PROFESSIONAL PRACTICE GUIDELINES

BUILDINGS

FIRE PROTECTION ENGINEERING SERVICES FOR BUILDING PROJECTS

VERSION 2.0
PUBLISHED OCTOBER 20, 2021

ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA

REVISED: VERSION 2.0, OCTOBER 20, 2021
FIRST PUBLISHED: VERSION 1.0, SEPTEMBER 2013

PREFACE

These *Professional Practice Guidelines – Fire Protection Engineering Services for Building Projects* were developed by Engineers and Geoscientists British Columbia to guide professional practice related to Fire Protection Engineering in British Columbia (BC).

These guidelines were first published in 2013 to outline the professional services related to Fire Protection Engineering that Engineering Professionals should generally provide for building projects governed by Part 3 of the *BC Building Code* and the Vancouver Building By-law (referred to collectively in these guidelines as the Code), and other regulatory requirements.

This current revision provides additional clarity on Fire Protection Engineering services for existing buildings, Letters of Assurance, Alternative Solutions, and conformance to the *BC Fire Code* and the Vancouver Fire By-law (referred to collectively in these guidelines as the Fire Code).

These guidelines describe expectations and obligations of professional practice in relation to the specific professional activity of Fire Protection Engineering to be followed at the time they were prepared. However, this is a living document that is to be revised and updated as required in the future, to reflect the developing state of practice.

TABLE OF CONTENTS

LIST OF APPENDICES

ABBREVIATIONS

ABBREVIATION	TERM
AHJ	Authority Having Jurisdiction
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BC	British Columbia
BCBC	*British Columbia Building Code*
CMTC	contractor's material and test certificates
CRP	Coordinating Registered Professional
EER	Electrical Engineer of Record
FPE	Fire Protection Engineer
FPER	Fire Protection Engineer of Record
MER	Mechanical Engineer of Record
NBC	*National Building Code of Canada*
NFPA	National Fire Protection Association
RP	Registered Professional
RPR	Registered Professional of Record
SER	Structural Engineer of Record
SFPE	Society of Fire Protection Engineers
SRP	Supporting Registered Professional
ULC	Underwriters Laboratories of Canada
VBBL	Vancouver Building By-law

DEFINED TERMS

The following definitions are specific to these guidelines. These words and terms are capitalized throughout the document.

TERM	DEFINITION
Act	*Professional Governance Act* [SBC 2018], Chapter 47.
Alternative Solutions	A design or solution which does not conform to the prescriptive requirements of the Code but provides the level of performance required by Division B of the Code in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (see Division A, Article 1.2.1.1. Compliance with this Code and Division C, Section 2.3.).
Architect	An individual who is registered or licensed by the Architectural Institute of British Columbia under the *Architects Act* [RSBC 1996], Chapter 17 to practice the profession of architecture and provide architectural services in British Columbia.
Authority Having Jurisdiction	The jurisdictional body (usually municipal) with authority to administer and enforce any part of the Code, or a local building bylaw or code, as well as government agencies that regulate a particular function on a building.
Bylaws	The Bylaws of Engineers and Geoscientists BC made under the *Act*.
Client	The party who engages the Fire Protection Engineer and/or the Fire Protection Engineer of Record to provide professional Fire Protection Engineering services.
Code	The *British Columbia Building Code* (*BCBC*) and the Vancouver Building Bylaw (VBBL). Unless otherwise noted, the use of "Code" as a defined term refers specifically to Division B of the Code.
Coordinating Registered Professional	A Registered Professional retained under Clause 2.2.7.2.(1)(a) of Division C of the Code to coordinate all design and Field Reviews of the Registered Professionals who are required for a project.
Design Drawings	Drawings (except Final Design Drawings, see below), including site instructions, prepared by a Registered Professional at any stage of a building project. Design Drawings, including those submitted for building permitting or other purposes, must be signed, sealed, and dated by the Registered Professional of Record who assumes overall responsibility for the particular aspect of the design that the Registered Professional of Record prepared.
Design Objective	A description of the performance benchmark against which the predicted performance of a design is evaluated.
Direct Supervision	The act of taking responsibility for the control and conduct of the engineering work of a subordinate, who could be an Engineer-in-Training, a person not registered or licensed to practice professional engineering, or another Engineering Professional.

TERM	DEFINITION
Electrical Engineer of Record	The Engineering Professional with general responsibility for the electrical integrity of the electrical systems. The Electrical Engineer of Record takes overall responsibility as the Registered Professional of Record for all items under the electrical discipline on Schedule B of the Letters of Assurance in the *Code*. See also *Professional Practice Guidelines – Electrical Engineering Services for Building Projects* (Engineers and Geoscientists BC 2020).
Engineering Professional(s)	Professional engineers, professional licensees engineering, and any other individuals registered or licensed by Engineers and Geoscientists BC as a "professional registrant" as defined in Part 1 of the Bylaws.
Engineers and Geoscientists BC	The Association of Professional Engineers and Geoscientists of the Province of British Columbia, also operating as Engineers and Geoscientists BC.
Field Review	The reviews conducted at the site of the implementation or construction of the engineering work by an Engineering Professional or a subordinate acting under the Engineering Professional's Direct Supervision for the purpose of ascertaining whether the implementation or construction of the work substantially complies in all material respects with the engineering concepts or intent reflected in the engineering documents prepared for the work. Defined in the Code as follows: "Field Review means a review of the work (a) at a building site, and (b) where applicable, at locations where building components are fabricated for use at the building site that a Registered Professional in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the Registered Professional."
Final Design Drawings	Drawings prepared by the Registered Professional of Record that reflect design changes made during construction of a building project. These drawings incorporate contract-related items such as addenda, change orders, and other significant design changes, but not necessarily site instructions. These drawings must be signed, sealed, and dated by the Registered Professional of Record who assumes overall responsibility for the design (see Section 4.1.2 Authenticating Documents).
Fire Code	The *British Columbia Fire Code* and the Vancouver Fire By-law.
Fire Protection Engineer (FPE)	An Engineering Professional who specializes in Fire Protection Engineering with the responsibility for fire and life-safety analysis, as outlined in Section 3.3 Fire and Life-Safety Analysis of these guidelines.
Fire Protection Engineering	The application of science and engineering principles to protect people and their environment from destructive fire, including: • analysis of fire hazards; • mitigation of fire damage by proper design, construction, arrangement, and use of buildings, materials, structures, industrial processes, and transportation systems; and • the design, installation, and maintenance of fire and life-safety systems such as fire detection, suppression, alarm, and communication systems.

TERM	DEFINITION
Fire Protection Engineer of Record	The Engineering Professional who specializes in Fire Protection Engineering and is responsible for the Fire Protection System Design, as outlined in Section 3.4 Basic Fire Protection System Design and Related Services of these guidelines. The Fire Protection Engineer of Record may be the Engineering Professional who seals the Letters of Assurance for one or more disciplines involving Fire Protection System Design. The Fire Protection Engineer of Record may also be a Supporting Registered Professional to the Registered Professional of Record (e.g., the Architect, Mechanical Engineer of Record, or Electrical Engineer of Record) for the same items. Note that for fire suppression systems, another Engineering Professional, typically the Mechanical Engineer of Record, may provide an objective-based specification and seal Letters of Assurance at the incipient stages of a project. This Engineering Professional is not considered the Fire Protection Engineer of Record.
Fire Protection System Design (services)	The basic fire protection system design and related services provided by the Fire Protection Engineer of Record, as set out in Section 3.4 Basic Fire Protection System Design and Related Services.
General Contractor	A contractor who has a contract with an Owner for construction of all or a portion of a building project.
Letters of Assurance	Uniform, mandatory documents that are intended to clearly identify the responsibilities of the Registered Professionals of Record in a building project, and which are executed in accordance with the applicable Code.
Mechanical Engineer of Record	The Engineering Professional with general responsibility for the mechanical integrity of the mechanical systems. The Mechanical Engineer of Record takes overall responsibility as the Registered Professional of Record for all items under the mechanical and plumbing discipline on Schedule B of the Letters of Assurance in the Code. See also *Professional Practice Guidelines – Mechanical Engineering Services for Building Projects* (Engineers and Geoscientists BC 2021a).
Objective-Based Design	An engineering approach to design that will achieve the minimum level of performance required by Division B of the Code in the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions.
Owner	A party who owns a building, or will own a building, once construction is complete.
Prescriptive-Based Design	A design that complies with prescriptive Code requirements, also known as acceptable solutions.
Record Drawings	Drawings prepared as a record of what was constructed, which may include measurements, elevations, and sizes. Record Drawings are typically prepared by a General Contractor or Subcontractor, and should not be authenticated by the Registered Professional of Record, unless an appropriate declaration is added (see Section 4.1.2 Authenticating Documents).

TERM	DEFINITION
Registered Professional	Defined in the Code as: "a) a person who is registered or licensed to practice as an Architect under the *Architects Act*, or b) a person who is registered or licensed to practice as a professional engineer under the *Engineers and Geoscientists Act*." The *Engineers and Geoscientists Act* has been superseded by the *Professional Governance Act*, which now defines a professional engineer as professional engineers, professional licensees engineering, and any other individuals registered or licensed by Engineers and Geoscientists BC as a "professional registrant" as defined in Part 1 of the Bylaws and having the appropriate scope of practice, all of whom must be qualified by training or experience to provide designs for building projects.
Registered Professional of Record	Defined in the Code as a Registered Professional retained to undertake design work and Field Reviews in accordance with Subsection 2.2.7. of Division C.
Registrant	Means the same as defined in Schedule 1, section 5 of the *Professional Governance Act*.
Shop Drawings	Drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data which are provided by the General Contractor to the Registered Professional of Record to illustrate details of a portion of work. See also *Professional Practice Guidelines – Shop Drawings* (Engineers and Geoscientists BC 2015).
Specialty Fire Protection Engineer (Specialty FPE)	A Fire Protection Engineer who is responsible for specific Code-related aspects of the fire and life-safety concepts of a building project, such as the development of an Alternative Solution that does not involve a broad overall project review. For Fire Protection Engineers designing speciality systems such as kitchen suppression systems, see the definition of Supporting Fire Protection Engineer.
Structural Engineer of Record	An Engineering Professional with general responsibility for the structural integrity of the primary structural system. The Structural Engineer of Record takes overall responsibility as the Registered Professional of Record for all items under the structural discipline on Schedule B of the Letters of Assurance in the Code. See also *Professional Practice Guidelines – Structural Engineering Services for Part 3 Building Projects* (Engineers and Geoscientists BC 2019).
Subcontractor	A contractor who has a contract with the General Contractor to provide labour, materials, and/or equipment for the execution and quality control of portions of the work shown in the contract documents. The Subcontractor's work is generally performed under the direct supervision of the General Contractor.
Supporting Fire Protection Engineer (Supporting FPE)	A Fire Protection Engineer providing supplementary supporting design and/or Field Review services to the Registered Professional of Record for a particular component or sub-component of a discipline, such as, for instance, a Fire Protection Engineer providing supplementary supporting services for fire protection systems (e.g., pressure vessels, kitchen suppression systems, explosion suppression systems, gaseous systems).

TERM	DEFINITION
Supporting Registered Professional	The Registered Professional providing supplementary supporting design and/or Field Review services to the Registered Professional of Record for a particular component or sub-component of a discipline. It is recommended that the Registered Professional of Record obtain and retain in the project file any Schedules S-B and S-C from any Supporting Registered Professionals, as identified in Appendix A of the *Joint Professional Practice Guidelines – Professional Design and Field Review by Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020). These schedules provide the Registered Professional of Record with assurance from the Supporting Registered Professional that the plans and supporting documents relating to the supporting engineering services for a particular fire protection component, or subcomponent, substantially comply, in all material respects, with the applicable requirements of the Code.
Sustainable Goals	Often referred to as high performance or green designs, the Sustainable Goals for a project should seek to strike a balance between economics, environmental issues, and social issues for buildings and/or the built environment. Ideally, goals should be set to progress towards a vision of the built environment as truly sustainable.

VERSION HISTORY

VERSION NUMBER	PUBLISHED DATE	DESCRIPTION OF CHANGES
2.0	October 20, 2021	Revised to reflect current industry practice and provide additional clarity on Fire Protection Engineering services for existing buildings, Letters of Assurance, Alternative Solutions, and conformance to the Fire Code.
1.0	September 2013	Initial version.

1.0 INTRODUCTION

Engineers and Geoscientists British Columbia is the regulatory and licensing body for the engineering and geoscience professions in British Columbia (BC). To protect the public, Engineers and Geoscientists BC establishes, maintains, and enforces standards for the qualification and practice of its Registrants.

Engineers and Geoscientists BC provides various practice resources to its Registrants to assist them in meeting their professional and ethical obligations under the *Professional Governance Act* (the *Act*) and Engineers and Geoscientists BC Bylaws (Bylaws). Those practice resources include professional practice guidelines, which are produced under the authority of Section 7.3.1 of the Bylaws and are aligned with Principle 4 of the Code of Ethics.

Each professional practice guideline describes expectations and obligations of professional practice that all Engineering Professionals are expected to have regard for in relation to specific professional activities. Engineers and Geoscientists BC publishes professional practice guidelines on specific professional services or activities where additional guidance is deemed necessary. Professional practice guidelines are written by subject matter experts and reviewed by stakeholders before publication.

Having regard for professional practice guidelines means that Engineering Professionals must follow established and documented procedures to stay informed of, be knowledgeable about, and meet the intent of any professional practice guidelines related to their area of practice. By carefully considering the objectives and intent of a professional practice guideline, an Engineering Professional can then use their professional judgment when applying the guidance to a specific situation. Any deviation from the guidelines must be documented and a rationale provided. Where the guidelines refer to professional obligations specified under the *Act*, the Bylaws, and other regulations/legislation, Engineering Professionals must understand that such obligations are mandatory.

These *Professional Practice Guidelines – Fire Protection Engineering Services for Building Projects* provide guidance on professional practice for Engineering Professionals who provide Fire Protection Engineering services for building projects governed by Part 3 of the *BC Building Code* (*BCBC*) and the Vancouver Building By-law (VBBL) (referred to collectively in these guidelines as the Code).

These guidelines were first published in 2013. This 2021 revision reflects current industry standards and practices at the time of publication.

1.1 PURPOSE OF THESE GUIDELINES

This document provides guidance on professional practice to Engineering Professionals who carry out a range of professional activities related to Fire Protection Engineering services. The purpose of these guidelines is to provide a common approach for carrying out this work.

Following are the specific objectives of these guidelines:

1. Describe expectations and obligations of professional practice that Engineering Professionals are expected to have regard for in relation to the specific professional activity outlined in these guidelines by:
    - specifying tasks and/or services that Engineering Professionals should complete; and

- referring to professional obligations under the *Act*, the Bylaws, other regulations/legislation, including the primary obligation to protect the safety, health, and welfare of the public and the environment; and
- describing the established norms of practice in this area.

2. Describe the roles and responsibilities of the various participants/stakeholders involved in these professional activities. The document should assist in delineating the roles and responsibilities of the various participants/stakeholders, which may include the Fire Protection Engineer, Fire Protection Engineer of Record, other Registered Professionals of Record, Owners or Clients, Authorities Having Jurisdiction, and General Contractors.
3. Define the skill sets that are consistent with the training and experience required to carry out these professional activities.
4. Provide guidance on the use of assurance documents, so the appropriate considerations have been addressed (both regulatory and technical) for the specific professional activities that were carried out.
5. Provide guidance on how to meet the quality management requirements under the *Act* and the Bylaws when carrying out the professional activities identified in these professional practice guidelines.

1.2 ROLE OF ENGINEERS AND GEOSCIENTISTS BC

These guidelines form part of Engineers and Geoscientists BC's ongoing commitment to maintaining the quality of professional services that Engineering Professionals provide to their clients and the public.

Engineers and Geoscientists BC has the statutory duty to serve and protect the public interest as it relates to the practice of professional engineering, including regulating the conduct of Engineering Professionals.

Engineers and Geoscientists BC is responsible for establishing, monitoring, and enforcing the standards of practice, conduct, and competence for Engineering Professionals. One way that Engineers and Geoscientists BC exercises these responsibilities is by publishing and enforcing the use of professional practice guidelines, as per Section 7.3.1 of the Bylaws.

Guidelines are meant to assist Engineering Professionals in meeting their professional obligations. As such, Engineering Professionals are required to be knowledgeable of, competent in, and meet the intent of professional practice guidelines that are relevant to their area of practice.

The writing, review, and publishing process for professional practice guidelines at Engineers and Geoscientists BC is comprehensive. These guidelines were prepared by subject matter experts and reviewed at various stages by a formal review group, and the final draft underwent a thorough consultation process with various advisory groups and divisions of Engineers and Geoscientists BC. These guidelines and the current revision were then approved by Council and, prior to publication, underwent final editorial and legal reviews.

Engineers and Geoscientists BC supports the principle that appropriate financial, professional, and technical resources should be provided (i.e., by the client and/or the employer) to support Engineering Professionals who are responsible for carrying out professional activities, so they can comply with the professional practice expectations and obligations provided in these guidelines.

These guidelines may be used to assist in the level of service and terms of reference of an agreement between an Engineering Professional and a client.

1.3 INTRODUCTION OF TERMS

See the Defined Terms section at the front of the document for a full list of definitions specific to these guidelines.

1.4 SCOPE AND APPLICABILITY OF THESE GUIDELINES

These guidelines provide guidance on professional practice for Engineering Professionals who carry out the practice of Fire Protection Engineering for buildings governed by Part 3 of the Code and its referenced documents. These guidelines are not intended to provide technical or systematic instructions for how to carry out these activities; rather, these guidelines outline considerations to be aware of when carrying out these activities. Engineering Professionals must exercise professional judgment when providing professional services; as such, application of these guidelines will vary depending on the circumstances.

Although these guidelines may provide thresholds above which professional involvement is specified as being required, Engineering Professionals must always use their professional knowledge, experience, and judgment to apply the appropriate standards of practice that is commensurate with the risk of their professional activities to public safety and/or the environment.

An Engineering Professional's decision not to follow one or more aspects of these guidelines does not necessarily represent a failure to meet professional obligations. For information on how to appropriately depart from the practice guidance within these guidelines, refer to the *Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021b), Section 3.4.2.

These guidelines outline the professional services which should generally be provided by the Fire Protection Engineer (FPE) and the Fire Protection Engineer or Record (FPER) for a project carried out under the requirements of those portions of the Code and regulatory requirements set out above. Provisions of the Fire Code related to building projects that are not specifically duplicated or referenced in the Code are also discussed.

These guidelines specify tasks which should be performed by the FPE and/or FPER to achieve designs that are in the best interest of the project, the public, and the environment, and which are properly coordinated with the work of other design and construction team participants. These guidelines should assist in maintaining the integrity of the overall and detailed designs. The FPE and/or FPER often work in conjunction with the Architect, Mechanical Engineer of Record (MER), Electrical Engineer of Record (EER), Structural Engineer of Record (SER) and/or other design team members or General Contractors on certain projects; these guidelines should assist in the delineation of responsibilities among these parties.

These guidelines also take into account the assurances that Authorities Having Jurisdiction may require from Engineering Professionals as set out in the Letters of Assurance.

See Appendix A: Letters of Assurance for Fire Protection Engineering Services for information about the Code Letters of Assurance for design and Field Reviews that an Authority Having Jurisdiction can require from an Engineering Professional.

1.5 ACKNOWLEDGEMENTS

This document was reviewed by a group of technical experts, as well as by various advisory groups and divisions of Engineers and Geoscientists BC. Authorship and review of these guidelines does not necessarily indicate the individuals and/or their employers endorse everything in these guidelines.

Engineers and Geoscientists BC thanks the authors and reviewers of the original document, as well as the authors and reviewers of this revision, for their time and effort in sharing their knowledge and experience.

2.0 ROLES AND RESPONSIBILITIES

2.1 COMMON FORMS OF PROJECT ORGANIZATION

Project organization varies according to the type of project and professional services required. The Fire Protection Engineer (FPE) and/or the Fire Protection Engineer of Record (FPER) can be engaged by the Owner, but are often engaged by the Architect. In rarer cases they may be engaged by other Registered Professionals (RPs) responsible for the delivery of part or all of the project, or a design/build contractor.

