Recommended Minimum Technical Core Competencies for the Practice of Fire Protection Engineering

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This document has been developed by the SFPE Standing Committee for Professional Qualifications; specifically, by the Subcommittee on Professional Competency and Credentialing.

This document advocates a minimum recommendation. Revisions will occur periodically to address any changes in the necessary knowledge and skills required for the practice of fire protection engineering and the evolution of the profession.

Preface

The Society of Fire Protection Engineers (SFPE) is the largest professional body of engineers practicing in the areas of fire protection engineering and fire safety engineering worldwide. Of the more than 4,000 members, more than 1,600 hold qualifications as licensed/registered Professional Engineers (PEs) or equivalent. Such a professional qualification reflects the pinnacle of recognition as a qualified and competent engineer — of having demonstrated minimum technical competencies and experience in the practice of engineering.

The SFPE mission, “to define, develop and advance the use of engineering best practices; expand the scientific and technical knowledge base; and educate the global fire safety community, to reduce fire risk,” is advanced through the identification of the minimum technical competencies required to practice fire protection engineering. Increasing global awareness of the specialized knowledge and experience needed for competent practice will improve recognition of the profession and help establish a recognized, global set of minimum technical competencies.

The “Recommended Minimum Technical Core Competencies for the Practice of Fire Protection Engineering” are designed to identify core knowledge and skill areas and corresponding experience duration in which practitioners must be competent. SFPE recognizes that requirements governing the use of the term “engineer” or the ability to practice “engineering” vary widely around the world. In some countries, one can call themselves an engineer on graduation with a university degree in engineering. Conversely, some jurisdictions may have very specific governing regulations that specify in great detail the knowledge and experience required before legally using the term “engineer” or, with respect to fire, the term “fire protection engineer.” In contrast, many parts of the world have no prescriptive or performance requirements governing the knowledge and experience required to practice engineering, or fire protection engineering in particular.

This document is not intended to circumvent a jurisdiction’s authority or requirements, but rather, is intended to outline a model framework that the SFPE believes represents the values of the Society and its membership, and that advocates for the profession in a way that has global applicability.

The most straightforward path to reach a competent level of practice is to pursue a university-level education with specialized coursework in fire protection engineering, followed by professional practice under the advice, oversight and guidance of competent fire protection engineers. Fundamentally, fire protection engineering should be practiced by professionals who possess the knowledge and can demonstrate the learning outcomes that a university-level education in fire protection engineering provides.

This document is principally for fire protection practitioners who are in the process of developing the technical competencies necessary to practice fire protection engineering professionally. SFPE acknowledges that there are current industry practitioners who are competent fire protection engineers and possess the appropriate level of knowledge, skill and experience, regardless of whether they followed the path prescribed by this document to obtain those competencies.

I. Scope

Note: *The term "fire protection engineering" should be viewed as synonymous with the terms "fire safety engineering" and "fire engineering." These terms apply to the application of engineering principles to prevent and mitigate the unwanted impact of fire. For practical purposes, only the term fire protection engineering is used in the remainder of the document.*

This document defines the "Recommended Minimum Technical Core Competencies for the Practice of Fire Protection Engineering." The recommended minimum technical competencies are core to the practice of fire protection engineering and are obtained upon the completion of structured education in specific knowledge and skill areas, and accompanying applied experience. This document identifies the minimum technical competencies and associated standards to be applied to fire protection engineering practitioners. To practice as a fire protection engineer, an individual must be competent in the identified areas. It is necessary to reach competency through a combination of education and experience. Competency is acquired only through structured education and applied experience.

By clearly identifying the areas in which SFPE believes fire protection engineers must be competent, and the degree to which practitioners use the term fire protection engineer with the understanding and expectations identified in this document, this document provides an additional means through which the profession of fire protection engineering can be recognized with status and importance internationally.

II. Application

Competency for an engineering professional in the USA is defined as "a cluster of related knowledge, skills and abilities that affects a major part of one's job (a role or responsibility), that correlates with performance on the job; that can be measured against well-accepted standards; and that can be improved through training, development and experience." [1] While different other countries use different definitions, those largely embody the same principles.

