DRAFT Minimum Standards for Fire Protection Engineering in the State of Oklahoma

1. **Introduction** - The intent of this document is to establish minimum standards for fire protection engineering conducted within the State of Oklahoma. The intended results of these standards are to promote public safety and lower construction costs by: streamlining design, review, and construction processes, and reducing financial burdens resulting from inconsistent fire protection practices. These minimum standards are necessary because:

   a. Fire protection engineering is not currently practiced consistently. This practice results in inconsistent and non-competitive bids from Contractors and from Engineers which creates financial hardships and increased delays in the design and construction process. It also presents unnecessary technical and administrative challenges to the various code authorities when performing construction and building systems plan reviews.

   b. Fire protection engineering is a critical engineering discipline to life safety and property protection. Fire protection engineering technology evolves rapidly, along with fire protection system design requirements, design technology, and system product technology.

   c. Building design requirements are, in some cases, granted significantly reduced requirements based on the presence of fire protection systems. Allowing more flexible building design because of the presence of fire protection systems highlights the importance that fire protection systems be properly designed, installed, and tested so that they function as desired when needed.

   d. The fire protection and life safety system design approach is currently distributed among multiple design disciplines including architects, mechanical engineers, electrical engineers, civil engineers, interior designers, and others depending on the project scope. These minimum standards do not aim to remove scope from qualified individuals. Rather, these minimum standards aim to provide a consistent fire protection and life safety quality assurance process, which results in improved safety from the effects of fire for building occupants, contents, and the building itself, a more amicable exchange with the fire protection Authorities Having Jurisdiction (AHJ), knowledge of fire protection and life safety-related code compliance issues prior to significant design development, and fire protection and life safety quality assurance which helps ensure coordination and accuracy of the overall design package.

Other states such as Texas, Florida, and Tennessee have officially recognized fire protection engineering minimum standards. In addition, this issue has been recognized and addressed by many national organizations. The National Society of Professional Engineers (NSPE), the National Institute for Certification in Engineering Technologies (NICET), and the Society of Fire Protection Engineers (SFPE) have developed a joint position statement, *The Engineer and the Engineering Technician Designing Fire Protection Systems*, which establishes minimum fire protection
engineering standards. The United States Department of Defense has developed minimum fire protection engineering standards, as documented in Unified Facilities Criteria (UFC) 3-600-01 *Fire Protection Engineering for Facilities*.

The recommendations set forth in these minimum standards borrow heavily from the references listed above.

2. **Applicability** – It is recommended that these standards be applied to all major new construction or renovation projects so that the life and property risk to the effects of fire are evaluated and mitigated. It is required that these standards be applied to any project that meets any of the criteria listed below. These thresholds are applicable to new construction or to renovations which cause these conditions to exist.

   a. Required by the building code official or fire protection authority having jurisdiction.
   b. Required by the building owner or design team.
   c. High Rise: Project results in a building which meets the IBC definition of a high rise.
   d. Inadequate Water Distribution System: Project results in a building which cannot be protected by the existing water distribution system; a fire pump and/or fire protection water storage tank would be required.
   e. High Challenge Fire Sprinkler System: Project results in a building which contains a hazard which requires protection in accordance with chapters 14, 15, 16, 17, 18, 19, 20, 21, or 22 of NFPA 13 (2013 Edition).
   f. Special Hazard Fire Suppression: Project results in a hazard which cannot be solely protected by an NFPA 13 fire sprinkler system; this may include but is not necessarily limited to systems designed in accordance with: NFPA 11, NFPA 11A, NFPA 12, NFPA 12A, NFPA 15, NFPA 16, NFPA 2001, or NFPA 2010.
   g. Emergency Voice Evacuation System: Project results in a building which requires, or the owner requests, a voice evacuation system; this may manifest as a voice fire alarm system or a mass notification system designed in accordance with NFPA 72.
   h. Smoke Control: Project results in a building which requires an active or passive smoke control system; this may manifest as development of the design fire scenario and smoke control system performance criteria but does not imply FPEs are necessarily competent in design or selection of the air handling equipment (typically coupled with mechanical, electrical, and architectural disciplines to accomplish design goals).
   i. Special Inspections: Project results in required special inspections (as defined by the IBC) for fire protection-related systems; this may manifest as special inspections for sprayed fire resistant materials, fire-resistant coatings, fire resistant penetrations and joints).
   j. Flammable and Combustible Materials: Project results in a building which stores or uses flammable or combustible materials in excess of the IBC tabular values in a single control area.
   k. High Hazard Occupancy (Group H): Project results in a building which meets the IBC definition of a high hazard occupancy (Group H).
2.3 **Definitions**