The roles of the FPE and/or the FPER, and their interactions with other members of the design and construction team, depends on the contractual involvement of the FPE and/or FPER, and the scope of Fire Protection Engineering services provided. The services and associated project organizations are described later in these guidelines.

Refer to the flow charts in Appendix E: Common Forms of Project Organization, which describe common contractual and functional relationships of the FPE and/or FPER with other RPs and members of the project team.

2.2 RESPONSIBILITIES

In addition to the professional responsibilities listed below, Engineering Professionals providing Fire Protection Engineering services for buildings have a professional responsibility to uphold the principles outlined in the Engineers and Geoscientists BC Code of Ethics, including protection of public safety and the environment. As such, the Engineering Professional must use a risk-based approach to decision making when providing professional services. Two of the risk factors that must be considered are the implications of climate change on the design as well as the potential impact of the design on climate change.

Fire protection systems can impact the environment through discharge of fire protection water on natural water courses. Additionally, the guidance for existing buildings seeks to minimize unnecessary demolition of existing building fabric in the upgrading of an existing structure.

The Engineering Professional has a responsibility to notify the Client of unnecessary removal of existing building fabric, as well as future climate-related risks, reasonable adaptations to lessen the impact of those risks, and the potential impacts should the Client refuse to implement the recommended adaptations. The Engineering Professional has a responsibility to be aware of and meet the intent of any climate change requirements imposed by the Client or the Authority Having Jurisdiction (AHJ).

2.2.1 OWNER

To ensure the design and construction of the project is carried out in a manner that meets appropriate standards of public safety, environmental legislation, and the requirements of applicable codes and regulations, the Owner should:

- where required, retain or cause to be retained qualified Registered Professionals (RPs) with responsibility for the design of all aspects of the project, including a Coordinating Registered Professional (CRP);
- cooperate with the Architect so that an adequate written description of the project is developed;
- cooperate with or direct the Architect or other appropriate and mutually acceptable party to

cooperate with the FPE in setting out a written description of the scope of the FPE's services, as described in Section 2.2.5 Fire Protection Engineer;

- cooperate with or direct the Architect or other appropriate and mutually acceptable party to cooperate with the FPER in setting out a written description of the scope of the FPER's services, as described in Section 2.2.6 Fire Protection Engineer of Record;
- before the commencement of the FPE and/or FPER's services, complete or cause to be completed a written agreement with the FPE and/or FPER (either directly with the Owner or with the Architect or another appropriate and mutually acceptable party) confirming the scope of services and associated compensation;
- cooperate with the Architect and the FPE and/or FPER to establish a realistic, mutually agreed upon schedule for the provision of the FPE and/or FPER's services;
- authorize in writing any additional services that may be required beyond the scope of the FPE's and/or FPER's agreement or original scope of services;
- ensure that all required approvals, licenses, permits, and if applicable, agreements in principle, from the AHJ are obtained;
- provide the FPE and/or FPER with the right of entry onto the project site for the purposes of assessing the project requirements and site conditions;
- recognize that drawings, specifications, reports, and other documents prepared by the FPE and/or FPER are for the project, and that such documents must not be used or copied for other projects without the agreement of the FPE and/or FPER;
- recognize that, because the AHJ's interpretation of the Code may differ from that of the FPE and/or FPER, changes may be required;
- disclose fully and promptly any and all information that may affect the FPE's and/or FPER's performance, scheduling, design, or payment for services, including but not limited to any existing fire protection reports or data, any situations that may require special testing or equipment, and all known or anticipated potential uses; and
- establish or cause to be established a clear delineation of the responsibilities of the various FPEs and/or FPERs, if applicable, including, where appropriate, the provision for independent review of the impact of specialty work on the fire protection system.

If the Owner fails or refuses to carry out the obligations as set out above, the FPE and/or FPER should:

- consider giving written notice to the Owner, advising the Owner of the FPE's and/or FPER's recommendations; and
- consider withdrawing from the building project if the Owner's approach will compromise the ability of the FPE and/or FPER to comply with the intent of these guidelines.

2.2.2 COORDINATING REGISTERED PROFESSIONAL

The role of the CRP, as described in the Letter of Assurance, Schedule A, Confirmation of Commitment By Owner and Coordinating Registered Professional, is to coordinate the design work and Field Reviews of the Registered Professionals of Record (RPRs) required for the project, in order to confirm that the design and construction will substantially comply with the Code and other applicable enactments regarding safety.

The role of the CRP is clearly defined in the Code, and is discussed in Note A2.2.7.2.(1)(a) of Division C.

The CRP should:

- distribute any agreements in principle with AHJs that may impact the design to the appropriate disciplines;
- provide timely information in sufficient detail as required to permit the FPE and/or FPER to adequately perform their duties;

- recognize that, because the AHJ's interpretation of the Code may differ from that of the FPE and/or FPER, changes may be required;
- coordinate and review the designs, drawings, and other contract documents produced by all the participants of the design team;
- coordinate communication of information between the Owner, the General Contractor, and the RPs, including the FPE and/or FPER, so the work proceeds in a manner that complies with applicable codes, regulations, and agreements in principle with AHJs, and meets the Owner's needs;
- coordinate the design of the fire and life-safety systems;
- coordinate and develop the test protocol and procedures for functional testing of the fire and life-safety systems; and
- for Engineering Professionals, be familiar with and, where appropriate, apply the *Professional Practice Guidelines – Sustainability* (Engineers and Geoscientists BC 2016) to the work, and develop and identify to the design team the Sustainable Goals for the project.

2.2.3 ARCHITECT

An Architect will often take the role of the CRP. In addition to the responsibilities of the CRP listed above, the Architect should:

- interpret and define the Owner's needs and objectives, in order for the design to meet the intended function;
- identify or cause to be identified by other participants of the design team any special design criteria such as anticipated occupancies, uses, future constructions, and other performance requirements or additional fire protection services not normally part of the scope of such projects, and advise the FPE and/or FPER accordingly;
- outline the scope of assignment to each RP (including the FPE and/or FPER) for design, preparation of contract documents, Field Reviews during construction, and contract administration;
- identify and advise RPs of any special architectural design criteria, and coordinate accordingly;
- provide appropriate information to allow RPs to adequately carry out their design responsibilities;
- disclose fully and promptly any and all information that may affect the FPE's and/or FPER's performance, scheduling, design, or payment for services, including but not limited to any existing fire protection reports or data, any situations that may require special testing;
- advise the FPE and/or FPER of special design criteria, such as kitchen equipment, utilities, venting, and other arrangements;
- coordinate architectural features with the FPE and/or FPER for preparation of contract documents, Alternative Solutions, and supporting documents, as necessary;
- where required, review any agreements in principle with the AHJ and assess existing construction and the impact of proposed changes on Code conformance and/or Fire Code issues;
- where applicable, review and assess existing conditions with the FPE and/or FPER as necessary to meet the criteria of any agreements in principle and/or any Alternative Solutions prepared by the FPE and/or FPER;
- where applicable, provide input on architecture-related items at the time of testing and commissioning; and
- keep a record of the architectural Field Review(s) and of any corrective action taken as a result of the Field Review(s), and make the record available to the AHJ.

2.2.4 OTHER REGISTERED PROFESSIONALS

To enable the FPE and/or FPER and any other RPs to perform their duties properly on projects, RPs should:

- coordinate information in a timely fashion and in sufficient detail, including Design Drawings and, depending on the project, specifications, proposed design changes, and change orders during construction;
- where proposed design changes affect the duties of the FPE and/or FPER, coordinate those changes with the FPE and/or FPER and the other relevant RP(s);
- where the FPE and/or FPER is involved in an Alternative Solution or an Objective-Based Design that impacts systems provided by other RP(s), incorporate the recommendations of the FPE and/or FPER into the design; and
- when required, such as on existing building projects, meet with stakeholders to discuss the scope and the most appropriate strategy to meet the intent of the upgrade mechanism for the project.

2.2.5 FIRE PROTECTION ENGINEER

2.2.5.1 Fire and Life-Safety Concepts

Under the Letters of Assurance, the Architect is responsible for the fire and life-safety concepts (i.e., fire-resisting assemblies, fire separations and their continuity, functional testing of architecture-related fire emergency systems and devices).

The FPE, typically in an advisory role as an SRP to the Architect, is generally responsible for fire and life-safety design and, where applicable, the associated Field Reviews. The FPE, together with the Owner or Architect, is responsible for determining the scope of the FPE's services sufficient to enable the FPE to meet the design and Field Review requirements of these guidelines and applicable building regulations.

Additionally, where applicable, the FPE should:

- develop the Fire Protection Engineering recommendations, such as the development of a basis for Fire Protection System Design, and preparation of reports to outline recommended design concepts;
- prepare recommendations and design concepts, which may involve relying upon project information and special building design criteria or other performance requirements provided by the Owner and other RPs, including the CRP and the Registered Professionals of Record (RPRs);
- provide recommendations for other aspects of a building project, such as accessibility aspects of the Code;
- when acting as an SRP to another RPR, complete Schedule S-B, Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional and Schedule S-C, Assurance of Professional Field Review and Compliance By Supporting Registered Professional and provide a copy to each applicable discipline RPR;
- coordinate and incorporate the work of a Specialty FPE when one is engaged for specific aspect(s) of the fire and life-safety concepts of a building project, such as the development of an Alternative Solution that does not involve a broad overall project review;
- generally review designs by other RPRs as they progress, to make sure that the FPE's preliminary design concepts are appropriately implemented from design through the construction and commissioning stages;
- during construction, review Alternative Solution features and fire and life-safety aspects in a broader context;
- provide independent review of designs by Specialty FPEs to assess risks associated with proceeding with such specialty work;
- advise on fire risk during construction and implications of the Fire Code on the design; and

- be familiar with and, where appropriate, apply the *Professional Practice Guidelines – Sustainability* (Engineers and Geoscientists BC 2016) to the work.

As per the Memorandum of Agreement (AIBC and Engineers and Geoscientists BC 1999), the FPE may take on the role of prime consultant and perform some of the roles that would otherwise be performed by an Architect or other Engineering Professional if the project meets all the requirements and the FPE has the appropriate education, training, and experience. Similarly, for certain projects where an Architect is not required or the project has a high percentage of fire and life-safety issues to address, such as industrial and upgrades to existing buildings, the FPE may also take on the role of CRP. It is important to note that these guidelines do not displace any statutory requirement for an Architect's involvement.

2.2.5.2 Fire and Life-Safety Concepts for Existing Buildings

For existing buildings, especially those requiring work that is challenging or complex, the Owner may retain an FPE to develop a strategy for achieving acceptable fire and life-safety performance in relation to the proposed changes.

In addition to those responsibilities mentioned above, the FPE may have the following responsibilities:

- Carry out a site survey to assess the existing construction and occupancy features of the building.
- Document existing building features as well as any potential Code-conforming features to be addressed as part of the design.
- Set out a strategy for Code conformance of the project and document the strategy (for example, in an agenda or another appropriate form) for discussion with the AHJ.
- Meet with the AHJ to set out the project objectives and the strategy for Code conformance and alignment of the project with the upgrade strategy of the AHJ.
- Prepare and submit minutes of meeting(s) to the AHJ, and follow up to negotiate acceptance of, or agreement on, the proposed approach, so the minutes can be used as a basis for design. In certain circumstances, the agreement on the proposed approach (for example, in the minutes or another appropriate form) can function as an agreement in principle.
- Follow up as required to address specific issues with the proposed strategy.
- Where required, prepare a report outlining:
  - the findings of the site assessment in relation to the existing structure and occupancy including fire risks to be addressed;
  - project requirements and potential Code issues to be addressed;
  - project requirements and proposed strategy for alignment with the upgrading strategy of the AHJ;
  - the strategy for Code conformance, setting out the fire protection system and other upgrading requirements; and
  - Alternative Solutions to address specific Code conformance issues.
- Where required, submit the report to the AHJ.
- Meet with the AHJ to create an agreement in principle as set out above (see also Section 3.3.3 Fire and Life-Safety Analysis of Existing Buildings).
- Where required, discuss requirements and strategies with heritage conservation agencies.

2.2.6 FIRE PROTECTION ENGINEER OF RECORD

2.2.6.1 Design Aspects

The FPER addresses specific design aspects of the Code as laid out in Schedule B, Assurance of Professional Design and Commitment for Field Review. The FPER's scope is usually limited to prescriptive requirements of the Code (possibly modified by other FPEs) for Fire Protection System Design such as fire suppression (sprinkler and standpipe) or fire alarm systems. For the purposes of these guidelines, the FPER refers to any FPE who is responsible for components in one or more disciplines in the Letters of Assurance, or has overall responsibility for Fire Protection System Design as noted in Section 3.4 Basic Fire Protection System Design and Related Services.

The design of fire protection systems is multi-disciplinary and, as such, often spans multiple disciplines in the Letters of Assurance. It is common for the FPER to be the RPR for the fire suppression systems and, where applicable, also be responsible for components in the architectural, plumbing, electrical, or mechanical disciplines of the Letters of Assurance (See Appendix A: Letters of Assurance for Fire Protection Engineering Services).

For new building projects with an Architect, Mechanical Engineer of Record (MER), or Electrical Engineer of Record (EER), the FPER should act as an SRP within those disciplines and authenticate Schedules S-B and S-C for their scope of work. For projects that do not require an Architect, or without an MER or EER, the FPER may act as RPR and authenticate the Schedule B line items for which they are responsible within those disciplines.

The FPER is responsible for the design and Field Review of fire protection systems within their scope of work, and may be engaged by the Owner, a supplier or General Contractor, the CRP, a design/build contractor, or other entity responsible for the delivery of the project.

In addition, the FPER has the following responsibilities:

- Authenticate the Schedule B for the Fire Protection Engineering aspects of the design that the FPER prepared for the discipline(s) for which the FPER is the RPR, such as fire suppression.
- When acting as an SRP to another RPR, complete Schedules S-B and S-C and provide a copy to each applicable discipline RPR.
- If a Supporting FPE is engaged for certain items, obtain Schedules S-B and S-C from the Supporting FPE for the relevant aspects of investigation, design, and Field Reviews for which the Supporting FPE is responsible.
- Where a Specialty FPE is responsible for specific aspects of the fire and life-safety concepts or analysis, provide all relevant information to the Specialty FPE, as well as to other relevant RPRs. This information should include all relevant performance criteria.
- If the FPER is the CRP for the design of an existing building, submit both Schedule A and Schedule B. The same FPER should submit schedules C-A and C-B upon completion of professional obligations.
- Be familiar with and, where appropriate, apply the Professional Practice Guidelines – Sustainability (Engineers and Geoscientists BC 2016) to the work.

Note that the RPR signing the Schedule C-B, Assurance of Professional Field Review (or Schedule S-C) should be the same RPR signing the Schedule B (or Schedule S-B).

If the initial FPER is changed during the project, and another Engineering Professional is retained to carry out analyses and design and/or to provide Field Reviews for some or all of the project, the Engineering Professional providing the latest design and/or Field Reviews must carry out such reviews, investigations, and analyses as required to accept full responsibility for the fire protection aspects of the project for which they are responsible. Where

appropriate, this will include completing and issuing Letters of Assurance.

For more information on how to document when there is a change in the Engineering Professional during design or construction, refer to the *Guide to the Letters of Assurance in the BC Building Code* (Province of BC 2010); the *Joint Professional Practice Guidelines – British Columbia Building Code Letters of Assurance Requirements for Part 9 Buildings* (AIBC and Engineers and Geoscientists BC 2021); and the *Practice Advisory – Permit to Practice Requirements for Letters of Assurance* (Engineers and Geoscientists BC 2021c).

In certain cases, another Engineering Professional such as the MER or EER may provide an objective-based specification in order to facilitate the building permit process. For the purposes of these guidelines, the FPER is the Engineering Professional performing the detailed design, not the Engineering Professional providing the objective-based specification. See Appendix A: Letters of Assurance for Fire Protection Engineering Services for responsibilities related to fire suppression systems.

2.2.7 STRUCTURAL ENGINEER OF RECORD

The Structural Engineer of Record (SER) is responsible for the structural integrity of the primary structural system of the building project.

The SER should:

- provide timely information in sufficient detail as required to permit the duties of the FPE and/or FPER to be adequately performed;
- inform the FPE and/or FPER of changes in the structural design where those changes may affect the duties of the FPE and/or FPER; and
- where an agreement in principle on an existing building is used by the FPE and/or FPER to determine the scope of work of a project with the AHJ, meet with all the appropriate stakeholders to ensure that input on the achievable level of upgrading, including seismic upgrading of the existing and any new structure, is provided.

Where there is a Specialty FPE, the SER has the following duties:

- Provide sufficient information on structural Design Drawings to allow fire-resistance ratings of structural members and assemblies to be determined.
- Where there are issues related to an Alternative Solution or an Objective-Based Design involving structural systems, incorporate the recommendations of the Specialty FPE into the structural design.

2.2.8 MECHANICAL ENGINEER OF RECORD

The MER is responsible for the mechanical integrity of the mechanical systems of the building project.

The MER should:

- provide timely information in sufficient detail as required to permit the duties of the FPE and/or FPER to be adequately performed;
- identify any special mechanical design criteria or systems that may affect the duties of the FPE and/or FPER such as commercial cooking equipment, industrial processes, smoke venting or related pressurization systems, or other performance requirements;
- where the MER has provided a preliminary Objective-Based Design (performance specification) of Fire Protection Engineering systems, with detailed design to be provided by the FPE and/or FPER, provide preliminary drawings to demonstrate the scope of work, the design intent, and layout feasibility for fire protection equipment and systems, in accordance with Subsection 3.2.4. Fire Suppression of Notes to Part 2 of Division C of the Code (see also Appendix A: Letters of Assurance for Fire Protection Engineering Services for information on the division of responsibilities);
- coordinate mechanical/plumbing clearances and functional requirements with other RPRs;

- inform the FPE and/or FPER of changes in mechanical system design where those changes may affect the duties of the FPE and/or FPER; and
- where there are issues related to an Alternative Solution or an Objective-Based Design involving mechanical systems, incorporate the recommendations of the FPE and/or FPER into the mechanical design.

2.2.9 ELECTRICAL ENGINEER OF RECORD

The EER is responsible for the electrical integrity of the electrical systems of the building project.

The EER should:

- provide timely information in sufficient detail as required to permit the duties of the FPE and/or FPER to be adequately performed;
- identify any special electrical design criteria that may affect the duties of the FPE and/or FPER, such as oil-filled transformers, unsprinklered electrical rooms, protection of electrical conductors, fire alarm criteria, or other project requirements;
- coordinate with the CRP and RPRs the test protocol and procedures for functional testing of the fire and life-safety systems;
- inform the FPE and/or FPER of changes to electrical systems that may affect the duties of the FPE and/or FPER; and
- where there are issues related to an Alternative Solution or an Objective-Based Design involving electrical systems, incorporate the recommendations of the FPE and/or FPER into the electrical design.

2.2.10 GENERAL CONTRACTOR

The General Contractor has a contract with the Owner. This contract usually provides that the General Contractor is responsible for:

- the labour, materials, and equipment for the work, as well as the quality of construction, construction methods, techniques, sequences, procedures, safety precautions, and programs associated with the construction work, all as set out in the contract documents;
- coordinating the work of the Subcontractors and checking the Subcontractor's work prior to Field Reviews by the FPE and/or FPER; and
- providing reasonable notice to the Owner, CRP, FPE, and/or FPER when components are ready for Field Reviews by the FPE and/or FPER.

2.2.11 DESIGN/BUILD CONTRACTOR

The design/build contractor has a contract with the Owner. In addition to the responsibilities of the General Contractor, the design/build contractor assumes general design and construction responsibilities for a project.

Additionally, the design/build contractor may take on certain responsibilities of the Owner (Section 2.2.1), and may take on certain responsibilities of the CRP (Section 2.2.2). Such responsibilities include retaining and facilitating coordination between the FPE and/or FPER and other participants of the design/build team.

2.2.12 AUTHORITY HAVING JURISDICTION

The AHJ is responsible for enforcing the Code, Fire Code, policies, standards, and local bylaws, or for assessing compliance with applicable codes, standards, and local bylaws.

