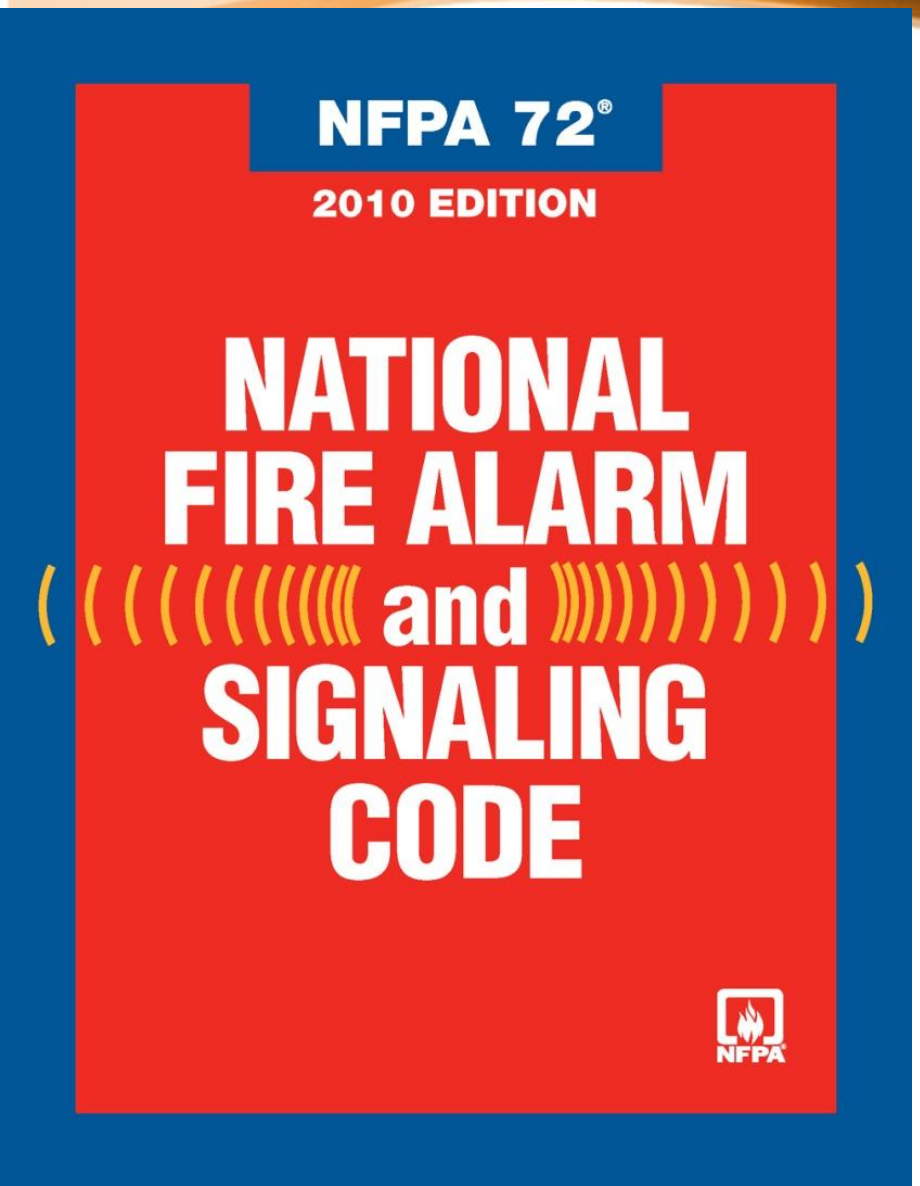
NFPA 25: STANDARD FOR THE INSPECTION, TESTING, AND MAINTENANCE OF WATER BASED FIRE PROTECTION SYSTEMS

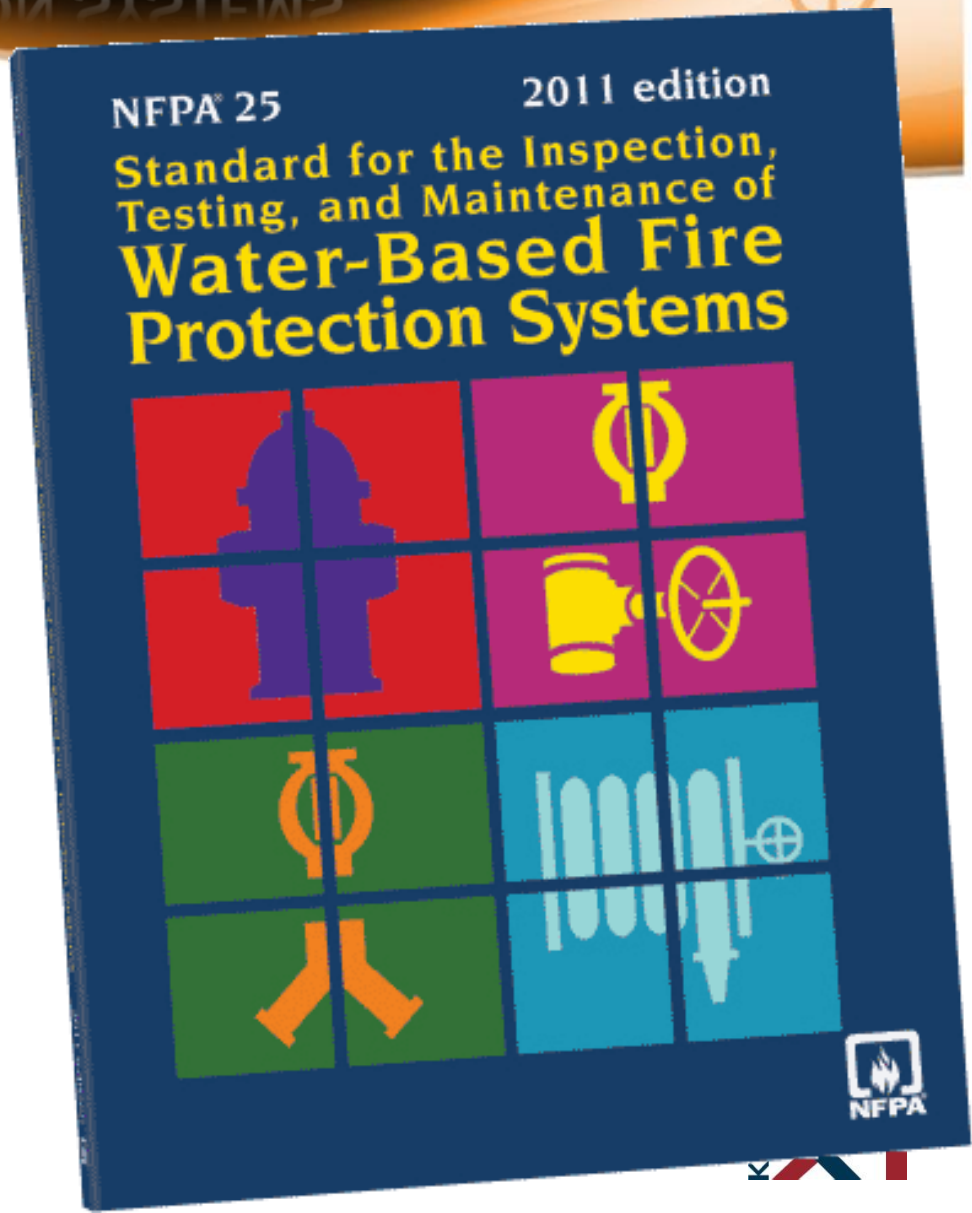
William E. Koffel, P.E., FSFPE
President
Koffel Associates, Inc.
www.koffel.com
wkoffel@koffel.com

