Eng, FSFPE	Carleton University, Ottawa, Ontario (Canada)
Robert Jönsson, FSFPE	Lund University (Sweden)
James Milke, Ph.D., P.E., FSFPE	University of Maryland, College Park, Maryland (USA)
Bart Merci, Ph.D.	Ghent University (Belgium)
Fredrick Mowrer, Ph.D., P.E., FSFPE	California Polytechnic State University, San Luis Obispo, CA (USA)
Kathy Notarianni, Ph.D., P.E., FSFPE	Worcester Polytechnic Institute, Worcester, Massachusetts (USA)
Jose Torero, Ph.D.	University of Edinburgh, Scotland (United Kingdom)
Elizabeth Weckman, Ph.D.	University of Waterloo (Canada)
Morgan Hurley, P.E., FSFPE	Society of Fire Protection Engineers (moderator)

Table 1. Roundtable Participants.

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**MOWRER:** Cal Poly offers a master of science degree in fire protection engineering.

**MERCI:** The International Master of Science in Fire Safety Engineering (IMFSE) is jointly issued by Ghent University, Lund University and The University of Edinburgh. We offer a joint master of science degree. Each partner university also offers Ph.D. degrees.

**JÖNSSON:** Lund University has a bachelor's program in fire protection engineering and a master's and Ph.D. program in risk management and safety engineering. In addition, the department is involved in two international master's programs, namely the master of disaster management program and the International Master of Fire Safety Engineering program.

**FLEISCHMANN:** The University of Canterbury offers a master's of engineering and a Ph.D. in fire engineering.

**TORERO:** The University of Edinburgh offers a bachelor's degree in structural and fire safety



engineering, a master's of engineering in structural and fire safety engineering, and a master of science in structures and fire engineering. We also are part of the international master's in fire safety engineering master's program in partnership with Ghent & Lund.

**MILKE:** The University of Maryland offers bachelor's, master of science and master of engineering degrees. The master of engineering degree is available in both on-campus and on-line formats. We also offer a Ph.D. in collaboration with other engineering departments.

**BOYCE:** The University of Ulster offers a post graduate diploma/master of science in fire safety engineering. Students can attend on either a full-time or part-time basis. We also offer a Ph.D. program in fire safety engineering.

**WECKMAN:** The degree at the University of Waterloo is mechanical engineering degree with a fire safety

certificate. We offer a master of engineering degree that only requires coursework, a master of science degree that requires thesis research, and a Ph.D.

**HURLEY:** What is the background of your typical students?

**CHOW:** Undergraduate students at Hong Kong Polytechnic University may enter directly from high school or with some college. Graduate students generally have a bachelor's degree and professional experience.

**MILKE:** The student population at the University of Maryland is diverse. Many undergraduates come to us directly from high school. Most of the undergraduates are from the United States. Graduate students come directly from their undergraduate studies or with some professional experience, with many being students from outside the United States.

**JÖNSSON:** About 70% of the undergraduate students at Lund come directly from high school; about 25% of the students are women.

**MOWRER:** Cal Poly attracts two types of students: students continuing directly from their undergraduate studies and students who are working professionals interested in enhancing their knowledge and credentials in fire protection engineering.

**NOTARIANNI:** WPI students come into the program from more than 40 nations with undergraduate degrees in mechanical, civil, chemical, electrical, environmental and robotic engineering, along with physics, chemistry, math, computer science, architecture, the social sciences and others.

**HADJISOPHOCLEOUS:** Carleton University has three types of students. Students who have just received their undergraduate degree in engineering,

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mainly civil or mechanical, and who would like to go on to graduate school for a master's degree; students who already have a master's degree and would like to continue to a Ph.D.; and students who have been working for sometime in the field of fire safety engineering and would like to improve their knowledge. Typically, the last group of students enrolls in the master's of engineering programs.

**MERCI:** Students seeking the International Master of Science in Fire Safety Engineering have a master's or bachelor's degree in engineering. Most incoming students do not have professional experience.

**FLEISCHMANN:** Students entering the University of Canterbury have an undergraduate engineering degree from an accredited program.

**TORERO:** Most students entering the University of Edinburgh have a background in civil engineering (about 70%). Others come from mechanical engineering (20%), chemical engineering (5%) or other sources (5%).

**BOYCE:** Typical full-time students at the University of Ulster come from civil engineering, construction engineering, fire safety engineering or fundamental science backgrounds. Part-time students come from similar academic backgrounds and are usually employed as building control officers or fire services personnel.

**WECKMAN:** Most students entering the University of Waterloo have an education in chemical, mechanical or civil engineering; some come from chemistry or industrial engineering. Many have been exposed to fire safety through a 4th year elective course at Waterloo or Saskatchewan.

**HURLEY:** What are your admission requirements?

**TORERO:** Students entering the University of Edinburgh seeking a bachelor's of engineering or a master's of engineering degree should have a strong background in math and physics.

**MILKE:** For undergraduates entering the University of Maryland,

we consider scores on standardized tests, high school grades for entering freshmen, and grades at other institutions and completion of gateway courses for transfer students. For graduate students, we require a bachelor's degree in engineering with a minimum grade average, but we will consider those with non-engineering degrees if they have taken a core set of engineering courses.

**NOTARIANNI:** High school graduates applying for the combined bachelor's/master's program must meet normal undergraduate admission criteria and submit a two-page essay articulating their interest in the field. Applicants for the master's or certificate programs should

disciplines may be required to take selected undergraduate courses to round-out their backgrounds. GRE scores are required for all international students and Ph.D. applicants, and strongly recommended for all others.

**WECKMAN:** Master's students at the University of Waterloo should have a bachelor of science degree with good grades. For Ph.D.-level study, they should have a master of science with good grades.

**HADJISOPHOCLEOUS:** The minimum requirement for admission to the master's program is a baccalaureate degree, with at least a 70% average in civil engineering or the sub-disciplines normally considered



have a bachelor's degree in engineering, engineering technology or the physical sciences. Applicants with no FPE work experience must submit a two-page essay articulating their interest in the field. Students with science degrees and graduates of some engineering technology

to be part of civil engineering. Applications also will be considered from graduates of other engineering programs or honors science programs; however, they may have additional academic requirements once they are admitted. The normal requirement for admission into the



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Ph.D. program is a master's degree with a thesis in civil engineering. Students with master's degrees in other engineering disciplines also are admitted, but in some cases additional courses may be specified.

**BOYCE:** The University of Ulster requires a degree in a related science or engineering discipline. Additionally, students must have a strong background in mathematics.

**CHOW:** Undergraduate students must have a high school diploma or an associate's degree. Graduate students must have a bachelor's degree or professional qualifications.

**MOWRER:** In general, the FPE program at Cal Poly requires students to have a BS degree in engineering or a related technical field. Students should have an undergraduate GPA of 3.0 or higher for full admission, but students with a GPA of 2.5 or higher are considered for conditional admission with strong recommendations.

**MERCI:** The minimum graduate admission requirements for the International Master of Science in Fire Safety Engineering are essentially: a bachelor's degree from an accredited institution (minimum three years full-time study) in engineering, material sciences, chemistry, physics, architecture, urbanism and spatial planning or a related discipline.

**JÖNSSON:** Students coming into Lund as undergraduates must have a basic high school education and certain expertise in mathematics, physics and chemistry. The intake is purely on the grade average from high school. For the FPE program, it is quite high, close to an "A" average.

**FLEISCHMANN:**

Students entering the University of Canterbury must have an undergraduate engineering degree. Students with a degree in science, architecture or building sciences must take a bridging course.

**HURLEY:** What is the academic focus of your program? Do you emphasize certain aspects of fire protection engineering or do you have a broad focus?

**BOYCE:** The aim of the University of Ulster is to produce graduates who will have an in-depth knowledge, understanding and critical awareness of the scientific, technological, psychological, physiological and socio-economic principles and techniques upon which fire safety engineering applications are founded. In this respect, we cover the core science and engineering subjects. There also is a practical focus where students are required to apply their knowledge and skills in developing solutions to a range of complex and real fire safety engineering problems.

**MOWRER:** Cal Poly has a well-deserved reputation for its "learn by doing" approach to education. In keeping with this philosophy, the FPE program at Cal Poly is intent on educating students who are fundamentally sound as well as practically applied. To this end, students are educated in the fundamentals of fire science as well as in the analysis and design of fire protection features and systems. In this regard, the FPE program at Cal Poly has a broad perspective.

**NOTARIANNI:** Teaching at WPI combines on-campus and online instruction seamlessly. We believe that students should understand how to apply knowledge – not just how to cite facts and theories. Our undergraduate and graduate students emerge ready to take on some of the most difficult challenges in FPE. More importantly, they understand how their work can truly have a positive impact on society and improve people's lives.

**MERCI:** The students in the International Master of Science in Fire Safety Engineering program can follow different tracks. After their first semester (basic fire protection engineering), they all go to Lund for their second semester, where they study advanced fire dynamics, risk assessment and human behavior. In their third semester, they choose between a focus on construction engineering (Edinburgh) and broad fire protection engineering (Ghent). The choice of the master's thesis (Semester 4) allows the students to further broaden their focus.