Additionally, the AHJ is typically responsible for:

- reviewing design submissions and, if satisfactory, accepting them for issuance of a permit;
- reviewing Alternative Solutions to assess if they meet the intent, objectives, and functional statements of the Code for design purposes;
- in the case of existing buildings or special structures where compliance with Division B Acceptable Solutions of the Code is not feasible, reaching an agreement in principle with the FPE regarding the strategy for Code compliance for acceptable fire and life-safety and alignment with the upgrade mechanism of the AHJ, which is typically made at an early stage of the project and documented in the form of accepted minutes, or another manner acceptable to the AHJ; and
- performing inspections as part of its compliance assessment, and possibly attending testing and commissioning, and other important stages of the project.

Note that inspections by the AHJ do not eliminate the requirement for Engineering Professionals to conduct Field Reviews of their scopes of work.

3.0 GUIDELINES FOR PROFESSIONAL PRACTICE

3.1 OVERVIEW

The services that an Engineering Professional should consider as part of good practice when working either as a Fire Protection Engineer (FPE) or a Fire Protection Engineer of Record (FPER) are described in this section.

This outline may assist in explaining the services of the FPE and/or FPER to a Client; however, it is not intended to be exhaustive and should not be interpreted to detract in any way from other provisions of these guidelines and what might be considered appropriate in the professional judgment of the FPE and/or FPER for the circumstances of a particular project.

The broad range of services provided by an FPE and/or FPER in building projects are covered under three categories, and are discussed in these subsections below:

- Fire and Life Safety Analysis
- Basic Fire Protection Engineering Systems Design and Related Services
- Ancillary Fire Protection Engineering Services

3.1.1 CONSIDERATION OF RISK

Engineering Professionals have a professional responsibility to uphold the principles outlined in the Engineers and Geoscientists BC Code of Ethics, including protection of public safety and the environment. As such, Engineering Professionals must use a documented approach to identify, assess, and mitigate risks that may impact public safety or the environment when providing professional services.

One of the risk factors that must be considered is climate change implications on the building. Engineering Professionals have a responsibility to notify their clients of future climate-related risks, reasonable adaptations to lessen the impact of those risks, and the potential impacts should a client refuse to implement the recommended adaptations. Engineering Professionals are themselves responsible for being aware of and meeting the intent of any climate change requirements imposed by a client or Authority Having Jurisdiction.

Other areas of risk encountered in professional practice are quality, technical, financial, and commercial risks. Engineering Professionals should consider risks in such areas using techniques that are appropriate to their area of practice.

3.2 SCOPE OF WORK

Following are examples of various scopes of work that may require the services of an FPE and/or FPER:

- Develop a fire and life-safety strategy for a new or existing structure
- Develop Objective-Based Design specifications for a building
- Prepare Alternative Solutions based on Objective-Based Design principles, often including fire dynamics analysis
- Evaluate fire and explosion hazards and risks, such as from fuel loads, processes, hazardous materials, or storage to assist in the design of fire protection systems or building and occupant safety features

- Conduct hazard analysis using techniques such as computerized fire modelling programs, in order to predict safe egress time, fire development, smoke production rates for the design of smoke management systems, activation times for sprinklers and/or detectors, and tenability conditions in buildings
- Predict or determine fire resistance for wood, steel, concrete, and other construction assemblies as determined by fire growth and heat transfer models
- Review system Design Drawings and/or installations, in order to provide recommendations and/or evaluation of fire protection systems, including for fire alarms, fire detection, fire suppression, smoke management, smoke control, emergency voice communications, emergency power supplies, emergency egress routes, and water supplies
- Conduct Field Review, performance testing, and evaluation of fire and life-safety systems
- Develop smoke management system designs and test methods used to predict smoke production and movement within a building
- Design fire suppression (automatic sprinkler and standpipe) systems
- Assess municipal fire risk and municipal fire flow and reliability requirements
- Design fire alarm systems

The above list is not necessarily complete and is not intended to exclude other services.

3.3 FIRE AND LIFE-SAFETY ANALYSIS

The FPE is generally responsible for fire and life-safety design and, where applicable, the associated Field Reviews.

The process of conducting a building fire and life-safety analysis comprises various tasks, including:

- defining an overview of a building to establish the requirements for fire and life safety;
- identifying building features that do or do not provide the appropriate level of safety; and
- developing appropriate remedies to achieve the required level of safety.

Fire and life-safety analysis may require a multi-disciplinary approach, where the FPE acts as a Supporting Registered Professional (SRP) to one or more Registered Professionals of Record (RPRs). The analysis may be based on the prescriptive requirements of the Code (a Prescriptive-Based Design) or on an Objective-Based Design involving an Alternative Solution. The latter approach requires the application of Fire Protection Engineering principles to demonstrate that the required objectives will be achieved.

For many building projects, the analysis may be a blend of the two approaches; that is, where an Objective-Based Design approach is used to identify the fire and life-safety requirements for the building. With this approach, building features that do not comply with acceptable solutions (i.e., Prescriptive-Based Design) are identified and Alternative Solutions to meet the fire and life-safety requirements of these features are developed (i.e., Objective-Based Design).

In the development of an Alternative Solution, or for an existing or complex building project, it may be appropriate for the FPE to present a proposal to the Authority Having Jurisdiction (AHJ) on the fire protection strategy, to gain an agreement in principle prior to fully developing the design. This presentation should occur early in the design process. Refer to Section 3.3.3 Fire and Life-Safety Analysis of Existing Buildings for more information on agreements in

principle, and Section 3.5.3 Alternative Solutions and Letters of Assurance for more information on Alternative Solutions.

The following various approaches to fire and life-safety analysis apply to both new and existing buildings, except where noted. Further guidance on the fire and life-safety analysis of existing buildings is provided in Section 3.3.3 Fire and Life-Safety Analysis of Existing Buildings.

3.3.1 PRESCRIPTIVE-BASED ANALYSIS

Following are some of the Prescriptive-Based Design services that the FPE may provide:

- Review schematic designs to identify building parameters, which determine the Code requirements applicable to the building
- Determine the applicable Code-related fire and life-safety requirements and how to apply those requirements to the building
- Review the functional statements underlying the Acceptable Solutions of the Code to identify how they apply to the analysis and design of the building
- Where appropriate, consider a holistic strategy to meeting the Code requirements
- Document the analysis and/or modelling input data and results
- Prepare a Code concepts report for the guidance of the design team
- Provide advice to the design team during the conceptual design and/or design development stage on how to achieve Code compliance for particular issues, including advising on compliance with standards referenced by the Code
- Review the working drawings at predetermined stages to check for general conformance to the applicable Code requirements
- Prepare a Code analysis report for submission to the AHJ prior to or during the building permit application review
- Provide advice to the design team for the resolution of Code-compliance issues that arise during the construction stage
- Assist the design team during the testing and commissioning of life-safety systems
- Conduct Field Review(s) to identify and resolve Code-compliance issues prior to the final occupancy Field Review

3.3.2 OBJECTIVE-BASED ANALYSIS

Many projects require using a combination of objective-based and prescriptive-based analyses. In most cases, the objective-based analysis will be submitted to the AHJ as an Alternative Solution (see Section 3.5.3 Alternative Solutions and Letters of Assurance).

Following are some of the objective-based analysis services that the FPE may provide:

- Review the conceptual plans of the building to identify building parameters that determine the Code objectives influencing the design of the building, and to identify areas or features where objective-based analysis is appropriate
- Review the Code to identify objectives that must be met in the building
- Meet with the Owner and the design team to determine any objectives or requirements in addition to the Code objectives
- Develop performance criteria that will establish that the objectives have been met
- Identify relevant fire scenarios and develop design fires; any comparative scenarios chosen as reference for the design should match the actual fire scenario as closely as possible
- Prepare a report for discussion with the design team and the AHJ to obtain an agreement in principle with the objectives, criteria, and design fires
- Where appropriate and practical, meet and/or follow up with the AHJ to gain acceptance of the concepts presented in the report
- Develop and evaluate trial designs, considering a holistic strategy where appropriate

- Where a trial design does not meet the performance criteria, re-evaluate and modify the design
- Document the analysis and/or modelling input data and results
- If design modification is not appropriate, review the Owner's objectives or any other special objectives to determine if the objectives and associated performance criteria can be modified; if this is not possible, abandon the design
- In consultation with the Owner and/or the design team, finalize the selection of the design and prepare an Objective-Based Design report either as a standalone report or as part of the Code analysis report that also includes the Prescriptive-Based Design
- Review the Objective-Based Design with the AHJ and other stakeholders to obtain comments and concurrence with the results of the analysis
- Finalize the Objective-Based Design report and submit the Alternative Solution(s) to the AHJ, where applicable
- Assist the design team in the preparation of contract documents to confirm that the documents reflect the requirements of the design report
- Conduct Field Reviews to ascertain that any special features required by the design report are installed correctly
- Witness the demonstration testing of fire and life-safety systems in the building, as necessary to assess satisfactory completion of the design and/or the installed Alternative Solution features
- Assist in the preparation of operations and maintenance manuals, and review those manuals to establish that they adequately describe the fire and life-safety systems requirements and any other special building features that are required
- When satisfied that the Objective-Based Design has been adequately executed, provide appropriate assurance documentation to the AHJ (see Section 3.5.3 Alternative Solutions and Letters of Assurance)

3.3.3 FIRE AND LIFE-SAFETY ANALYSIS OF EXISTING BUILDINGS

The analysis of existing buildings typically employs a mixed approach using acceptable existing conditions, prescriptive-based requirements, and objective-based requirements, as outlined above. This mixed approach is generally appropriate for tenant changes and small projects, as well as for large whole-building renovations.

The actual building fabric of an existing building may not align with the assumed conditions used to develop the Code requirements, making it challenging to comply with the prescriptive-based Code requirements. In this instance, an agreement in principle can be developed by the FPE for a bespoke fire and life-safety strategy that meets the intent of the Code. Acceptance of agreements in principle by an AHJ is typically determined by the Chief Building Official or an equivalent administrator.

In general, an agreement in principle is "over-arching"; that is, it sets out the overall approach to the project. The agreement in principle should outline the existing building's features and conditions, together with the extent of upgrading work required in the context of proposed changes. The agreement in principle should address most Code requirements and include a proposed strategy for how the upgrading mechanism will apply. In addition to providing fire and life-safety concepts, an agreement in principle should describe existing conditions to retain; mechanisms for energy, accessibility, structural, and other applicable upgrades; and required Alternative Solutions.

Developing a bespoke fire and life-safety strategy for an existing building could be beneficial, as it allows for optimal retention of existing building features, thereby minimizing required demolition, and providing opportunities to meet other Sustainable Goals. Additionally, maintaining and upgrading existing building features, rather than fully replacing existing conditions, may be a cost-effective fire and life-safety solution.

In addition to the services provided for new construction, the services required for an existing building may also include the following:

- Conduct a complete building assessment to determine building fabric, occupancy, and other issues
- Review and assess the impact of Code requirements/upgrading mechanisms, which may include preparing preliminary cost estimates
- Develop a strategy to meet Code requirements and upgrade mechanisms
- Meet with the AHJ and present the strategy for Code alignment and retention of existing conditions
- Provide documentation and acceptance of the strategy in meeting minutes
- Provide additional submissions such as structural reports or additional Alternative Solutions

3.3.4 SPECIALTY FIRE PROTECTION ENGINEERING SERVICES

In addition to providing Fire Protection Engineering design and analysis services for an entire project, an FPE may also be requested to act as a Specialty FPE to provide services for one or more specific aspects of a building project. This may include activities such as developing Alternative Solutions (see Section 3.5.3 Alternative Solutions and Letters of Assurance), conducting analyses of certain aspects of a building to assess Code compliance, or providing assistance to project designers or Owners with respect to determining the best method of meeting Code requirements.

When providing specialty Fire Protection Engineering services, a Specialty FPE should:

- develop a scope of services that clearly defines the Specialty FPE's specialty services and areas of involvement;
- establish clear lines of communication for receiving direction for the required work, and for reporting results, recommendations, or observations; and
- review applicable documents with respect to the required scope of services.

Specialty Fire Protection Engineering services may include, but are not limited to the following:

- Review Alternative Solution designs, products, or materials
- Program items such as the Owner's equipment and fire and life-safety systems, where investigation and analysis are necessary to determine user requirements for a statement of system requirements, materials, performance, and reliability
- Conduct a risk and reliability analysis
- Conduct Field Review and testing or commissioning of fire and life-safety systems
- Survey existing fire and life-safety systems and equipment
- Carry out computer fire modelling
- Act as an expert witness in connection with a public hearing, arbitration, or court proceeding concerning the project, including associated preparation for those activities
- Conduct an analysis of the fire-resistance rating of fire separations, or of an existing or proposed structural member or assembly
- Review special hazards such as industrial processes or storage regulated by the Fire Code or other relevant municipal requirements
- Design Fire Protection Engineering systems to protect special hazards
- Conduct an analysis of egress and exiting from a building or a portion of a building
- Conduct a spatial separation analysis of a building or a portion of the building
- Conduct Field Review during construction for specific building features or systems
- Review fire department access to a building
- Conduct an analysis of fire protection water supply for a building or development
- Conduct an analysis of combustible load in a building or a portion of a building

- Develop Alternative Solutions or Objective-Based Design aspects with respect to compliance with the intent of specific Code requirements

Where the specialty Fire Protection Engineering services include developing Alternative Solutions or Objective-Based Design approaches to meet the intent of the Code requirements, the Specialty FPE should:

- identify the intent of the prescriptive-based Code requirement(s) that will not be met, and the criteria that will be used to evaluate the acceptability of an Alternative Solution;
- determine potential alternatives that meet the intent of the prescriptive requirement(s);
- evaluate the alternatives and, in consultation with appropriate members of the design team, finalize the selection of the design;
- prepare a report on the analysis as a stand-alone document or for incorporation in a Code analysis report;
- review, as appropriate, the proposed Alternative Solution(s) with the AHJ and respond to questions or concerns regarding the proposed approach, which normally includes submitting documentation in a format acceptable to the AHJ;
- review appropriate contract documents to establish that the Alternative Solution(s) are adequately described;
- conduct Field Reviews, where considered necessary to assess construction or installation of the Alternative Solution(s);
- where applicable, assist in the preparation of operations and maintenance manuals to ensure they contain the appropriate information with respect to the Alternative Solution(s);
- where applicable, witness the testing and commissioning of any special systems that are required by the Alternative Solution(s); and
- provide appropriate assurance documentation to the AHJ when the Alternative Solution(s) have been satisfactorily constructed or installed (see Section 3.5.3 Alternative Solutions and Letters of Assurance).

3.4 BASIC FIRE PROTECTION SYSTEM DESIGN AND RELATED SERVICES

The stages of Fire Protection System Design are usually set out in a contractual agreement according to the sequential stages of a typical project. Each stage of Fire Protection System Design then includes services that are typical to the progress of work for that stage of design and construction. However, depending on the requirements of a specific project, certain Fire Protection System Design services may be performed out of the normal sequence or in different stages than those indicated in the scope of services.

An FPE may provide one or more types of services on the same project. Fire Protection System Design services may also be performed by a MER or EER, provided they are qualified to do so; for example, the MER often provides objective-based specifications and signs Letters of Assurance. However, for the purposes of these guidelines, the FPE who provides the detailed design for the fire suppression system is the FPER.

A summary of an Engineering Professional's specific responsibilities under each of the fire suppression items identified on Schedule B of the Letters of Assurance is included in Appendix A: Letters of Assurance for Fire Protection Engineering Services.

AHJs may require that a detailed design of the fire protection systems be included in the building permit submission or within a prescribed time frame following the submissions by other consultants; for this reason, Design Drawings for fire protection systems are completed at an early stage in the project. Refer to Scenario 1 and Scenario 2 in Appendix A: Letters of Assurance for Fire Protection Engineering Services.

The FPER may also be brought on as part of a design-build contract. In that case, many of the steps in the following subsections may not be required. Even if an FPER actively participates in earlier stages of the project, involvement in many of these steps may be minimal. For instance, reports on types of systems will generally not be required.

The FPER may be the RPR for only one of the disciplines within the scope of Fire Protection System Design. Other Engineering Professionals, such as the MER, the EER, or other FPEs, may be undertaking design for the other disciplines within the scope of Fire Protection System Design. Any Engineering Professional acting as the RPR for Fire Protection System Design within the scope of their discipline, such as the MER or EER, must provide those services in accordance with these guidelines. In this case, professional practice guidelines for providing mechanical and electrical engineering services should also be consulted. In the event of conflicting requirements, the most rigorous guidance should apply.

3.4.1 CONTRACT STAGE

Before commencement of design services, the FPER should agree with the Client on:

- the terms of reference and scope of work for Fire Protection System Design including related and/or additional services;
- fees, payment schedule, and professional liability insurance coverage, including contract terms and conditions;
- for a "fast-track" project, in addition to the above, the terms and conditions under which Design Drawings may be issued in phases in advance of completion of the whole project design, including methods for ensuring individual phases issued are complete and clearly marked for the intended use; and
- the Design Objectives for the project.

For more information, refer to the Contracts page on the Association of Consulting Engineering Companies British Columbia (ACEC-BC) website, which includes templates, guides, and forms such as the Standard Client-Consultant Agreement, a Contract Language Management Plan, and Position Papers on Key Contractual Issues (ACEC-BC 2021).

3.4.2 CONCEPTUAL OR SCHEMATIC DESIGN STAGE

In the conceptual or schematic design stage, the FPER may provide the following services:

- Attend, as required, periodic meetings with the Client and design team to obtain the Client's instructions regarding the Client's functional, aesthetic, cost, and scheduling requirements, in order to prepare a preliminary design concept and to report on the fire protection systems. The report may include consideration of economy, performance, capital cost, sustainability, compatibility with other design elements, and requirements of relevant codes and regulations.
- Assist the Coordinating Registered Professional (CRP) or Owner in:
  - defining whether any specialty Fire Protection Engineering or consulting services are required for the project, such as for Alternative Solutions or life cycle assessments, or whether a Code consultant or Certified Professional should be involved;
  - reviewing the project schedule including any milestone dates;
  - determining channels of communication;
  - determining drawing standards and specifications format; and
  - determining the number and timing of design team meetings during each stage of the project.
- Establish the dates by which information affecting the Fire Protection System Design must be received from other disciplines.
- Conduct a site investigation and review existing drawings, where appropriate.
- Establish criteria for the electrical, mechanical, and other consultants, as required.

- Identify Fire Protection System Design criteria and prepare preliminary calculations for:
  - sprinkler and standpipe design, including establishing basic hydraulic design criteria, determining water supply arrangements and characteristics, defining the need for fire pump or unusual water supply, and ascertaining the type of standpipe system;
  - fire alarm design, including basic fire alarm system requirements, and special fire alarm system requirements such as high building measures and institutional needs; and
  - other Fire Protection System Designs, including basic system criteria required to provide the basis for the system design.
- Consider developing Sustainable Goals for the project with the Client, CRP, and the design team.
- Develop the fire protection scheme for the fire protection systems; develop alternate schemes where appropriate; consider materials and systems suitable to the project requirements; consider the requirements of the other RPs; and provide the information they require.
- Check applicable codes, regulations, and restrictions; insurance requirements; and other factors affecting the design of the project.
- Prepare a preliminary cost estimate or cooperate appropriately with others responsible for reporting the estimate.
- Determine the allocation of suitable space for service rooms and other major fire protection installations.
- Establish, where appropriate, comparative information to be used in selection of the fire protection system for the project.
- Provide, if required, brief outline specifications for proposed materials.
- Describe the major fire protection system(s) and each significant component and material.
- Explain to the Client all new construction materials or new techniques proposed for use in the project and their alternatives, including the risks, advantages, and disadvantages over both the short and long term, so the Client can weigh the choices and make an informed decision before the FPER proceeds further.
- Advise the Client of the recommended fire protection system, and review the effect of the system on the fire protection system's construction budget for the project.

A Client may assume responsibility for all or some of the foregoing conceptual or schematic design stage activities provided:

- the FPER's ability to satisfy the requirements of the subsequent stages of these guidelines is unimpaired;
- the responsibility for such preliminary design activities is clearly defined in writing; and
- the Client or FPER, in writing, waives the FPER's responsibility for such preliminary design activities and their effect on the selection of the fire protection system, while recognizing that this waiver does not relieve the FPER of the requirement to comply with items the FPER is responsible for signing on Schedule B.

