THE EVOLVING ROLE OF THE FIRE PROTECTION ENGINEER

SAME
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Dan Brace, FPE
Fire Protection Engineer

Dan Brace, P.E., is a licensed fire protection engineer with **Pond & Company**, with 10+ years of experience in fire protection engineering and consulting. Expertise includes the design and analysis of fire sprinkler, fire alarm, mass notification, special hazard, clean agent, and foam fire suppression systems. He has successfully managed and delivered projects for both private and government clients, domestically and internationally.

Dan Brace, PE

POND - Fire Protection Engineer IV

Peachtree Corners, GA

Experience

- **10+** Years in the Fire Protection Industry

Education

- BSET - Fire Protection and Safety Engineering Technology - Oklahoma State University.

PRESENTATION OVERVIEW

Section 1 – History

- Early Building and Fire Laws
- Development of Building and Fire Codes

Section 2 – Role of the Fire Protection Engineer

- The Connection Between Codes and the Fire Protection Engineer
- What is a Fire Protection Engineer?
- Role of the Fire Protection Engineer – DoD
- Project Examples

Section 3 – Summary and Q&A

ACRONYMS:

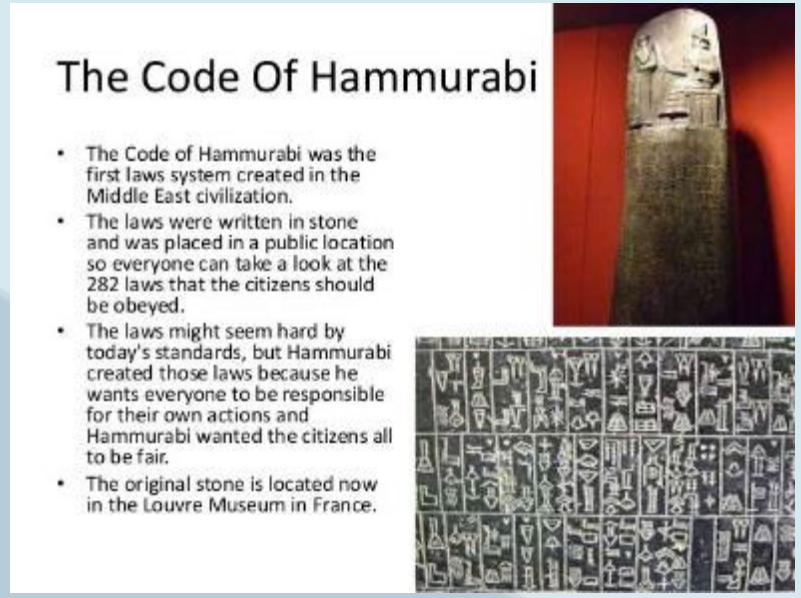
- AHJ – Authority Having Jurisdiction
- FPE – Fire Protection Engineering(er)

EARLY BUILDING AND FIRE LAWS

The First Documented Building Code

The Code of Hammurabi ~ c. 1,300 BC.

- If a builder has built a house for a man and his work is not strong, and if the house he has built falls in and kills the householder, that builder shall be slain.
- If the child of the householder be killed, the child of that builder shall be slain.
- If goods have been destroyed, he shall replace all that has been destroyed.
- If a builder has built a house for a man, and his work is not done properly and a wall shifts, then that builder shall make that wall good with his own silver.



EARLY BUILDING AND FIRE LAWS

The earliest recorded building laws were concerned with the prevention of collapse.

Under the reigns Julius and Augustus Caesar, Rome became the site of a large number of hastily constructed apartment buildings – may of which were erected to considerable heights. Due to structural failure and collapse, laws were passed that limited the heights of buildings.

Later in history there evolved many building regulations for preventing fire and restricting its spread.

London 14th Century

- An ordinance was issued requiring that chimneys be built of tile, stone, or plaster; the ordinance prohibited the use of wood for this purpose.