**CHOW:** The focus at Hong Kong Polytechnic University is the integration of fire safety with building services and facility management.

**WECKMAN:** We maintain a broad focus at the University of Waterloo. The course offerings currently include fire dynamics, advanced enclosure fires, fire modeling, fire risk, fire resistance, fire testing and two advanced fire safety design courses.

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Additional specialty courses are considered as opportunities arise and funding/interest permits.

**JÖNSSON:** Lund has a broad focus, but an in-depth focus in fire dynamics, risk analysis and human behavior and very little or nothing in structural engineering and industrial fire protection.

**HADJISOPHOCLEOUS:** Carleton University has quite a broad focus that encompasses both full-scale and small-scale testing as well as computer modeling to study structural fire safety and the study of the performance of active fire protection systems.

**FLEISCHMANN:** The University of Canterbury provides a very broad fire engineering education, although with most of our graduate going into the consulting industry, our focus could be described as more practice rather than research-focused.

**TORERO:** At the University of Edinburgh, we have a broad focus,

while encouraging students to gain a deep understanding.

**MILKE:** The University of Maryland also has a broad focus.

**HURLEY:** What are your graduation requirements?

**MILKE:** The bachelor's program is a nominal four-year course of study with classes in the major, math, science, etc. The master of science degree is a nominal 1.5 to two-year course of study with a thesis, while the master of engineering does not require a thesis. Of course, part-time students generally take longer.

**FLEISCHMANN:** Master's students at the University of Canterbury must complete six courses and a thesis or project report, which typically takes 18 to 24 months of full-time study. Doctoral students must complete a thesis, which generally takes 36 to 48 months of full-time study.

**HADJISOPHOCLEOUS:** Study at the master's level can be pursued

through a thesis leading to a master of science, a project option leading to a master of engineering, or a coursework option leading to a master of engineering. The project replaces some of the coursework, and the thesis replaces more of the coursework than the project does. The requirements for the Ph.D. degree, after the master's degree, include additional coursework and a dissertation.

**NOTARIANNI:** The master's degree requires two years of study and the Ph.D. requires about six years of study on a full-time basis. Graduate certificates require a minimum of four courses. All Ph.D. students conduct and publish scholarly research that advances knowledge in the field. Master of science students can choose either a thesis or non-thesis option.

**MOWRER:** Students must successfully complete 10 courses and a culminating project. Students must present and defend their culminating projects to a review panel.

**WECKMAN:** To receive a master of engineering from the University of Waterloo, students must complete eight courses. A fire safety design project can be substituted for two of the courses. Master of science students must complete four courses with a research thesis, and a Ph.D. requires an additional three courses with a research thesis.

**CHOW:** At Hong Kong Polytechnic University, all degree programs require a combination of academic credits and independent study.

**MERCI:** The students in the International Master of Science in Fire Safety Engineering must pass all courses and successfully complete and defend a master's thesis. The entire program takes about 20 months.

**JÖNSSON:** To graduate from Lund, students must pass all the courses and complete a thesis.

**TORERO:** Students at Edinburgh must complete a combination of courses and research.

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**BOYCE:** Students at the University of Ulster must complete eight modules for the award of a post-graduate diploma and must complete a dissertation in a fire science-related area for a master of science degree.

**HURLEY:** What success do your students have in obtaining a job following graduation?

**FLEISCHMANN:** Canterbury's students find it easy to obtain employment in fire engineering. Most students have found employment before graduating and, in most cases, have multiple offers to consider.

**NOTARIANNI:** The number of career opportunities consistently outweighs the number of engineers available to fill them. In fact, the unemployment rate among WPI's fire protection engineering grads today is little more than zero percent, a far cry from many professions.

**JÖNSSON:** All graduates from Lund have found employment.

**TORERO:** All graduates from the University of Edinburgh have found jobs, usually before graduation.

**HADJISOPHOCLEOUS:** All of Carleton University's students find employment by the time they graduate.

**WECKMAN:** Graduates from the University of Waterloo have good success. All of our graduates are employed.

**CHOW:** Similarly, since the first cohort graduated in 1989, graduates from Hong Kong Polytechnic University have had no difficulty obtaining a job in fire engineering or building services engineering.

**MOWRER:** One of the first students scheduled to graduate from the Cal Poly FPE program has been interning with a prominent FPE consulting firm and has just accepted an offer of full-time employment with this firm. Other full-time students seeking employment following graduation are pursuing a number of leads.

**MILKE:** Graduates from the University of Maryland have a high success rate in finding employment.

**BOYCE:** Graduates from the

University of Ulster also have a high success rate in employment within the industry, even before graduation. Each year, approximately 20-25% of graduates have embarked on further study both in the UK and abroad.

**HURLEY:** If there was one thing the profession could do to assist your program, what might that be?

**TORERO:** Engage directly with students (e.g., guest lectures, internships). Students' motivation and practical understanding increases significantly with first-hand experience.

**NOTARIANNI:** Help us get the word out that fire protection engineering is a good career choice.

**MOWRER:** The mission of the FPE program at Cal Poly is primarily to educate students to become productive practicing fire protection

**JÖNSSON:** At Lund, we would like to see more internships abroad.

**MILKE:** We would like to see an increase in the need for formal education in fire protection engineering. Financial support for research, assistantships and scholarships also would be great.

**BOYCE:** We would like the opportunity for the program to be fully accredited by a fire safety engineering professional body. Unfortunately, at the moment this opportunity does not exist within the UK – the IFE can give Approval with Academic Exemption but is not in a position to accredit courses. It is important that we are in a position to get accreditation, given that the UK's engineering council will shortly require accredited master's



engineers. The one thing that the profession can do to help the FPE program at Cal Poly achieve this goal is to help recruit talented and interested students to the program and mentor these students during their education in FPE.

**HADJISOPHOCLEOUS:** Increase awareness of the program among fire protection practitioners and potential employers.

**CHOW:** Industry assistance in research funding.

**MERCI:** Guaranteed sponsorships for high-quality students that enable them to register for the program – and to live and travel in Europe. Promotion of the program and internships also would be good.

qualifications for chartered engineering status.

**WECKMAN:** As with other universities, an infusion of funding would help all programs. For us, this could take the form of co-sponsorship of one of our courses on an annual basis. The course could be a key course for future FSEs; therefore, a mechanism should be established to have it count towards continuing education credits because that would attract additional students from industry as well. This could then domino into additional contacts and support for the program over time. ■

For more, see <http://fpemag.com/articles/article.asp?i=539>.



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# NEW MODEL CURRICULUM FOR A BS DEGREE IN FIRE PROTECTION ENGINEERING

**By James A. Milke,  
Ph.D., P.E., FSFPE,  
and Richard Davis,  
P.E., FSFPE**

In 2010, the Higher Education Committee of the SFPE completed an update of the model curriculum for fire protection engineering that was developed in the 1990s.<sup>1</sup> That update was approved by SFPE's board of directors in April 2010, and is titled "Recommendations for a Model Curriculum for a BS Degree

in Fire Protection Engineering (FPE)".<sup>2</sup> The intent of the model curriculum is to provide assistance to universities exploring the development of new, undergraduate programs in fire protection engineering.

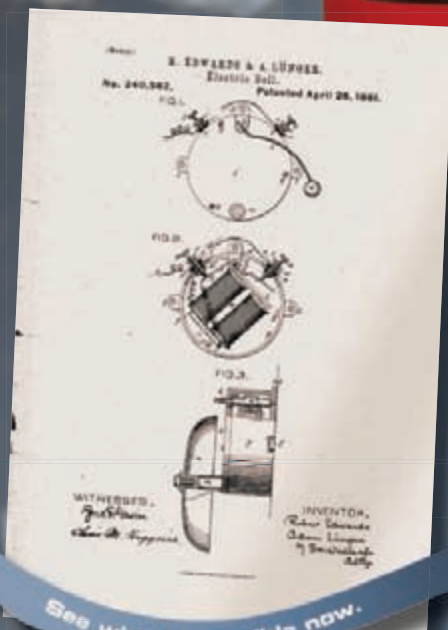
Over the years, SFPE staff and faculty at fire protection engineering programs have been sought as

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a resource by faculty at other institutions considering initiating new fire protection engineering programs. One of the typical questions posed by the institution is “what should be included in a fire protection engineering program?” As such, the model curriculum provides a set of suggestions of topics that could be included in an undergraduate program in fire protection engineering. It is not intended to be the only acceptable combination of courses within such a program.

In addition, faculty at existing fire protection engineering institutions may find the model to be a good resource as a way of keeping pace with developments in the profession. Periodically, the institutions may conduct a self-study to review whether the courses being offered in that program are still appropriate and whether new courses should be considered. These new courses could reflect changes in technology or involve new topic areas. For example, courses in computer modeling or fire

investigations are relatively recent changes in the field.

The newly-released document takes advantage of the extensive discussion in the 1995 publication. As such, the 2010 version provides a succinct discussion of courses that could comprise a fire protection engineering program. When implementing the recommendations of the 2010 version, the 1995 publication still serves as a useful reference. Also, the 2010 document relates specifically to an undergraduate program in fire protection engineering, while the 1995 publication was broad-based, related to undergraduate or graduate degree programs. The Higher Education Committee of SFPE is currently engaged in developing a comparable guide solely for master’s degree programs.

