

Multilevel Approach for OPP, Monitoring, and Control at District Stations

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Version 12.0



Agenda

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Layers of OPP

Dynamic Risk Findings/Actions

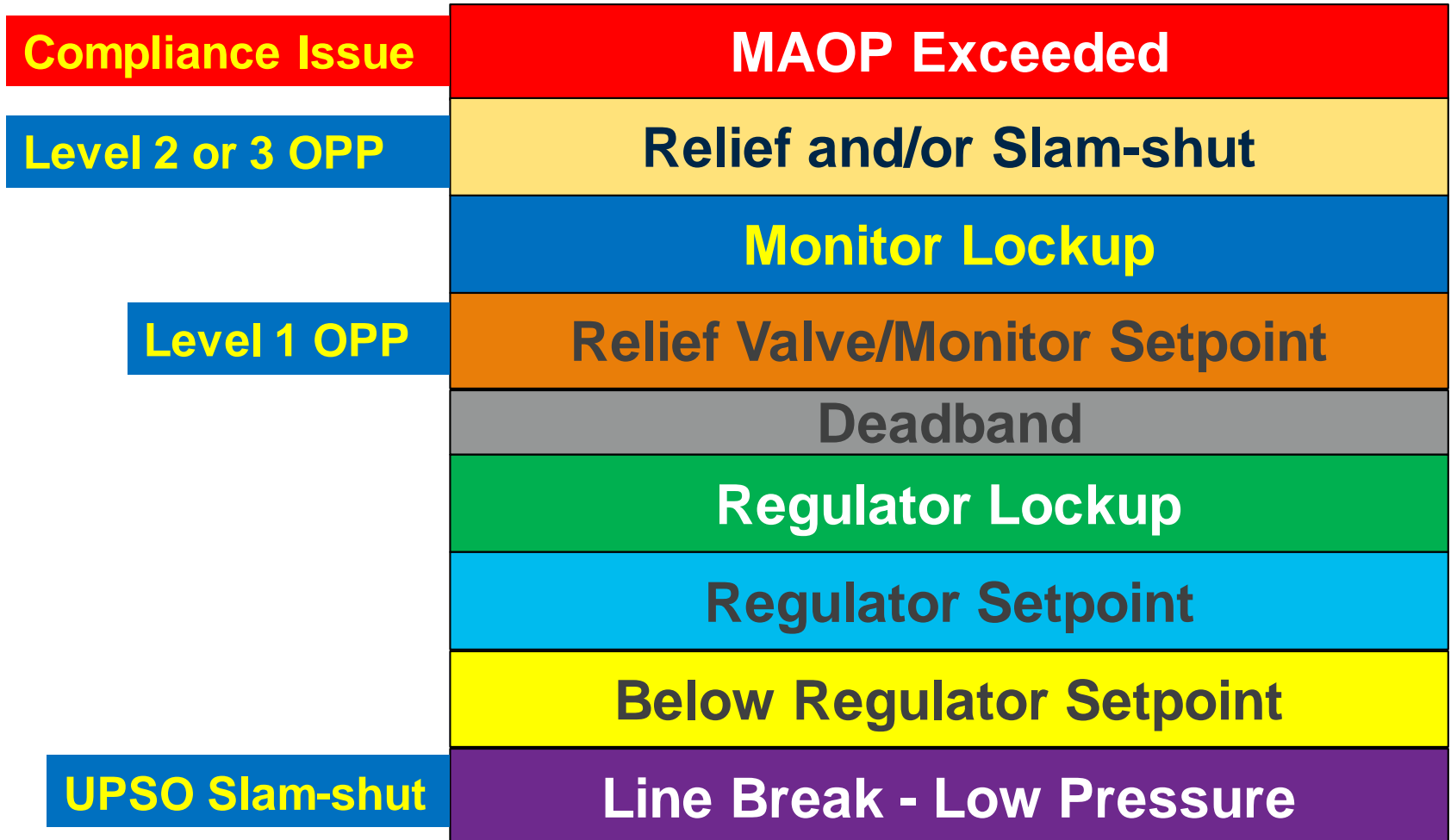
What to Protect?

District Stations Today

District Stations of the Future Upgrade
Path

Wrap Up

Layers of OPP in Gas Distribution



Layers of OPP in Gas Distribution – Another Layer?