The competency model in the USA is quite detailed and comprehensive, starting with broad personal effectiveness competencies and core science, technology, engineering and mathematics requirements, and culminating with management and occupation-specific competencies. [1] Since each engineering profession is different, the model has many common tiers of competency requirements, as well as an undefined level — Tier 5, which builds on Tiers 1–4 and is intended to be defined by specific industry sectors. The information presented in this document represents competency requirements for Tier 5 as specific to fire protection engineering. Figure 1 provides a diagram that illustrates the different tiers, starting with a broad learning skill set and academic preparation, and culminating in the fire protection engineering knowledge base that is specific to the fire protection engineering profession.

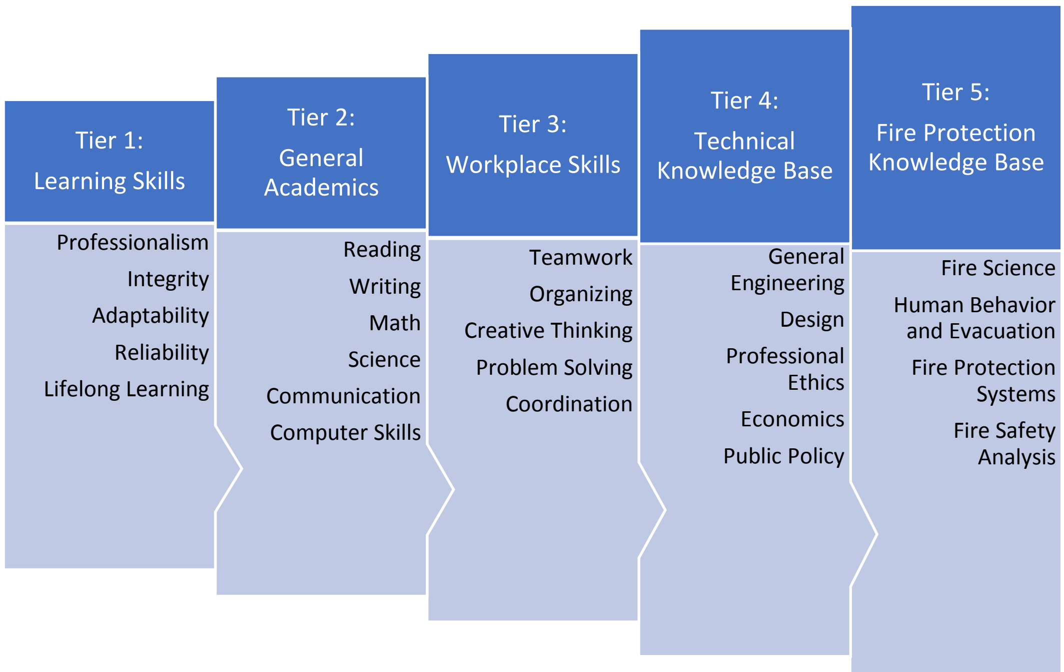

Figure 1: The tiers of knowledge and skills needed for fire protection engineering.

Using this model, the details discussed in this document establish a common set of industry-specific criteria for the profession of fire protection engineering. As observed in Figure 1, the basis is academic preparation. However, academic knowledge alone is not sufficient to reach the competency mentioned here. Experience is an essential element in the development of a competent engineer, but not all experience is equal. The extent of experience is measured by duration of time and by the effective depth of understanding during that span of time.

Effective experience is diverse and progressive in complexity. It requires a variety of projects and tasks, along with interactive feedback from peers, clients and reviewers. The interactive feedback provides new knowledge and reinforces sound judgment and decisions. Multiple years of experience should add variety and breadth to the knowledge of the individual seeking to be competent.

The development of minimum fire protection engineering competence should begin with completion of a curriculum at a university or educational institution of accepted standing.[1]

1 Per the SFPE Qualifications Board Table, "Accepted Standing" related to engineering curriculum is defined as an engineering curriculum that is ABET- (Accreditation Board for Engineering and Technology-) accredited (USA), CEAB- (Canadian Engineering Accreditation Board-) accredited (Canada), FEANI-listed (European Federation of National Engineering Associations), or equivalent. This also includes programs outside North America that have been reviewed and accepted by ECEI (Engineering Credentials Evaluation International) or WES (World Education Services) and found to be comparable to those accredited in the USA.