a. **Fire Protection Engineer** – An Oklahoma Licensed Professional Engineer (hereinafter referred to as an “Engineer”) who demonstrates sound knowledge and judgment in the application of science and engineering to protect the health, safety, and welfare of the public from the impacts of fire. Specifically, this individual shall meet one of the following conditions:

   i. Passed the Principles and Practice of Engineering Exam in Fire Protection administered by the National Council of Examiners for Engineering and Surveying (NCEES).

   ii. Passed an NCEES Principles and Practice of Engineering Exam in a related engineering discipline who demonstrates sound knowledge and judgment in the application of science and engineering to protect the health, safety, and welfare of the public from the impacts of fire. This includes the ability to apply and incorporate a thorough understanding of fundamental systems and practices as they pertain to life safety and to fire protection, detection, alarm, control, and extinguishment. This could include, but is not limited to:

      1. **Fire Protection Analysis:** A basic understanding of hazard analysis, risk analysis, and economic analysis techniques. A working knowledge of codes and standards, occupancy and hazard classifications, fire test methods, and the interpretation of fire test data.

      2. **Fire Protection Management:** A basic understanding of the capabilities and limitations of design, facility impairment procedures, and inspection frequencies.

      3. **Fire Science & Human Behavior:** An ability to apply principles of fire dynamics as related to fire and smoke behavior, fire growth, combustion, materials properties, and heat transfer. A basic knowledge of human response principles as related to evacuation movement, human response to fire cues, and timed egress analysis.

      4. **Fire Protection Systems:** An ability to assess and design water-based fire suppression systems, special hazard systems, fire alarm systems, smoke management systems, and explosion protection systems.
5. Passive Building Systems: A working knowledge of the principles of building construction as they relate to fire protection, such as construction types, construction materials, interior finish, structural fire resistance, compartmentalization, vertical openings, and the protection of openings. The ability to assess adequacy of means of egress taking into account exits, occupancy, occupant loads, emergency lighting, and the marking of the means of egress.

b. Contractor – The Oklahoma licensed company (hereinafter referred to as a “Contractor”) who provides the personnel, products, and submittals necessary to complete the system installation dictated by the engineering documents.
   i. It is the intent of these standards that all Contractors comply with the Oklahoma statutes and rules governing their industry, in addition to these standards.

c. Certified Fire Protection Engineering Technician – An individual (hereinafter referred to as a “Technician”) who has achieved NICET LEVEL III or IV certification in the appropriate subfield and who has the knowledge, experience, and skills necessary to layout fire protection systems. The decision of whether the Technician shall be Level III or IV is made by the Engineer based on system complexity.
   i. This standard was written to match the SFPE/NSPE/NICET Joint Position Statement which defines a “Technician” as above, which is different than how a “Technician” is described in the Oklahoma Department of Labor’s Alarm and Locksmith Industry Rules. It is not the intent of this standard to modify the Alarm and Locksmith Industry Act or Rules.

3.4. Engineer’s Responsibility - The guidelines below include those scenarios most frequently encountered. This document shall not be used as a substitute for compliance with requirements from the Authority Having Jurisdiction (AHJ), any applicable design criteria, or sound engineering practice.
   a. Generally:
      i. Evaluate the entire project for fire protection and life safety related hazards and shall be a part of the design team to develop workable, integrated solutions.
      ii. Work with the architect and property owner during the project planning phase to determine required fire protection and life safety systems, and the fire protection and life safety-related code compliance approach.
      iii. Research and identify applicable fire and life safety codes and standards which shall be applied, or where no such standard exists, provide the engineering study, judgments, and/or performance based analysis and conclusions.
      iv. Develop fire protection and life safety related systems commissioning and acceptance testing requirements.
      v. All tasks which are considered “the practice of engineering” by the state statutes (as interpreted by the Oklahoma State Board of Licensure for Professional Engineers and Land Surveyors) shall be performed or reviewed and approved by the Engineer (all final engineering documents shall be dated and...
bear the stamp, and signature of the Engineer as required by the Oklahoma State Board of Licensure for Professional Engineers and Land Surveyors).

vi. Supplemental detailed hydraulic calculations, voltage drop calculations, and other similar practices of engineering may be delegated in the project specifications to the Technician. When supplemental detailed calculations are delegated to the Technician, the Engineer shall review and approve the submittal, but shall not be required to affix their professional engineering stamp and signature.

vii. Ensure the project site and building have been properly designed to accommodate the fire protection systems. For example, the Engineer shall ensure that the design team (Electrical, Mechanical, Architect in this example) have properly designed the building to accommodate the fire pump (electrical service, fire-resistance rated construction, ventilation, drainage, etc.).