The outline of the model curriculum (developed by the committee) groups the courses outside of engineering while identifying the engineering courses individually. A

Considering that an engineering curriculum leading to a BS degree requires approximately 120 to 125 credits at most U.S. universities, the general courses comprise almost half of the degree requirements.

brief description of the objectives for each course is included in the model curriculum developed by the committee. The groups of general courses outside of engineering listed a total of 51-53 credits of coursework, including:

- Physics
- Chemistry
- Math (calculus and differential equations)
- English
- General education and technical elective courses

Considering that an engineering curriculum leading to a BS degree



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requires approximately 120 to 125 credits at most U.S. universities, the general courses comprise almost half of the degree requirements. This is consistent with most other engineering fields.

Engineering fundamentals listed in the model curriculum include:

- Statics
- Mechanics of materials
- Dynamics
- Engineering economics
- Fluid mechanics
- Thermodynamics
- Heat transfer
- Computer-aided drafting

These subjects generally are covered in courses that are 3 credits each, comprising 24 credits, or about 20% of the undergraduate curriculum. This is based on a typical 14-15 week semester with 3 hours of classroom time per week.

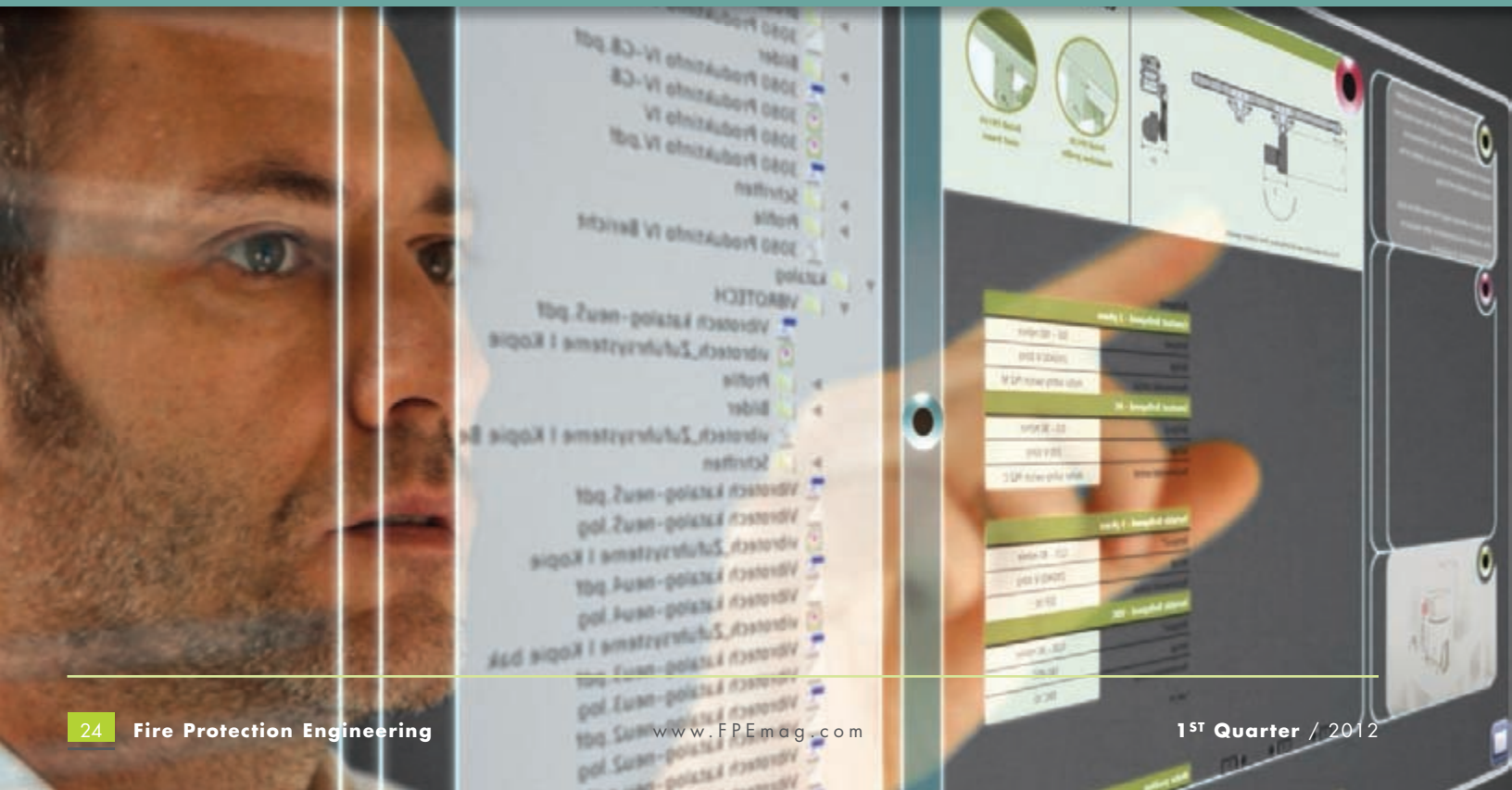
The remaining courses listed in the model curriculum would be courses in areas of fire protection engineering. These include:

- Fire chemistry
- Fire hazard and risk analysis
- Water-based suppression
- Special hazards – Non-water-based suppression

- Fire dynamics
- Fire modeling
- Fire protection related codes & standards
- Structural fire protection
- Storage & transportation of hazardous materials
- Egress and life safety analysis
- Fire testing
- Fire investigation
- Detection, alarm & smoke control
- Explosion prevention & protection
- Fire risk management
- Senior capstone project

Variations in the actual curriculum adopted by a particular

Many of the courses outside of the major are included so that fire protection engineering graduates will have the background to enable them to be reasonably well prepared for the Fundamentals of Engineering examination (and later the Principles of Engineering examination in fire protection engineering), required to become a registered professional engineer.







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While there is much emphasis currently on the use of computer models in fire protection engineering, considerable emphasis must be placed on understanding the science behind the models as well as their limitations.

institution are expected. The fire protection engineering courses listed in the model curriculum are intended to provide degree recipients with a broad background in fire protection engineering. Many of the courses outside of the major are included so that fire protection engineering graduates will have the background to enable them to be reasonably well prepared for the Fundamentals of Engineering examination (and later the Principles of Engineering examination in fire protection engineering), required to become a registered professional engineer. While the general (non-major) courses are likely to be offered at any institution with an engineering program, the fire protection engineering courses may need to be tailored to the expertise of the full-time or part-time faculty offering the courses.

The committee was very careful to indicate that the above list of courses (in and out of the major) was not intended to be limiting, i.e., to imply that all fire protection engineering programs need to contain these specific courses. In fact, none of the curricula at schools with existing undergraduate fire protection engineering programs agrees with all aspects of this model.

Also, the fire protection engineering program at a particular institution may opt to provide for a particular focus, potentially offering multiple courses in a selected topic, or may want to offer a course in a topic not listed above, e.g., wildland fires. Where additional courses beyond those identified in the model curriculum are proposed by an institution to be part of the degree program, one or more of the courses noted above would likely need to be deleted in order

to keep the total number of credits in the area of 120-125, in keeping with most engineering curricula at U.S. schools.

While there is much emphasis currently on the use of computer models in fire protection engineering, considerable emphasis must be placed on understanding the science behind the models as well as their limitations.

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One of the next endeavors for the SFPE Higher Education Committee is to develop curriculum content for a master's degree in Fire Protection Engineering. A task group has been established and an initial meeting has taken place.

Issues to be considered in this new initiative include:

1. Potential students include both students with an undergraduate degree in FPE as well as students with an undergraduate degree in other engineering disciplines.
2. The larger percentage is likely to be students with an undergraduate degree in other engineering disciplines.
3. Courses offered should include core courses that are required, unless previously taken at the undergraduate level. Courses also should include more versatile and focused topics to allow a variety of course selection and prevent repetition of previous courses taken, regardless of the student's prior education.
4. Course selection should be such that all four core areas are covered, with the option for specialization in a certain area:
  - a. Fire science
  - b. Fire protection engineering
  - c. Fire safety evaluation
  - d. Fire protection management

Members of the SFPE Higher Education Committee who helped develop the updated model curriculum in fire protection engineering are: Dick Davis (Chair), Kathleen Almand, Carl Baldassarra, Doug Brandes, Art Cote, Gavin Horn, Robert Jönsson, Dan Madrzykowski, Michael Madden, Brian Meacham, Jim Milke, Jerry Vuoso, Jack Watts and Chris Jelenewicz (staff liaison).

*James Milke is with the University of Maryland. Richard Davis is with FM Global.*

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# FPE@CALPOLY

By Frederick W. Mowrer, Ph.D., P.E., FSFPE



## INTRODUCTION

**A**fter years of planning and development, a new graduate program in Fire Protection Engineering (FPE) was launched during the Fall 2010 quarter at the California Polytechnic State University (Cal Poly) in San Luis Obispo, CA. The FPE program leads to a master of science (MS) degree in fire protection engineering that is offered through the college of engineering at Cal Poly. With its well-earned reputation for turning out highly qualified engineers based on its learn-by-doing philosophy, and with its location along the West Coast of the United States, Cal Poly is an ideal place to offer the third graduate program in FPE in the United States.