OBJECTIVE

- Provide an overview of the inspection, testing, and maintenance requirements for
  - Automatic sprinkler systems
  - Related systems and equipment such as fire pumps
- Emphasize differences between current editions of NFPA standards and those referenced by TJC

INSPECTION, TESTING, AND MAINTENANCE OF FIRE PROTECTION SYSTEMS





THE OWNER'S RESPONSIBILITY

- The owner is responsible for all inspection, testing, and maintenance procedures
  - BE CAREFUL WITH YOUR CONTRACT LANGUAGE
- The owner may delegate the authority for the inspection, testing, and maintenance of the fire protection systems.
- The designated representative must comply with all requirements identified for the owner.

QUALIFICATIONS (PER NFPA 72)

- Service personnel shall be qualified
- Qualifications may include:
  - Factory trained and certified for the make/model being serviced
  - National certification approved by AHJ
  - Registered or licensed by AHJ
  - Employed by listed service company
- Provide evidence of qualifications to AHJ

KOFFEL

THE OWNER'S RESPONSIBILITY

- The owner is responsible for all inspection, testing, and maintenance procedures
  - BE CAREFUL WITH YOUR CONTRACT LANGUAGE
- The owner may delegate the authority for the inspection, testing, and maintenance of the fire protection systems.
- The designated representative must comply with all requirements identified for the owner.

THE OWNER'S RESPONSIBILITY

- Notify proper entities
  - AHJ, fire department, insurance carrier
- Correct deficiencies
- Analyze changes that may impact the system
- Maintain records
  - Available to AHJ upon request

KOFFEL

ITM RECORDS

- Retain all records until one year after the next test
- Records must be promptly provided to the AHJ upon request

ITM RECORDS

- For hospitals that accreditation for deemed status purposes, documentation of ITM procedures for fire protection systems shall include
  - Name of activity
  - Date of activity
  - Required frequency
  - Name of person performing activity
  - NFPA Standard referenced
  - Results of the activity
- EC 02.03.05 revised effective July 1, 2011

NFPA 25 SCOPE

1.1.3 This standard addresses the operating condition of fire protection systems . . .

1.1.3.1 This standard does not require the inspector to verify the adequacy of the design of the system.

IMPAIRMENTS

- Where an impairment is to last for more than 10 hours in a 24 hour period one of the following must be done:
  - Evacuation of the affected area
  - Fire Watch
  - Temporary water supply
  - Implement an approved fire control program
- Note that NFPA 101 until the 2012 Edition referred to fours hours in a 24 hour period

Table 5.1.1.2

Item	Frequency	Reference
Inspection		
Gauges (dry, preaction, and deluge systems)	Weekly/monthly	5.2.4.2, 5.2.4.3, 5.2.4.4
Control valves		Table 13.1
Waterflow alarm devices	Quarterly	5.2.5
Valve supervisory alarm devices	Quarterly	5.2.5
Supervisory signal devices (except valve supervisory switches)	Quarterly	5.2.5
Gauges (wet pipe systems)	Monthly	5.2.4.1
Hydraulic nameplate	Quarterly	5.2.6
Buildings	Annually (prior to freezing weather)	4.1.1.1
Hanger/seismic bracing	Annually	5.2.3
Pipe and fittings	Annually	5.2.2
Sprinklers	Annually	5.2.1
Spare sprinklers	Annually	5.2.1.4
Information sign	Annually	5.2.6.1
Fire department connections		Table 13.1
Valves (all types)		Table 13.1
Obstruction, internal inspection of piping	5 years	14.2
Test		
Waterflow alarm devices		
Mechanical devices	Quarterly	5.3.3.1
Vane and pressure switch type devices	Semiannually	5.3.3.2
Valves supervisory alarm devices		Table 13.1
Supervisory signal devices (except valve supervisory switches)		Table 13.1
Main drain		Table 13.1
Antifreeze solution	Annually	5.3.4
Gauges	5 years	5.3.2
Sprinklers — extra-high temperature	5 years	5.3.1.1.1.4
Sprinklers — fast-response	At 20 years and every 10 years thereafter	5.3.1.1.1.3
Sprinklers	At 50 years and every 10 years thereafter	5.3.1.1.1
Sprinklers	At 75 years and every 5 years thereafter	5.3.1.1.1.5
Sprinklers — dry	At 10 years and every 10 years thereafter	5.3.1.1.1.6
Maintenance		
Valves (all types)		Table 13.1
Low-point drains (dry pipe system)		13.4.4.3.2
Sprinklers and automatic spray nozzles protecting commercial cooking equipment and ventilation systems	Annually	5.4.1.9
Investigation		
Obstruction		14.3

