Sprinkler Protection for Data Centers

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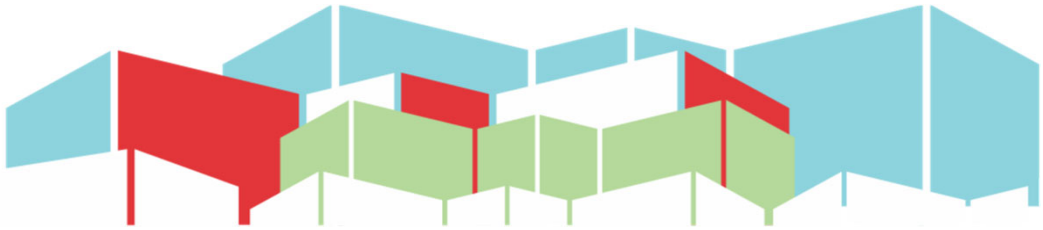

John August Denhardt, P.E., ET, CWBSP, FSFPE

AMERICAN FIRE SPRINKLER ASSOCIATION

John August Denhardt, P.E., ET, CWBSP, FSFPE, is the vice president of engineering and technical services for the American Fire Sprinkler Association (AFSA). He is responsible for strengthening AFSA's engineering and technical approaches to meeting member, industry, and operational priorities, with an emphasis on service, quality, and integrity. Denhardt is a registered professional engineer (P.E.) in the District of Columbia as well as the states of Delaware, Maryland, Pennsylvania, and Virginia. He is NICET Level III certified in water-based systems layout, NICET Level III certified in inspection and testing of bater-based systems, and a certified water-based system professional through NFPA. Denhardt is a member of the NFPA 13 technical committee on sprinkler system discharge criteria, a fellow in the Society of Fire Protection Engineers (SFPE), a member of the SFPE Board of Directors, a member of the Board of Trustees for NFPA's Fire Protection Research Foundation and sits on the University of Maryland Department of Fire Protection Engineering's Board of Visitors. A native of Maryland, Denhardt holds a Bachelor of Science degree from the University of Maryland, College Park in fire protection engineering. Prior to this role, Denhardt was employed by Strickland Fire Protection in Forestville, Maryland since 1994, overseeing large-scale projects and assisting with design and installation technical issues.



Vice President, Engineering and Technical Services

Understanding Data Centers

Types, Tiers, and Risks

Modern Types of Data Centers

Cloud

- Off-premises hosted by cloud service provider







Managed/Colocation

- Space that is rented by one or more companies, owned by others







Enterprise

- A specific company owns, builds, and manages the data center









Data Center Tiers

	Redundancy In:		Protection Provided For		Client-Side	
	Power	**Cooling**	**Downtime**	**Fault Tolerance**	**Cost Level (Relative)**	**Type**
Tier 1					$	Small business, Office
Tier 2	✓	✓			$$	Investment firms, Colocation groups
Tier 3	✓	✓	✓		$$$	Google, Amazon
Tier 4	✓	✓	✓	✓	$$$$	Government, Security, etc.



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Common Causes for Data Center Fires







Actual Fires

- Markley, Boston, MA
  - Managed data center
  - Shorting power supplies
  - Battery cabinet explosion



- Google, Council Bluffs, IA
  - Enterprise data center
  - Cabinet arc flash explosion
  - Three injuries



The Cost of Fire

- 59 civilian injuries
- $370 million in property damage
- Operational costs
  - ~$9,000 per minute of downtime
  - 20% contract value from service level agreements
  - Recovery costs





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History of the Hazard









Protecting Data Centers

NFPA Codes & Standards



NFPA Codes and Standards for Data Centers

- NFPA 75
- NFPA 855
- NFPA 13
- NFPA 2001
- NFPA 72
- NFPA 90A
- NFPA 220
- NFPA 750
- NFPA 770

Where to start?