The fire protection engineering program at Cal Poly is designed to build on the broad scientific and engineering principles students acquire in an

undergraduate engineering program or in a related technical field. The required and elective courses composing the MS degree in fire protection engineering address the body of knowledge currently required by the fire protection engineering profession. Students completing the program acquire the technical knowledge, skills and tools required to practice fire protection engineering in a variety of local, national and international settings. Upon completion of this program, students will possess the necessary knowledge to pursue professional certification and licensure in the fire protection engineering discipline.

## THE CURRICULUM

The goal of the FPE program at Cal Poly is to educate students who are fundamentally sound as well as highly qualified to practice in the fire protection engineering profession. To this end, the curriculum has been devised to offer a fundamentals track, which addresses topics in fire science, and an applications track, which addresses current practice topics in fire protection

engineering. The curriculum is rounded-out with a number of elective courses as well as a culminating project experience as described below.

The fundamentals track is a 4-course sequence of classes designed to provide students with the knowledge and skills to quantitatively analyze fire hazards and fire scenarios in support of performance-based design, fire protection system design, fire investigation and reconstruction as well as for other purposes. The courses in the fundamentals track include:

- FPE 501 – Fundamental Thermal Sciences
- FPE 502 – Fire Dynamics
- FPE 503 – Flammability Assessment Methods
- FPE 504 – Fire Modeling

Unique to the Cal Poly FPE program, the fundamental thermal sciences course is intended to provide students lacking a background in the thermal sciences with the knowledge of thermodynamics, fluid mechanics and heat and mass





transfer needed for the subsequent courses in this track as well as for their professional careers.

The applications track is a 4-course sequence of classes designed to provide students with the knowledge and skills needed to analyze and design building fire safety subsystems based on a solid understanding of relevant engineering principles and in accordance with current standards and practices. The courses in the applications track include:

- FPE 521 – Egress Analysis and Design
- FPE 522 – Fire Detection, Alarm and Communications Systems
- FPE 523 – Water-based Fire Suppression Systems
- FPE 524 – Structural Fire Protection

In these courses, students are introduced to traditional approaches to designing systems based on current codes and standards as

well as to emerging performance-based approaches to fire safety design. In this way, students gain both practical skills associated with the current practice of FPE as well as advanced skills associated with alternative design approaches and specific performance objectives, thus preparing them to become leaders in the future practices and development of the FPE profession.

Two elective courses are currently approved, with more to follow. The two current elective courses include:

- FPE 551 – Fire Safety Regulation and Management
- FPE 552 – Smoke Management and Special Hazards

Additional electives are being planned to address fires and fire safety in the wildland-urban interface fires and forensic fire analysis and reconstruction.

The FPE MS degree program at Cal Poly requires the successful completion of 45 credits, including ten

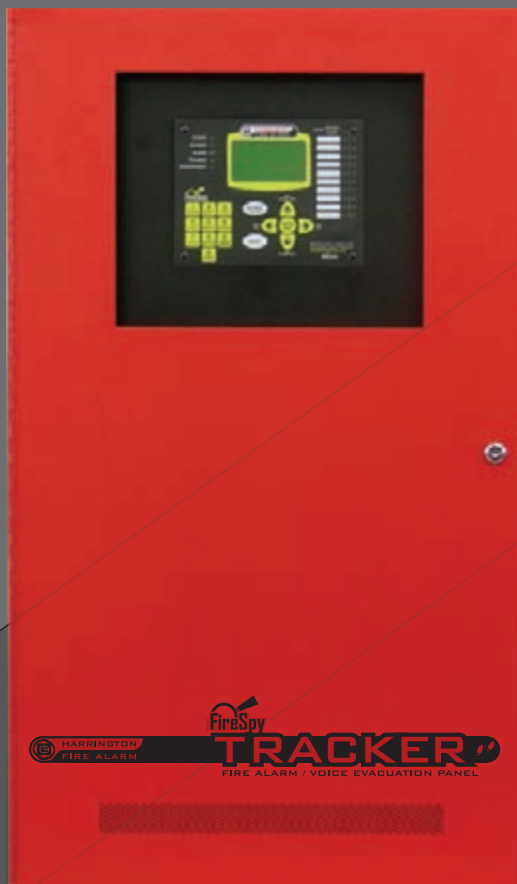
4-credit courses and one 5-credit culminating project experience. Cal Poly operates on the quarter system, so each 4-credit course is equivalent to a 3-credit course under the semester system.

The culminating project concept is unique to the Cal Poly FPE program. The typical culminating project experience requires students to perform a comprehensive fire and life safety evaluation of a selected building, prepare a report documenting this evaluation and present their analysis and findings to a review committee. Other culminating projects of similar scope and complexity may be submitted for approval. These culminating projects provide students with written and oral communication skills sought by fire protection engineering employers.





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## PROGRAM DELIVERY

The FPE program at Cal Poly is offered simultaneously both on-campus and online. Students continuing directly from their undergraduate studies are encouraged to



course, two-hour lectures are typically presented twice per week from 4 to 6 p.m. Pacific time to allow working professionals throughout

the U.S. to attend lectures online without interfering with their normal business hours. Lectures also are recorded so that students can review them at a later time, either to observe a lecture they could not attend live or to review materials requiring clarification.

enroll full-time in the on-campus program, where they can interact directly with faculty members and other students as they complete the program in 1.5 to 2 years. Working professionals who seek to enhance their skills and qualifications in FPE can enroll part-time in the online distance program, where they will take the same courses as the on-campus students and work with professional mentors in the field, but will typically take longer to complete the program.

This format offers students a high degree of flexibility in managing their educational and professional needs. Students enrolled in the online MS degree program are required to travel to San Luis Obispo at their own expense on at least one occasion to present and defend their culminating projects at the end of their degree programs.

The Cal Poly FPE program is unique in that on-campus and online students participate together in the same classroom setting. The combination of students with FPE experience along with those new to the field provides for dynamic interactions on topics of current interest to the profession. For each

As part of the mentoring process, the FPE program at Cal Poly is working with SFPE chapters to identify chapter members who are willing and able to serve as professional mentors to students in the program.



## FACULTY

The FPE program includes both Cal Poly faculty members and working FPE professionals as instructors. Many courses are taught by teams of instructors to provide both theoretical and practical perspectives on the subject matter.

Dr. Frederick Mowrer is director of fire protection engineering programs at Cal Poly and a professor-in-residence in the program. Dr. Mowrer spent 20+ years on the faculty of the Department of Fire Protection Engineering at the University of Maryland before retiring with emeritus status in 2008; he served on the board of directors of the Society of Fire Protection Engineers for eight years, including a term as president of SFPE in 2002. Dr. Mowrer has broad expertise in the field of fire protection engineering and is involved in teaching a number of courses in the program as well as directing the program.

Professor Christopher Pascual is graduate coordinator of the FPE program. Prof. Pascual is a professor of mechanical engineering at Cal Poly with expertise in the thermal sciences. He is involved in teaching courses related to the thermal sciences and fire dynamics. Prof. Pascual received a grant from the U.S. Nuclear Regulatory Commission to develop the FPE 501 course on Fundamental Thermal Sciences. Additional full-time faculty members at Cal Poly also are engaged in the FPE program.

Fire protection engineering professionals currently involved in teaching in the FPE program include Dr. Christopher Lautenberger and Dr. David Rich from the University of California, Berkeley, and currently with Reax Engineering in Berkeley. Daniel Gemeny, formerly with the RJA Group and currently with Varietal Matrix Consulting, is another FPE professional teaching in the program. With its online format, the FPE program also is able to tap into the specialized expertise of people throughout the U.S. and beyond to provide guest lectures on specific topics. For example, Dr. Kevin McGrattan, principal developer of the FDS fire model at NIST, provides guest lectures on the development and application of this widely used fire model.



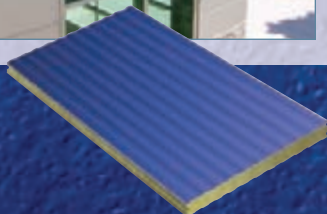
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## RECRUITMENT AND MENTORING PROGRAM

The FPE program at Cal Poly is developing relationships with SFPE chapters in the U.S., starting with chapters in California and other western states, as part of its recruitment and mentoring program. The goal of the recruitment effort is for SFPE chapters to establish connections with undergraduate engineering programs at local universities by providing guest lectures and participating in career fairs as a means of spreading the word about career opportunities in fire protection engineering and helping to recruit students to the FPE program at Cal Poly.

As part of the mentoring process, the FPE program at Cal Poly is working with SFPE chapters to identify chapter members who are

willing and able to serve as professional mentors to students in the program, particularly students located within close proximity to a SFPE chapter.

Two mentoring models are being developed concurrently. In the first model, a student seeks out an individual mentor to provide guidance throughout the time a student is enrolled in the Cal Poly FPE program and to oversee the student's culminating project. In the second model, the SFPE chapters identify members with specific subject matter expertise whom students can contact to reinforce their education and learn more about these subjects. These models are not mutually exclusive; ideally, students will have individual mentors as well as subject matter mentors to help them along the way. Regular chapter

meetings provide a good opportunity for students and mentors to interact as well as an excellent way for students to become more involved in the FPE profession.