3.4.3 DESIGN DEVELOPMENT STAGE

In the design development stage, when the selected schematic design has been developed in sufficient detail to enable commencement of the final design and construction documents by all participants of the design team, the FPER may provide the following services:

- Attend, if required, meetings with the Client and design team.
- Consider reviewing the Sustainable Goals and strategies identified during the conceptual design stage of the project.

- Review results of studies by appropriate specialist consultants.
- Prepare preliminary fire protection system analysis and design calculations for typical fire protection elements of the fire protection systems, and select appropriate equipment.
- Prepare preliminary Design Drawings based on information coordinated with other consultants showing layouts of typical areas.
- Coordinate fire protection systems with space and servicing criteria to meet the requirements of the other design team participants. In particular, the FPER should notify and coordinate with the EER, MER, and/or Architect on all points of interface between the fire protection system and the other disciplines, and determine as soon as possible the electrical characteristics and electrical requirements of all fire protection system loads and any potential conflicts between the fire protection system and the mechanical and electrical riser locations.
- Coordinate the location of the fire hose and standpipe systems with other disciplines of the design team to ensure that the standpipe risers are properly protected and located, and they do not compromise the minimum clearance in the exit stairs.
- Coordinate the fire extinguishers in conformance with NFPA 10, Standard for Portable Fire Extinguishers.
- Specify the types of fire suppression systems used in areas subject to freezing, and the development of appropriate design details or specifications. If heat tracing is provided, specify the minimum heating per unit area or per unit length of pipe, and the type and thickness of thermal insulation.
- Submit design development documentation to the Client for review and approval.
- Review the documents prepared at the design development stage for consistency with the Design Objectives.

3.4.4 CONTRACT DOCUMENT STAGE

In the contract document stage, when the selected scheme is developed in sufficient detail to enable the preparation of contract documents (i.e., Design Drawings), the FPER may undertake the tasks outlined in the following subsections.

3.4.4.1 General Responsibilities

General responsibilities of the FPER in the contract document stage include the following:

- Design the fire protection system
- Attend periodic coordination meetings, as required
- Coordinate with the AHJ, as required
- Establish testing and Field Review requirements
- Comply with fire-resistance requirements, as determined by the CRP or specialty consultants
- Confirm that the fire protection system meets the Sustainable Goals of the project, and that the Sustainable Goals identified by the design team at the design development stage are met with respect to the responsibilities of the FPER
- Authenticate documents for which the FPER is responsible (see Section 4.1.2 Authenticating Documents)
- Follow standard procedures ensuring all designs are checked (see Section 4.1.5 Documented Checks of Engineering Work)
- Review the contract documents for consistency with the Design Objectives

3.4.4.2 Fire Protection System Calculations

The FPER must prepare fire protection system calculations to support all Fire Protection System Designs. The fire protection system calculations should be dated, legible, and retained in the project file for record purposes. Records of input and output of any computer analysis should be included in the project file, along with a description of the software used. (See Section 4.1.5 Documented Checks of Engineering Work.)

In general, fire protection system calculations typically will include, but are not limited to, the following information:

- Design criteria
  - Discussion and description of design basis including assumptions
  - codes and design standards referenced, with edition dates
  - List of fire protection system parameters and provisions greater than requirements of the Code, as requested by the Client or otherwise used by the FPER
- Location diagrams for fire protection system elements
- Computer analysis and design results, if applicable
- Special studies and analyses, where required by the Code

3.4.4.3 Fire Protection System Design

Fire Protection System Designs are usually based on the Code and referenced standards, such as those prepared by the National Fire Protection Association (NFPA), Underwriters Laboratories of Canada (ULC), and Factory Mutual Approvals (FM Approvals).

Other design guides, such as the Canadian Electrical Code, standards published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and indirectly referenced NFPA standards, should be used where appropriate.

In addition, designs may be based on other criteria determined by other FPEs or the AHJ.

3.4.4.4 Fire Protection System Design Drawings

The FPER should prepare complete Design Drawings. The drawings should use an appropriate scale such that the work is legible and, if possible, matches the scale of the drawings produced by other consultants. All Design Drawings, as well as details, elevations, and sections should be properly cross-referenced.

Where applicable and required, the following information should be provided on Design Drawings:

- Where the scale of drawings or complexity of work make drawings difficult to read and interpret, separate drawings in an appropriate scale for areas of the work such as the fire protection system and other related special systems.
- Schematics and diagrams for all major systems with notes to describe the function of control, flow, and operation.
- Plot plans and/or site plans showing water supply arrangements and connections to public utility services, complete with elevations.
- For hydraulic calculations, node points with self-explanatory interconnection between the drawings and hydraulic calculations.
- Floor plan layouts for all design systems, such as sprinkler or fire alarm systems.
  - Complete pipe and/or conductor sizing should be shown on these documents, along with pipe hanger, seismic restraint, and freeze protection details.
  - Sizes, types, locations, and temperature ratings of all sprinkler heads and hose connection outlets, pressure and location of pressure regulating valves, and types of fire alarm devices should also be shown.
- Supplementary details for valve/pump or electrical rooms and congested areas.
- Where the FPER is also responsible for wiring, locations where protection of conductors is mandated by the Code (such as required for high buildings or fire pumps).
  - In many other cases, wiring locations are not required and can be located by the General Contractor. However, in renovations, there may be a need to minimize the impact of wiring on existing architectural spaces. In such instances, conduits and piping work can be shown in single line details.

  - Where it is necessary to show arrangements and clearance for piping or duct work in ceiling spaces, shafts, header trenches, pipe chases, and for tight or close-coupled equipment, conduits and piping should be shown in double-line detail with appropriate valves, fittings, and accessories.
  - Valences and other architectural details to minimize visual impact, specifically in existing buildings, may also be shown on the drawing.
- If required, any instance where the basis of the design criteria was established by others.
- Schedules that list capacities and details of elements such as performance of compressors and pumps. Alternatively, these schedules may be included in the specifications.

Depending on the FPER's scope of work, the Design Drawings the FPER prepares for construction may include some or all of the work related to the fire protection systems for a project. These drawings should comply with the contract documents, as well as with details referenced in the relevant design standards, the requirements and recommendations outlined in the Fire Protection Engineering reports prepared by the FPER or other FPEs, and sound engineering and construction practices.

Because FPEs' drawings or reports may contain requirements that affect, and therefore must be integrated into, the design prepared by the FPER, the FPER must review other FPEs' drawings. The FPER should review other FPEs' drawings to ascertain general conformance with the contract documents and intent of the Fire Protection Engineering recommendations, but not to determine adequacy of elements and correctness of dimensions or quantities for which other FPEs are responsible. Similarly, the FPER should not assume responsibility for approval of the General Contractor's methods of construction or safety measures in or near the work site.

3.4.4.5 Specifications

Where the documents form part of a tender package, the FPER should prepare specifications using a format suitable for inclusion with the overall contract documents.

Where applicable, the specifications should include information on:

- scope of the work and/or fire protection aspects;
- submittals required;
- standards, codes, and local bylaws governing work;
- quality control requirements;
- materials including material specification to meet the Sustainable Goals of the project;
- where applicable, waste management for materials related to the installation of the fire protection systems;
- workmanship and fabrication;
- tolerances;
- information for temporary works and erection information, where necessary to ensure the intent and integrity of the design;
- construction Field Review and testing;
- notification by the General Contractor before significant segments of the work are begun;
- warranties; and
- performance criteria for design and detailing by Supporting FPEs.

Where appropriate, the specifications may be abbreviated and become part of the drawings.

The specifications generally set out that the FPER's review of submittals and Field Review of work, as well as any testing by independent agencies reporting to the Client, are undertaken to inform the Client of the quality of the General Contractor's performance, and that they are not for the benefit of the General Contractor. The General Contractor must provide an independent quality control program.

3.4.5 PERMITTING STAGE

During the permitting stage, the FPER may undertake the following:

- Prepare and supply Letters of Assurance and documents required by these guidelines, the AHJ, or the Code
- Assist the Client in obtaining required approvals, licences, and permits

3.4.6 TENDERING STAGE

During the tendering stage, the FPER may undertake the following:

- Assist in the preparation of prequalification documents, if required
- Assist in reviewing bidder's qualifications, if required
- Assist in analysis and evaluation of tenders submitted
- Assist the Client in answering queries raised by the bidding General Contractors, and issue fire protection system addenda and clarifications of fire protection system documents, as required
- Assist in the preparation of the contract, if required
- For existing or complex buildings, manage the tender process, including coordinating clarifications and addenda, and make recommendations for award of the contract

3.4.7 CONSTRUCTION STAGE

It is essential that Field Reviews be provided for all systems for which the FPER is responsible, to ascertain whether the work substantially complies with the fire protection system contract documents and Design Drawings.

Preferably, the FPER should conduct the Field Reviews and provide the services during construction; however, where practical, the FPER may delegate these duties to other qualified individuals. For detailed guidance on responsibilities for delegating work and conducting Field Reviews, see Section 4.1.3 Direct Supervision and Section 4.1.6 Documented Field Reviews During Implementation or Construction.

Field Reviews may include construction observation and testing, to allow the FPER to form a professional opinion about the Fire Protection System Design aspects of the work undertaken by the General Contractor. The number and extent of Field Reviews, including level of observation and testing, required is at the discretion of the FPER, based on what the FPER considers necessary to meet the requirements of the Letters of Assurance being submitted to the appropriate AHJ.

Field Reviews and services provided during construction by the FPER are intended to be separate from the General Contractor's responsibilities for construction of the project, controlling progress, providing safe working conditions, and correcting any deviations from project requirements.

Some items reviewed by the FPER may also require review by other members of the design team or by testing and inspection agencies. Such work may include proprietary products and fire protection system elements designed by others.

3.4.7.1 General Services Provided During Construction

Services provided during construction should include, but not necessarily be limited to, the following and may vary depending on the complexity of the project.

During the construction stage, the FPER may undertake the following:

- Attend construction meetings
- Confirm communication channels and procedures
- Assist in confirming, reporting, and scheduling procedures for testing and Field Reviews
- Assist in confirming procedures for Shop Drawings and other submittals
- Confirm that the qualifications of manufacturers meet the specifications

- Advise the General Contractor and the CRP on the interpretation of the fire protection system drawings and specifications, and issue supplementary details and instructions during the construction period, as required
- If requested, advise the Client on the validity of charges for additions to or deletions from the contract and on the issue of change orders
- Review and comment on, if requested by the Client, the General Contractor's applications for progress payments, and estimate, if required, completed work and materials on site, for payment according to the terms of the construction contract
- Review reports from the testing and inspection agencies, to determine if the agency has verified compliance of the reported item of work with contract documents related to the fire protection system, and initiate any necessary action
- Coordinate Field Reviews of frost protection of concealed fire protection system-related piping in walls and ceilings with the Architect
- Conduct substantial and total performance Field Reviews of the fire protection system components of the project, note deficiencies, and review completed corrections
- Submit, if required, Letters of Assurance and Final Design Drawings to the CRP or the AHJ, as appropriate
- Attend the start-up of the fire protection systems and respond as required to any design-related operational difficulties
- Arrange and perform a Field Review when the General Contractor has applied for substantial completion of the project
- Prepare a list of deficiencies (workmanship, completeness, and function) and, when these have been rectified, issue the final Field Review report

3.4.7.2 Review of Submittals

Submittals should be reviewed for general compliance with the contract documents related to the fire protection system. The review does not generally include checking dimensions or quantities, or reviewing the General Contractor's safety measures or methods of construction.

During the construction stage, the FPER may undertake the following:

- Review the Shop Drawings and other submittals for conformance with the contract documents and the intent of the design. For more information, see *Professional Practice Guidelines – Shop Drawings* (Engineers and Geoscientists BC 2015).
- Confirm that the submittals have been reviewed by the General Contractor and relevant Subcontractor(s) before review by the FPER.
- When appropriate and/or required, confirm that the relevant Shop Drawings have been authenticated by the Supporting FPE responsible for the design
  - Responsibility for the detail design remains with the Supporting FPE who authenticated the specialty drawings. To clarify responsibility, the FPER may qualify the extent of work that has been designed by the Supporting FPE.
  - The Supporting FPE should submit Schedules S-B and S-C to the FPER, according to the *Joint Professional Practice Guidelines – Professional Design and Field Review by Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).
- When required in the contract documents, review Record Drawings prepared and submitted by the General Contractor to reflect the constructed condition of the project as turned over to the Client.
  - Where appropriate, the Client should be advised that Record Drawings were prepared by the General Contractor and were reviewed by the FPER only for general conformity to the

drawing standards and the intent of the design, and that the FPER is relying on the accuracy of the information supplied by the General Contractor.

  - The FPER may authenticate Record Drawings if an appropriate declaration is provided on the Record Drawings. Record Drawings may not need to be provided if there are no significant changes from the Final Design Drawings prepared and authenticated by the FPER. For more information, see Section 3.2.1.5 of the *Quality Management Guides – Guide to the Standard for the Authentication of Documents* (Engineers and Geoscientists BC 2021d).

- Arrange for the General Contractor to submit and review the operation and maintenance manual for the equipment/systems supplied on the project.
  - The data submitted should include manufacturer's recommendations for maintenance of each piece of equipment, and any other information that will enable the Client to assume operation of the building.
  - In addition to regulatory or contractual requirements, the manual should explain special features of the system, such as filling antifreeze systems or pressure tanks, setting pressure regulating valves, or special hazards, such as the potential for explosions, if not properly detailed in the manufacturer's literature.

3.4.7.3 Field Review

Field Reviews by the FPER are intended to confirm that the work or progress of the work substantially conforms to the Design Drawings and the Design Objectives.

For Field Reviews during the construction stage, the FPER may undertake the following:

- Visit the site at intervals appropriate to the stage of construction, to determine the quality and the progress of the construction of those elements designed by the FPER.
  - At the discretion of the FPER, proprietary products, connections, and seismic restraint elements designed by Supporting FPEs can undergo Field Review by those Supporting FPEs at the appropriate stage of construction; a Field Review report must be provided to the FPER.
  - For more information, see the *Joint Professional Practice Guidelines – Professional Design and Field Review by Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).
- Prepare Field Review reports outlining observations and deficiencies in the work and bring any deficiencies to the attention of the General Contractor's site representative.
- Distribute Field Review reports to the General Contractor, CRP, and other parties, as appropriate. Where the Owner directly retains the services of the FPER, it is recommended that the Owner also be sent copies of the Field Review reports.
- Conduct a final project review and advise the Client of continuing or newly determined defects or deficiencies in the project.

3.4.7.4 Commissioning

Though Field Reviews are conducted during construction, the demonstration of the efficacy of the fire protection systems at the completion of a project is essential for the safety of the public.

The FPER should ensure testing has been performed by the General Contractor or Subcontractors in accordance with the contract documents and in accordance with the relevant codes and standards.

Such tests include the following:

- For fire alarm designers, following verification by the appropriate supplier, manufacturer, and/or Subcontractor,
  - spot checking fire alarm devices for alarm initiation and zoning;
  - checking audibility of the alarm devices; and

  - confirming off-site monitoring by the central station, where provided.
- For sprinkler designers,
  - checking the water supply with a flow test from the main drain;
  - checking flow operation of the sprinkler system and associated alarm devices;
  - confirming that required sprinkler-related fire alarm devices have been provided, the system has been verified, and all sprinkler-related zone indications on fire alarm panels are correct; and
  - any fire pumps and other water supplies are tested in accordance with the referenced standard.
- For HVAC designers,
  - review the balancing of the system for compliance with the Design Objectives; and
  - review the interaction of the system with other design components (such as the fire alarm system) to check overall performance as a total system.
- For other designers,
  - provide functional tests to demonstrate the efficacy of the systems.

The FPER must ascertain that upon completion of the contractor's material and test certificates (CMTC) as per NFPA standards, the following has been properly done:

- Underground feed mains have been flushed.
- Dry and/or pre-action system trip times have been reviewed.
- Trip tests have been made to:
  - ensure that the dry and/or pre-action system will trip; and
  - ensure that water will reach the site of the fire within a reasonable amount of time.
- Full drain tests for irregularities that may indicate problems with the sprinkler system water supply have been reviewed.

Although it may not be feasible to conduct full operational tests, the demonstration should test the interaction of as many components as practicable to check whole-system compatibility. The testing should demonstrate that the system will be free and clear in all directions of flow, and that the control systems for starting/annunciation will all function as designed. When there are private water mains and hydrants, actual flow tests of the water mains to check for closed valves is recommended.

It is good practice to outline a test protocol for the specific test sequence attendance and acceptance by the General Contractor and Subcontractors. Reliance should not be placed entirely on trades' submissions. Where the EER and/or the MER are also the FPER for certain system components, they should attend all tests for systems falling under their scope of work.

3.5 ANCILLARY FIRE PROTECTION ENGINEERING SERVICES

Services beyond those outlined under Section 3.3 Fire and Life-Safety Analysis and Section 3.4 Basic Fire Protection System Design and Related Services are frequently required. These services are generally not considered part of the basic Fire Protection System Design services.

These ancillary Fire Protection Engineering services may be provided by the FPE and/or FPER under terms mutually agreed upon by the Client and the FPE and/or FPER.

3.5.1 ADDITIONAL SERVICES

Additional services are those that ordinarily cannot be foreseen when the scope of services is first developed or are not normally included as basic Fire Protection System Design services. These may be included in Specialty FPE services outlined in Section 3.3.4 Specialty Fire Protection Engineering Services.

The following includes some of the additional services that may be required:

- Provide additional services due to changes in the scope, complexity, diversity, design, location, or magnitude of the project as described and agreed to under the basic service agreement.
- Prepare alternate fire and life-safety system designs and related documentation after selection of the original system during the conceptual or schematic design stages.
- Review, design, and document an Alternative Solution or substitute systems, if requested by the CRP, Client, or General Contractor, for tendering to obtain competitive bids for items such as proprietary products.
- Prepare documents for tendering segregated contracts, pre-tendered contracts, phased or "fast-track" construction, legal agreements, or covenants required.
- Review Alternative Solution designs or products after completion of the contract documents.
- Provide services resulting from changes necessary because of construction cost over-runs not under the control of the FPE and/or FPER.
- Translate contract documents into a second language, calculate conversions to other units, or prepare special drawings for reduction.
- Analyze long-range plans as defined by the CRP and provide attendant preliminary sketches and reports (master planning).
- Prepare alternative building or system designs and provide attendant documentation, when required by the CRP or Client for review or competitive tender prices.
- Provide construction, project management, coordination, or negotiation services.
- Conduct risk and reliability analysis and/or value engineering (life-cycle costing) analysis, including schematics, where required by the CRP, Client, or AHJ.
- Prepare analyses, designs, or other documentation for future implementation not included in the construction contract.
- Prepare bills of material or schedules of material at any time during the project.
- Provide resident engineering services during construction.
- Prepare analyses, drawings, specifications, and change orders, and administer contract additions and/or deletions that are initiated by the Client but either have not been implemented or result in a reduction in the contract price.
- Conduct testing of building system components requiring confirmation of conformance with specifications and standards.
- Prepare or conduct detailed review of operation or maintenance manuals.
- Prepare Final Design Drawings, where requested.
- Prepare Record Drawings (refer to Section 3.2.15 of the *Quality Management Guides – Guide to the Standard for the Authentication of Documents* [Engineers and Geoscientists BC 2021d]).
- Provide services after expiry of the period of one (1) year following issuance of the certification of substantial performance or "occupancy," depending on services provided.
- Provide complete or partial revision of contract documents previously approved by the Client or in keeping with written instructions or drawings previously received from the Client.
- Complete commissioning of building fire and life-safety systems, including mechanical, electrical, and other emergency systems.
- Provide advisory services, including testimony, consultation and advice, appraisals, valuations, research, and other services leading to specialized conclusions and recommendations.
- Conduct surveys of existing fire and life-safety systems and equipment.
- Review balancing of air and water/liquid systems where they directly impact on the FPE's and/or another FPER's scope of work.