Public Issue

Catastrophic Event

The gap between compliance and a catastrophic event..

Compliance Issue

MAOP Exceeded

Level 2 or 3 OPP

Relief and/or Slam-shut

Monitor Lockup

Level 1 OPP

Relief Valve/Monitor Setpoint

Deadband

Regulator Lockup

Regulator Setpoint

Below Regulator Setpoint

UPSO Slam-shut

Line Break - Low Pressure

OPP at District Stations

Dynamic Risk Report Jan 29th, 2020

- Initiated by the Massachusetts Department of Public Utilities (DPU) as a Statewide assessment of gas pipeline safety in Massachusetts

Scope of this Assessment

This Assessment, conducted in Phase 1 and Phase 2 by the Independent Review Panel (the Panel), evaluated the physical integrity and safety of the Commonwealth's gas distribution systems operated by the seven investor-owned gas distribution companies and four municipal gas companies (collectively, the Gas Companies) and the operations and maintenance policies, practices, and execution by the Gas Companies. The Panel also offers observations developed during this Assessment regarding various organizations involved in pipeline safety within the Commonwealth, such as the DPU, the Attorney General's Office (AG Office), and other Interested Parties.

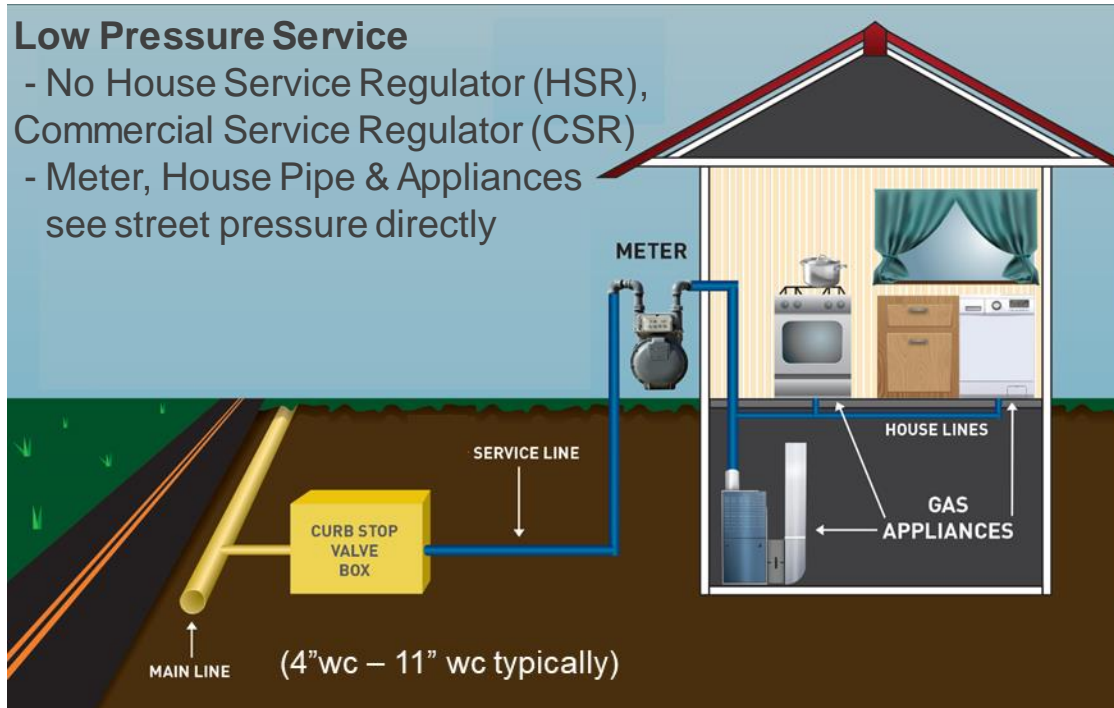
Dynamic Risk Findings (not exhaustive)

- 23% of all pipe mains in MA are considered leak prone which is 7% of all the leak prone pipe in the USA
- Overconfidence on the jobsite
- Meaningful job briefs non existent
- Pipeline SMS API 1173 implementation
- Silos of management hinder communications
- Tracking of overpressure events
 - Low pressure systems
 - Higher pressure systems
- Asset tracking