*Frederick Mowrer is with California Polytechnic State University.*



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# WHAT'S UP WITH

# **MANDATORY**

# CONTINUING PROFESSIONAL COMPETENCY?

By Chris Jelenewicz, P.E.

**A**re fire protection engineers maintaining their professional competency in a manner that does not jeopardize the health, safety and welfare of the general public? This question, along with the idea of lifelong learning for fire protection engineers, has been debated for years in the fire protection community. Although most agree there needs to be a means for fire protection engineers to stay abreast of the rapid changes in the science and technology that keeps the world safe from fire, agreement on the best way to implement Continuing Professional Competency (CPC) is much more difficult.

In the past, licensed engineers were asked to take charge of their own CPC development and voluntarily engage in educational activities that they needed to practice competently.<sup>1</sup> Although this is still the case in some jurisdictions in the United States, this trend has changed significantly over the last 10 years. Currently, about 38 states and territories in the United States have adopted mandatory CPC requirements for licensed engineers.<sup>2</sup> As part of these requirements, licensed engineers are required to complete a certain number of professional development hours in order to maintain their license.

Moreover, as an increasing number of jurisdictions adopt and implement CPC requirements, establishing uniformity in the requirements across jurisdictions has become a critical issue. As jurisdictions implement

different variations of CPC requirements, it is difficult for engineers who are licensed in multiple jurisdictions to keep track of what CPC activities are acceptable in each jurisdiction.<sup>3</sup>

As the trend towards mandatory CPC continues to rise, there are many unanswered questions about the best way to ensure lifelong learning in the profession of fire protection engineering. This article attempts to answer some of the questions fire protection engineers may have as they navigate the CPC system.



### **DO MANDATORY CPC REQUIREMENTS PROTECT THE PUBLIC'S HEALTH, SAFETY AND WELFARE?**

The verdict is still undecided on whether mandatory CPC is the best way to ensure lifelong learning for the engineering community. For example, the fact that many jurisdictions do not currently have CPC requirements demonstrates the diversity of opinions on this issue.

Those in favor of CPC requirements believe it improves the quality of professional practice and is a good way to protect the public from incompetent engineers. Others think the engineering profession cannot keep up with the rapid pace in the advancement of science and technology without establishing CPC requirements. And, others believe that lifelong learning has always been a





requirement for professionals in other disciplines and implementing CPC in the engineering profession will increase the status and image of the profession.<sup>4</sup>

Some states that recently adopted CPC requirements thought the new regulations were necessary so engineers in their states could be competitive. It is believed that if other jurisdictions have more stringent CPC requirements, it would be difficult for engineers who are licensed in their state to practice across state lines.

Moreover, the National Council for Examiners for Engineering and Surveying (NCEES) supports the establishment of CPC requirements for licensed professional engineers in *NCEES Position Statement 10, Continuing Professional Competency*.<sup>5</sup> NCEES is a non-profit organization composed of engineering and surveying boards that represent all states and territories in the United States. Its mission is to advance licensure for engineers and surveyors in order to protect the health, safety and welfare of the public. NCEES provides

national examinations for engineers and surveyors. It also establishes uniform model engineering laws and rules for adoption by its Member Boards.

On the other hand, many say there is no evidence that shows CPC programs provide any public benefits because the benefits of CPC do not exceed the time and money expended. Also, because a common methodology is not used to evaluate the outcomes of CPC educational activities, questions have been raised about the quality of the CPC activities and whether participants take these activities seriously. At the same time, others feel the existing licensure process without CPC does an adequate job of protecting the public's health, safety and welfare.

Another argument against CPC requirements comes from the fact that mandatory CPC requirements only apply to licensed engineers. In the United States, only about 20 percent of all engineers are licensed.<sup>1</sup> Consequently, only a small percentage of engineers are required to comply with CPC requirements.





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## **NCEES POSITION STATEMENT 10, CONTINUING PROFESSIONAL COMPETENCY**

NCEES endorses the establishment of uniform Continuing Professional Competency (CPC) requirements for licensed professional engineers and surveyors to promote the health, safety and welfare of the public by requiring licensees to remain competent within their profession and to facilitate renewal.

CPC should be focused on the advancement, extension and improvement of the scientific knowledge and professional skills of the licensee and on the enhancement of professional ethics. CPC should be structured in a way that demonstrates compliance but also recognizes the autonomy and strong ethical standards of licensees.

Licensees are expected to meet the CPC requirements of the states in which they have been granted a license by comity, reciprocity or endorsement. Applicants for a license by comity, reciprocity or endorsement who are licensed in a jurisdiction without equivalent CPC requirements should not be denied a license for that reason.

Because many engineers and surveyors are licensed in multiple jurisdictions, uniformity of CPC requirements among licensing jurisdictions that mandate CPC is



imperative to simplify the licensure renewal process, to facilitate the recognition of CPC by multiple jurisdictions, and to ensure the viability of continuing professional competency. NCEES encourages licensing boards to follow the NCEES *Model Rules* as outlined in the NCEES *Continuing Professional Competency Guidelines* when adopting CPC requirements.

NCEES encourages the efforts of professional and technical societies, educational programs and industry in the development of continuing education opportunities to enhance the competency of engineers and surveyors.

Fortunately, because fire protection engineering is highly focused on protecting the public's health, safety and welfare, a higher percentage of fire protection engineers are licensed. According to the SFPE annual compensation survey, about 65 percent of all fire protection engineers who practice in the United States are licensed.<sup>6</sup> Therefore, mandatory CPC requirements tend to provide a greater benefit to the profession of fire protection engineering when compared to other engineering disciplines.

### **WHEN CPC IS MANDATORY, HOW MUCH TIME PER YEAR MUST AN ENGINEER DEDICATE TO CPC ACTIVITIES? AND WHAT IS THE DIFFERENCE BETWEEN A PDH AND A CEU?**

A PDH is defined as a contact hour of instruction or presentation. Alternatively, some educational providers, such as the Society of Fire Protection Engineers (SFPE), issue

certificates of completion for participation in educational activities and define the number of contact hours in terms of Continuing Education Units (CEUs). In this case, 0.1 CEUs are defined as one contact hour. Therefore, one CEU is equivalent to 10 Professional Development Hours (PDHs).

According to NCEES Model Rule 240.30 – *Continuing Professional Competency*, a licensed professional engineer is required to obtain 15 PDHs per year. Since the NCEES requirement is a model rule, each individual jurisdiction is free to adopt its own requirements. Although most jurisdictions adopt the NCEES requirement, the amount of required PDH units can vary between jurisdictions from zero to 36 per year.<sup>3</sup>

To complicate matters, many jurisdictions often require the standard to be expressed as a biennial or triennial requirement and the calendar dates defining a renewal period vary among jurisdictions. When this is the case, the NCEES





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Model Rule requires 30 PDH units for a biennial reporting period and 45 PDH units for a triennial reporting period.

Many jurisdictions allow the licensed engineer to carry over a certain number of PDH units if he or she exceeds the annual requirement in a specific renewal period. When carry-over is permitted, the NCEES Model Rule recommends a maximum of 15 PDH units be permitted to carry over into the following reporting period.

If a licensed engineer is unable to fulfill the requirements in a reporting period, many states allow specific exemptions from CPC requirements. For example:<sup>3</sup>

- Newly licensed engineers are usually exempt from CPC requirements for their first renewal period.
- Engineers serving on active duty in the armed forces for a period exceeding 120 consecutive days in a year are exempt from CPC requirements during that year.
- With supporting documentation, engineers experiencing physical disability, illness or other extenuating circumstances may be permitted a time extension to obtain the required PDH credits.
- Engineers who list their licensure status as "retired" or "inactive" are exempt from CPC requirements.

An engineer is permitted to bring an "inactive" license back to "active" status by obtaining all delinquent PDH credits up to a maximum of 30. However, before an engineer decides to declare an exemption from CPC requirements, it is important to contact the appropriate state board of engineering.

#### **WHAT TYPES OF CPC ACTIVITIES ARE CONSIDERED TO BE RELEVANT?**

Although the requirements vary from jurisdiction to jurisdiction, the required PDHs usually may be earned through the completion of a combination of a) college courses, b) continuing education courses, c) distance-education courses, d) presenting or attending technical presentations made at meetings, conventions or conferences, e) teaching, f) authoring published papers or g) obtaining a patent. Specific requirements for individual jurisdictions can be found at: <http://rcep.net/Licensing-Requirements-State-Continuing-Education-Requirements/Engineering-1186.htm>.