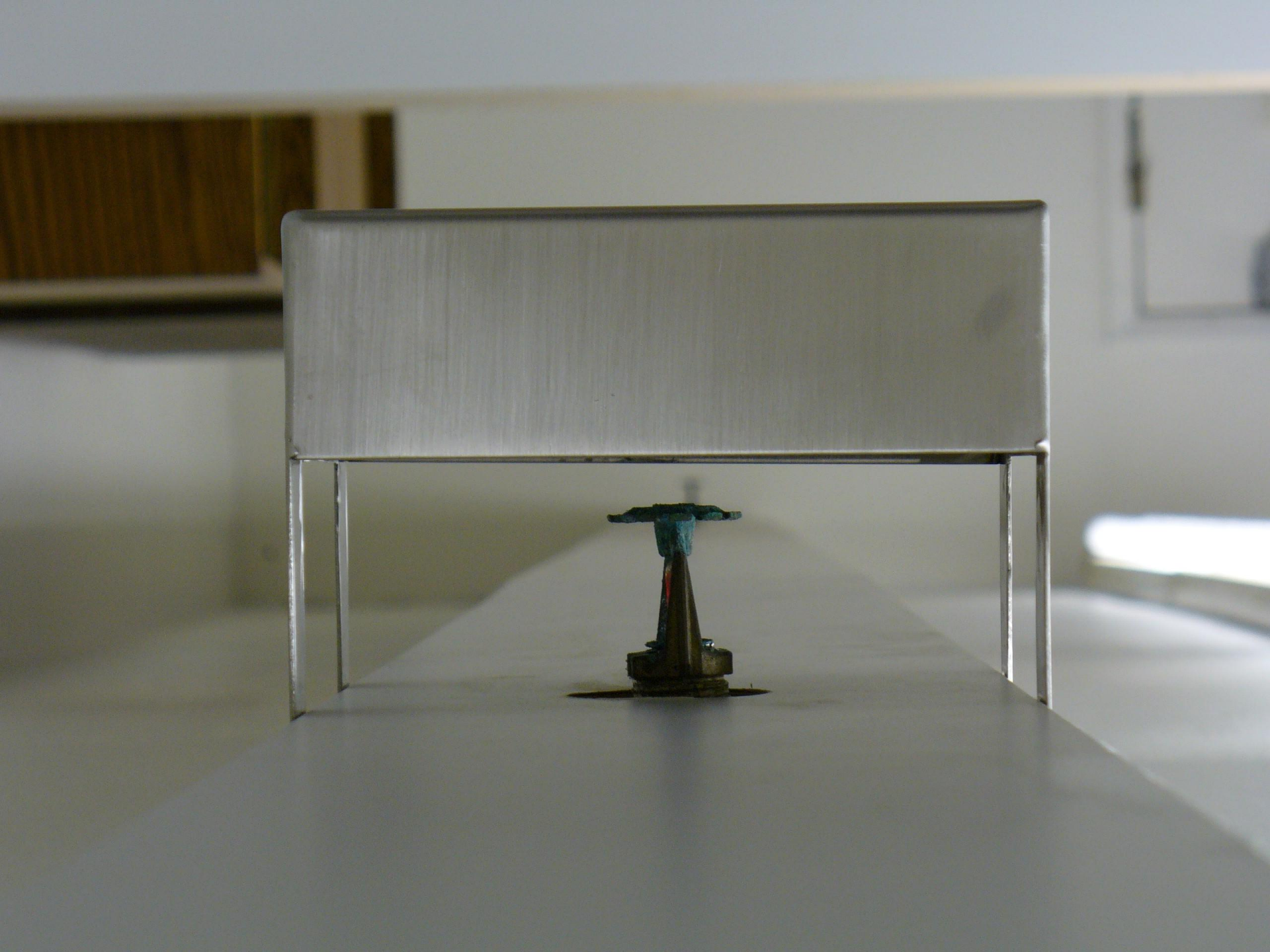
TYPICAL INSPECTION


MEN


Restrooms

SPRINKLERS ARE INSPECTED FOR:

- Leakage
- Corrosion
- Paint
- Loading
- Orientation
- Empty bulbs
- Clearance below sprinkler (such as storage)



SPRINKLER TESTING

- Standard response sprinklers tested or replaced at 50 years and 10 years thereafter
- Fast-response sprinklers tested or replaced at 20 years and 10 years thereafter
- Dry sprinklers tested or replaced at 10 years and 10 years thereafter
- Sprinklers exposed to harsh environment tested at 5 year intervals

SPRINKLER TESTING

- Test includes 4 sprinklers or 1 percent of sample area whichever is greater
- If one sprinkler fails then all sprinklers in sample are must be replaced

ANTIFREEZE SOLUTIONS

- Tested annually
- The Concentration of solution must be limited to the minimum that is necessary to protect for the lowest anticipated temperature