EARLY BUILDING AND FIRE LAWS

1871 – Chicago Fire

Chicago, IL

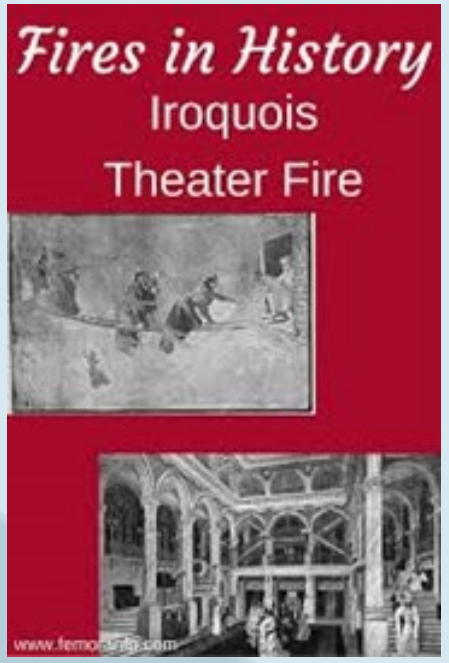
- 17,430 buildings destroyed.
- **250** people killed.
- $168M Loss.
- 56 insurance companies bankrupted.

Reaction:

1903 – Iroquois Theatre Fire

Chicago, IL (stage curtain fire)

- 602 people killed due to:
  - Exits covered by curtains
  - No exit signs
  - Locked exits
- New Laws enacted:
  - Visible lighted exit signs
  - Fire resistance curtains
  - Prohibited locked exits
  - Door swing in direction of travel



Hot Stage Light Ignited Velvet Curtain; Flammable Oil Paint Backdrops.

Worst Theatre and Single Building Fire in American History.

Section 1

EARLY BUILDING AND FIRE LAWS

1908 – Rhodes Opera House

Boyertown, PA (stage fire)

- 170 people killed due to:
  - Insufficient number of Exits
  - Blocked exits
  - Locked exits

Reaction:

- New Laws enacted:
  - Adequate number of exits
  - Fire escapes
  - Prohibited locked exits
  - Prohibited blocked exits

1911 – Triangle Shirtwaist Factory

New York City, NY (fabric fire)

- 146 people killed due to:
  - All exits locked
  - Insufficient number of fire escapes (1) (jumping to their deaths)

Reaction:

- New Laws enacted:
  - Prohibited locking of exit doors
  - Door swing in direction of travel

DEVELOPMENT OF BUILDING AND FIRE CODES

Code Development

1913 – Appointment of the **NFPA Committee on Safety to Life.**

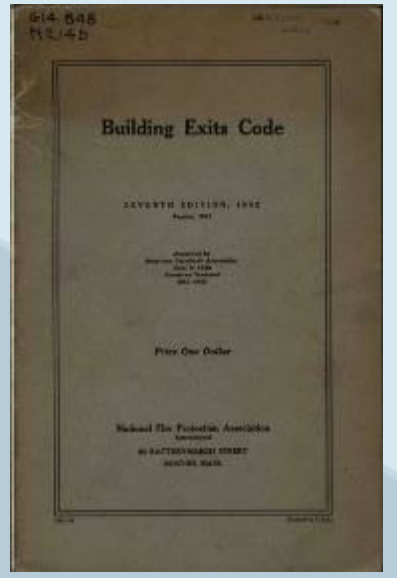
Previous examples are largely responsible for the appointment.

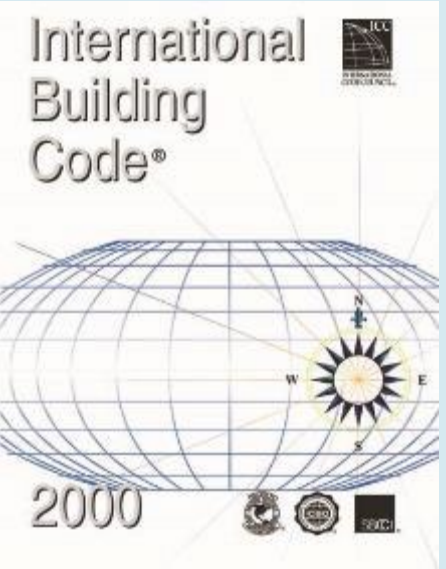
1927 – NFPA Committee on Safety to Life published its first edition of the **NFPA Building Exits Code** (eventually, the "*Life Safety Code*").

1995 – **ICC** was established by ICBO, SBCCI and BOCA.

2000 – First edition of **IBC and IFC** are published.

2002 – **UFC** program was formally established by a memor`andum from the Under Secretary of Defense (AT&L).