Because some of the activities listed above do not inherently provide PDH units for completion, the NCEES Model Rule provides guidance on how to convert these activities into PDHs. For example:



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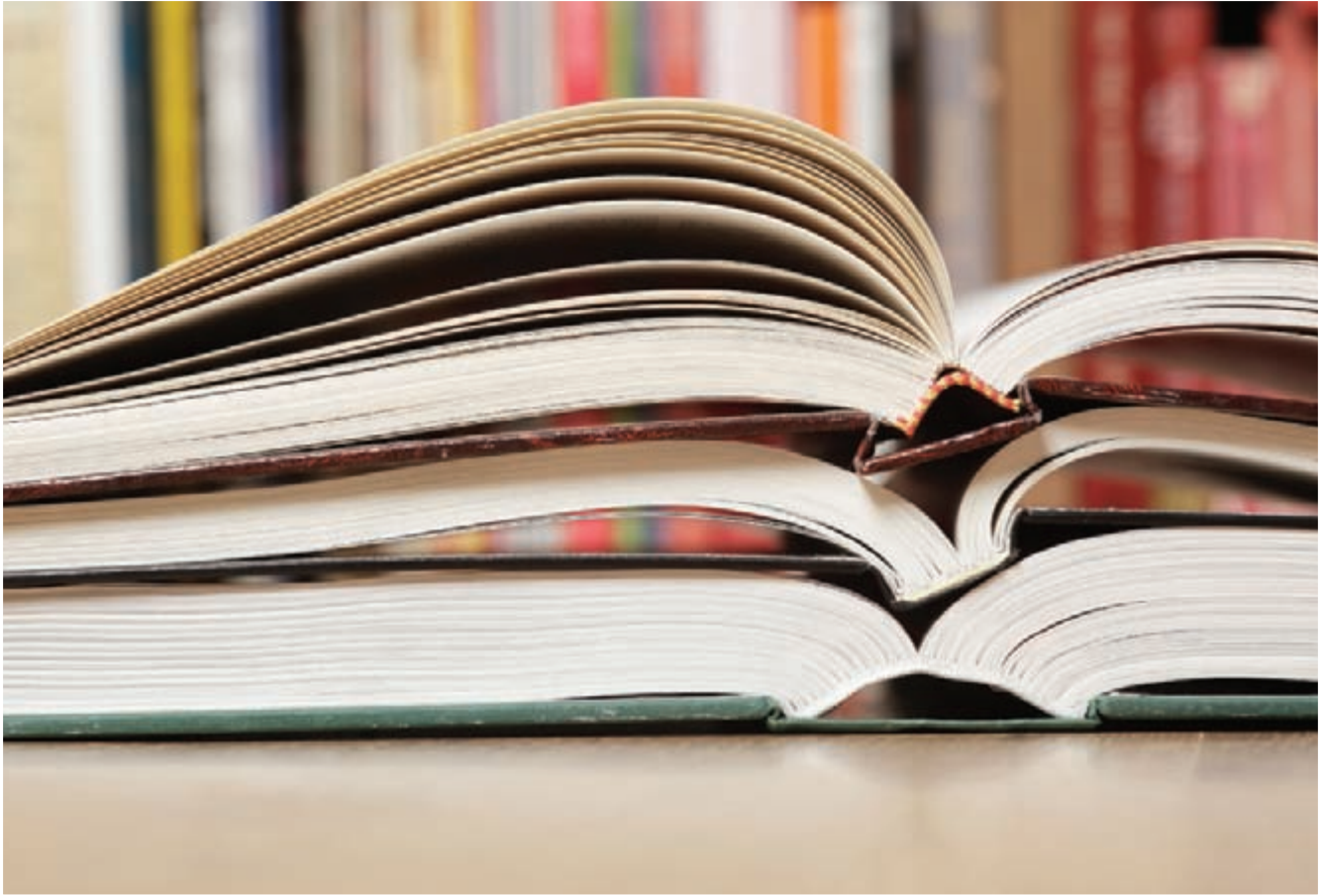
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- 1 college or unit semester hour = 45 PDHs
- 1 college or unit quarter hour = 30 PDHs
- 1 hour of professional development = 1 PDH
- Each published peer-reviewed article in area of practice = 10 PDHs
- Each published paper or article (non-peer-reviewed) in area of practice = 5 PDHs
- Active participation in a professional society = 2 PDHs
- Each patent = 10 PDHs

If the licensed engineer is the instructor for any of the above activities, he or she is permitted to multiply the number of PDHs by two. However, teaching credit is only valid for the first course offering. Also, to receive credit for active participation in a professional society, the licensed engineer is required to serve as an officer and/or actively participate in one of the society's committees. This includes writing and reviewing problems for the Principles and Practice of Engineering (P.E.) in fire protection.

### WHAT ARE THE BEST WAYS TO KEEP RECORDS OF CPC ACTIVITIES?

The licensed engineer is responsible for maintaining records that can be used to support PDH credits. This reporting should include a log showing the a) type of activity, b) sponsoring organization, c) location, d) duration, e) PDH credits earned and f) instructor's name. Completion certificates or other documents supporting evidence of attendance also must be maintained.

Besides all of the perceived costs and benefits of mandatory CPC, the variability in requirements can present a recordkeeping challenge for engineers who are licensed in multiple jurisdictions. To simplify the CPC process, the NCEES started the Registered Continuing Education Program (RCEP).

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- Download certificates of completion for educational activities completed with providers registered by the RCEP.
- Give state licensing boards access to his or her PDH history and records for an efficient audit and renewal of licenses.

All of the above services are available free-of-charge at the RCEP website: <https://rcep.net/>. RCEP offers additional services if an annual subscription is purchased for a small fee. These additional services also are described on the RCEP website.

Many in the engineering community believe that CPC should be a collaborative process among industry, academia, local governmental jurisdictions and professional

societies.<sup>7</sup> The Society of Fire Protection Engineers (SFPE) is doing its part by being an approved provider in the RCEP program. All SFPE seminars and conferences are approved courses in the RCEP program.

*Chris Jelenewicz is with the Society of Fire Protection Engineers.*

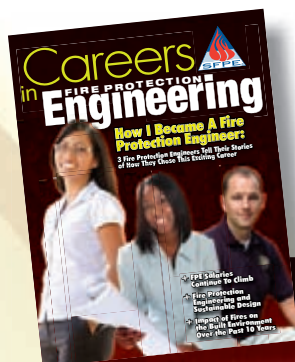
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# POWER SUPPLY REQUIREMENTS FOR FIRE ALARM AND SIGNALING SYSTEMS



The calculations used to design power supplies for fire alarm and signaling systems are not rocket science and rarely even rise to be considered “engineering.” However, knowing the conditions under which a system must perform and specifying the parameters necessary for

proper performance under adverse operating conditions is an important element of the practice of engineering.<sup>1,2</sup> This article addresses the requirements and best practices for specifying power supplies and for determining the required demands and operating durations for the most common types of alarm and signaling

system power supplies. A future article will address the calculation of a net required energy capacity based on the required demands and durations.

Power requirements for fire alarm and signaling systems are specified in the *National Fire Alarm and Signaling Code*.<sup>3</sup> The code requires a system to have either two sources

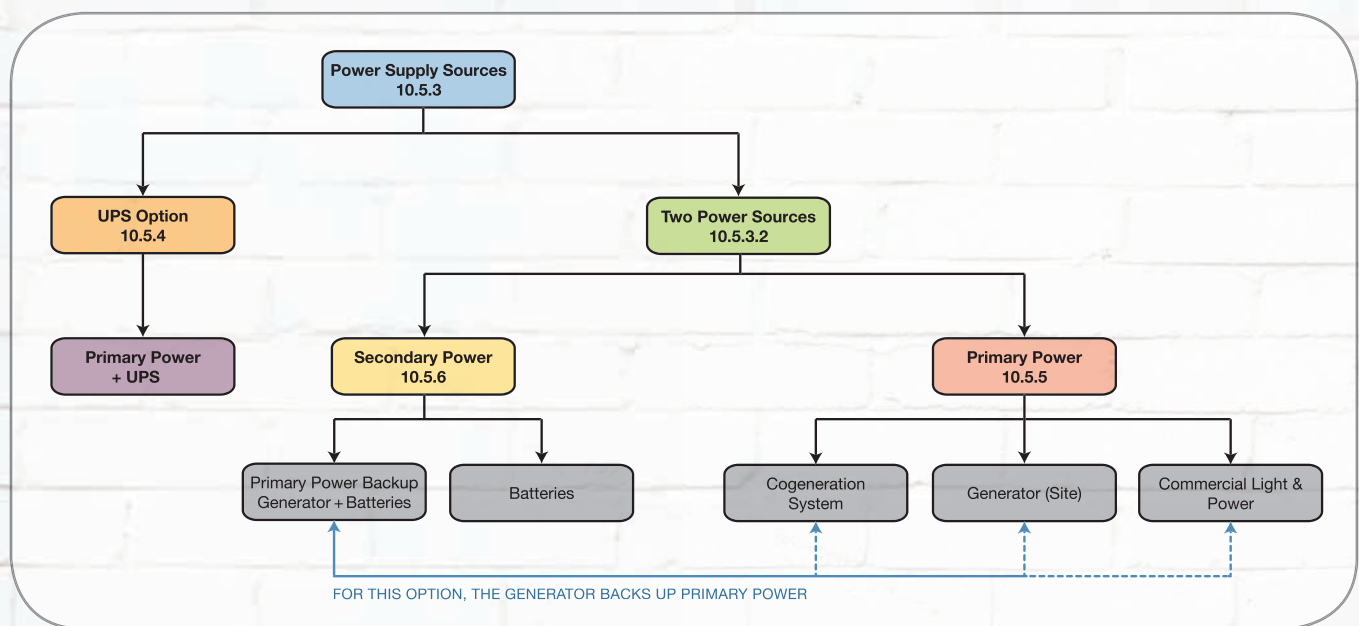


Figure 1. Power Supply Requirements

of power (primary and secondary) or a single Uninterruptible Power Supply (UPS). Where primary and secondary power supplies are used, the secondary supply can consist of batteries or batteries plus a standby generator. Figure 1 summarizes the power supply options and lists the applicable code sections.