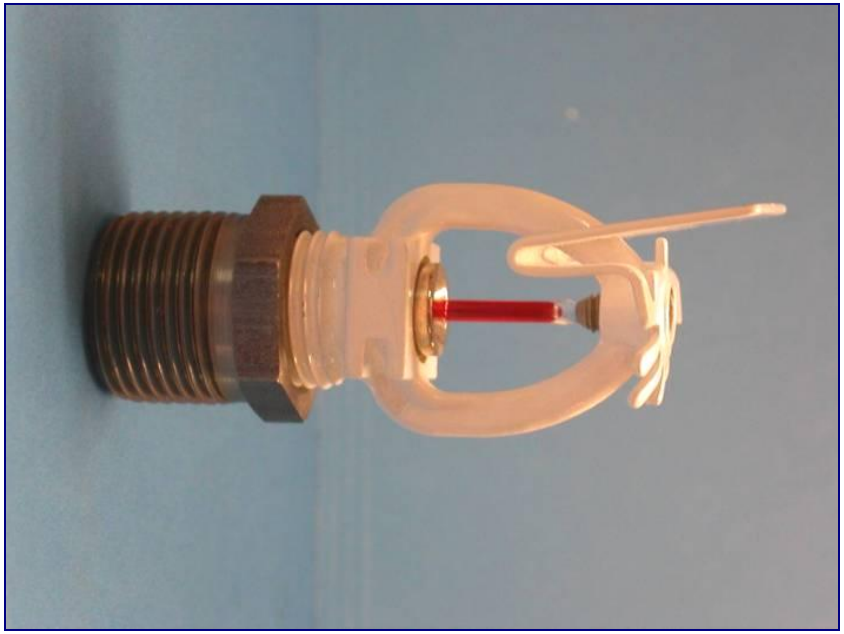
KOFFEL

HISTORICAL PERSPECTIVE

- Traditionally
  - Anti-freeze used to protect sprinkler systems installed in small areas where adequate heat is not provided
    - Previous editions of NFPA 13 contained an Annex note indicating that anti-freeze not likely to be economical in excess of 40 gallon capacity of piping system
  - Other solutions include:
    - Dry-pipe sprinkler systems
    - Preaction sprinkler systems
    - Heat trace systems

KOFFEL

NEW TECHNOLOGIES



FIRE INCIDENTS

- August 18, 2009 – Truckhee, CA
- Cooking fire in kitchen of occupied apartment
  - Cooking onions in oil

FIRE INCIDENTS

- Truckhee, CA (cont)
- One adult fatality, one adult severely injured, three children with minor injuries
- Fire and explosion resulting in
  - 8 sprinklers in the unit operating
  - Glass was blown 86 ft across the parking lot
  - Bathroom door was separated approx 3 inches from the frame
- 72% antifreeze, 28% water in system.
  - Should have been 50/50

MSDS INFORMATION

- Propylene Glycol
  - Heat from fire can generate flammable vapor when mixed with air and exposed to ignition source.
  - Vapors can explode if confined. Vapors may travel long distances along ground before igniting/flashing back to vapor source.
  - Fine sprays/mist may be combustible at temperatures below normal flash point (211F-228F)

MSDS INFORMATION

- Propylene Glycol
  - Do not handle near heat, sparks, or open flame.
  - Aqueous solutions greater than **22%** by weight, if heated sufficiently, will produce flammable vapors.

LYONDELL

ENVIROGUARD

KOFFEL

LITERATURE REVIEW

- UL Tests
  - Under certain conditions a large-scale ignition is possible from the discharge of a sprinkler system containing solutions of 70% glycerin or 60% propylene glycol in water onto certain ignition sources
  - Dependent on the
    - Characteristics of the fuel source
    - Spray distribution pattern
    - System pressure
    - Type of sprinkler
    - Location of the fire relative to the sprinkler
    - Concentration of the antifreeze solution in the mixture.
  - NOTE: NFPA 13 has permitted 50% glycerin and 60% propylene glycol

LITERATURE REVIEW

- Fire Protection Research Foundation Test Program
  - Concentrations of propylene glycol > 40% by volume and concentrations of glycerin > 50% by volume have the potential to ignite when discharged through automatic sprinklers.
  - Consideration should be given to an appropriate safety factor for concentrations of antifreeze solutions that are permitted by future editions of NFPA 13.
  - The use of solutions of di-ethylene glycol and ethylene glycol in home fire sprinkler systems should also be limited.

NFPA RESPONSE

- Tentative Interim Amendments issued for NFPA 13, NFPA 13R, NFPA 13D
  - Effective date: August 25, 2010
  - Antifreeze not permitted within dwelling units
- Considered to be an initial response

NFPA RESPONSE

- TIA's issued for NFPA 13, NFPA 13R, NFPA 13D
  - Effective date: March 21, 2011
  - Premixed antifreeze solutions
    - By manufacturer to ensure proper suspension
  - Permitted concentrations reduced
    - Special provisions for ESFR systems
    - Note still exceed 22% per at least one MSDS
    - NFPA 13D (and NFPA 25) permit higher concentrations for existing

NFPA RESPONSE

- TIA issued for NFPA 25
  - Effective date: March 21, 2011
  - Drain anti-freeze if properties undetermined
  - Permitted concentrations reduced
    - Existing **SOLUTIONS** permitted at higher concentrations
  - Test details
    - Size of system
    - Drops