Following the educational foundation, a fire protection engineering practitioner shall have practical experience that is indicative of growth in engineering competency and achievement of not less than four years, three of which shall have been in responsible charge of fire protection engineering work. A post-graduate degree may serve in lieu of one year of practical experience.

The recommended minimum technical competencies may serve as a reference to other organizations for ensuring that appropriate knowledge and skills are met when practicing fire protection engineering. Organizations such as the National Council of Examiners for Engineering and Surveying (NCEES), which develops, administers and scores examinations used for engineering and surveying licensure in the United States, provide support for, and consistency of, engineering competency for many recognized practices. Similar to the specifications used for NCEES testing in fire protection engineering, the recommended minimum technical competencies exemplify the information areas a practitioner needs to practice fire protection engineering. The minimum technical competencies are independent of geographic location and may serve as a basis for jurisdictions that lack fire protection engineering credentialing programs or prescribed minimum competencies.

In addition, this information can be referenced by educational institutions. Those universities wanting to setup new programs related to fire protection engineering or review current programs can arrange their curriculum to provide their students the opportunity to gain the academic knowledge needed to enter the workplace and, with practice, become competent. For additional guidance on recommended curricula, [2] [3] [4] SFPE has models for a bachelor's degree and master's degree in fire protection engineering. A model curriculum is also available from SFPE for a bachelor's degree in fire protection engineering technology. These documents focus on the development of a university program, while the information here is dedicated to achieving professional competency, which will require experience in the industry and may need supplemental education to reach the desired breadth of knowledge.

Organizations that accredit engineering degree programs so the instruction received meets expectations provide considerable service to the fire protection engineering field. The Accreditation Board for Engineering and Technology (ABET) is an example of an organization that evaluates university programs. Accreditation is consistent with this effort to ensure those striving to become fire protection engineers have received the appropriate education on completion of a fire protection engineering program.

Practitioners can reference these technical competencies to identify areas where they lack knowledge and need further development. It is the responsibility of the practitioner to keep his/her knowledge and skills up to date so he/she can deliver the quality of service that meets the expectations of customers and the public, along with the requirements of the profession.

Employers or other organizations could also use these competencies in seeking employees. The information could be applied when establishing requirements for desired competencies in fire protection engineers.

As reflected in the tiered model, [1] corporate entities and others are likely to impose competency requirements in terms of management skills, capability and experience, as well as industry-/occupation-specific knowledge, for an individual to reach the level of overall professional competency.

III. Definitions

The following sections provide short descriptions/definitions of key words used in this document. These are included to provide clarification of these words in the context of the objective of this document. These descriptions should not be considered to be official definitions, but rather are descriptions created to give a better understanding of this specific document.

Minimum competency: *A minimum competency is the accumulation of the academic knowledge base and applied experience that is necessary to successfully perform a certain task.*

Knowledge area: *A knowledge area is an important subject area that forms part of the overall knowledge base needed for a certain competency.*

Adequate knowledge base: *An adequate knowledge base is the summary of the information about a particular subject known by an individual; that information must be sufficient for an individual to be able to perform related tasks.*

Minimum knowledge: *Minimum knowledge is considered the knowledge base needed to gain a comprehensive understanding of a specific subject; to be able to understand how to use the knowledge of that specific subject in analysis, etc.*

Minimum qualifying experience: *This is practical experience that is indicative of growth in engineering competency and achievement of not less than four years, three of which shall have been in responsible charge of fire protection engineering work. A post-graduate degree may serve in lieu of one year of practical experience.*

IV. Aims and Objectives

The aim of this document is to provide a set of universally recognized minimum criteria, which are used globally, to ensure that a suitably high level of quality is maintained within the fire protection engineering profession and its related activities. This will help the fire protection engineering discipline gain professional recognition and acceptance in countries where it is not yet recognized. This recognition will let other professional engineers know there is an intricacy of knowledge and relevant experience needed to ensure appropriate fire protection engineering considerations have been taken. It is understood that although materials and methodologies, as well as customs and cultures, may vary around the world, the principles needed to evaluate and protect against fire are the same.