- Undertake modelling analysis, which involves the use of computer programs or other models/mock-ups to simulate a potential fire in a building.
- Provide work beyond the extent of the project.
- Review seismic restraints designed by SRPs for fire and life-safety systems.
- Prepare or assist with the preparation of cost estimates.
  - The FPE and/or FPER should inform the Client of the variables inherent in the estimate and the expected degree of variation from the estimate. Where the degree of variation is critical, the Owner should have the estimate independently verified.
- Complete filing or assist in a full or staged building permit application.
- Prepare demolition documents.
- Provide tenant improvement-related design services.
- Design or review the effects of the General Contractor's methods, procedures, or construction equipment on the project.
- Complete work resulting from corrections or revisions required because of errors or omissions not related to work under the responsibility, obligation, or duty of the FPE and/or FPER.
- Provide services that are beyond or inconsistent with original instructions given by the Client or Owner resulting from changes in codes, laws, or regulations, or from change orders.
- Provide services required as a result of errors, omissions, or poor workmanship by the General Contractor, Subcontractors, or other RPs on the project.
- Provide services involved with regulatory meetings, public hearings, or legal proceedings concerning the project, including attendant preparation.
- Act as an expert witness or fact witness in project-related disputes.
- Review and/or design substitute systems.
- Prepare Shop Drawings or fabrication drawings not part of the basic scope of work.
- Provide extra services due to extended time schedules for design or construction.
- Provide services resulting from damage as the result of fire, human-made disasters, or natural disasters.
- Undertake an environmental impact comparison between various fire protection systems using a lifecycle assessment process.

3.5.2 CONFORMANCE TO THE FIRE CODE

Buildings must comply with requirements of both the Code and the Fire Code. The Code covers the fire safety and fire protection features that are required to be incorporated in a building at the time of its original construction. Unless the building is undergoing alteration or change of use or is being demolished, the Code typically no longer applies once a building is occupied.

The Fire Code contains provisions regarding safety and fire protection features that must be met when certain hazardous activities or processes are introduced in buildings.

Such Fire Code provisions include:

- ongoing testing and maintenance of fire protection systems;
- design of hazardous areas;
- handling, use, and processing of dangerous goods;
- establishment of fire safety plans; and
- establishment of construction fire safety plans.

Some of the Fire Code provisions are not duplicated directly in the Code and instead are adopted through cross-references to the Fire Code. Fire Code provisions may apply to original construction, alterations, or change of use.

The General Contractor is responsible for the preparation of the construction fire safety plan, and the Owner is responsible for the preparation of the fire safety plan. An FPE may be engaged to provide input on one or both of these plans.

It is standard practice to require the completion of a fire safety plan in time for occupancy. It is also standard practice to incorporate Fire Code provisions during the analysis and design stages of large or complex facilities. Areas of priority for design purposes are covered in the following section.

3.5.2.1 Scope of Services Related to the Fire Code

The following services may be provided by the FPE as part of fire and life-safety analysis, to ensure that the completed building meets the intent of both the Code and the Fire Code. These services may also be carried out in conjunction with services provided by the other RPs.

Such services may include:

- a preliminary analysis of applicable Fire Code requirements;
- a review of existing use and operations to determine hazards, followed by a proposal for fire and life-safety controls to be incorporated in the design;
- a preliminary analysis and proposal related to existing interior finishes alterations or change of use;
- identification of fire protection requirements for
  - fire hazards and dangerous goods,
  - exposure hazards, including during construction,
  - helicopter landing pads (or heliports) on roofs,
  - marinas and boatyards,
  - indoor and outdoor storage, and/or
  - flammable and combustible liquid storage and handling considerations including, but not limited to
    - flammable liquid rooms,
    - use of flammable liquids in the open,
    - tank storage, leak detection, and piping and transfer systems at fuel dispensing stations, bulk plants, piers, and wharves, and
    - process plants, distilleries, tank vehicles, loading/unloading/dispensing.

Alternative Solutions should be as set out under the Administrative Provisions of Part 2 of the Fire Code.

3.5.2.2 Coordination with the Fire Service

Although the requirements for fire access and firefighting are covered in the Code, project-specific coordination may be required with the fire service to address any concerns regarding the provisions agreed upon by the FPE and/or FPER and AHJ during the building permit or agreement in principle processes. Meetings may be required between the fire service, the FPE and/or FPER, and the AHJ to come to a mutually agreeable solution.

For existing buildings, the fire service may issue an order for fire and life-safety improvements. In these instances, a comprehensive review for conformance to the Fire Code should be conducted to ensure that reasonable fire and life-safety is achieved.

For industrial or complex buildings, additional coordination may be required with the fire service and/or the on-site emergency response team regarding arrangement and adequacy of water supply, specific equipment requirements, fixed extinguishing systems, and other project-specific fire protection items.

Refer to Appendix D: Additional Guidelines for Complex Industrial Buildings for further information.

3.5.3 ALTERNATIVE SOLUTIONS AND LETTERS OF ASSURANCE

In many cases, Alternative Solutions will not be feasible for existing buildings due to existing conditions that make it impractical or impossible to meet the objectives and functional statements of the Code. Existing buildings frequently require review and agreement with the AHJ to confirm an acceptable extent of upgrading. This is separate from the Alternative Solution process. The Notes to Division A Part 1 of the Code provide additional information on the analysis required for existing buildings.

As described in Article 1.2.1.1. in Part 1 of Division A, compliance with the Code can be achieved by either complying with the acceptable solutions described in

Division B, or by Alternative Solutions that fulfill the objectives and functional statements described in Subsection 1.1.2. of Division B. Section 2.3 of Division C of the Code describes the requirements for Alternative Solutions.

The *BC Building Code 2018* does not specifically require that Alternative Solutions be prepared by RPs, and does not specifically require that Field Reviews of the mitigating features in the Alternative Solutions be undertaken by the author of the Alternative Solution.

Regardless, AHJs may require assurance that the mitigating features provide a level of performance equal to or greater than the Code, which may include Field Review by the author of the Alternative Solution.

In addition to requesting Field Reviews by the RPRs, the CRP and/or RPR may request Field Reviews by the author of the mitigating features. The author of the Alternative Solution may, at their sole discretion, provide Field Reviews to ascertain that the mitigating features have been appropriately incorporated in the construction.

Note that the Vancouver Building By-law (VBBL) 2019 does require that Alternative Solutions be prepared by RPs and does require that Field Reviews of the mitigating features in the Alternative Solutions be undertaken by the author of the Alternative Solution. Refer to Article 2.3.2.1. of Division C of the VBBL 2019.

The Letters of Assurance in the Code have been developed to address the design approach using the acceptable solutions described in Division B. These Letters of Assurance are not an appropriate form of accountability for Alternative Solutions. An AHJ may require that the person requesting to use an Alternative Solution provide documentation to demonstrate that the level of performance required by the Code has been achieved. Refer to the *Guide to the Letters of Assurance in the BC Building Code* (Province of BC 2010) for more information.

It is the responsibility of the CRP to coordinate, and of the RPRs to incorporate the mitigating features of the Alternative Solutions into their Design Drawings. It is the responsibility of the author of the Alternative Solution to ascertain that each RPR's Design Drawings have appropriately incorporated such mitigating features, consistent with the intent of the Alternative Solution.

4.0 QUALITY MANAGEMENT IN PROFESSIONAL PRACTICE

4.1 ENGINEERS AND GEOSCIENTISTS BC QUALITY MANAGEMENT REQUIREMENTS

Engineering Professionals must adhere to applicable quality management requirements during all phases of the work, in accordance with the Engineers and Geoscientists BC Bylaws and quality management standards.

To meet the intent of the quality management requirements, Engineering Professionals must establish, maintain, and follow documented quality management policies and procedures for the following activities:

- Use of relevant professional practice guidelines
- Authentication of professional documents by application of the professional seal
- Direct supervision of delegated professional engineering activities
- Retention of complete project documentation
- Regular, documented checks using a written quality control process
- Documented Field Reviews of engineering designs and/or recommendations during implementation or construction
- Where applicable, documented independent review of structural designs prior to construction
- Where applicable, documented independent review of high-risk professional activities or work prior to implementation or construction
- Engineering Professionals employed by a Registrant firm are required to follow the quality management policies and procedures implemented by the Registrant firm as per the Engineers and Geoscientists BC's permit to practice program

4.1.1 PROFESSIONAL PRACTICE GUIDELINES

Engineering Professionals are required to comply with the intent of any applicable professional practice guidelines related to the engineering work they undertake. As such, Engineering Professionals must implement and follow documented procedures to ensure they stay informed of, knowledgeable about, and meet the intent of professional practice guidelines that are relevant to their professional activities or services. These procedures should include periodic checks of the Engineers and Geoscientists BC website to ensure that the latest versions of available guidance are being used.

For more information, refer to the *Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines* (Engineers and Geoscientists BC 2021b), which also contains guidance for how an Engineering Professional can appropriately depart from the guidance provided in professional practice guidelines.

4.1.2 AUTHENTICATING DOCUMENTS

Engineering Professionals are required to authenticate (seal with signature and date) all documents, including electronic files, that they prepare or deliver in their professional capacity to others who will rely on the information contained in them. This applies to documents that Engineering Professionals have

personally prepared and those that others have prepared under their direct supervision. In addition, any document that is authenticated by an individual Engineering Professional must also have a permit to practice number visibly applied to the document. A permit to practice number is a unique number that a Registrant firm receives when they obtain a permit to practice engineering or geoscience in BC.

Failure to appropriately authenticate and apply the permit to practice number to documents is a breach of the Bylaws.

For more information, refer to the *Quality Management Guides – Guide to the Standard for the Authentication of Documents* (Engineers and Geoscientists BC 2021d).

4.1.3 DIRECT SUPERVISION

Engineering Professionals are required to directly supervise any engineering work they delegate. When working under the direct supervision of an Engineering Professional, an individual may assist in performing engineering work, but they may not assume responsibility for it. Engineering Professionals who are professional licensees engineering may only directly supervise work within the scope of their licence.

When determining which aspects of the work may be appropriately delegated using the principle of direct supervision, the Engineering Professional having ultimate responsibility for that work should consider:

- the complexity of the project and the nature of the risks associated with the work;
- the training and experience of individuals to whom the work is delegated; and
- the amount of instruction, supervision, and review required.

Careful consideration must be given to delegating Field Reviews. Due to the complex nature of Field Reviews, Engineering Professionals with overall responsibility should exercise judgment when relying on delegated field observations, and should conduct a sufficient level of review to have confidence in the quality and accuracy of the field observations. When delegating Field Review activities, Engineering Professionals must document the Field Review instructions given to a subordinate. (See Section 4.1.6 Documented Field Reviews During Implementation or Construction.)

When delegating components of Fire Protection System Design to a subordinate or a Fire Protection Engineer (FPE), the Fire Protection Engineer of Record (FPER) must be involved at all stages of the design process. The FPER should not be engaged after the design is completed or asked to authenticate drawings with limited prior involvement. In cases where the latter cannot be avoided, refer to the *Quality Management Guides – Guide to the Standard for Authenticating Documents* (Engineers and Geoscientists BC 2021e), under Section 3.5 Authenticating Documents With Limited Prior Involvement.

The following minimum steps should be followed by the FPER when delegating work:

1. Before the Fire Protection System Design (sprinklers and/or standpipes) commences, outline the basic design concepts such as design standard, areas with sprinkler coverage, need for standpipes, and preliminary design criteria and approach.
2. If the design was developed by the subordinate or the FPE, review the initial layout for general compliance and confirm the areas requiring hydraulic calculations and design/density or flow rate requirements.
3. Review, in detail, the final design and hydraulic calculations.
4. At all stages, ensure there is direct interaction between the FPER and the subordinate or FPE.

Where a change in Registered Professional of Record (RPR) occurs prior to issuing contract documents, the incoming FPER must conduct a thorough review of the project and repeat the steps listed above, as necessary, prior to accepting professional responsibility for the project.

For other types of fire suppression systems, such as clean agent or chemical suppression systems, the design may be based on proprietary calculation software, so adherence to the review stages noted above may not be appropriate.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021e).

4.1.4 RETENTION OF PROJECT DOCUMENTATION

Engineering Professionals are required to establish and maintain documented quality management processes to retain complete project documentation for a minimum of ten (10) years after the completion of a project or ten (10) years after an engineering document is no longer in use.

These obligations apply to Engineering Professionals in all sectors. Project documentation in this context includes documentation related to any ongoing engineering work, which may not have a discrete start and end, and may occur in any sector.

Many Engineering Professionals are employed by firms, which ultimately own the project documentation. Engineering Professionals are considered compliant with this quality management requirement when reasonable steps are taken to confirm that (1) a complete set of project documentation is retained by the organizations that employ them, using means and methods consistent with the Engineers and Geoscientists BC Bylaws and quality management standards; and (2) they consistently adhere to the documented policies and procedures of their organizations while employed there.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Retention of Project Documentation* (Engineers and Geoscientists BC 2021f).

4.1.5 DOCUMENTED CHECKS OF ENGINEERING WORK

Engineering Professionals are required to perform a documented quality checking process of engineering work, appropriate to the risk associated with that work. All Engineering Professionals must meet this quality management requirement.

The checking process should be comprehensive and address all stages of the execution of the engineering work. This process would normally involve an internal check by another Engineering Professional within the same organization. Where an appropriate internal checker is not available, an external checker (i.e., one outside the organization) must be engaged. In some instances, self-checking may be appropriate. Where internal, external, or self-checking has been carried out, the details of the check must be documented. The documented quality checking process must include checks of all professional deliverables before being finalized and delivered.

Engineering Professionals are responsible for ensuring that the checks being performed are appropriate to the level of risk associated with the item being checked. Considerations for the level of checking should include:

- the type of item being checked;
- the complexity of the subject matter and underlying conditions related to the item;
- the quality and reliability of associated background information, field data, and elements at risk; and
- the Engineering Professional's training and experience.

As determined by the Engineering Professional, the individual doing the checking must have current expertise in the discipline of the type of work being checked, be sufficiently experienced and have the required knowledge to identify the elements to be checked, be objective and diligent in recording observations, and understand the checking process and input requirements.

In Fire Protection System Design, the timing and nature of the documented quality checking process will depend on the scope of the design. It may be appropriate to check small or straightforward Prescriptive-Based Designs or Objective-Based Designs only once, when the design is substantially complete; however, large, complex, or multi-stage designs may need to be checked at various stages during the design. The frequency and extent of checking is at the sole discretion of the Engineering Professional responsible for the design.

The Engineering Professional responsible for the design must also do a risk-based approach to determine if the checking should be done by a third party or if self-checking is appropriate.

Documented checking must be part of the quality management process; creating a procedure (such as a checklist) by which the Engineering Professional can check the design against appropriate criteria might be part of that process. See Appendix C: Sample Checklists for resources and considerations for using existing checklists. This list of existing checklists is not intended to be exhaustive for the indicated design types, or imply that other designs do not require, or would not benefit from, checklists. Engineering Professionals may also choose to create checklists for their specific designs, such as fire alarm systems, as part of their quality management process.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Checks of Engineering and Geoscience Work* (Engineers and Geoscientists BC 2021g).

4.1.6 DOCUMENTED FIELD REVIEWS DURING IMPLEMENTATION OR CONSTRUCTION

Field Reviews are reviews conducted at the site of the construction or implementation of the engineering work. They are carried out by an Engineering Professional or a subordinate acting under the Engineering Professional's direct supervision (see Section 4.1.3 Direct Supervision).

Field Reviews enable the Engineering Professional to ascertain whether the construction or implementation of the work substantially complies in all material respects with the engineering concepts or intent reflected in the engineering documents prepared for the work.

Field Reviews must be conducted for all systems the FPER is responsible for, to ascertain whether or not the work substantially complies with the Fire Protection Engineering contract documents or Design Drawings. If an FPE is engaged as a Supporting Registered Professional (SRP) for certain items, that FPE is responsible for the relevant aspects of investigation, design, and Field Reviews for those items. As an SRP, that FPE should submit Schedules S-B and S-C to the FPER. For more information, see the *Professional Practice Guidelines – Professional Design and Field Review by Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).

Because more than one Registered Professional (RP) may be involved in fire and life-safety design and Fire Protection System Design, it is prudent to adequately outline the associated Field Review responsibilities so that each RP is clear on their scope of work and can do their due diligence to satisfy themselves that their scope of work, as implemented on site, substantially complies with the Design Objectives or intent.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Field Reviews During Implementation or Construction* (Engineers and Geoscientists BC 2021h).

4.1.7 DOCUMENTED INDEPENDENT REVIEW OF STRUCTURAL DESIGNS

Engineering Professionals developing structural designs are required to engage an independent review of their structural designs. An independent review is a documented evaluation of the structural design concept, details, and documentation based on a qualitative examination of the substantially complete structural design documents, which occurs before those documents are issued for construction or implementation. It is carried out by an experienced Engineering Professional qualified to practice structural engineering, who has not been involved in preparing the design.

The RPR must conduct a risk assessment after conceptual design and before detailed design to (1) determine the appropriate frequency of the independent review(s); and (2) determine if it is appropriate for the independent reviewer to be employed by the same firm as the RPR, or if the independent reviewer should be employed by a different firm.

The risk assessment may determine that staged reviews are appropriate; however, the final independent review must be completed after checking has been completed and before the documents are issued for construction or implementation. Construction must not proceed on any portion of the structure until an independent review of that portion has been completed.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Independent Review of Structural Designs* (Engineers and Geoscientists BC 2021i).

4.1.8 DOCUMENTED INDEPENDENT REVIEW OF HIGH-RISK PROFESSIONAL ACTIVITIES OR WORK

Engineering Professionals must perform a documented risk assessment prior to initiation of a professional activity or work, to determine if that activity or work is high risk and requires a documented independent review.

If the activities or work are deemed high risk, and an independent review is required, the results of the risk assessment must be used to (1) determine the appropriate frequency of the independent review(s); and (2) determine if it is appropriate for the independent reviewer to be employed by the same firm as the RPR, or if the independent reviewer should be employed by a different firm.

The documented independent review of high-risk professional activities or work must be carried out by an Engineering Professional with appropriate experience in the type and scale of the activity or work being reviewed, who has not been involved in preparing the design.

The documented independent review must occur prior to implementation or construction; that is, before the professional activity or work is submitted to those who will be relying on it.

For all Fire Protection Engineering services, including those related to Fire Protection System Design, the FPE and/or FPER must use a risk-based approach to determine whether their work (designs, reports, or other types of services or project deliverables) is considered high risk and requires independent review.

For more information, refer to the *Quality Management Guides – Guide to the Standard for Documented Independent Review of High-Risk Professional Activities or Work* (Engineers and Geoscientists BC 2021j).

Similar to an independent review, a peer review may be required. Peer reviews are more likely to be required by agencies or stakeholders (e.g., the Client or the Authority Having Jurisdiction) for significant or complex Performance-Based Designs, or if they determine that

such a review is justified based on the project's risk or economic impact. The terms of the peer review should be established and be acceptable to relevant agencies or stakeholders, prior to commencement of the review. In general, the peer review should be conducted in accordance with the Society of Fire Protection Engineers (SFPE) publication *Guidelines for Peer Review in the Fire Protection Design Process* (SFPE 2020), except when modified by agreement among the relevant stakeholders.

4.2 OTHER QUALITY MANAGEMENT REQUIREMENTS

Engineering Professionals must also be aware of any additional quality management requirements from other sources that are relevant to their work, which may include but are not limited to:

- legislation and regulations at the local, regional, provincial, and federal levels;
- policies of Authorities Having Jurisdiction at the local, regional, provincial, and federal levels;
- agreements and service contracts between clients and Engineering Professionals or their firms; and/or
- standards for engineering firms, particularly those that apply to quality management system certification, such as the ISO 9000 family.

Engineering Professionals should assess any areas of overlap between the Engineers and Geoscientists BC quality management requirements and the requirements of other applicable sources. If the requirements of different sources overlap, Engineering Professionals should attempt to meet the complete intent of all requirements.