1. The Engineer is not expected to review their design for correctness, as that is ultimately the responsibility of the associated discipline’s engineer, but the Engineer shall ensure the coordination item was addressed.

viii. The Contractor may be made responsible for coordination of the location of their equipment with other trades (sprinklers with ceilings, piping with HVAC ductwork, fire alarm remote power supplies with dedicated branch circuits, and other similar coordination).

b. Design Phase

i. Engineering Documents

1. The Engineer shall develop engineering documents that clearly define the fire protection and life safety design criteria, functions, and features for the project, which solicit accurate, consistent, and competitive bids.

2. The specifications shall clearly establish the Contractor’s scope of work, qualifications, product performance, installation, detailed acceptance testing criteria, and the required documentation to be submitted and reviewed for approval.

3. When the Contractor has been made responsible for coordination with other trades for system installation, it shall be clearly stated on the engineering documents.

4. The engineering documents shall be of sufficient clarity to indicate the location, nature, and extent of the work proposed and show that they conform to the provisions of relevant laws, codes, ordinances, rules, and regulations.

ii. Fire Suppression Systems – The Engineer shall perform the following tasks, when applicable. The results and direction shall be clearly indicated on the engineering documents.

1. Determine if a system is required.

2. Determine the type of system(s).
3. Determine the performance discharge criteria of the system.
4. Evaluate the adequacy of the water supply system (i.e. determine if a fire pump and/or tank are necessary).
   a. Perform or witness hydrant flow test(s) in accordance with NFPA 291 (historical flow test data shall not be relied upon).
   b. Understand reliability, seasonal fluctuations, other demands on the water distribution system, and other significant factors which could affect the accuracy of the hydrant flow test data.
5. Evaluate environmental conditions of the water supply system (MIC corrosion potential, for example).
6. Locate system riser, backflow prevention assembly, fire pump, fire department connection and other major equipment which must be coordinated with other design trades (detailed system design such as sprinklers, hangers, and detailed piping may be delegated to the Contractor).
7. Locate the main routing where the building design (aesthetic or functional) limits main routing to a particular route.
8. Locate water flow switches.
9. Locate local exterior waterflow alarm.
10. Locate all control valves and define method of supervision to be provided.
11. Coordinate fire protection-related site design features with Civil Engineer (i.e. hydrant spacing, fire department connection, valves controlling water supply, design of private fire service main, fire department access, fire lanes, etc.).
12. Coordinate structural hanging and penetration requirements with project Structural Engineer.
14. Determine applicable product performance requirements.
15. Determine if protection from earthquakes is required.
16. If a fire pump, fire protection water storage tank, or other equipment necessary to supplement the water supply are required, the Engineer shall establish their type, size, location, installation details, and other requirements necessary to solicit competitive bids.

iii. Fire Detection and Notification Systems - The Engineer shall perform the following tasks, when applicable. The results and direction shall be clearly indicated on the engineering documents.
   1. Determine if a fire alarm, mass notification, or other emergency communication system is required.
   2. Determine the type of system(s).
   3. Develop system concept riser diagram(s).
4. Locate the fire alarm control panel and ensure the building design can accommodate (proper environmental conditions, electrical service, wall construction if recessed, etc.).
5. Locate all system initiating devices.
6. Locate all system notification appliances, audible, visual, and textual. Include all strobe candela settings and speaker tap settings.
7. Locate equipment necessary to accomplish emergency control function interface (modules for door release, emergency elevator functions, pump and tank supervision, HVAC controls, etc.).
8. Identify all system input and output functions (input/output matrix or sequence of operations).
9. Identify mode (public or private) of audible and visual notification.
10. Identify acoustically distinguishable spaces (ADS) in accordance with NFPA 72.
11. Identify intelligibility requirements for each ADS.
12. Identify design ambient sound pressure levels and required audible notification sound pressure levels.
13. Identify circuit classification requirements.
14. Identify circuit survivability requirements.
15. Identify secondary power supply requirements.