Most systems use commercial light and power sources for the primary power supply. A key requirement is that primary power must be supplied by a dedicated branch circuit. The intent is that no other system or equipment can be powered from the same circuit. So, for example, it would be improper to install an electrical receptacle outlet on the circuit for technicians to use when servicing the system.

This requirement does not limit that one dedicated branch circuit to serving only one power supply within a system. Thus, the dedicated branch circuit could supply several power supplies within a control unit or within multiple interconnected control units that serve the signaling system.

The circuit must be properly sized and protected in accordance with NEC<sup>4</sup> requirements. The dedicated circuit can be supplied from any properly installed electrical panel board – even sub-panels.

A common misconception is that circuit breakers are required to have locks that permit them to operate properly, but that prevents inadvertently turning off the breaker. NFPA 72 only requires that the breaker be properly labeled and that it be accessible only to authorized personnel.

Although neither NFPA 72 nor NFPA 70 defines “accessible only to authorized personnel,” NEC 110.26(F) does say that “Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.”<sup>4</sup>

located in panel boards that are in locked electrical rooms) meet the requirements of the code as well as those secured with breaker locks.

The UPS option requires that the UPS be a Type 0, Class 24, Level 1 system per NFPA 111.<sup>5</sup> Type 0 means that there is no switchover time when power is transferred from the primary power source to the UPS batteries.

Essentially, the load is always on batteries that are being charged by the primary supply.

This type of UPS is a valuable tool for critical systems, such as those controlling large suppression systems as it can prevent computer chip malfunctions that sometimes occur when a system switches from primary to secondary power and when the switchover causes a short duration dip in system voltage.

The Class 24 requirement addresses the duration that the supply must operate. A Level 1 system is one where “failure of the equipment to perform could result in loss of human life or serious injuries.”

An important consideration for design engineers is protection of the circuit between the UPS and the signaling system. That circuit is responsible for carrying both primary and second-

ary power and is, therefore, subject to common mode failures. A system with separate primary and secondary supplies has two different circuits for power delivery and is not subject to common mode failures (except at the control unit itself).

The code does not require any special protection for the UPS circuit



The circuit disconnecting means needs to be accessible for technicians' use and for safety purposes and its location must be listed at the point of connection to the control equipment. However, the intent is that it be protected against accidental operation. Therefore, breakers located in locked panel boards (or



and does not limit its length, hence exposure. Both should be considered by the design engineer in the context of the risks involved. (Note that this same consideration should be given to the circuit between a transfer switch and the load where a backup generator is used as part of a secondary supply.) Also, although the UPS must be supplied by a dedicated branch circuit, the code does not say that the UPS must only serve the fire alarm or signaling system. However, from risk management and failure mode standpoints, sharing the UPS with other loads should not be done unless care is taken to ensure that it can serve the entire connected load for the required duration or shed load as needed to meet its mission.



Figure 1 makes it evident that there will always be batteries on a fire alarm or signaling system. Batteries must be properly sized to provide adequate capacity and the ability to discharge at a rate demanded by the system load for a specified duration.

It is a failure when a secondary (standby) power system does not have either the stored capacity or the ability to discharge at a rate that will meet a signaling system's demand over a set time period. The energy capacity to be stored depends on the demand (load, discharge or rate of consumption) and on the duration over which that demand must be met.

$$\text{CAPACITY} = \text{DEMAND} \times \text{DURATION}$$

As shown in Figure 1, there are three different configurations using

batteries: 1) batteries only as secondary power; 2) batteries with a backup generator as secondary power; and 3) batteries as integral part of a UPS. NFPA 72 has specific requirements for each.

For a basic fire alarm system that uses primary power with batteries only as secondary power, the battery capacity must be sufficient *"to operate the system under quiescent load (system operating in a nonalarm condition) for a minimum of 24 hours"* and then still be able to operate *"all alarm notification appliances"* and all other connected loads for a period of five minutes. The code specifies that the net capacity be based on two different demand rates (quiescent and alarm) for two different durations (24 hours and 5 minutes).

Emergency communications systems (ECSs) used for mass notification or for in-building fire emergency voice/alarm communications service have the same 24-hour quiescent load requirement but require 15 minutes of full-load alarm capacity. This is because

these systems are usually operated for longer periods during an emergency. They sometimes may be used for 30 – 60 minutes, but only under partial load as announcements are made to certain floors. They might then be called upon to operate under an increased or even full load for some period. The code requirement for 15 minutes of full load should be evaluated by the system designer in conjunction with a risk analysis to determine if a larger capacity should be provided.

Where a backup generator is part of the secondary supply, NFPA 72 addresses the required capacity for the batteries and the generator. The battery capacity must be based on four hours of demand load, but the code does not indicate if the quiescent demand or the alarm demand

should be used to calculate the resulting net battery capacity.

The generator must have a Class 24 rating per NFPA 110,<sup>6</sup> which means it must be capable of operating for 24 hours at its rated load. Since the generator must be sized to handle the greatest load imposed upon it, this requirement indicates that the generator must have sufficient fuel capacity to operate for 24 hours under full-alarm mode. (Note that if the generator supplies other loads in addition to the signaling system, they must be included in the fuel capacity calculation.) The required fuel capacity for a generator operating at full load will usually be calculated by the generator manufacturer or supplier.

Where the UPS option is used to condition primary power and provide secondary power, the UPS must be Class 24, which means that 24 hours of capacity must be provided; however, the code does not indicate if the quiescent demand or the alarm demand should be used to calculate the net battery capacity for that duration. It would seem logical to follow the requirements for secondary batteries and provide 24 hours of capacity at the quiescent load and five minutes of capacity at the alarm load.

A future article will address calculating the net required energy capacity using the established loads and durations.

#### References:

- 1 "Engineering Failure or Failure to Engineer?" *Fire Protection Engineering*, Winter 2003.
- 2 "Professional Qualifications for Designers of Fire Alarm and Signaling Systems," *Fire Protection Engineering*, 3rd Quarter 2011.
- 3 NFPA 72, *National Fire Alarm and Signaling Code*, National Fire Protection Association, Quincy, MA, 2010.
- 4 NFPA 70, *National Electrical Code*, National Fire Protection Association, Quincy, MA, 2011.
- 5 NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, National Fire Protection Association, Quincy, MA, 2010.
- 6 NFPA 110, *Standard for Emergency and Standby Power Systems*, National Fire Protection Association, Quincy, MA, 2010.

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## UPCOMING EVENTS

### March 6–9, 2012

Suppression, Detection and Signaling Research and Applications – A Technical Working Conference (SUPDET 2012)  
Phoenix, AZ, USA

Info: [www.nfpa.org/Foundation](http://www.nfpa.org/Foundation)

### March 14–16, 2012

5th International Symposium on Tunnel Safety and Security  
New York, NY, USA

Info: [www.istss.se](http://www.istss.se)

### May 13–16, 2012

7th International Conference on Wood and Fire Safety  
Štrbské Pleso, Slovakia

Info: [michaela.colonova@fsi.uniza.sk](mailto:michaela.colonova@fsi.uniza.sk)

### June 6–8, 2012

7th International Conference on Structures in Fire (SiF'12)  
Zurich, Switzerland

Info: <http://www.structuresinfire.com/>

### June 11–14, 2012

2012 NFPA Conference & Expo  
Las Vegas, NV, USA

Info: [www.nfpa.org](http://www.nfpa.org)

### June 20–22, 2012

9th International Conference on Performance-Based Codes and Fire Safety Design and Methods  
Hong Kong, Japan

Info: [www.spfe.org](http://www.spfe.org)

### September 19–21, 2012

Human Behaviour in Fire 2012 – 5th International Symposium  
Cambridge, England

Info: [www.intersciencecomms.co.uk](http://www.intersciencecomms.co.uk)

### September 27–28, 2012

2nd International Conference on Fires in Vehicles (FIVE)  
Chicago, IL, USA

Info: [www.firesinvehicles.com](http://www.firesinvehicles.com)

### October 14–19, 2012

2012 Annual Meeting: Professional Development Conference and Exposition  
Savannah, GA, USA

Info: [www.sfpe.org/Education.aspx](http://www.sfpe.org/Education.aspx)

### June 24–26, 2013

Interflam 2013  
London, England

Info: [www.intersciencecomms.co.uk](http://www.intersciencecomms.co.uk)

## BRAINTEASER >

## Problem / Solution

### Problem

Someone walks south for one kilometer, turns and walks west for one kilometer, then turns again and walks north for one kilometer. The person ends at the same point from which it started. If the person is not standing on the north pole, where is he or she standing?

### Solution to Last Issue's Brainteaser

Two cars are drag racing. The track length is 0.5 km. The first car accelerates to a speed of 100 km/hr in six seconds and maintains this speed until the conclusion of the race. The second car accelerates to a speed of 120 km/hr in 10 seconds, then maintains this speed until the end of the race. Which car won the race?