Where there are conflicts between requirements, Engineering Professionals should negotiate changes or waivers to any contractual or organizational requirements which may conflict with requirements of legislation, regulations, or the Engineers and Geoscientists BC Code of Ethics. Generally, no contractual obligation or organizational policy that may apply to an Engineering Professional will provide justification or excuse for breach of any of the Engineering Professional's obligations under any legislation, regulation, or the Engineers and Geoscientists BC Code of Ethics. Where such conflicts arise and cannot be resolved, Engineering Professionals should consider seeking legal advice from their own legal advisers on their legal rights and obligations in the circumstances of the conflict, and they may also seek practice advice from Engineering and Geoscientists BC on any related ethical dilemma that they may face in the circumstances.

4.3 PRACTICE ADVICE

Engineers and Geoscientists BC provides their Registrants and others with assistance addressing inquiries related to professional practice and ethics.

Practice advisors at Engineers and Geoscientists BC can answer questions regarding the intent or application of the professional practice or quality management aspects of these guidelines.

To contact a practice advisor, email Engineers and Geoscientists BC at practiceadvisor@egbc.ca.

5.0 PROFESSIONAL REGISTRATION & EDUCATION, TRAINING, AND EXPERIENCE

5.1 PROFESSIONAL REGISTRATION

Engineering Professionals have met minimum education, experience, and character requirements for admission to their professions. However, the educational and experience requirements for professional registration do not necessarily constitute an adequate combination of education and experience for providing Fire Protection Engineering services. Professional registration alone does not automatically qualify an Engineering Professional to take professional responsibility for all types and levels of professional services in this professional activity.

It is the responsibility of Engineering Professionals to determine whether they are qualified by training and/or experience to undertake and accept responsibility for carrying out Fire Protection Engineering services for building projects (Code of Ethics Principle 2).

5.2 EDUCATION, TRAINING, AND EXPERIENCE

Fire Protection Engineering, as described in these guidelines, requires minimum levels of education, training, and experience in many overlapping areas of engineering.

Engineering Professionals who take responsibility for Fire Protection Engineering services for building projects must adhere to the second principle of the Engineers and Geoscientists BC Code of Ethics, which is to "practice only in those fields where training and ability make the registrant professionally competent" and, therefore, must evaluate their own qualifications and must possess the appropriate education, training, and experience to provide the services.

The level of education, training, and experience required of Engineering Professionals should be adequate for the complexity of the project. This section describes indicators that Engineering Professionals can use to determine whether they have an appropriate combination of education and experience.

Note that these indicators are not an exhaustive list of education and experience types that are relevant to Fire Protection Engineering. Satisfying one or more of these indicators does not automatically indicate adequate competence.

5.2.1 EDUCATIONAL INDICATORS

Certain indicators show that Engineering Professionals have received education that might qualify them to participate professionally in Fire Protection Engineering services for building projects. Educational indicators are subdivided into formal education (such as university or engineering school) and informal education (such as continuing education).

Formal educational indicators include having obtained or completed one or more of the following:

- An undergraduate-level degree in mechanical, electrical, civil, chemical, or a related engineering field from an accredited engineering program
- Graduate-level courses or programs related to Fire Protection Engineering

Informal educational indicators include having participated in or undertaken one or more of the following, on topics such as fire dynamics and risk analysis:

- Training courses facilitated by the Engineering Professional's employer
- Continuing education courses or sessions offered by professional organizations, such as Engineers and Geoscientists BC or the Society of Fire Protection Engineers (SFPE)
- Conferences or industry events
- A rigorous and documented self-study program involving a structured approach using materials from textbooks and technical papers

5.2.2 EXPERIENCE INDICATORS

Engineering Professionals who take responsibility for Fire Protection Engineering services for building projects are expected to have an appropriate level of knowledge of fire dynamics, along with understanding of architectural, mechanical, electrical, and structural systems as they relate to fire protection. These Engineering Professionals are also expected to have thorough knowledge of the fire safety requirements of the Code and relevant standards (e.g., NFPA), in order to determine that the design concepts are compatible with the prescriptive or objective requirements of the Code and any relevant standards. Engineering Professionals are expected to be able to apply their knowledge to protect the public and the environment, where their knowledge may be obtained through experience, self-study, or formal education.

Note that when preparing a Code analysis for an Alternative Solution, Engineering Professionals will be required to disclose their experience and qualifications.

While still meeting the basic requirements outlined above, it may be acceptable for an FPE providing the fire and life safety analysis to have somewhat limited knowledge of fire dynamics, provided that knowledge is sufficient to meet the Prescriptive-Based Design requirements of the relevant Code and/or standard(s) governing the FPE's services.

The following core competencies are outlined in the SFPE publication *Recommended Minimum Technical Core Competencies for the Practice of Fire Protection Engineering* (SFPE 2018). Refer to the publication for details.

- Fire science
- Active fire protection
- Passive protection
- Human behavior and evacuation
- Performance-based design
- Fire protection analysis
- Computational modeling
- Fire hazard and risk assessment
- General building design
- Code and regulations

6.0 REFERENCES AND RELATED DOCUMENTS

Documents cited in these guidelines and appendices appear in Section 6.1: Legislation, Section 6.2 References, and Section 6.3 Codes and Standards.

Related documents that may be of interest to users of this guideline but are not formally cited elsewhere in this document appear in Section 6.4: Related Documents.

6.1 LEGISLATION

The following legislation is referenced in these guidelines:

Architects Act [RSBC 1996], Chapter 17.

Professional Governance Act [SBC 2018], Chapter 47.

6.2 REFERENCES

The following documents are referenced in these guidelines:

Architectural Institute of British Columbia (AIBC) and Engineers and Geoscientists BC. 2020. Joint Professional Practice Guidelines – Professional Design and Field Review for By Supporting Registered Professionals. Version 1.0. Vancouver and Burnaby, BC: AIBC and Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Association of Consulting Engineering Companies British Columbia (ACEC-BC). 2021. Contracts. [web page with multiple resources]. Vancouver, BC: ACEC-BC. [accessed: 2021 May 14]. https://acec-bc.ca/category/contracts/.

British Columbia (BC) Building Code (BCBC). 2018. Letters of Assurance. [website]. [accessed: 2021 May 14]. http://www.bccodes.ca/letters-of-assurance.html.

City of Vancouver. 2019. City of Vancouver Building By-law 2019. Vancouver, BC: City of Vancouver. [accessed: 2021 May 14]. http://www.bccodes.ca/vancouver-bylaws.html.

Engineers and Geoscientists BC. 2021a. Professional Practice Guidelines – Mechanical Engineering Services for Building Projects. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2021b. Quality Management Guides – Guide to the Standard for the Use of Professional Practice Guidelines. Version 1.1. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021c. Practice Advisory – Permit To Practice Requirements for Letters of Assurance. Version 1.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 Oct 18]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2021d. Quality Management Guides – Guide to the Standard for the Authentication of Documents. Version 3.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021e. Quality Management Guides – Guide to the Standard for Direct Supervision. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021f. Quality Management Guides – Guide to the Standard for Retention of Project Documentation. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021g. Quality Management Guides – Guide to the Standard for Documented Checks of Engineering and Geoscience Work. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021h. Quality Management Guides – Guide to the Standard for Documented Field Reviews During Implementation or Construction. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021i. Quality Management Guides – Guide to the Standard for Documented Independent Review of Structural Designs. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2021j. Quality Management Guides – Guide to the Standard for Documented Independent Review of High-Risk Professional Activities or Work. Version 1.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Quality-Management-Guides.

Engineers and Geoscientists BC. 2020. Professional Practice Guidelines – Electrical Engineering Services for Building Projects. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2016. Professional Practice Guidelines – Sustainability. Version 1.1. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2015. Professional Practice Guidelines – Shop Drawings. Version 2.0. Burnaby, BC: Engineers and Geoscientists BC. [accessed: 2021 May 14]. https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC. 2010. Bulletin K: BCBC – Letters of Assurance in the BC Building Code and Due Diligence. (September 2010). Burnaby, BC: Engineers and Geoscientists BC 2010. [accessed: 2021 May 14]. https://www.egbc.ca/Practice-Resources/Individual-Practice/Guidelines-Advisories.

Engineers and Geoscientists BC and AIBC. 1996. Memorandum of Agreement between The Association of Professional Engineers and Geoscientists of the Province of British Columbia and Architectural Institute of British Columbia. April 2, 1996. Burnaby and Vancouver, BC: Engineers and Geoscientists BC and AIBC. [accessed: 2021 Aug 23]. https://www.egbc.ca/getmedia/6639f1d9-630d-42cc-b42a-624d71e9c95f/APEGBC-AIBC-Memorandum-of-Agreement.pdf.aspx.

Province of British Columbia. 2010. Guide to the Letters of Assurance in the B.C. Building Code 2006. (December 2010). Victoria, BC: Building and Safety Standards Branch. [accessed: 2021 May 14]. https://www.bccodes.ca/letters-of-assurance.html.

Society of Fire Protection Engineers (SFPE). 2020. Guidelines for Peer Review in the Fire Protection Design Process (2020 Edition). Gaithersburg, MD: SFPE. [accessed: 2021 May 18]. https://www.sfpe.org/standards-guides/guides/peerreviewguide.

SFPE. 2018. Recommended Minimum Technical Core Competencies for the Practice of Fire Protection Engineering. [Adopted: December 19, 2018]. Gaithersburg, MD: SFPE. [accessed: 2021 May 18]. https://www.sfpe.org/advocacy-qualifications/core-competencies.

6.3 CODES AND STANDARDS

The following codes and standards are referenced in these guidelines:

BC Building Code 2018. (accessed: 2021 May 18). https://www.bccodes.ca/building-code.html.

BC Fire Code 2018. (accessed: 2021 May 18). https://www.bccodes.ca/fire-code.html.

National Building Code of Canada (NBC). 2015. (accessed: 2021 May 18). https://nrc.canada.ca/en/certifications-evaluations-standards/codes-canada/codes-canada-publications/national-building-code-canada-2015.

NFPA 10, Standard for Portable Fire Extinguishers.

NFPA 13, Standard for the Installation of Sprinkler Systems.

NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.

NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies.

NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.

NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials.

NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

Vancouver Building By-law 2019. (accessed: 2021 May 18). https://www.bccodes.ca/vancouver-bylaws.html.

6.4 RELATED DOCUMENTS

The following resources are provided for information:

Society of Fire Protection Engineers (SFPE). 2016. SFPE Handbook of Fire Protection Engineering (5th Edition). Gaithersburg, MD: SFPE.

SFPE. 2007. Engineering Guide to Performance-Based Fire Protection (2nd Edition). Gaithersburg, MD: SFPE.

SFPE. 2006. Fire Risk Assessment. Gaithersburg, MD: SFPE.

7.0 APPENDICES

APPENDIX A: LETTERS OF ASSURANCE FOR FIRE PROTECTION ENGINEERING SERVICES

A1 OVERVIEW

Letters of Assurance were introduced in 1990 in the Vancouver Building By-law (VBBL) and in 1992 in the *British Columbia Building Code* (*BCBC*), and they continue to be referenced in the current editions of the VBBL and the *BCBC* (referred to collectively from now on in this appendix as "the Code").

Letters of Assurance were developed after discussions with the City of Vancouver, the British Columbia (BC) Building Safety and Standards Branch, the Architectural Institute of BC, and Engineers and Geoscientists BC, and in close consultation with the Building Officials' Association of BC.

The intent of the Letters of Assurance is to assure the Authority Having Jurisdiction (AHJ) for a particular building project that:

- activities of the various Registered Professionals of Record (RPRs) are coordinated by the CRP;
- Design Drawings submitted in support of the application for a building permit substantially comply with the Code;
- building designs substantially comply with the requirements of the Code; and
- the RPR will undertake, and has undertaken, the necessary Field Reviews to determine that building construction substantially complies with the Code.

Where unanticipated conditions are observed, the Registered Professional (RP) should provide recommendations and additional Field Reviews to achieve the Design Objectives. RPs are responsible for ensuring deficiencies identified in the Field Reviews for which they are responsible are adequately addressed. The AHJ may need to be notified of significant changes to the Design Drawings and/or agreements in principle.

A1.1 SCHEDULE A

Schedule A, Confirmation of Commitment by Owner and Coordinating Registered Professional identifies to the AHJ that the Owner has retained a CRP to coordinate the design work and Field Reviews of the RPRs for the project, in order to ascertain that the design will substantially comply with the Code and other applicable enactments respecting safety, not including the construction safety aspects.

A1.2 SCHEDULE B

Schedule B, Assurance of Professional Design and Commitment for Field Review identifies the various RPRs who take responsibility for their designs, and confirms that their designs substantially comply with the Code respecting safety, except for construction safety aspects.

Schedule B also provides a commitment that the RPRs will be responsible for the Field Reviews required for the project.

A1.3 SCHEDULE C-A

Schedule C-A, Assurance of Coordination of Professional Field Review confirms that the necessary Field Reviews of the RPRs, and the functional testing of the fire protection and life-safety systems, have been coordinated to ascertain that the project substantially complies in all material respects with the Code.

A1.4 SCHEDULE C-B

Schedule C-B, Assurance of Professional Field Review and Compliance confirms that the necessary Field Reviews have been completed by the RPR, and that the finished project substantially conforms to the design and the Code.

A1.5 SCHEDULES S-B AND S-C

RPRs should only undertake design and Field Review for items identified on the Letter of Assurance that are within their competency and area of practice.

An RPR or an Owner may require supplementary supporting engineering services for a particular component or subcomponent. When supporting engineering services are required, it is recommended that the relevant RPR obtains the appropriate assurances from the Supporting Registered Professional (SRP) (who could be engaged by the RPR, by the Owner, or by a General Contractor, sub-trade, or supplier) providing the supporting design service and/or field service.

After receiving assurance from an SRP that a particular component or subcomponent substantially complies, in all material respects, with the applicable requirements of the Code, the RPR can complete and submit the Letter of Assurance for that discipline.

Schedule S-B, Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional, and Schedule S-C, Assurance of Professional Field Review and Compliance By Supporting Registered Professional are recommended for use by an RP acting as an SRP. These model schedules are available from the *Joint Professional Practice Guidelines – Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).

A1.6 CODES, BYLAWS, AND GUIDANCE DOCUMENTS

More information on the Letters of Assurance in the Code is available from the following sources (see also Section 6.0 References and Related Documents):

- *BC Building Code*, Letters of Assurance (BCBC 2018)
- City of Vancouver Building By-law, Letters of Assurance (City of Vancouver 2019)
- Guide to the Letters of Assurance in the BC Building Code (Province of BC 2010)
- Bulletin K: BCBC – Letters of Assurance in the BC Building Code and Due Diligence (Engineers and Geoscientists BC 2010)
- *Joint Professional Practice Guidelines - Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020)

The following table summarizes the schedules referred to in this appendix to these guidelines.

Table A - 1: List of Letters of Assurance Related to Fire Protection Engineering Services

SCHEDULE	PURPOSE	SOURCE
Schedule A	Letter of Assurance Form: Confirmation of Commitment by Owner and Coordinating Registered Professional	*BCBC* or VBBL[b]
Schedule B	Letter of Assurance Form: Assurance of Professional Design and Commitment for Field Review	*BCBC* or VBBL[b]
Schedule C-A	Letter of Assurance Form: Assurance of Coordination of Professional Field Review	*BCBC* or VBBL[b]
Schedule C-B	Letter of Assurance Form: Assurance of Professional Field Review and Compliance	*BCBC* or VBBL[b]
Schedule S-B	Intra-Professional Form: Assurance of Professional Design and Commitment for Field Review By Supporting Registered Professional	*Joint Professional Practice Guidelines - Professional Design and Field Review By Supporting Registered Professionals* [a]
Schedule S-C	Intra-Professional Form: Assurance of Professional Field Review and Compliance By Supporting Registered Professional	*Joint Professional Practice Guidelines - Professional Design and Field Review By Supporting Registered Professionals* [a]

NOTES:

[a] AIBC and Engineers and Geoscientists BC 2020

[b] Some Authorities Having Jurisdiction, such as the Vancouver Airport Authority, may require alternative accountability documents and/or have specific polices related to accountability documents.

A2 LETTERS OF ASSURANCE FOR FIRE PROTECTION ENGINEERING PRACTICES

While the scope of services provided by many Engineering Professionals, such as the Fire Protection Engineer of Record (FPER), is included in Schedules B and C-B, many of the services provided by other Fire Protection Engineers (FPEs) either do not fit clearly within the items identified in the schedules, or fall within other disciplines such as mechanical, electrical, or architectural.

The model Schedule S was developed to provide a standard and uniform intra-professional form that covered both the Supporting FPE and other Supporting Registered Professionals (SRPs). Examples of where the model Schedules S would apply include kitchen hood fire suppression systems mandated by NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, under Part 6 of the Code (usually under the overall coordination of the kitchen hood by the Mechanical Engineer of Record [MER]), dry chemical systems (such as for a paint spray booth mandated by the Fire Code), and gaseous fire suppression systems (usually designed to reduce property damage and business interruption). For the model Schedules S-B and S-C, see the *Joint Professional Practice Guidelines - Professional Design and Field Review By Supporting Registered Professionals* (AIBC and Engineers and Geoscientists BC 2020).

The fire suppression schedules are generally associated with water-based fire suppression systems, as outlined in Subsection 3.2.5 of the Code.

The design of automatic sprinkler systems in accordance with NFPA 13D, Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes may not require professional design.

The following scenarios are taken from the Code, and describe options for carrying out the fire suppression (typically automatic sprinkler and standpipe) system design:

- Scenario 1: The FPER carries out the detailed fire suppression system design as part of the design team of Registered Professionals (RPs).
- Scenario 2: The MER provides a performance specification only.

While both approaches are currently acceptable under the Code, best practice is to address these critical fire and life-safety measures during the design stage of the project, as described in Scenario 1. Some municipalities, such as the City of Vancouver, City of Coquitlam, and City of Surrey, do not accept submissions under Scenario 2. For projects with complex fire and life-safety systems, such as fire pumps or booster pumps, performance specifications may introduce uncertainty in the design requirements.

A2.1 SCENARIO 1: FPER CARRIES OUT THE DETAILED FIRE SUPPRESSION SYSTEM DESIGN

The responsibilities outlined below apply to both an FPER acting as the engineer of record (Registered Professional of Record), as described in Scenario 1 in Notes to Part 2 of Division C of the Code, or as the sprinkler design engineer (Supporting Registered Professional) responsible for the detailed design in conformance with a performance specification provided by the MER, as described in Scenario 2 in Notes to Part 2 of Division C of the Code.

The items discussed below are numbered consistently with the numbers in Schedule B of the Code.

5.1 Fire Suppression System Classification for Type of Occupancy

The FPER is responsible for determining the classification and hazard protection requirements of the occupancy and for the fire suppression system type for the building.

The Code references NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies, NFPA 14, Standard for the Installation of Standpipe and Hose Systems, and NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection. These are the standards to be used for the design and installation of fire suppression systems. Good engineering practice is to review other relevant standards, such as NFPA and FM Approvals, where the application of NFPA 13 may not adequately address the risk.

Definitions in NFPA 13 are not necessarily consistent with the Code. The definitions used in NFPA 13 apply to the application of the NFPA standard and its referenced standards. For instance, NFPA 13 contains tables of occupancies that are to be used in determining occupancy. These may not be consistent with occupancy classifications listed in the Code (Group, A, B, C, D, and F).

It is therefore important when specifying and designing the fire suppression system that a precise understanding of the intended use of the building is acquired prior to commencing the system design. If this is not possible, then the limits of the system design must be specified.

5.2 Design Coverage, Including Concealed or Special Areas

The FPER is responsible for detailed fire suppression design coverage for all areas of the building, including concealed combustibles or special areas that are either covered by the NFPA standards or are beyond the coverage of the NFPA standards (e.g., gaseous systems in computer rooms, dry chemical systems in commercial kitchens and range hoods). The special protection coverage in some areas may be the result of Alternative Solutions developed by the FPEs or other RPs.

5.3 Compatibility and Location of Electrical Supervision, Ancillary Alarm, and Control Devices

The FPER is responsible for:

- designing the fire suppression systems' alarm and supervisory devices;
- confirming that all fire suppression system supervisory devices are properly located and connected to the fire alarm system;
- confirming that the fire alarm and fire suppression systems function in the event of any fire alarm conditions (e.g., pull stations, heat/smoke detectors, sprinkler or standpipe flow sensors, sprinkler, and standpipe valve monitoring); and
- confirming that all required freeze-protection devices are installed and functional.