iv. Special Hazard Fire Suppression Systems - The Engineer shall perform the following tasks, when applicable. The results and direction shall be clearly indicated on the engineering documents.
   1. Determine if a special hazard fire suppression system is required.
   2. Determine the type of the system(s).
   3. Identify the hazard area and the hazards to be protected, including the fire barrier wall requirements and fire dampers.
   4. Identify minimum design concentration, normal cylinder storage temperature, cylinder location, and control panel location.
   5. Identify system interfaces and customer requirements.
   6. Identify all system input and output functions (input/output matrix or sequence of operations).

c. Construction Phase
   i. Submittal Review
      1. The Engineer shall review all submittals required by the engineering documents (shop drawings, product data, detailed calculations, e.g.) for compliance with the engineering documents.
   ii. Construction Observation
      1. Visit the project site as necessary to ensure the systems are installed in compliance with the engineering documents and approved submittals.
      2. Verify the accuracy of the contractor’s red-lines and/or as-built drawings (minimum is to at least perform a ‘spot check').
3. Documentation of construction observations shall be made available to the AHJ or inspector upon request.

iii. Acceptance Testing
1. Witness all acceptance tests and/or commissioning of fire protection systems and sign the acceptance test documentation developed by the Contractor upon their successful completion.

d. Overall Fire Protection and Life Safety Quality Assurance
i. The Engineer shall review the entire design package for fire protection and life safety system design code compliance and coordination prior to submittal to the AHJ. NOTE: It is NOT the AHJ’s responsibility to correct design errors. This review shall include (but not necessarily limited to):
   1. Occupancy classification
   2. Construction type
   3. Maximum allowable height and area
   4. Means of egress (width, arrangement, components)
   5. Fire- and/or smoke-resistance rated construction location and details
   6. Multi-discipline coordination with fire-resistance rated construction (firestopping, dampers, etc.)
   7. Fire extinguisher selection and placement
   8. Exit signage and emergency lighting
   9. Fire protection water supply distribution systems
 10. Fire department access
 11. Fire lanes
 12. Signage for fire protection equipment room

ii. The Engineer shall write a basis of design document which describes the overall project design approach to fire protection and life safety-related code compliance. This document shall be retained by the Engineer and shall be made available to the AHJ upon request.

iii. Where the project design approach includes performance-based fire protection and/or life safety design, the Engineer shall be responsible for the approach development and documentation. Performance-based fire protection and/or life safety design shall be in compliance with the SFPE Engineering Guide to Performance-Based Fire Protection. The Engineer responsible for the performance-based design/alternative shall also perform verification to ensure the system(s) were installed and functioning in accordance with the approved performance-based design/alternative.

iv. Where the project design approach involves alternative materials, design, or methods which involve fire protection and life safety systems, the Engineer shall be responsible for the approach development and documentation.

4.5 Technician’s Responsibility
a. Generally
i. Comply with all Oklahoma statutes and rules governing their industry.
ii. Be able to provide documentation of involvement in the submittal, installation, and acceptance testing process described below and as required by the engineering documents.

b. Submittals
   i. Develop or immediately supervise the development of all submittals required by the engineering documents.
   ii. All submittals shall be submitted to the Engineer before forwarding to the AHJ. Upon receipt of submittal approval from the Engineer, the Technician shall then submit to the AHJ for construction permit.
   iii. Perform the detailed system layout required by the engineering documents based on the equipment specifically selected to be used on the project.
   iv. Perform the supplemental detailed calculations required by the engineering documents.

c. Construction
   i. Periodically visit the project site to confirm system installation is in compliance with the engineering documents and approved submittals.
   ii. Attend all acceptance tests and sign acceptance test documentation upon their successful completion.
   iii. Ensure the system as-built drawings and/or red-lines are accurate.

5.6 References
   e. State of Tennessee Department of Commerce and Insurance Board of Architectural and Engineering Examiners, Appendix A, Standard of Care for Fire Sprinkler System Design
   g. Texas Board of Professional Engineers Policy Advisory, Planning of Fire Sprinkler Systems (April 22, 2004)
   i. Oklahoma State Board of Licensure for Professional Engineers and Land Surveyors, Regulations and Statutes