The intent is to clearly identify the areas of knowledge and experience — *the minimum technical competencies* — that are core to the fire protection engineering profession. In doing so, these competencies will provide a means through which the profession of fire protection engineering can be recognized across borders.

The Fire Protection Engineer

For the purposes of this document, the term "Fire Protection Engineer" will include other similar titles such as Fire Safety Engineer and Fire Engineer, since many titles are used by this profession globally. A high-level description and general understanding of the type of work tasks that are expected to be performed by the Fire Protection Engineer has been developed to assist in clarifying the individuals who should meet the minimum competencies laid out in this document.

The definition below refers to a practitioner who has a university education in fire protection engineering (e.g., a graduate of an engineering curriculum of accepted standing; see Section II) and relevant experience in the industry. Individuals who are engaged in the fire protection engineering profession, but who lack this level of education and experience, should strive to reach the same knowledge base held by a Fire Protection Engineer referred to in this document.

A Fire Protection Engineer is an individual who, by formal training and professional experience, carries the necessary competency, and has the skills to provide guidance and direction to protect life, property and environment from threats posed by fire and its related mechanism.

It is considered very important to have a common understanding of the role of a Fire Protection Engineer. therefore, the definition above has been further developed into the accompanying role description.

Fire protection engineers identify hazards, characterize risk, and design safeguards that aid in preventing, controlling and mitigating the effects of fires. They have the ability to use and develop engineering methods and techniques related to fire safety design of buildings, industrial constructions, infrastructures, equipment and environment interfaces.

It is understood that the competence carried by the fire protection engineer is used within any sector of the fire safety industry, such as the building industry, oil and gas industry, nuclear industry, forestry industry, etc.

A fire protection engineer is expected to identify and manage complex issues both independently and collaboratively. Through technical analysis the fire protection engineer is able to analyze, evaluate and develop various technical solutions to fire safety problems.

Fire protection engineers have an interdisciplinary role of assisting project/design teams (which may include but are not limited to architects, building owners and developers) in reaching life safety, property protection and environmental protection goals.

The fire protection engineer is expected to understand, in addition to general engineering principles:

- *Fire Science — the underlying physical principles of fire and its related mechanisms*
- *Active Fire Protection — the role of fire protection systems in fire safety design*
- *Passive Protection — the role of passive protection measures in fire safety design*
- *Human Behavior & Evacuation — the behavior of persons during an emergency and the principles of evacuation design and escape facilities*
- *Performance-Based Design (PBD) — the principles of using a PBD approach for fire safety design*
- *Fire Protection Analysis — the principles of technical analysis related to fire safety design*
- *Computational Modeling — the use of advanced modeling related to fire safety design*
- *Fire Hazard and Risk Assessment — the basic principles of risk management and probabilistic analysis*
- *General Building Design — how architectural, engineering and technical principles are incorporated into the design of buildings, industrial construction and other similar facilities*
- *Code and Regulations — the role of regulations in relation to fire safety design*

V. Technical Knowledge Base — Academic and Experiential Competencies

The objective is for a practitioner to gain a comprehensive understanding of the competencies considered to be core to the profession. A practitioner must understand fire protection principles and the application of these principles in the engineering analysis and design of fire safety measures. Only by understanding these core subjects will the professional achieve the minimum knowledge base considered necessary for the professional practice of fire protection engineering.

It is considered extremely important, when practicing fire protection engineering, to work within the scope of one's professional and technical competency, as is true in any engineering discipline. Understanding one's technical and professional limitations is an integral part of professional ethics related to the practice of engineering. Such ethical standards are in place to help assure that professionals undertake and complete only the tasks that they are competent to perform.