CONNECTION BETWEEN CODES & FPE

History has shown us that building codes were based largely on historical **fire** events, and to some extent occupant safety. (**Reactive**)

More than 50% of modern building codes refers to **fire protection and life safety** in the built environment, such as:

- Building Separation Distances
- Fire Resistance Rated (FRR) Construction (Passive Protection)
  - Types of Construction (Type I-A, I-B, II-A, II-B, etc.)
  - Compartmentation (limitation strategy)
- Fire and Smoke Protection Features (Passive Protection)
  - Structural FRR (stability)
  - Fire Wall / Barriers / Partitions (FRR separations)
  - Protection of Vertical Openings (smoke migration – occupant protection)

CONNECTION BETWEEN CODES AND THE FPE

- Interior Finishes (Passive Protection)
  - Flame Spread Ratings
- Fire Protection Systems (Active Protection)
  - Fire Suppression Systems
  - Fire Alarm Systems / Mass Notification Systems
  - Smoke Control Systems
- Means of Egress (MOE) Components
  - Evacuation Protection from Hazard
  - Exits (quantity, location, etc.)
  - Travel Distances to Exits
  - Exit Signs
  - Emergency Lighting (during occupant evacuation)

WHAT IS FIRE PROTECTION ENGINEERING

What is Fire Protection Engineering?

Fire Protection Engineering is the application of science and engineering principles to protect people and their environment from destructive fire, including but not limited to:

- Analysis of fire hazards,
- Mitigation of fire damage by proper design, construction, arrangement and use of buildings, materials, structures, industrial processes, and transportation systems,
- The design, installation and maintenance of fire detection and suppression and communication systems, etc.
- "Whole Building Design" Concept

Engineering A Fire Safe World ®

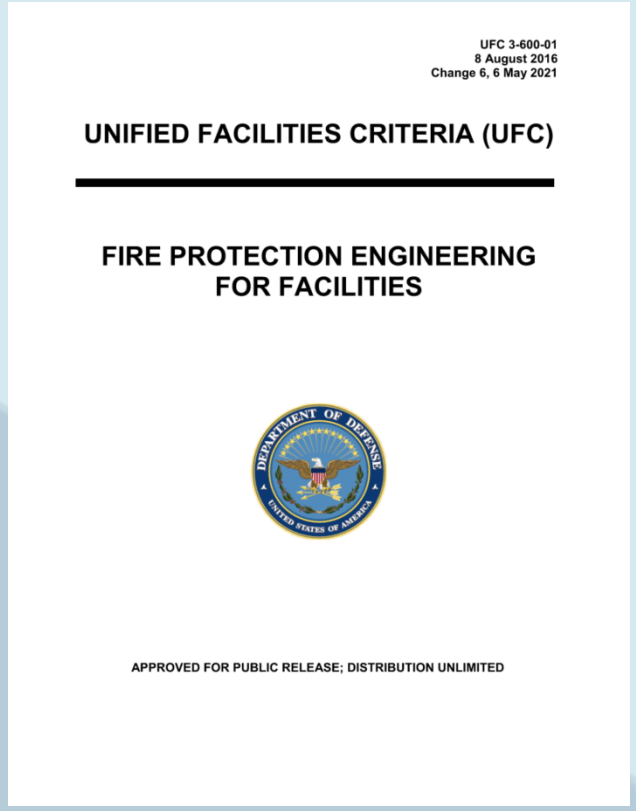
ROLE OF THE FPE – DoD

What is the Role of the Fire Protection Engineer?

THE DEPARTMENT OF DEFENSE (DoD) PERSPECTIVE

- **UFC 3-600-01 (Change 6), Fire Protection Engineering for Facilities**, defines Three FPE roles, the "***DFPE***", "**CFPE**", and the "***QFPE***." (**2-1.16**) ALL have specific responsibilities.

The Fire Protection Engineer is the only discipline that is specifically required by UFC and specifically defined.