Since  $A = \frac{\Delta V}{\Delta t}$ , car 1 accelerates at a rate of 60,000 km/hr<sup>2</sup>, and car 2 accelerates at a rate of 43,200 km/hr<sup>2</sup>.

Since  $D = v_0 t + \frac{1}{2} A t^2$ , car 1 travels 0.083 km as it accelerates, and car 2 travels 0.167 km as it accelerates. It takes car 1 15 seconds to travel the remaining 0.417 km, and it takes car 2 10 seconds to travel the remaining 0.333 km. Therefore, car 1 crosses the finish line in 21 seconds, and car 2 finishes in 20 seconds. Car 2 wins!

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**www.ffeuk.com**

— Fire Fighting Enterprises Ltd.

## Fire Alarm Software

PS-TOOLS software is designed to simplify fire alarm system installs and service while building a database of information on each installation. The program assists users in system configuration and helps with remote diagnostics. It can be used with nearly every Fire-Lite Alarms' addressable and conventional control panel on the market today. The software and user instructions can be downloaded for free from [www.firelite.com](http://www.firelite.com).



**www.firelite.com**

— Fire-Lite Alarms

## Water Mist Fire Protection

The HI-FOG® Water Mist Fire Protection has received Underwriters Laboratory (UL) listing for use in Ordinary Hazard Group 1 (OH1) applications, in addition to its existing Factory Mutual (FM) Light Hazard (LH) system approval. HI-FOG uses high pressure to force potable water through sprinklers. The result is a mist of fine droplets with an increased surface area that absorbs heat efficiently through vaporization. The mist also rapidly cools the surrounding area, facilitating a safer escape for occupants.



**www.marioff.com**

— Marioff Corp.

## IP/GSM Fire Alarm Communicator

Honeywell has released a fire alarm communicator that offers a choice of either IP (Internet Protocol) or GSM (Global System for Mobile Communications) cellular as its primary communications pathway. The IPGSM-DP dual path, dual primary fire alarm communicator eliminates the costly phone lines historically employed for fire alarm reporting. Utilizing IP and GSM technology together improves the reliability and speed of communications over single-path technology devices while solving many fire alarm reporting dilemmas associated with challenging applications.

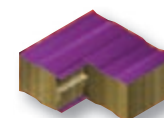


**www.honeywellpower.com**

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## Metal Wall Panels

Metl-Span's ThermalSafe metal wall panel is the latest development in fire resistant wall construction technology. Metal facings bonded to a mineral wool core create composite panels that achieve up to 3-hour fire resistance ratings under the most demanding conditions. The LockGuard® interlocking side joint further enhances the fire resistance performance. Metl-Span's panels install in one step with one crew – saving time and money.



**www.metl-span.com**

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## Emergency Communications Microsite

NOTIFIER has launched a microsite to educate users on effective deployments of integrated fire alarm and emergency communications systems through virtual demonstrations of emergency scenarios. The Emergency Communications System Microsite explores real-world fire, weather, intruder and hazardous gas leak disaster events within various facilities throughout a common campus setting while demonstrating the life-saving functions of NOTIFIER systems.



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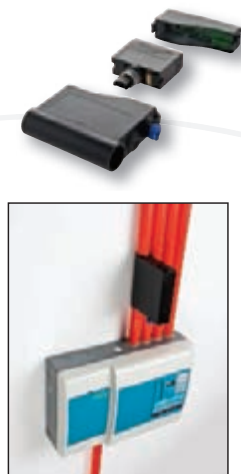


## Gas Detection

Xtralis® has released an enhanced version of its VESDA® ECO™ gas detection product. ECO is a gas detection extension for the Xtralis VESDA aspirating smoke detection (ASD) system. The enhanced version includes six new gas detection options as well as additional programming, testing and monitoring capabilities. The VESDA ECO approach to gas detection utilizes efficient multi-hole aspirating technology, which removes the guess work in gas detector placement.

**www.xtralis.com**

—Xtralis



## Extended Coverage Sprinklers

Tyco announces enhancements to existing FM Global Approvals of the TYCO Model EC-25 Extended Coverage Sprinkler in extra hazard and storage occupancies. With the enhanced FM Approvals, the Model EC-25 Sprinkler provides advanced, cost-effective solutions — including lower installed cost — for higher density, extended coverage applications. Benefits include fewer branch lines and sprinklers, low operating pressures, low hydraulic system demand, fewer opened sprinklers and fewer consumed pallets than standard coverage sprinklers as shown in full-scale fire tests.

**www.tyco-fire.com**

—Tyco Fire Protection Products



## New DDX Type F PrePaK

Reliable Automatic Sprinkler Co. has expanded its PrePaK line with the new DDX Type F PrePaK. The new PrePaK uses a lightweight DDX deluge valve with Type F (Electric/Pneumatic Galvanized Trim). It is a completely self-contained, supervised preaction system that can be readily installed within a floor space of less than five sq.ft. Just three piping connections are required. The PrePaK has 10 psi to 26 psi of system supervising air pressure and is available with options.

**www.reliablesprinkler.com**

—Reliable Automatic Sprinkler Co.



## Emergency Responder Collaboration Tool

TrueVector Technologies has introduced a web-based, interactive drawing solution for Emergency Responder web mapping software. The first deployment of the technology is by Defense Group, Inc. (DGI). DGI will market the solution as part of its CoBRA® WEB Mapping, which will allow users to quickly develop situational awareness by viewing all essential information on a map, down to street level detail. Emergency personnel will be able to collaborate on a single map in real time to reflect changing events on the ground.

**www.truevectortech.com**

—TrueVector Technologies



## Hybrid Fire Alarm Upgrades

Silent Knight (SK) has upgraded its hybrid conventional/addressable fire alarm system to simplify installation and operation while expanding capabilities with a second line of initiating devices and a new remote annunciator. Version 2.00 of the IntelliKnight 5600 is a 25-point fire alarm control panel designed to provide small applications with the same features as larger, addressable systems at a conventional system price.

**www.silentknight.com**

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

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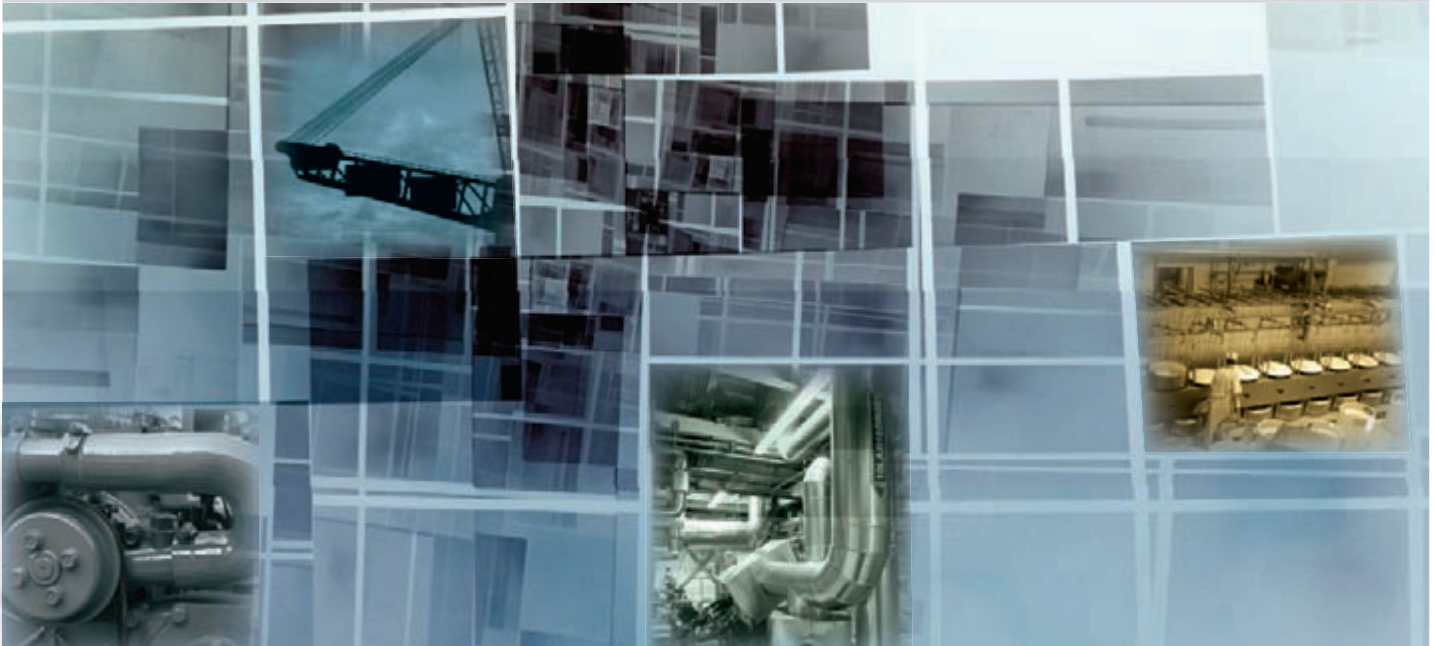
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