A fire protection engineer is often required to include and rely on the expertise and competency of other professionals (such as engineers in other disciplines, architects, scientists, etc.) as part of delivering a competent analysis/competent design (i.e., building design, infrastructure design or other). The other members of a team have a similar expectation of the fire protection engineer. This shared expectation — that each team member is qualified and competent in their respective discipline — is fundamental to engineering a fire-safe world.

Table 1 shows a summary of the recommended minimum technical competencies and knowledge areas.

Table 1 – Technical Competencies

Minimum Competency	***Fire Science***	***Human Behavior and Evacuation***	***Fire Protection Systems***	***Fire Protection Analysis***
Knowledge Areas	- Heat Transfer - Fire Chemistry - Fire Dynamics	- Human Behavior and Physiological Response to Fire - Egress and Life Safety Design Concepts	- Passive Systems - Active Systems Fire Detection and Alarm Fire Suppression	- Performance-based Design - Smoke Management - Evacuation Analysis - Structural Fire Protection - Risk Management - Numerical Methods and Computer Fire Modeling - Building and Fire Regulations & Standards

The minimum technical competencies are foundationally essential, but they will not generally translate to expertise in all those areas. Expertise in all of the areas of minimum technical competency is not practical, and probably not possible for an individual over the course of a professional life. The individual fire protection engineer will develop expertise in particular areas of practice and may maintain only basic understanding in other areas. It is understood that each individual, depending on his/her current competence and his/her specific area of expertise, might concentrate on only some of these core competencies when developing their expertise.

Competence in the following four (4) areas is considered to be core to the profession of fire protection engineering:

- Fire Science
  A comprehensive understanding of the underlying physical principles of fire and its related mechanisms. This would include the principles of ignition, combustion, heat transfer, mass transfer, fire chemistry and fire dynamics.

- Human Behavior and Evacuation
  A comprehensive understanding of human behavior and the principles of means of egress design. This would include the behavior of people during an emergency, different design approaches, tools and methods to perform egress, evacuation, and escape assessments.

- Fire Protection Systems
  A comprehensive understanding of fire mitigation, including water- and non-water-based suppression; fire detection and alarm systems; smoke management systems; passive systems; fire testing; and code and standard concerns.

- Fire Protection Analysis
  A comprehensive understanding of the principles of technical analysis related to fire protection design. This would include means of identifying and quantifying fire-related risks and hazards, design approaches, concepts for evaluating design options, application of numerical methods and computer fire models, establishing boundary conditions, and limits of analysis and design.

For each one of these competencies, a number of core knowledge areas have been identified. The expectation is that the practitioner is proficient in these knowledge areas, i.e., in the application of science and engineering to protect the health, safety and welfare of the public, along with protecting property from the impacts of fire. The knowledge areas presented in the following sections can be seen as descriptions of the objectives of courses needed to be taken to achieve proficiency in each specific topic.

The knowledge areas for *Fire Science* are the following:

- Heat Transfer
  The objective of this topic is to provide a knowledge of the theory and application of steady-state and transient heat conduction in solids; the principles of thermal radiation with application to heat exchange between black and non-black body surfaces; surface radiation properties; and principles of convection heat transfer.

- Fire Chemistry
  The objective of this topic is to provide an understanding of fire chemistry. This would include basic chemical concepts that apply to combustion, specifically combustion

reactions. It would also define physical and chemical properties of gases and liquids that are necessary for their ignition and combustion, and the production and movement of combustion products.

- Fire Dynamics

The objective of this topic is to understand the various stages of fire, provide a knowledge base concerning the different methods and techniques applied in the analysis of a fire sequence, and develop the ability to critically examine those methods in terms of practical application. This could include pool fires, point source models, pre-flashover compartment fire dynamics and assessment, post-flashover fire dynamics and assessment, and deflagrations and detonations.

The knowledge areas for *Human Behavior and Evacuation* are the following:

- Human Behavior and Physiological Response to Fire

The objective of this topic is to provide knowledge of human behavior in fire, including physiological and psychological response, decision-making and movement. This could include discussion on cues, recognition, decision making, response, social and cultural issues, crowd dynamics, toxicity, tenability limits, etc.