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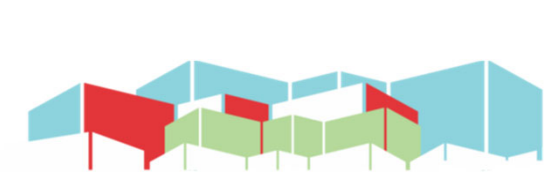
NFPA 75 Design Approaches

Prescriptive Design

- Chapter 4
  - Utilizes NFPA 13 (9.1.2) and:
    - Chapter 6 – Construction
    - Chapter 7 – Materials and Equipment
    - Chapter 9 – Fire Protection Equipment
    - Chapter 12 – Emergency Planning

Performance-Based Design

- Chapter 5
  - Goals and Objectives
  - Performance Criteria
  - AHJ Approval



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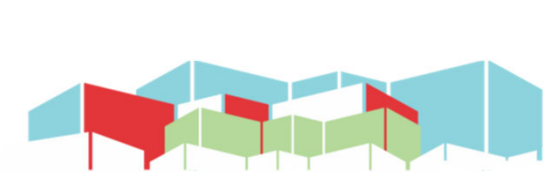
Fire Risk Assessment

Section 4.2.3

The following elements shall be considered to determine the level of acceptable fire risk in Information Technology Equipment(ITE) spaces:





Life Safety and Fire Threat





Fire Risk Assessment

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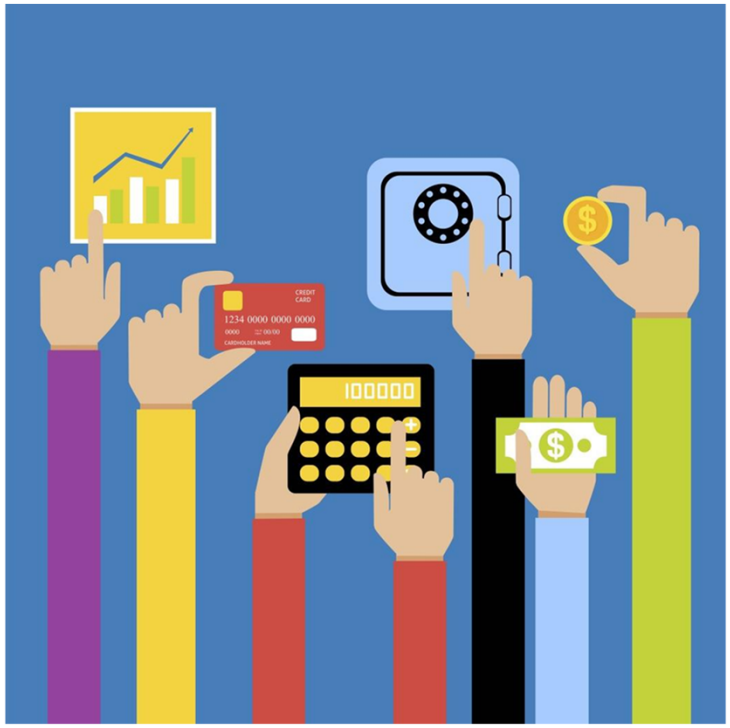
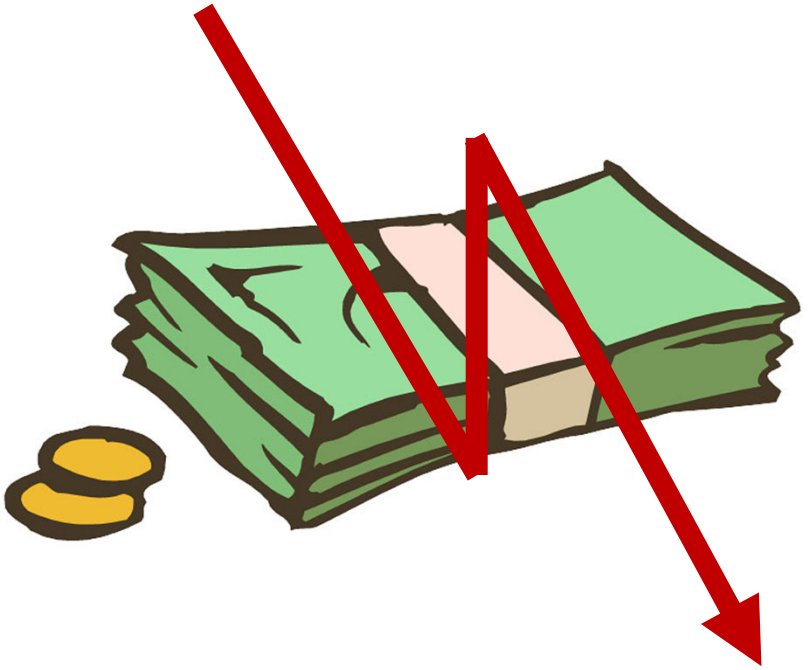
Economic Impact