The requirements for the alarm and monitoring functions of fire suppression systems are set out in the Code. The primary responsibility for the fire alarm systems lies with the RPR responsible for that system. However, the FPER also has a responsibility to coordinate the alarm and supervisory devices with the RPR responsible for the fire alarm system (in most cases, the Electrical Engineer of Record [EER]).

In the case of an existing building regulated under Part 9 of the Code with no fire alarm system, more involvement may be required by the FPER because an alarm system must be designed and provided.

5.4 Evaluation of the Capacity of Cities' (Municipal) Water Supply versus System Demands and Domestic Demand, Including Pumping Devices Where Necessary

The FPER is responsible for comparing the demands of the fire protection and domestic water systems relative to the water supply, to determine if supplemental fire pumping capacity is required. This requires evaluation and coordination with the building domestic water plumbing design requirements and intended operation. NFPA 13R requires that the domestic demand be included in the automatic sprinkler demand. Unless it has already been designed by another RP, the FPER is responsible for specifying the proper water connection size and the size of the water service lines. If fire pumps or booster pumps are required, the FPER is responsible for determining the pump capacities as well as the locations and the coordination of the power supply for the pumps with the EER if electric drive is used.

Unless it has already been designed by another RP, if a water supply system is required to be designed and installed for the project, the FPER is responsible for the determination of the fire water demand and pressure required, and for the development of the specifications and drawings for the water supply system. The FPER must determine the appropriate standard in such applications. For sprinklered buildings, the relevant NFPA sprinkler standard is the appropriate standard in addition to the referenced standards for specialized risks. For unsprinklered buildings, coordination with the local fire department is essential, and the design should conform with the appropriate standards referenced in the Code.

An investigation of the available water source and supply is necessary at the onset of any sprinkler system design. Municipalities that provide normal static and peak demand supply as well as residual pressure information are the most convenient sources of reliable information. Where data is not provided by the municipality, the FPER should undertake or coordinate a flow test of the system. If relying on a flow test, the FPER should consider a sufficient safety factor to allow for peak demand, low water levels, less than optimal conditions, or increased demand over time that may result in reductions in available water supply. Friction losses through backflow and associated devices should be considered to confirm adequacy of line sizes. Other design issues, including the Owner's requirements or insurer's needs, may have to be considered in certain circumstances.

The FPER must be able to implicitly rely upon the information provided by the municipality and others, subject to good engineering judgment.

For modifications to existing sprinkler systems, the degree to which any particular requirements can be relaxed without affecting the existing level of safety of the Code requires judgment on the part of both the designer and the AHJ.

5.5 Qualification of Welder, Quality of Welds and Material

The FPER is responsible for specifying the required welding qualifications, and for providing a verification process to ensure that the qualifications and quality standards have been met.

5.6 Review of All Applicable Shop Drawings

The FPER is responsible for reviewing all applicable Shop Drawings to ensure suitable application to, and integration with, the overall design.

See the *Professional Practice Guidelines – Shop Drawings* (Engineers and Geoscientists BC 2016).

5.7 Acceptance Testing for "Contractor's Materials and Test Certificate" as per NFPA Standards

The FPER is responsible for ensuring that all tests as outlined in the contractor's material and test certificates (CMTC) for the fire suppression systems are completed properly by the General Contractor prior to accepting the final installation and system verification. This includes the underground services, which are often designed by civil or mechanical Engineering Professionals. Regardless of who is responsible for the design, the FPER should be provided with a copy of the CMTC for underground piping.

A variety of CMTC formats are available, depending on which NFPA standards apply to the specific fire suppression system installation.

5.8 Maintenance Program and Manual for Fire Suppression Systems

The FPER is responsible for specifying the content of the maintenance program and manual for the fire suppression system, so that it complies with the appropriate NFPA standard. The FPER is also responsible for ascertaining that the maintenance program and manual for the same is prepared in accordance with the specification, and to direct that the maintenance program and manual for those systems be provided to the appropriate party.

5.9 Structural Capacity of Sprinkler Components, Including Anchorage and Seismic Restraint

The FPER is responsible for designing adequate support and seismic restraint of the primary elements of the automatic sprinkler and standpipe system piping and related components (i.e., fire/booster pump, water storage tanks, controllers, batteries, valves, exhaust manifolds) such that it meets the project design standards (e.g., NFPA 13). If complex seismic issues exceed the expertise of the FPER, the FPER is responsible for ensuring a qualified structural/seismic engineer is retained.

The FPER is responsible for the structural capacity of the support and fastening of the fire suppression system components but not for the structural integrity of the fire suppression system components themselves. The FPER is responsible for reviewing fire suppression equipment and system component weights, and for coordinating with the project Structural Engineer of Record (SER) to provide adequate supporting structure.

5.10 For Partial Systems, Confirm Sprinklers are Installed in All Areas Where Required

Partial systems relate to instances where sprinklers are installed in only a portion of a building or structure. The FPER is responsible for determining and specifying fire suppression sprinklers in areas of a building or zone where they are required for specific occupancies and/or hazards.

For example, if automatic sprinklers are required for a paint spray booth in an otherwise unsprinklered building, the FPER must confirm that all relevant ducts are provided with sprinkler protection in accordance with NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials.

5.11 Fire Department Connections and Hydrant Locations

The FPER is responsible for locating the fire department connection with respect to the hydrant locations, as well as coordinating the types of connections, access requirements, and water supply locations with the Architect, Coordinating Registered Professional (CRP), and/or the local fire department. Under this scenario, the FPER is responsible for coordination of these major system components with other disciplines of the design team.

Where additional fire hydrants are required on a building site, the FPER is responsible for determining, specifying, and verifying that fire hydrants and water supplies meet the relevant Codes, standards, and local fire department access requirements. The area between the hydrant and the fire department connection must be sufficiently free of obstructions to allow firefighting personnel reasonable access to connect a hose.

5.12 Fire Hose and Standpipes

The FPER is responsible for designing the fire hose and standpipe systems and locating the fire hose connections and hose stations to conform to NFPA 14, as modified by the Code.

5.13 Freeze Protection Measures for Fire Suppression Systems

The FPER is responsible for identifying those portions of a sprinkler and standpipe system that require freeze protection measures, including back-up and emergency power, and for confirming that all required freeze protection devices are installed and functional.

5.14 Functional Testing of Fire Suppression Systems and Devices

The FPER is responsible for verifying that the functional testing of all fire suppression systems and devices has been carried out. These tests may include, but are not limited to, tests of water supply through the main drain, water supply through private fire mains, trip testing of dry and pre-action sprinkler systems, flow testing of fire and booster pumps, water supplies from tanks and reservoirs, and alarm and supervisory signals.

The FPER should oversee the testing to ensure that it is performed in a manner consistent with the intent of the specified methods and that the total fire protection system will function. The EER is responsible for confirming that all fire alarm devices are fully operational and that signals confirmed at all panels are being received at the central station.

A2.2 SCENARIO 2: MER PROVIDES A PERFORMANCE SPECIFICATION ONLY

The responsibilities outlined below apply to an MER providing performance specifications in accordance with Scenario 2 in Appendix A of Division C of the Code.

When an MER provides a performance specification and signs for the fire suppression component of the Schedule B, the MER is undertaking the responsibility that the detailed fire suppression design will incorporate all elements in the specification. The MER must determine whether they are qualified by education, training, and experience to take responsibility for the fire suppression systems. Under Scenario 2, the FPER should sign Schedules S-B and S-C for Fire Protection Engineering.

The MER undertakes the responsibility of the detailed fire suppression design as outlined in the specifications by reviewing the detailed fire suppression Design Drawings prepared by the FPER, and by relying on the FPER's professional assurance. Consequently, the MER will have a coordinating role in items 5.2, 5.5, 5.9, 5.10, and 5.13 of Schedule B, and is responsible for ensuring that those items are addressed. In this coordinating capacity, the MER's responsibilities will be met, with reliance placed on the FPER to address these items. Any issue of concern that the MER observes must be coordinated with the FPER. Refer to Subsection 3.2.4. Fire Suppression of Notes to Part 2 of Division C of the Code for more information on Scenario 1 and Scenario 2.

The other items as identified below should be directly addressed in the specifications and follow up reviews by the MER. The MER may provide more detailed specifications in order to better protect the Owner's interests.

The MER's responsibility for these other items is as follows:

5.1 Suppression System Classification for Type of Occupancy

At minimum, the MER is responsible for determining and specifying the appropriate automatic sprinkler standard (NFPA 13, 13R, or 13D); determining whether a standpipe system is required per the Code; and identifying any Alternative Solutions required. The MER should include the necessary information on the type of occupancy in the detailed performance specifications and/or drawings.

5.2 Design Coverage, Including Concealed or Special Areas

The MER is responsible for coordinating this requirement. See also Section 5.2 of Scenario 1.

5.3 Compatibility and Location of Electrical Supervision, Ancillary Alarm, and Control Devices

At minimum, the MER is responsible for interfacing with the EER, in order to provide sufficient information for the EER to complete the design of the electrical aspects of the fire suppression system.

The MER should provide all of the electrical requirements for the alarm and supervisory aspects of the fire suppression systems as part of the detailed performance specifications. The FPER should follow these requirements in the preparation of the Final Design Drawings; any discrepancies and/or changes should be brought to the attention of the MER, in writing.

5.4 Evaluation of the Capacity of City's (Municipal) Water Supply Versus System Demands and Domestic Demand, Including Pumping Devices Where Necessary

The MER should ascertain the capacity of the municipal water supply to meet the demands of the fire protection and domestic water systems, and specify a fire pump or booster pump only if the municipal water supply system cannot meet the flow or pressure demands. The need for an extraordinary water supply should be addressed if there is insufficient capacity or if there is an Alternative Solution which requires it.

The MER should coordinate the requirement for and capacity of the fire pump or booster pump with the EER. This will be confirmed when the FPER completes the Fire Suppression System Design.

The MER is responsible for ensuring that the appropriate Engineering Professional specifies the proper water connection size and the size of the water service line.

The MER's performance specifications will often require that the FPER reconfirm the municipality water supply and the water flows required for the fire suppression systems, including modifications to tenant improvements.

For modifications to existing sprinkler systems, the degree to which any particular requirements can be relaxed without affecting the existing level of safety of the Code requires judgment on the part of both the designer and the AHJ.

5.5 Qualification of Welder, Quality of Welds and Material

The MER is responsible for coordinating this requirement. See also Section 5.5 of Scenario 1.

5.6 Review of all Applicable Shop Drawings

The MER is responsible for reviewing the FPER's drawings and appropriate Shop Drawings to ascertain that they substantially comply with the MER's performance specifications.

See the *Professional Practice Guidelines – Shop Drawings* (Engineers and Geoscientists BC 2016).

5.7 Acceptance Testing for "Contractor's Material and Test Certificate" as per NFPA Standards

The MER is responsible for reviewing the CMTC for the fire suppression systems to ensure the intent of the performance specifications are met.

5.8 Maintenance Program and Maintenance Manual for Fire Suppression Systems

At minimum, the MER should specify the maintenance manual requirements and review the maintenance manual for the fire suppression systems as part of the overall maintenance manuals for the project. This includes a detailed description of testing of the fire protection systems at the required intervals.

The FPER may rely on the MER to ensure that the intent of the performance specifications has been met.

5.9 Structural Capacity of Sprinkler Components, Including Anchorage and Seismic Restraint

The MER is responsible for coordinating this requirement. See also Section 5.9 of Scenario 1.

5.10 For Partial Systems, Confirm Sprinklers are Installed in all Areas Where Required

The MER is responsible for coordinating this requirement. See also Section 5.10 of Scenario 1.

5.11 Fire Department Connections and Hydrant Locations

The MER should determine the location of nearby hydrants and locate the fire department connections for coordination with architectural features and conformance to the Code.

The area between the hydrant and the fire department connection must be sufficiently free of obstructions to allow firefighting personnel reasonable access to connect a hose.

5.12 Fire Hose and Standpipes

The MER should determine the basic design criteria for a standpipe system and, if hose connections are required, the MER should show all the fire hoses and standpipes on the performance specification drawings. The layouts should be reviewed with the FPER.

5.13 Freeze Protection Measures for Fire Suppression Systems

The MER is responsible for specifying the requirements for heat tracing and insulation, or other means for freeze protection, of all automatic sprinkler and standpipe systems.

5.14 Functional testing of Fire Suppression Systems and Devices

The MER is responsible for coordinating this requirement. See also Section 5.14 of Scenario 1. In this role, the MER should either attend all the functional testing or delegate the same to the FPER.

APPENDIX B: GUIDELINES FOR DESIGN/BUILD FIRE SUPPRESSION SYSTEMS

For design/build fire suppression systems, many sprinkler and standpipe systems involve a combined design by a Fire Protection Engineer of Record (FPER) and a General Contractor's designer. The FPER is reminded that any aspects of the design prepared by the General Contractor's designer must be done under the FPER's Direct Supervision. Refer to the *Quality Management Guides – Guide to the Standard for Direct Supervision* (Engineers and Geoscientists BC 2021e).

If the tender documents include a pipe layout with detailed pipe sizing, the Engineering Professional preparing that design should be the FPER and should have the documentation and calculations to support their design.

If the documents indicate Objective-Based Design or if the General Contractor elects to significantly modify the tender design in accordance with the tender documentation, then the FPER responsible for the final design should be involved in the following steps:

1. Prior to any drawing or sizing of piping, review the structure and architectural arrangement to optimize the location of mains and branch lines.
2. Review the water supply arrangements. The water supply characteristics also require review to determine an acceptable design supply curve.
3. Determine the hazard level and basic design requirements.
4. Draw the fire suppression system piping and sprinkler head arrangement.
5. Determine the hydraulic calculated area.
6. Ascertain whether seismic design is required and incorporate it into the design as appropriate.
7. Hydraulically calculate the system, and transfer sizing information to the drawings. Economic considerations should be considered in pipe sizing. Details are added to the drawings as required.
8. Review the entire design.
9. Review the installation including items such as before boarding, after boarding, and hearing alarms, where appropriate.

The above guidelines may be modified to suit different types of projects.

While the involvement of the FPER may vary, only under unusual circumstances, such as the unavailability of the original FPER, should another FPER get involved, and only when the design is complete.

Similar guidelines can be developed for other Fire Protection Engineering systems.

APPENDIX C: SAMPLE CHECKLISTS

C1 OVERVIEW

As per the Engineers and Geoscientists BC quality management guides, Engineering Professionals must have checking processes for quality management and quality control of their work. See Section 4.0 Quality Management in Professional Practice of these guidelines.

One means to manage the checking processes is to use pre-existing or project-specific checklists.

Pre-existing checklists may not be appropriate for all buildings (e.g., storage lists typically do not apply to residential buildings). Engineering Professionals must use their judgment to determine whether a pre-existing checklist is appropriate for the project at hand, and/or create any project-specific checklists deemed necessary.

For example, some pre-existing Fire Protection System Design checklists may omit important preliminary steps for design or more detailed aspects of design such as:

- temperature rating of sprinklers in certain locations such as skylights or unventilated attics or near unit heaters;
- obstructions to sprinkler discharge;
- velocity of pipes in hydraulic calculations (may indicate incorrect node assignment to pipes);
- spacing of sprinklers or fire alarm detectors (may be affected by listing, ceiling finish, height above floor, or elevator recall);
- water supply safety factor considerations, particularly if based on a single flow test; and/or
- audibility of fire alarm systems in all areas.

C2 RESOURCES

The following are pre-existing checklists that may be used for quality management of Fire Protection System Designs:

- NFPA 13, Standard for the Installation of Sprinkler Systems
  - Automatic Sprinkler System Plan Review Checklist – Automatic Sprinkler Systems Handbook (NFPA)
  - Fire Sprinklers Plans Examination Checklists (NFSA)
  - Vancouver Sprinkler System Shop Drawing Review Checklist
- NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection
  - Sample Plan Review Checklist – Stationary Fire Pumps Handbook (NFPA)

APPENDIX D: ADDITIONAL GUIDELINES FOR COMPLEX INDUSTRIAL BUILDINGS

D1 OVERVIEW

The nature and complexity of industrial building projects may require different or additional responsibilities than those outlined in these guidelines, including in Appendices A, B, and C.

Although these guidelines are intended for building projects, many of the principles outlined may be applicable to other projects, including special structures and industrial facilities that may not be considered buildings, such as oil storage tanks at refineries or cranes.

The design process for new or existing industrial buildings involves the assessment of processes for fire and life-safety, Fire Code conformance, and any project-specific fire and life-safety measures. Regardless of whether the Fire Protection Engineer (FPE) is acting as the Coordinating Registered Professional (CRP), the FPE may play a key role in the following:

- Arrangement of water supplies including secondary and tertiary supplies for both reliability and insurance purposes.
- Analysis of the building and processes to enable a strategy to be developed for Code compliance, acceptable fire and life-safety, such as response to emergencies and communications. This may also include analysis of features required for occupant safety, such as egress and exit systems.
- Conceptual design of the fire protection system showing the general arrangements and major fire protection components
- Analysis of fire protection requirements for individual parts of the process. This enables tanks, pump sizes, and arrangement of any pumps (by type of driver) to be set out.
- Overall design criteria of the fire and life-safety systems, as well as the strategy for fire alarm systems, detection, and response.
- Assessment of fire and explosion potential of processes. See Section 3.5.2 Conformance to the Fire Code of these guidelines.
- Design of fire and life-safety systems and/or coordination of fire and life-safety systems with the Architect, as well as with the mechanical, electrical, and other Engineering Professionals.

D2 TYPICAL FIRE PROTECTION SYSTEM DESIGN SERVICES

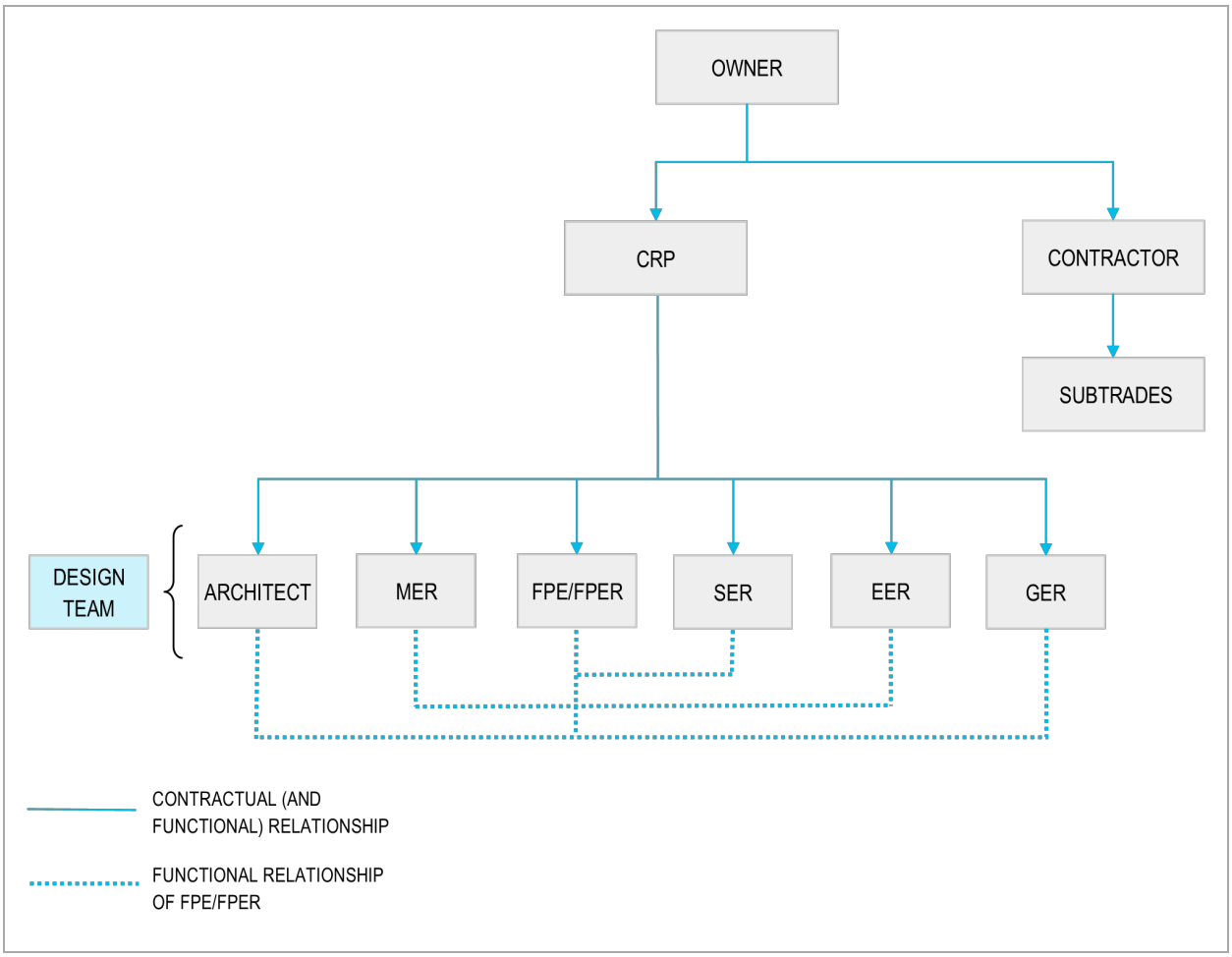
Although these services may be duplicated in other sections, the following services may take a higher priority in complex industrial building projects than in other building projects. The services discussed throughout these guidelines, but not mentioned again in this section, still apply.