- Egress and Life Safety Design Concepts

The objective of this topic is to provide knowledge of building features, approaches, tools (including egress models) and systems that, given human behavior, physiological responses and fire effects, may be suitable for assuring that occupants can reach a place of safety in the event of fire in a building.

The knowledge areas for *Fire Protection Systems* are the following:

- Passive Systems

The objective of this topic is to provide knowledge of the role of passive protection measures and systems in fire safety design, fundamental principles, design criteria and installation requirements. Passive Systems that may play an important role include fire separations, closures in fire separations, structural members and protection of means of egress.

- Active Systems

The objective of this topic is to provide knowledge of the role of active fire protection systems in fire safety design, fundamental principles, design criteria and installation requirements. This could include principles of engineering analysis, concepts of system design and components, design requirements for different hazards, response times and related issues, reliability, testing, and robustness.

- Fire Suppression
  The objective of this topic is to provide knowledge of fundamental principles, design criteria and installation requirements for fire suppression systems (including water-based, clean agent, gaseous, chemical extinguishing and foam fire suppression systems). The design of systems for the specific construction features and occupancy involved, and the effects of various forms of heat transfer and oxygen displacement characteristics relating to the specific systems, are included.

- Fire Detection and Alarm
  The objective is to provide knowledge of fundamental principles, design criteria and installation requirements for fire detection (including smoke detectors, heat detectors, flame detectors, etc.) and occupant notification (including horn/strobe devices, speaker/strobe devices, etc.) systems based on hazard and occupancy, including how to analyze, evaluate and specify these systems.

The knowledge areas for *Fire Protection Analysis* are the following:

- Performance-based Design

The objective of this topic is to provide knowledge regarding development of fire protection engineering solutions from first principles to achieve performance goals, objectives and criteria from specific quantified fire scenarios. This could include the concepts of goals, objectives and criteria, design fires, fire safety analysis, concepts for evaluating design options, concepts of uncertainty, sensitivity analysis, and documentation.

- Smoke Management

The objective of this topic is to provide knowledge of fundamental principles, design criteria, installation and testing requirements for smoke control systems, including how to analyze, evaluate, specify and test these systems. This could include principles of smoke production and spread, entrainment, axisymmetric and spill plumes, stratification, natural and mechanical smoke exhaust system design, and reliability and robustness.

- Evacuation Analysis

The objective of this topic is to provide knowledge regarding approaches, tools and methods to evaluate evacuation in the event of fire or other similar events. This could include the use of a range of different calculation methods, from simple hand calculations to sophisticated computer simulations that may include behavioral rules of human interaction. This topic would also incorporate the design of egress systems, including performance-based design.

- Structural Fire Protection

The objective of this topic is to provide knowledge regarding the impact of fire exposure on structural elements, using either the prescriptive compliance method or structural fire engineering.

The prescriptive compliance method relates to the qualification and prescription of structural fire protection as measured by the level of fire resistance, including the understanding of fire testing qualification, equivalence calculations per fire testing and its specific acceptance criteria, and explicit simulation of fire testing (if permissible). Structural fire engineering relates to the explicit design of structural systems to adequately endure thermal load effects from structural design fires based on specific performance objectives. This alternative method requires participation by a structural engineer.

- Risk Management

The objective of this topic is to provide knowledge in the areas of probability and statistics, of the concepts, tools and methods of hazard assessment and risk analysis, and of the use and application of these concepts, tools and methods with fire protection problems. A general understanding of how fire affects people (including egress), property and society as a whole should be provided.

- Numerical Methods and Computer Fire Modeling

The objective is to provide knowledge of zone and field models, including the technical basis for enclosure fire model elements, limitations of computer-based fire models, validity and validation of fire models, and use of current computer-based fire models for practical fire protection engineering problems, including computer-based analysis of fire within the built environment.

- Building and Fire Regulations & Standards

The objective of this topic is to provide knowledge of the use and application of building regulations (codes) and related reference standards, including for both active and passive fire protection. In addition, it is important to understand how regional and local ordinances, along with established contracts, dictate which codes, standards and regulations will apply to a specific project.