Fire Risk Assessment

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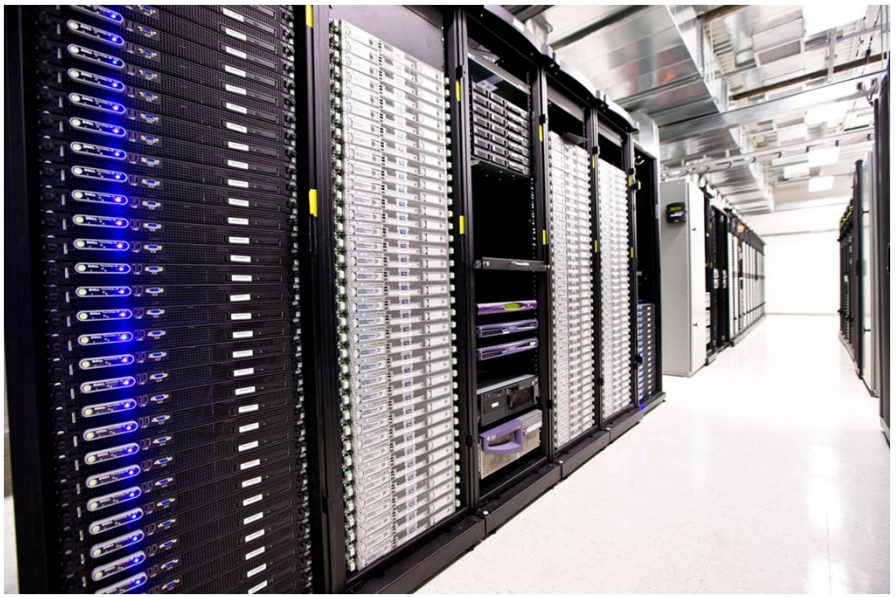
Invisible Damage



FERC

BLOCKBUSTER®

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Fire Risk Assessment

Features for Design







Fire Risk Assessment

Fire Department Capabilities





Fire Risk Assessment

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Questions for Design

- How important is this data center?
- Do you have backups?
- What type of protection can you use?



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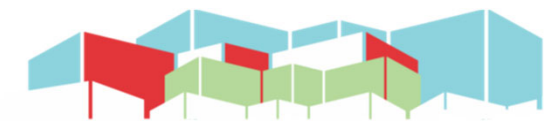
Protection of ITE Spaces

- Automatic sprinkler systems follow NFPA 13
- Systems protecting ITE areas shall be valved separately
- Smoke detectors to be used in accordance with NFPA 72
- ITE Personnel are to be thoroughly trained



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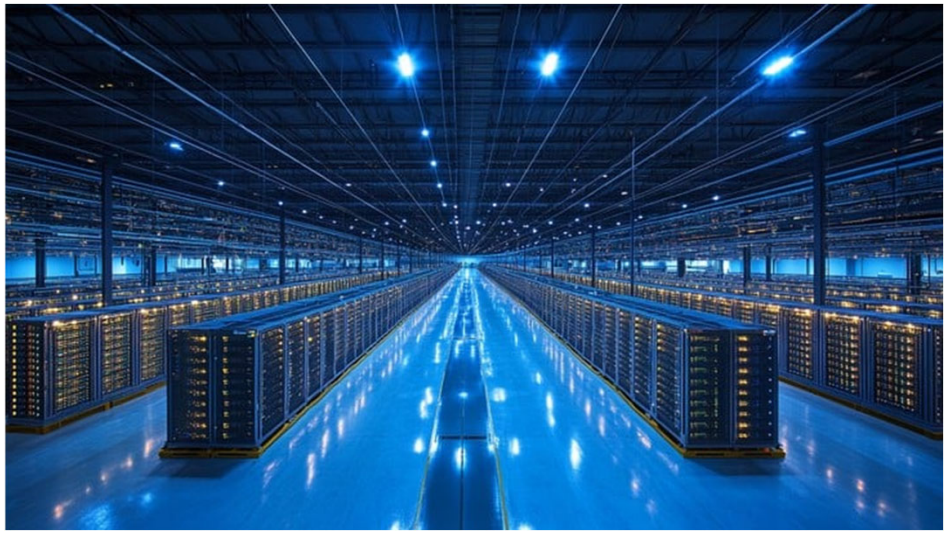
Chapter 9

