Cross-Connection Control vs. Fire Protection:
A WIN-WIN APPROACH FOR INSTALLING BACKFLOW PREVENTERS ON MILITARY FIRE SUPPRESSION SYSTEMS

Presentation By:

A-J Wangner, PE
RASco, Inc.
703-643-2952
www.rascoengineers.com
Purpose:

Outline an approach that lets us appropriately mitigate risk posed by cross-connections between fire protection systems and distributions systems, but not jeopardize sprinkler system performance.
Introduction

• Background
  – Fire protection systems (FPS)
  – Backflow prevention devices (BPD)

• Outline Approach
  – Identify need/Establish Priority
  – Hydraulic Analyses/BPD Design
  – Implementation
Background: Fire Protection Systems

• Purpose--Control/suppress spread of fire

• Require specific flow and pressure for proper operation
Fire Protection Systems

• Water-Based Systems
  • Wet pipe
  • Standpipes
  • Dry pipe
  • Preaction
  • Deluge

• Supplied from domestic water distribution system
Fire Protection Systems

- Single [Alarm] [Detector] Check
- Static Pressure Loss as low as 1 psi
- Residual Pressure Loss as low as 3 psi
- Not a testable, approved BPD
Background: Backflow Prevention Devices (BPD)

- **Purpose**--To prevent the backflow of contaminating or polluting substances into the drinking water system
- **Degree of Hazard dictates BPD type**
  - Contaminate (High)--requires reduced pressure assembly [RPZ]
  - Pollutant (Low)--requires double check valve assembly [DCV]
Backflow Prevention Devices

• Pressure Losses

<table>
<thead>
<tr>
<th>Type/Flow</th>
<th>DCVA (6” dia.) Pressure Loss</th>
<th>RPZ (6” dia.) Pressure Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 gpm</td>
<td>4-6 psi</td>
<td>8-10 psi</td>
</tr>
<tr>
<td>500 gpm</td>
<td>2-7 psi</td>
<td>9-14 psi</td>
</tr>
<tr>
<td>750 gpm</td>
<td>3-8 psi</td>
<td>9-14 psi</td>
</tr>
</tbody>
</table>

• Periodic Maintenance
  • Annual (at minimum) testing
  • Annual flow through BPD
Systematic Approach

- IDENTIFY NEED
- ESTABLISH PRIORITY
- HYDRAULIC ANALYSIS
- DESIGN BPD
- IMPLEMENT
Identify Need

• 14 of 15 FPS studied (in Utah) had water that did not meet EPA Safe Drinking Water standards.
• 56 FPS studied had NTUs ranging from 1-2,000, oily residue, and bacteria “too numerous to count.”

• AWWA recent study (most comprehensive to date)
  • 84 Wet-pipe FPS in 30 water utilities nationwide.
  • Pb & Cd over primary limits in all samples.
  • Fe, Mn, TDS, sulfate, color over secondary limits.
  • Reason for backflow is failure of single check.
  • 100 gal. of FPS water backflowed in only 3 minutes.
Identify Need
Identify Need

• Cross-connection survey
  • Familiarity with:
    • Local plumbing codes
    • Military branch/installation specific requirements
    • FPS types
  • (Example) 1996 I.P.C. all FPS; but 2000 I.P.C. specifies only wet-pipe
Establish Priority--Existing FPS

- High Degree of Hazard (HDOH)
  - AFFF
  - Corrosion control chemicals
  - Anti-freeze
  - Storage tanks

- Low Degree of Hazard (LDOH)
  - Wet-pipe, standpipes
  - Dry-pipe, preaction, deluge

PRIORITY
Systematic Approach

- IDENTIFY NEED
- ESTABLISH PRIORITY
- HYDRAULIC ANALYSIS
- DESIGN BPD
- IMPLEMENT
Hydraulic Analyses-- Necessary to Answer:

- What is flow and pressure demand of FPS, to function properly?
- What flow and pressure is available “out in the street”?
- What is BPD impact on flow and pressure available?
FPS Demand

- Data collection
  - Survey sprinkler system
    - Type of FPS, type of sprinklers, pipe material, age of system, heights, lengths, fittings
  - Classify building activity
- Model sprinkler system to determine Hydraulically Most Remote Area using NFPA guidance
Supply Available

- Hydrant Flow Testing

- Water distribution system model (If current and accurate)
Designing BPD Installation

• Correct BPD Type
• Devices must be approved by UL and FM

• Sized for FPS flow demand
• Space constraints
• Provisions to permit routine BPD testing
FIGURE 3: Conceptual supply versus demand curve showing adjustment for BPD
Options for Getting a FPS to Accommodate a BPD

- Select another BPD
- Remove alarm check valve
- Change out sprinkler heads
- Change pipe material
- Create loops in FPS or distribution system
- Administrative
Systematic Approach

• IDENTIFY NEED
• ESTABLISH PRIORITY
• HYDRAULIC ANALYSIS
• DESIGN BPD
• IMPLEMENT
Implementation—Considerations

• Retrofit in priority posed by degree of hazard
  • HDOH take priority.
  • LDOH
    • When alarm checks require replacement.
    • When FPS is down for repairs.

• Ensure:
  • Proper BPD type
  • Proper installation
  • BPD tested, tagged, inventoried
APPROACH SUMMARY
EXISTING FIRE PROTECTION SYSTEMS W/O BPDs

IDENTIFY NEED
Classify FPS; Degree of Hazard; Need for BPD, as per A.H.J.

NO

Ensure single alarm checks are properly maintained & repaired/replaced as necessary.

ESTABLISH PRIORITY
Is FPS a High D.O.H.?

NO

System is a Low D.O.H.
Ensure single alarm checks are properly maintained.

HYDRAULIC ANALYSES
Quantify FPS demand.
Quantify supply available.

NO

Proceed after all High D.O.H. sites addressed, based on Low D.O.H. Priorities: wet-pipe, standpipes, dry pipe systems

DESIGN BPD
SUPPLY - BPD > FPS DEMAND?

NO

Explore options for FPS or BPD design modifications that will allow installation of a BPD.

IMPLEMENT

RASco, Inc.
Summary
Satisfying environmental regulations and your cross-connection program does not have to come at the expense of fire protection.

• Retrofit existing Fire Protection Systems:
  • Using a systematic approach;
  • Based on degree-of-hazard priority.

• For new and retrofit jobs, ensure:
  • Proper BPD type, size, and model are installed;
  • BPD is properly maintained/tested.