VI. Recommended Time Needed to Gain a Comprehensive Understanding of Required Knowledge areas

Section V presented the four (4) competencies that are considered to be core to the profession, and provided several knowledge areas for each core competency.

It is not the purpose of this document to give a detailed description of these knowledge areas nor is it the intention of this document to exactly show the necessary length of study needed for these topics if part of a course program or similar resource. However, it is considered to be of utmost importance to show a recommended range of hours that are considered to be needed to gain a comprehensive understanding of these knowledge areas, i.e., to gain a minimum knowledge level for each topic.

The ranges of recommended hours presented here have been estimated based on input from the academic communities in the USA and Europe, and on the European Credit Transfer and Accumulation System (ECTS), [5] [6] where credits are a standard means for comparing the "volume of learning based on the defined learning outcomes and their associated workload," and where *"*workload indicates the time students typically need to complete all learning activities (such as lectures, seminars, projects, practical work, self-study and examinations) required to achieve the expected learning outcomes.*"*

For simplicity, the tables show a range of recommended hours for workload. If needed, these could be transformed to ECTS credits by assuming that one (1) ECTS credit can be estimated as 25–30 hours (or 1.5 ECTS credits = approximately one full-time week, 40 hours).

Briefly, the differences between ECTS and U.S. College Credit System [7] are: *"ECTS is the most commonly used credit system in Europe. The major difference between the European Credit System ECTS and the U.S. College Credit System is that the first is based on student workload and the second on contact hours. The student workload represents the number of hours needed to follow and prepare for a class, taking examinations, and preparing for these examinations. The ECTS is oriented toward the time required for a student to meet the intended study outcomes, while the U.S. system is more oriented toward the time a faculty member needs to teach."*

The hours shown in the table must be seen as a proposed range of recommended hours needed to gain a comprehensive understanding of the knowledge area, not to reach the minimum competence level. To reach the minimum competence level, it is necessary to add project experience of the specific matter. Taking a course on a specific knowledge area does not mean that an individual will be considered an expert on the subject nor does it mean that an individual can be considered to have achieve a minimum competence level on the subject. It should be noted that no single individual is likely to have a high level of competence in all of these knowledge areas. However, it is considered extremely important that every individual has the minimum competence required in those knowledge areas required to perform the role of a practitioner.

It is of utmost importance to make it clear that the knowledge areas (or the range of hours) shown are not intended to show what subjects an individual must have learned (or the hours needed) for a specific university degree. It is recognized that university degrees in fire protection engineering have specific orientations and specializations that depend on the geographical location, industry need, historical development of the university program, etc., which will make them all slightly different from each other, especially in the amount of workload that each university consider to be necessary for their specific knowledge areas.

The following table is only a recommended range of hours considered needed to gain a comprehensive understanding of the knowledge areas for the four core competencies.

For additional guidance on recommended curricula, SFPE has model curricula for a bachelor's degree and master's degree in fire protection engineering and a bachelor's in fire protection engineering technology. These documents should be used when developing courses for a university program.

Table 2 – Recommended Hours

Minimum Competency	*Fire Science*	*Recommended Hours*	*Human Behavior and Evacuation*	*Recommended Hours*
Knowledge Areas	- Heat transfer	120–160	- Human Behavior and Physiological Response to Fire	80–120
	- Fire Chemistry	80–120	- Egress and Life Safety Design	80–120
	- Fire Dynamics	160–200		
Minimum Competency	***Fire Protection Systems***	***Recommended Hours***	***Fire Protection Analysis***	***Recommended Hours***
Knowledge Areas	- Passive systems	60–90	- Performance Based-design	160–200
	- Active systems	60–90	- Smoke Management	120–160
	○ Fire Detection and Alarm	120–160	- Evacuation Analysis	120–160
	○ Fire Suppression	120–160	- Structural Fire Protection	120–160
			- Risk Management	140–180
			- Numerical Methods & Computer Fire Modeling	160–200
			- Building and Fire Regulations & Standards	60–90

It should also be mentioned that this document does not specify a certain way or method for how these knowledge areas should be taught. Nevertheless, it is considered that a suitable way of learning these is through a university course. In principle, any course must prepare the student to have proficiency in that specific subject.