RECENT FPRF RESEARCH

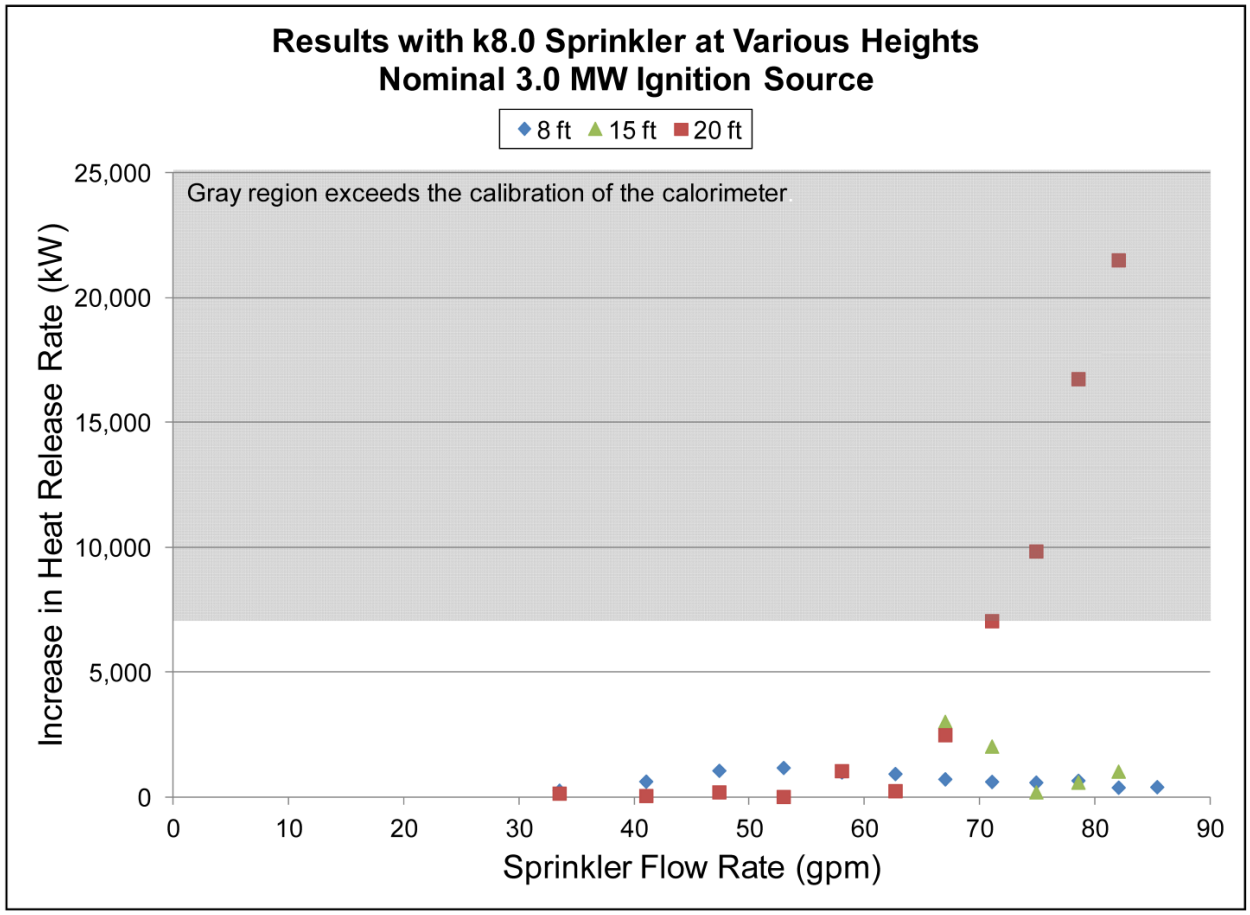


Figure 5. Comparison of increase in heat release rate based on sprinkler height.

NFPA RESPONSE

- NFPA 13, 13R, and 13D – Potential restriction on all new antifreeze systems unless solution is listed for use in a fire protection system
  - Current submission to UL for a salt water based, with corrosion inhibitor, being evaluated
- Existing systems – Mtg on April 20th
  - Retain existing provisions (from previous TIA)
  - Reduce concentrations further
  - Require risk analysis
  - Prohibit even existing systems

SOLUTIONS

- Other options remain possible
  - Dry pipe sprinkler systems
  - Pre-action sprinkler systems
  - Heat-trace
  - Insulation
  - Risk analysis for non-occupied areas
    - Considered by the NFPA 25 Technical Committee when processing the TIA's