Early Detection Location Requirements

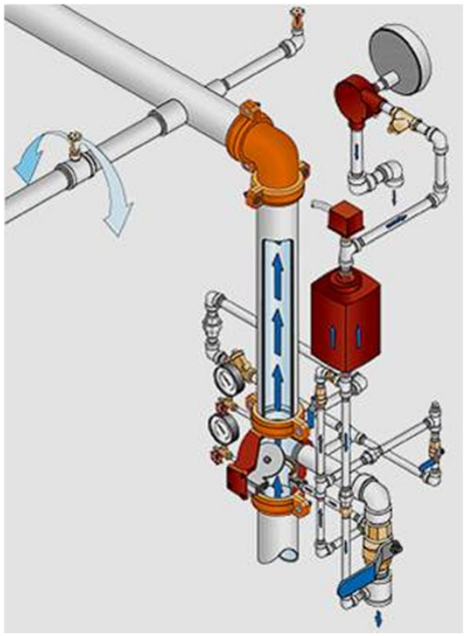






Commonly Accepted Designs





Commonly Accepted Designs



MULTI-SPECTRUM INFRARED
FLAME DETECTOR



ULTRAVIOLET/INFRARED
FLAME DETECTOR



INFRARED FLAME DETECTOR



NFPA 75 Fire Protection

- Hazard Classification
  - Ordinary Hazard Group 1(Minimum)
- Wet or Pre-action systems
- Proposed Changes
  - Annex Note
  - Blocking valves for pre-action



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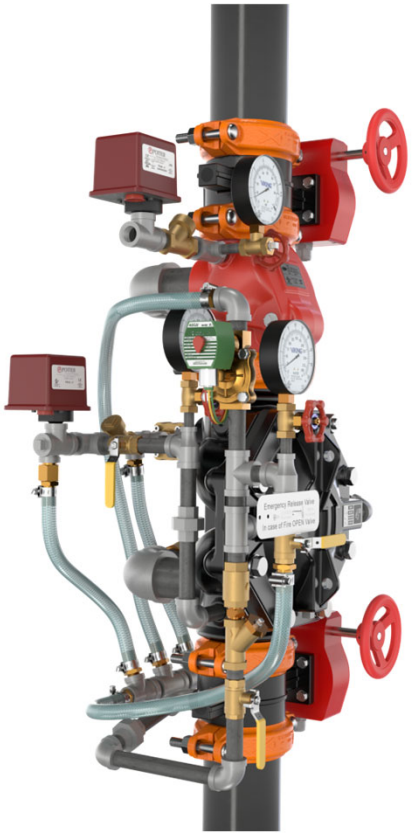
Recommended Practices

- Owner Dependent
  - Age Dependent
- Early detection
  - Clean agent system
- Single Interlock Pre-action
  - 286 deg. Sprinklers(high temp)
    - Standard Response
  - 130 sqft spacing



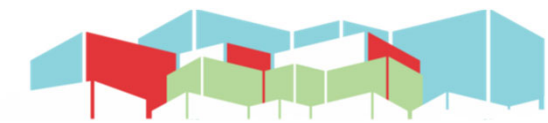
Why Single?

Single Interlock Preaction

- Water Delivery Time
- Design Area
- Damage Protection

Double Interlock Preaction

- Meant for Freezers
- Overused
- Expensive



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Another Option…

- Water mist systems
  - Smaller amount of water
  - Larger cooling effect
  - Longer length of time for operation on tanks



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For additional questions regarding the content in today's presentation, please contact:

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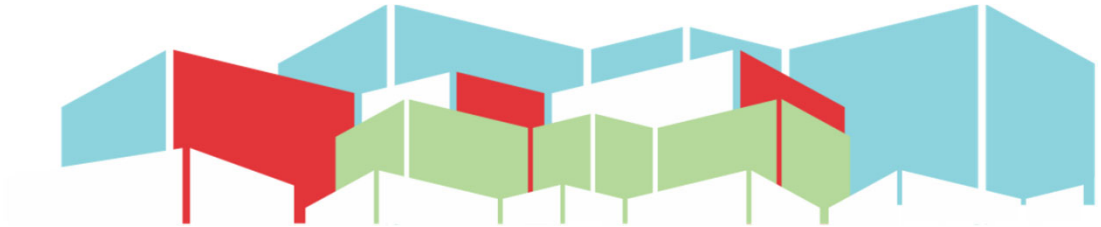

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