UFC 3-600-01
8 August 2016
Change 6, 6 May 2021

UNIFIED FACILITIES CRITERIA (UFC)

FIRE PROTECTION ENGINEERING FOR FACILITIES

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ROLE OF THE FPE - DoD

Component Fire Protection Engineer (*CFPE*)

- This is a government held position (usually)
- 2-1.4 - “Where the codes and standards referenced in this UFC refer to an individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure will be interpreted to mean the CFPE.”
- CFPE offices are as follows :

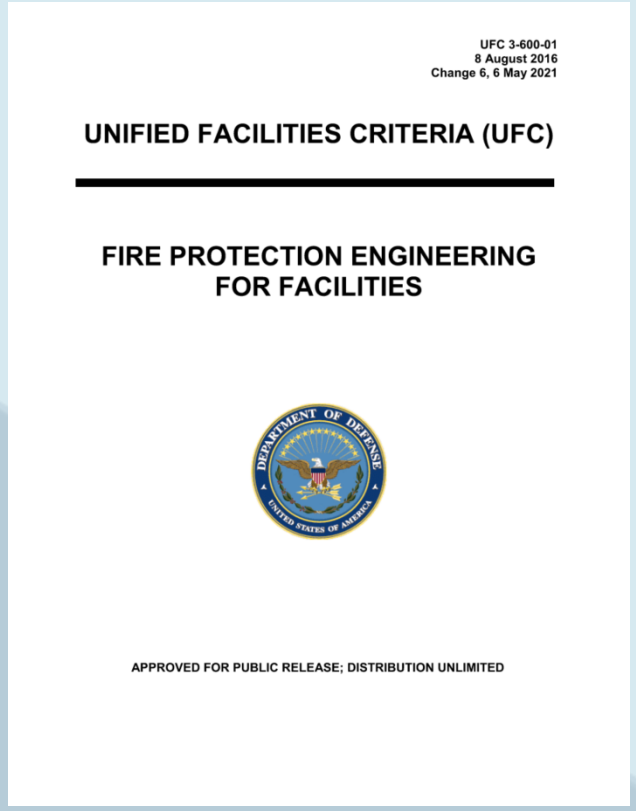
  U.S. Army - HQ USACE/CECW-CE.

  U.S. Navy - NAVFACENGSYSCOM HQ, Chief Fire Protection Engineer.

  U.S. Marine Corps - HQMC Code LF.

  U.S. Air Force - AFCEC/CO.

- This is the must be a Licenses Fire Protection Engineer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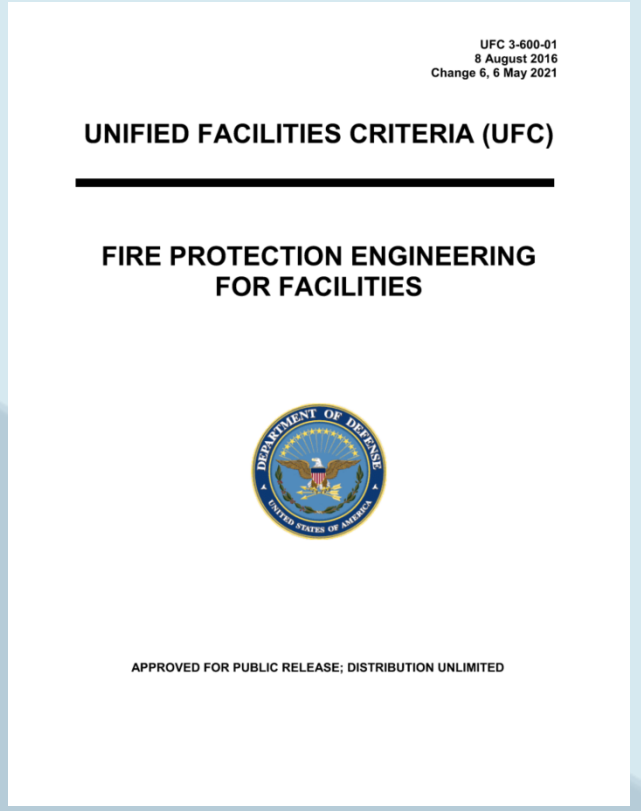
ROLE OF THE FPE - DoD

Designated (or Service) Fire Protection Engineer (*DFPE*)

- This is a government held position (usually) typically at the installation or regional level
- 2-1.16.1 - “The DoD fire protection engineer that oversees that Area of Responsibility for that project. This is sometimes referred to as the ‘cognizant’ fire protection engineer.

  Note 1: For USACE, this is usually the District or Center FPE.