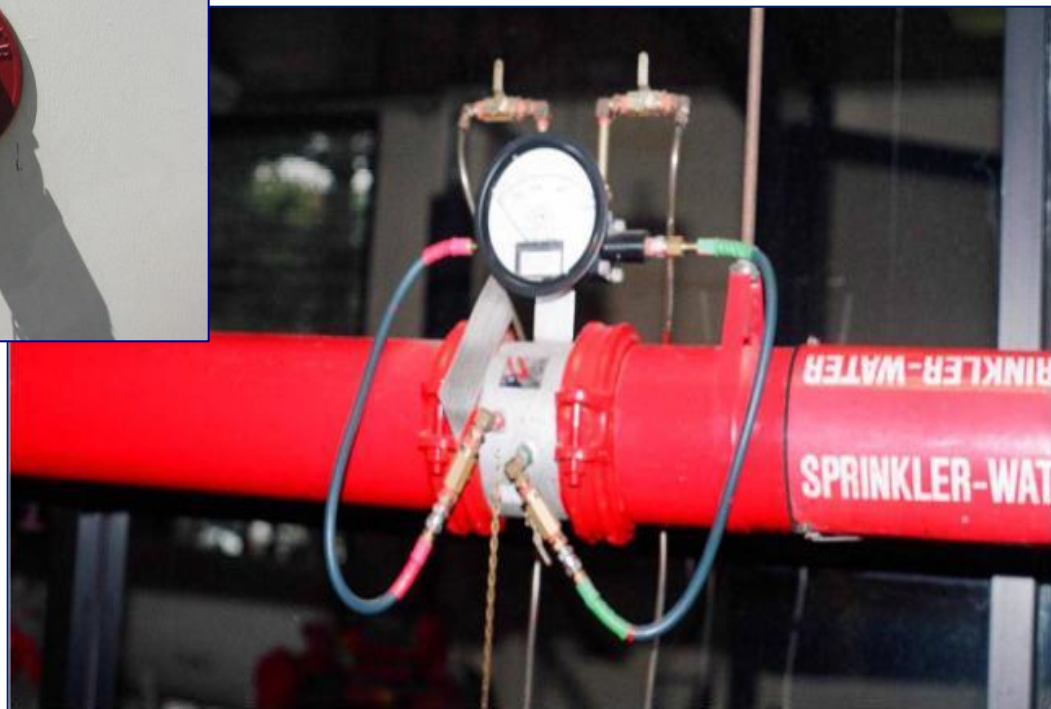
MAIN DRAIN TEST

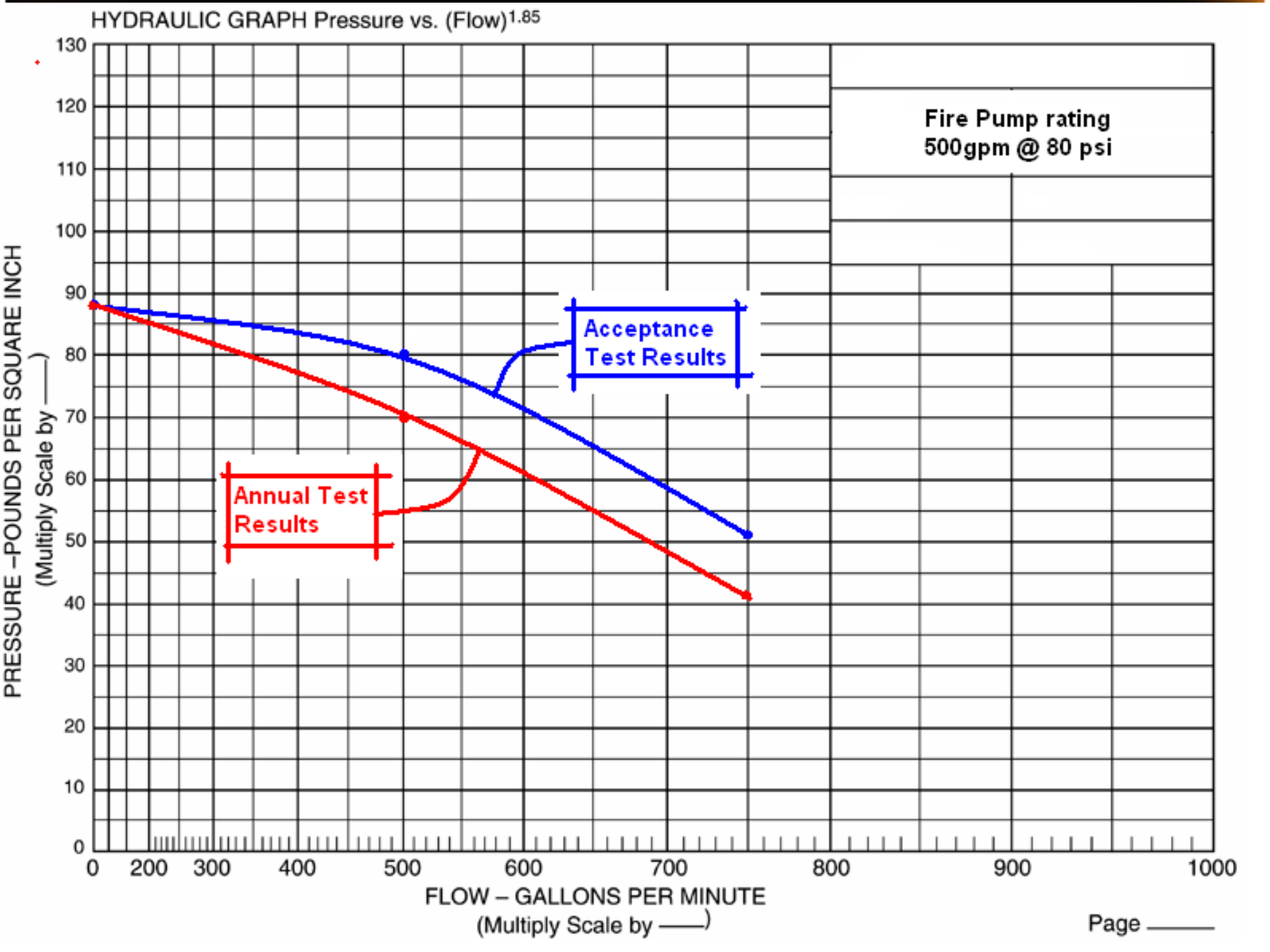
FIRE PUMPS

KOFFEL

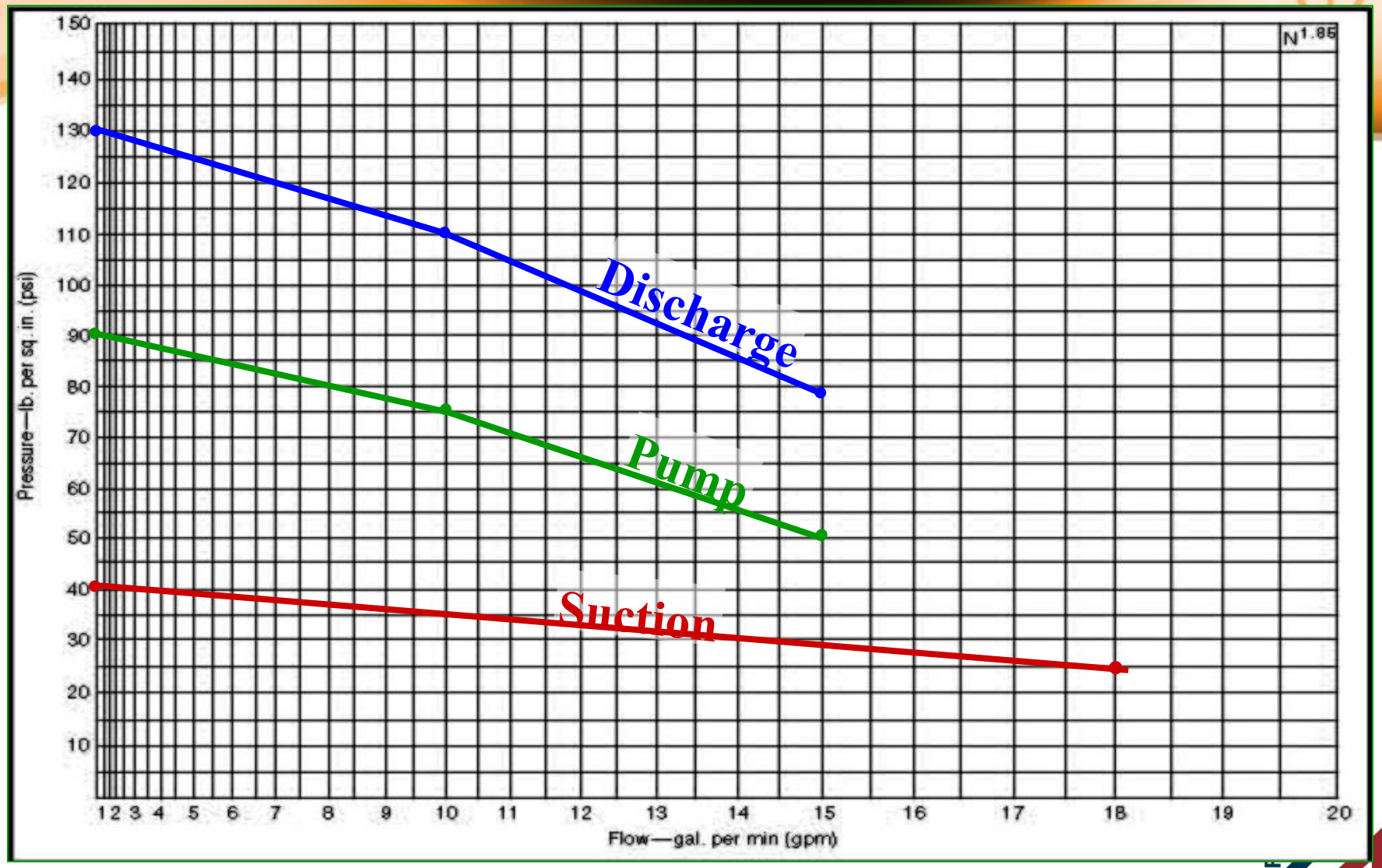

CHURN TEST

ANNUAL FLOW TEST




HYDRAULIC GRAPH Pressure vs. (Flow)1.85
Fire Pump rating
500gpm @ 80 psi
Acceptance
Test Results
Annual Test
Results
PRESSURE –POUNDS PER SQUARE INCH
(Multiply Scale by ____)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
200
300
400
500
600
700
800
900
1000
FLOW – GALLONS PER MINUTE
(Multiply Scale by ____)
Page ____