It is also of absolute importance that the specific individual teaching the course has an acceptable knowledge level of the topic. It is understood that any person involved in teaching these knowledge areas must have the proper education and experience of the topic itself (and be able to show evidence of how this knowledge and experience was achieved), and should also be recognized as an expert on the matter.

VII. Ethics

The professional conduct of engineers is of utmost importance. The role of ethics in engineering is imperative because our ethical values ensure honest and open transactions in the profession, it is only in this way that professionals are able to work without any type of partiality. Ethics ensures that engineers are held accountable for their actions and by that keeping the interests of the public, clients, employers, colleagues and the profession in mind. The integrity of the profession depends on ethics, and therefore all fire protection engineers are expected to read, accept and abide by the SFPE Canons of Ethics. [8]

VIII. Reaching Competency

It is expected that an engineering background, including math, sciences, engineering basics and other general electives, is part of one's education when pursuing a career in fire protection engineering.

The most-efficient route to gaining the knowledge for a foundation in fire protection engineering is through university study, specifically in fire protection engineering. These recommended minimum technical competencies for fire protection engineering are not intended to replace an in-depth university education in fire protection engineering. University courses traditionally offer a more in-depth look at a particular subject, due to the length of instruction and activities, such as homework and projects, associated with the course. In addition to classroom education, becoming competent in many subject areas also involves practicing and applying the knowledge to real world projects.

SFPE acknowledges that, as one of the younger engineering disciplines, fire protection engineers may follow different paths to reach a competent level of practice. Although it is important to understand that the path to minimum technical competency may vary from one individual to another, university programs are essential to providing a fundamental grounding in engineering knowledge, which every fire protection engineer should possess.

The document does not limit or prescribe the precise means and methods by which the identified minimum standards are obtained by practitioners. University-level programs with specialized fire protection coursework are deliberately designed to deliver a comprehensive set of learning outcomes that build the foundational knowledge in the recommended core competencies. Alternative methods for obtaining knowledge in the identified core competencies should be carefully compared and evaluated, using the standards identified in this document. Regardless of how foundational knowledge is obtained, obtaining minimum competency must include observed and verified professional practice outside a traditional classroom.

Maintaining skills
Continuing Professional Development (CPD) is the main vehicle with which practitioners will ensure that they maintain the minimum level of competency needed throughout their career. CPD essentially adapts the base knowledge and skills for new needs evolving over time.

Engineers in the fire protection industry must take the necessary steps to develop and maintain knowledge, skills and expertise essential to perform their roles successfully throughout their careers. By participating in relevant training, professional development programs, and mentoring and independent research, they can remain competent through education about new technologies, new methodologies and improved ways of implementing fire protection engineering.

IX. Acknowledgments

This document has been prepared by the SFPE Subcommittee on Professional Competencies and Credentialing.

The document has also been subject to external reviews by people in the international fire protection engineering community and has also been developed with help from other committees and groups within SFPE. Special recognition is given to the SFPE Subcommittee on Higher Education for their efforts on this project. The members of this subcommittee would like to offer their sincerest gratitude to all contributing people, committees and groups for their comments and help during the development of this document.

At the time of publication, the SFPE Subcommittee on Competencies and Credentialing is composed of the following members.

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Chair	Jimmy Jönsson	JVVA Fire & Risk	Spain
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Member	Russell Bainbridge	American Fire Sprinkler Association	USA
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Member	Justin Schmeer	Chevron	USA

The SFPE staff liaison is Victoria Valentine.

References

The following documents are considered to be closely related to this specific document and it is recommended that readers of this document take a closer look at these references.

[1] Competency model for engineering: AAES or USDLETA websites (e.g., https://www.careeronestop.org/CompetencyModel/competency-models/engineering.aspx).

[2] SFPE, Model Curriculum for a Bachelor's of Science (BS) Degree in Fire Protection Engineering (FPE): https://c.ymcdn.com/sites/sfpe.site-ym.com/resource/collection/24609C80-7253-49A5-83AF-D0499353EAEA/SFPE_BS_Model_Curriculum.pdf.

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