  Notes 2: For NAVFAC, this is usually the Facilities Engineering Command (FEC) FPE.”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ROLE OF THE FPE - DoD

What are the Specific Responsibilities of the DFPE?

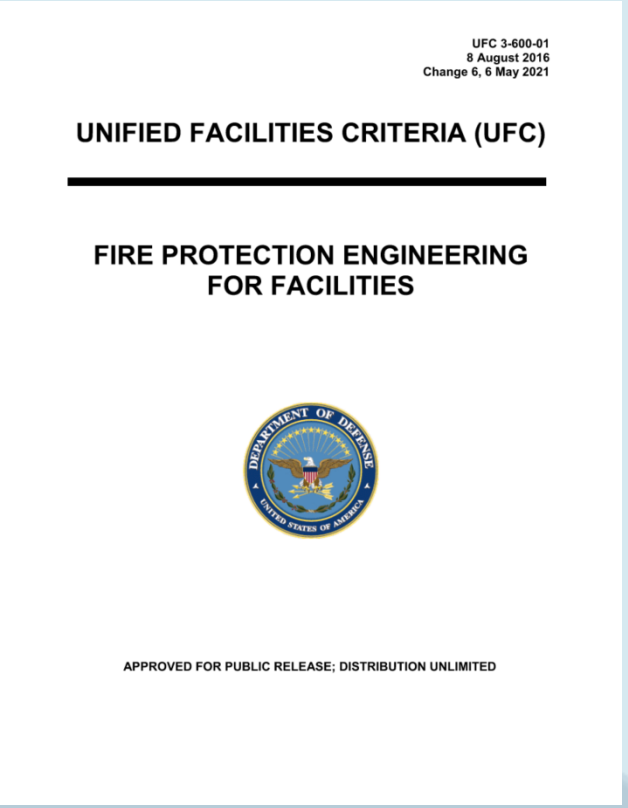
UFC 3-600-01; 1-12:

- "It is the DoD's responsibility to determine whether or not the *Installation* infrastructure is adequate to support the project. (1-12.1.1.1) Including water supply (1-12.5.1) and fire department access.
- The "The *DFPE* must **determine if a *Reliable Power Source* is available to the *Installation* or *Facility* in the planning stages** of the project in order to ensure that the cost and space associated with secondary power is considered and included in the project." (1-12.7.2)
- "The *DFPE* must **determine if an automatic sprinkler or other fire suppression system is required for the *Facility*** (1-12.8.1)
- The *DFPE* must **determine if sprinkler protection must be provided for facilities less than 5,000-sq.ft."** (1-12.12.1).
- Review shop drawings that bear the *Review Stamp* of the *QFPE*. (9-6.3.2 / 9-18.2)
- As well as many other duties!

ROLE OF THE FPE - DoD

Qualified Fire Protection Engineer (*QFPE*)

- 2-1.15.2.1 - “The engineer of record (sometimes referred to as the designer of record) or the fire protection quality control engineer.”
- 2-1.16.2.2 – “An individual who is a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience.”
- 2-1.15.2.3 – “For Army, an individual who is a registered professional engineer with experience designing all facets of fire protection and life safety systems for at least three projects with the same type of facility and system(s) as utilized in the project, including responsibility for fire suppression, life safety (including building code analysis) and fire alarm and mass notification systems.”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ROLE OF THE FPE - DoD

What are the Specific Responsibilities of the QFPE?

UFC 3-600-01;1-7.1.1. *Major Projects* require:

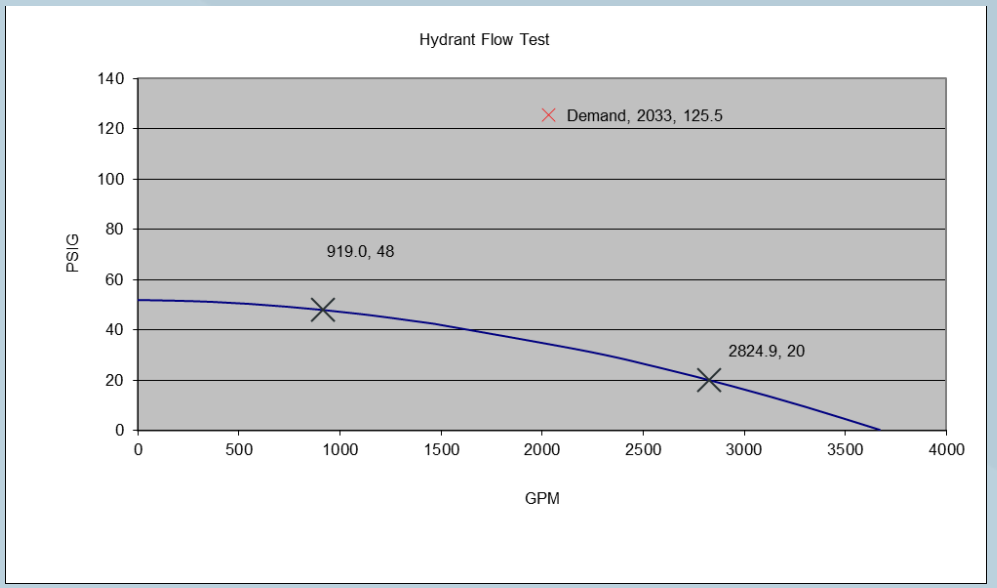
- "The design, review and oversight services of a **QFPE**."
- The "**QFPE must** be involved in every aspect of the design, **construction and testing/commissioning** as it relates to fire protection and life safety. This includes, but is not limited to:
  - Water Flow Test/ Water supply analysis
  - Design of automatic fire alarm, detection, mass notification and suppression systems
  - Building Code Analysis
  - Life safety code analysis (1-7.2.2)
  - Life Safety Plan (1-7.2.3)
  - Code Compliance **Site Plan** (1-7.2.4.2)
  - A multi-discipline review of the entire project
  - Construction inspections and witnessing of fire protection acceptance testing/commissioning."

ROLE OF THE FPE - DoD

- The **QFPE** must review the shop drawings, hydraulic calculations and material submittals. Shop drawings must bear the **Review Stamp** of the QFPE prior to submitting the fire **extinguishing** / fire **alarm** system shop drawings to the DFPE. (9-6.3.2 & 9-18.2)
- For Army projects, construction (shop) drawings and calculations must **be prepared by, or prepared under the immediate supervision, of the QFPE**. The **QFPE** must **affix their professional engineering stamp with signature to the shop drawings, calculations and material data sheets**, indicating approval prior to submitting the fire **extinguishing** / fire **alarm** system shop drawings to the DFPE. The **QFPE** must **monitor the installation of the fire protection /fire alarm systems and certify in writing that the fire protection / fire alarm systems have been constructed and operate as intended in the design plans and specifications**. (9-6.3.2 & 9-18.2)