PUMP PERFORMANCE

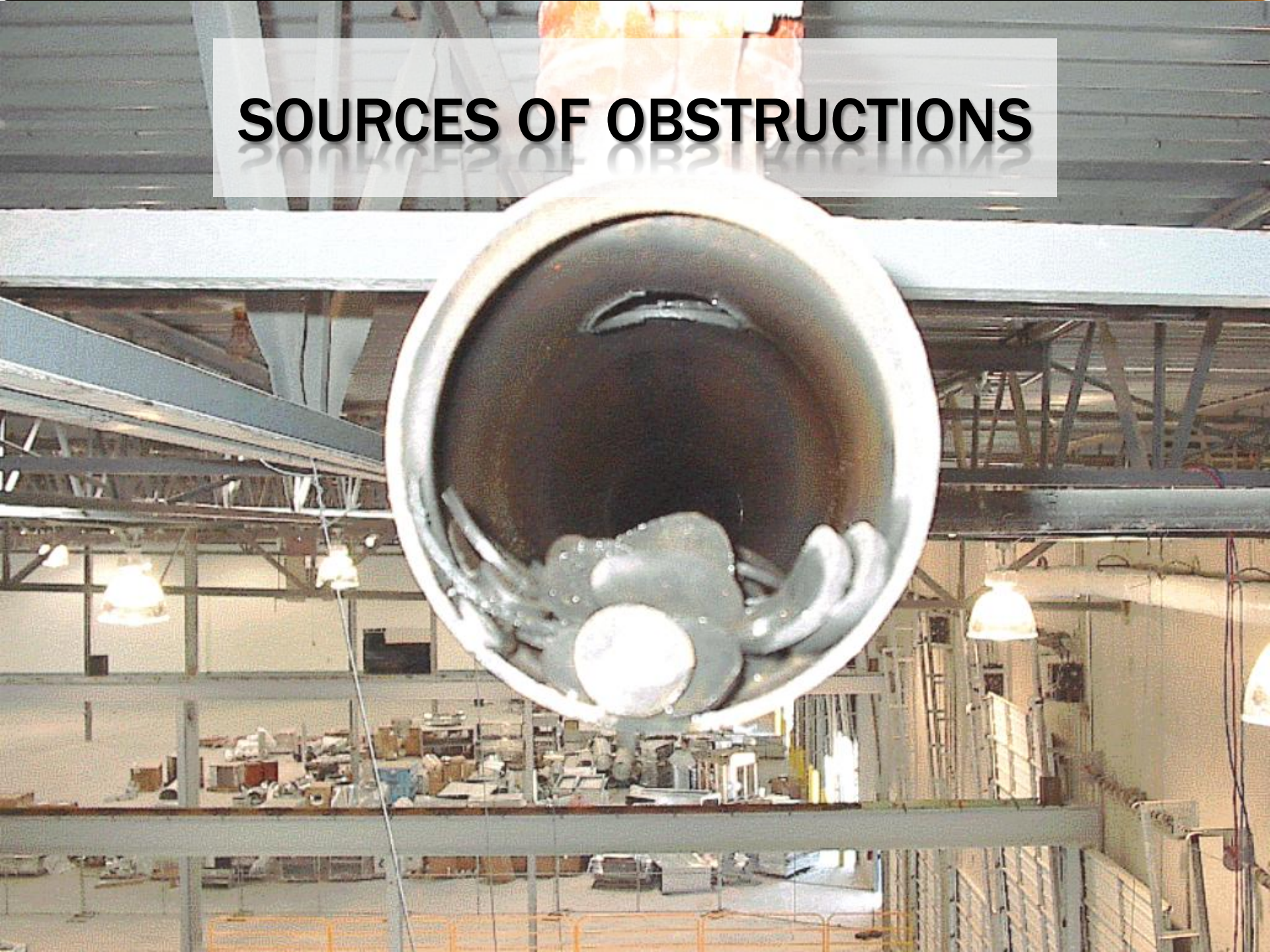


INSPECTION AND EXAMINATION

- Inspection
  - Conducted at specified intervals
  - Covers two points in the system (end of one main and sprinkler on one branch line)
- Examination
  - Conducted when certain conditions exist
  - Covers four points in the system (valve, riser, cross main, branch line)

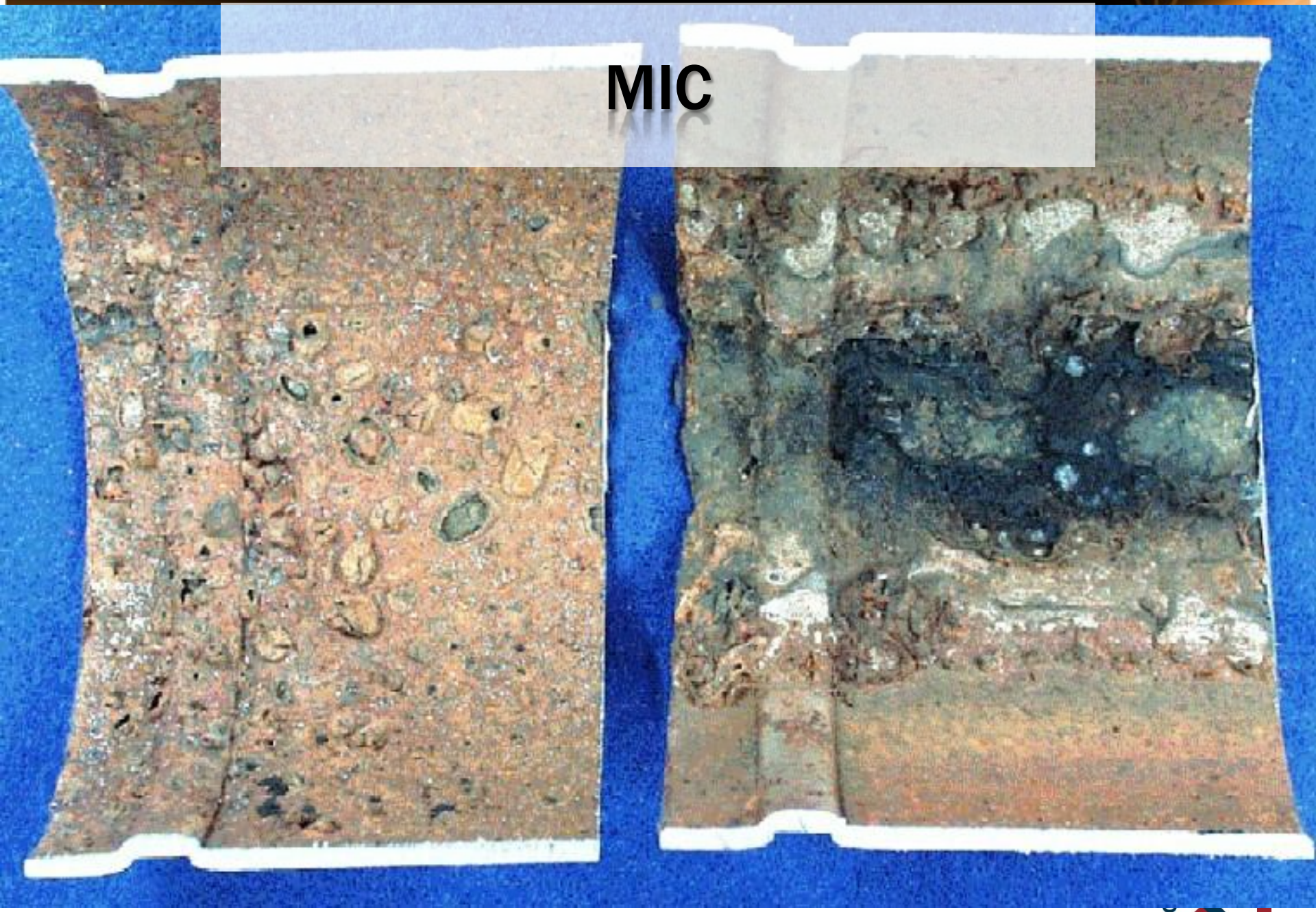
SOURCES OF OBSTRUCTIONS

SOURCES OF OBSTRUCTIONS




SOURCES OF OBSTRUCTIONS

MIC



COMPONENT ACTION REQUIREMENTS

- Required for any component that is adjusted, repaired, reconditioned, or replaced
- Main drain test is required if any system control valve or other upstream valve was operated
- It is not intended that a design review be conducted

ANNEX E – 2011 EDITION

- Classifies how critical the deficient condition is
  - Is it an impairment?
  - How critical is the deficiency?

QUESTIONS AND DISCUSSION