- Conduct a site assessment, including the assessment of existing facilities, construction, and processes, where applicable.
- Prepare preliminary strategy for the site and preliminary design requirements.
- Prepare various fire and life safety strategies including budget estimates for Code compliance
- Provide Fire Protection System Design services

- Prepare and coordinate specifications and Final Design Drawings, which may include the following:
  - Design of water supply or review and coordination of water supply design by others. Large or complex industrial projects may require a higher level of reliability of water supply.
  - General concept for the site including
    - arrangement of water supplies,
    - sizing and feed arrangement of mains,
    - location of key components of the system,
    - fire department and on-site emergency response as well as any equipment requirements,
    - fire protection of various areas/fixed extinguishing systems,
    - explosion prevention requirements,
    - flammable liquid storage and handling arrangements,
    - fire alarm and communications systems design,
    - principal fire alarm panels and annunciation, and
    - protection of key data processing facilities and high-risk facilities.
  - Submission for building and/or other permits.
  - Review and acceptance by the Authorities Having Jurisdiction.

APPENDIX E: COMMON FORMS OF PROJECT ORGANIZATION

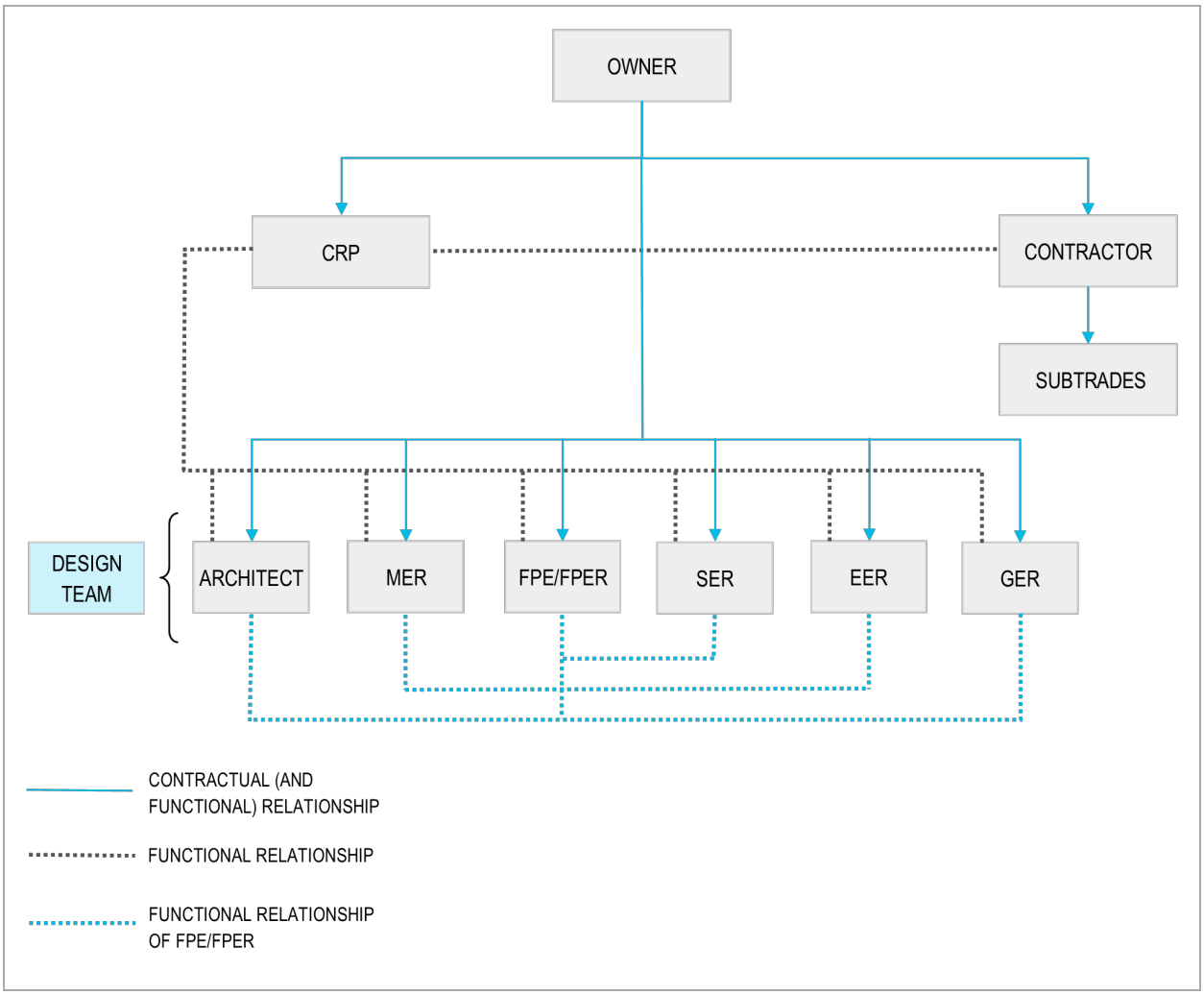
FIGURE E1: FPE/FPER CONTRACT WITH THE CRP



NOTES:

- The CRP may or may not be a member of the design team, but must be a Registered Professional.
- Abbreviations: CRP = Coordinating Registered Professional; EER = Electrical Engineer of Record; FPE = Fire Protection Engineer; FPER = Fire Protection Engineer of Record; GER = geotechnical engineer of record; MER = Mechanical Engineer of Record; SER = Structural Engineer of Record

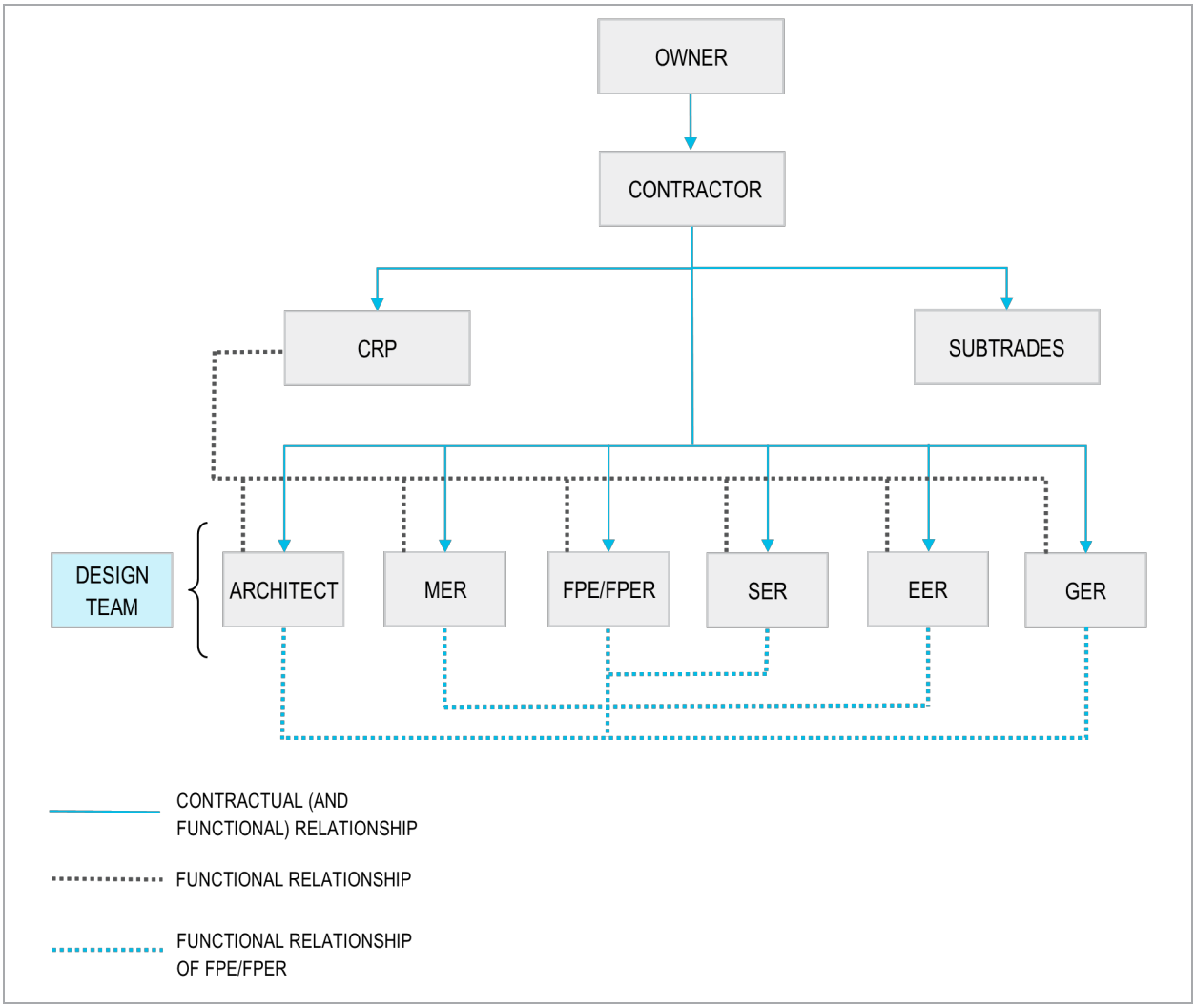
FIGURE E2: FPE/FPER CONTRACT WITH THE OWNER



NOTES:

- The CRP may or may not be a member of the design team, but must be a Registered Professional.
- Abbreviations: CRP = Coordinating Registered Professional; EER = Electrical Engineer of Record; FPE = Fire Protection Engineer; FPER = Fire Protection Engineer of Record; GER = geotechnical engineer of record; MER = Mechanical Engineer of Record; SER = Structural Engineer of Record

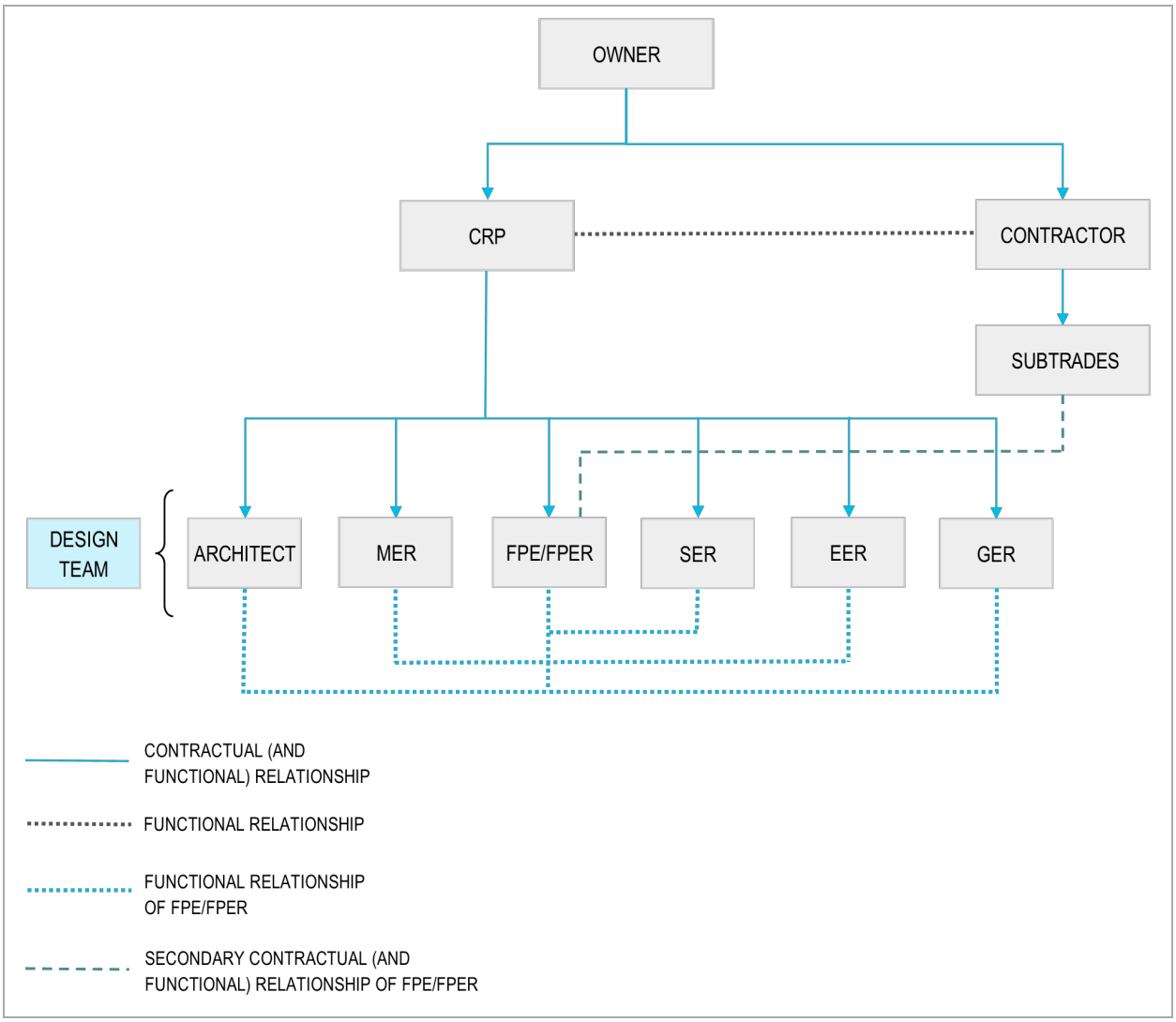
FIGURE E3: FPE/FPER CONTRACT WITH THE CONTRACTOR – DESIGN/BUILD CONTRACT



NOTES:

- The CRP may or may not be a member of the design team, but must be a Registered Professional.
- Abbreviations: CRP = Coordinating Registered Professional; EER = Electrical Engineer of Record; FPE = Fire Protection Engineer; FPER = Fire Protection Engineer of Record; GER = geotechnical engineer of record; MER = Mechanical Engineer of Record; SER = Structural Engineer of Record

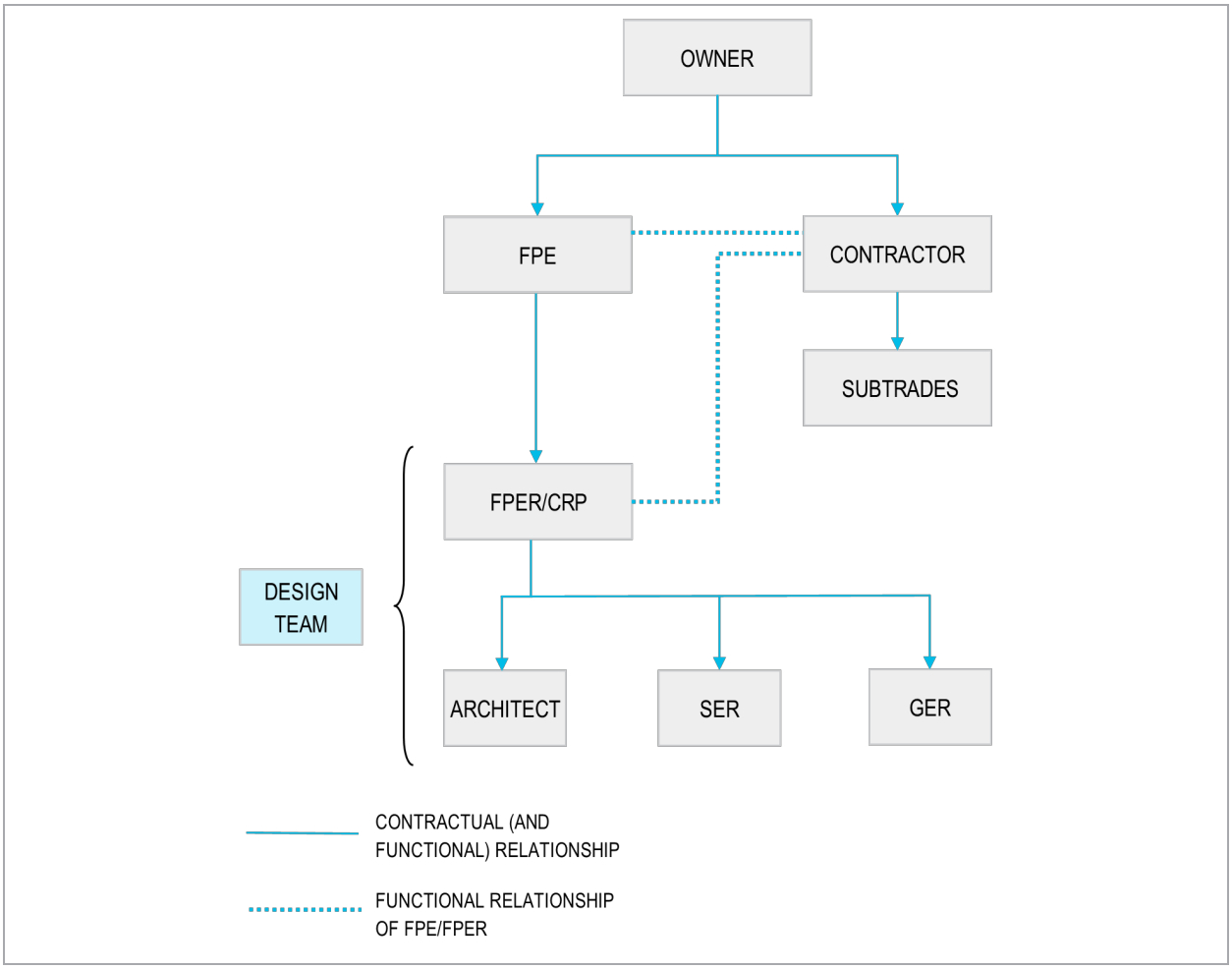
FIGURE E4: FPE/FPER CONTRACT WITH THE CRP AND SUBTRADES



NOTES:

- The CRP may or may not be a member of the design team, but must be a Registered Professional.
- Abbreviations: CRP = Coordinating Registered Professional; EER = Electrical Engineer of Record; FPE = Fire Protection Engineer; FPER = Fire Protection Engineer of Record; GER = geotechnical engineer of record; MER = Mechanical Engineer of Record; SER = Structural Engineer of Record

FIGURE E5: FPE/FPER AS CRP – RENOVATION OR COMPLEX PROJECTS WITH HIGH PERCENTAGE OF FIRE PROTECTION ENGINEERING SERVICES



NOTES:

- Fire analysis is conducted by the FPE.
- The FPER functions as the CRP.
- The FPER retains, or causes to be retained, Supporting Registered Professionals, as required.
- Abbreviations: CRP = Coordinating Registered Professional; FPE = Fire Protection Engineer; FPER = Fire Protection Engineer of Record; GER = geotechnical engineer of record; SER = Structural Engineer of Record

NOTES:

200 • 4010 REGENT STREET, BURNABY, BRITISH COLUMBIA, CANADA V5C 6N2
MAIN 604.430.8035 TOLL FREE 1.888.430.8035 EMAIL info@egbc.ca WEBSITE egbc.ca