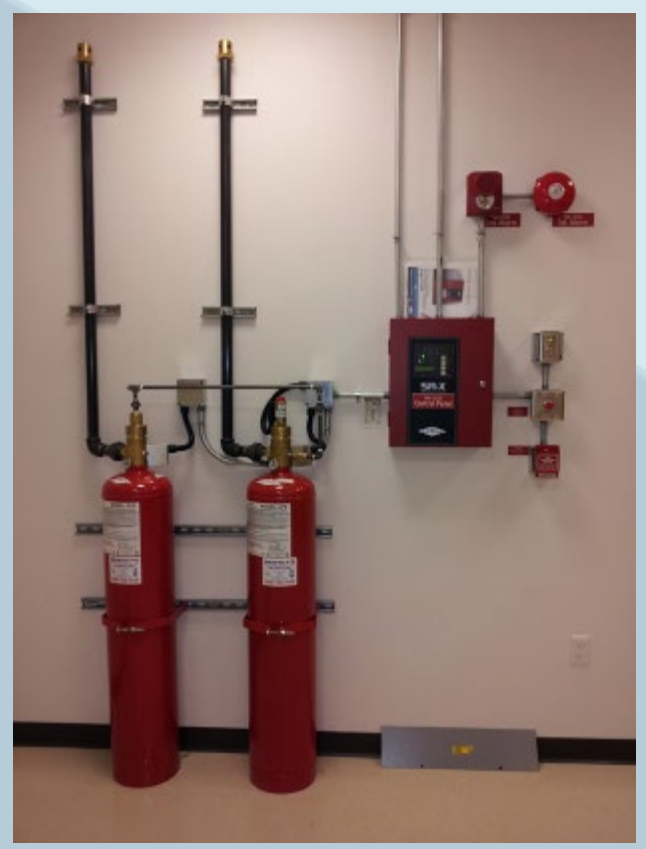
ROLE OF THE FIRE PROTECTION ENGINEER

- Perform/ Witness Fire Hydrant Flow Test; Water Supply Analysis
  - Conduct waterflow tests, in accordance with the procedures contained in NFPA 291 to determine available water supply for the water-based fire extinguishing systems. The flow test must be performed under the direction of the **QFPE**. (9-6.4)
  - "Hydraulic calculations should be based on a waterflow test that was performed no more than 6 months prior to submission of the calculations."
  - Requires a graphical analysis of the relationship



ROLE OF THE FIRE PROTECTION ENGINEER

- The design of fire pump, water storage tank and special hazard systems



ROLE OF THE FIRE PROTECTION ENGINEER

- Design fire suppression and fire alarm/ mass notification systems for all types of facilities and projects.

ROLE OF THE FIRE PROTECTION ENGINEER

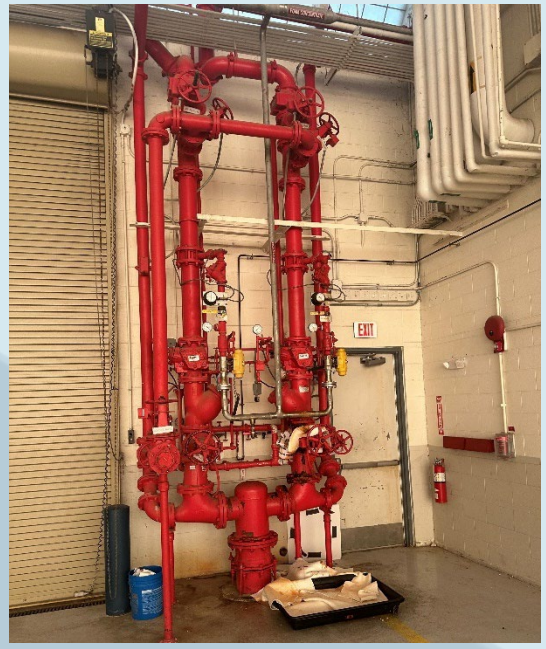
AND ALSO, THIS:

- Code Consulting
- Code Equivalencies
- Life Safety Evaluations
- Performance Based Design Alternatives
- Preparation of Variance Requests
- Life Safety & Building Code Compliance Review & Due Diligence
- Fire Sprinkler System Design & Evaluation
- Fire Alarm System Design & Evaluation
- Mass Notification System Design & Evaluation
- Special Hazards Systems (Foam, Clean Agent) Design & Evaluation
- Assistance with Hazardous Materials Management Plans
- Smoke Control Rational Analysis Reports, Systems Assessments, & Modeling
- Smoke Control Special Inspector – Systems Inspections & Commissioning
- Construction Period Services

Section 3

Project Examples

- Project Examples:
  - PACAF – DET 2 Planning
    - HQ – Yokota AB, Japan
  - TXANG – Hangars
    - AF Sundown Policy
  - Joint Base Andrews – 747 Hangar
    - Large hangar “campus” with multi facility design central pump system.
  - Hill AFB – Munition Operations Facilities.
    - High hazard maintenance/ordnance packaging bay with ICD 705 space
  - Many facilities at Robins AFB.



Section 3

SUMMARY

- Fire protection and life safety features are inherent considerations in Codes.
- Early fire and life safety concerns lead to fire research and development, and eventually evolved into Fire Protection Engineering programs of study, as a distinct, professional discipline.
- Authorities Having Jurisdiction (AHJ), especially the DoD, recognize the **Role of the FPE,** value the FPE as an "**integral part of the design team**", and as such, require the FPE to be involved at the beginning of the design process and through to completion, to develop and ensure the **"Whole Building" Design** concept.
- AHJ requires the FPE to perform safety analysis and develop design documents for **submission at all major milestones** throughout a project's progression timeline.
- Fire Protection Engineers work together will all disciplines, owners, and users to design functional and safe buildings to protect the mission (operations), its assets, property and lives!

Questions?

Dan Brace, FPE

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