Columbia Gas of Massachusetts System Improvements

- Implements SMS
- Low pressure station documentation
- Regulator station design and over-pressure protection
- Remote monitoring
- Infrastructure modernization – pipeline upgrades
- Professional engineers
- Tie in and tapping procedures
- Capital projects review
- Management of change
- Damage prevention

Typical Low Pressure (LP) Systems



- **MAOPs : Typically at 14" w.c or lower**
 - How was this pressure derived? : Tribal knowledge?
- **No service regulator, only meter**
 - Many meter sets are indoors and will be moved outdoors
- **OPP is usually installed at the district station**
 - Does not protect if an IP system is tied into LP system, or if district station regulator fails

The Question :

Which part of the system should we protect?

- **District Regulator(DR) Station OPP**
 - What technology should we consider?
 - How many layers?
 - Do we need monitoring of our DR?
 - Is a remote shut off valve required?
- **End User OPP**
 - What technology should we consider?
 - Have we considered a regulated bypass?
 - How many layers of OPP?

LDC Direction : Prediction

- Low pressure will be regulated to add two layer OPP at all district stations
- All other stations will be under **risk assessment** because if a LP station could have a failure what about all the other district and city gate stations?
 - Scenario: P1 = 800-1,000 psig and P2 = 60 psig delivery
 - What happens if 1,000 psig ends up in a 60 psig distribution system?
 - Is it catastrophic?
 - What are the implications?
 - What is the best way to protect this system?

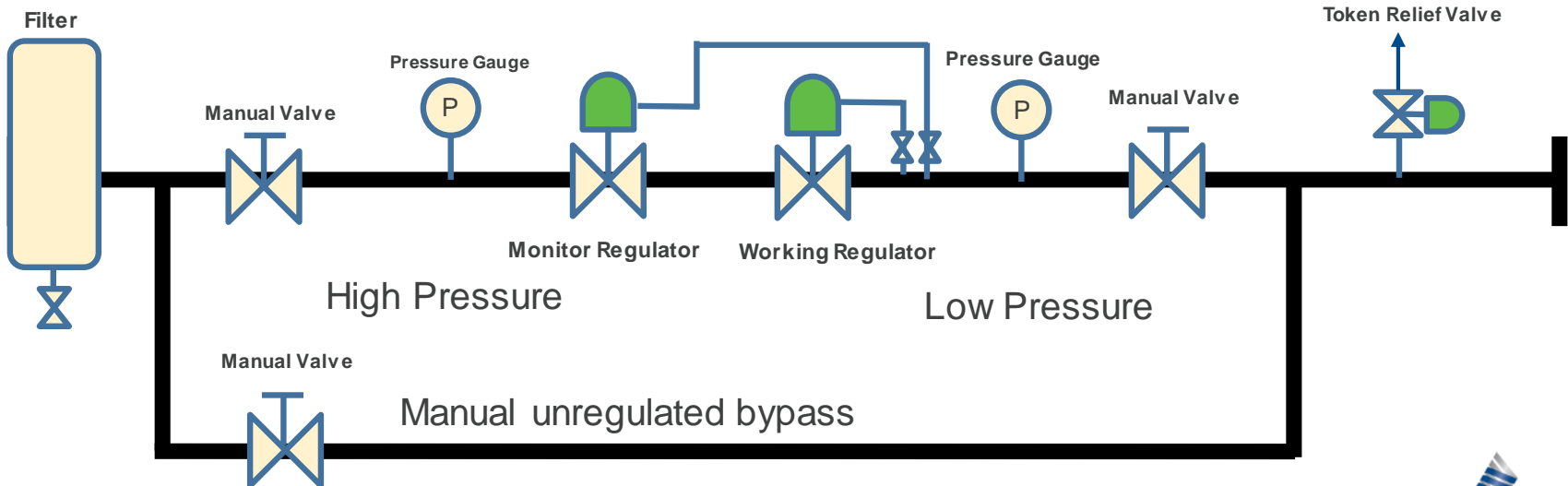
Basic District Station Scenario Today



- Worker/monitor as single layer OPP
- Token relief valve ?
- Single manual valve with unregulated bypass

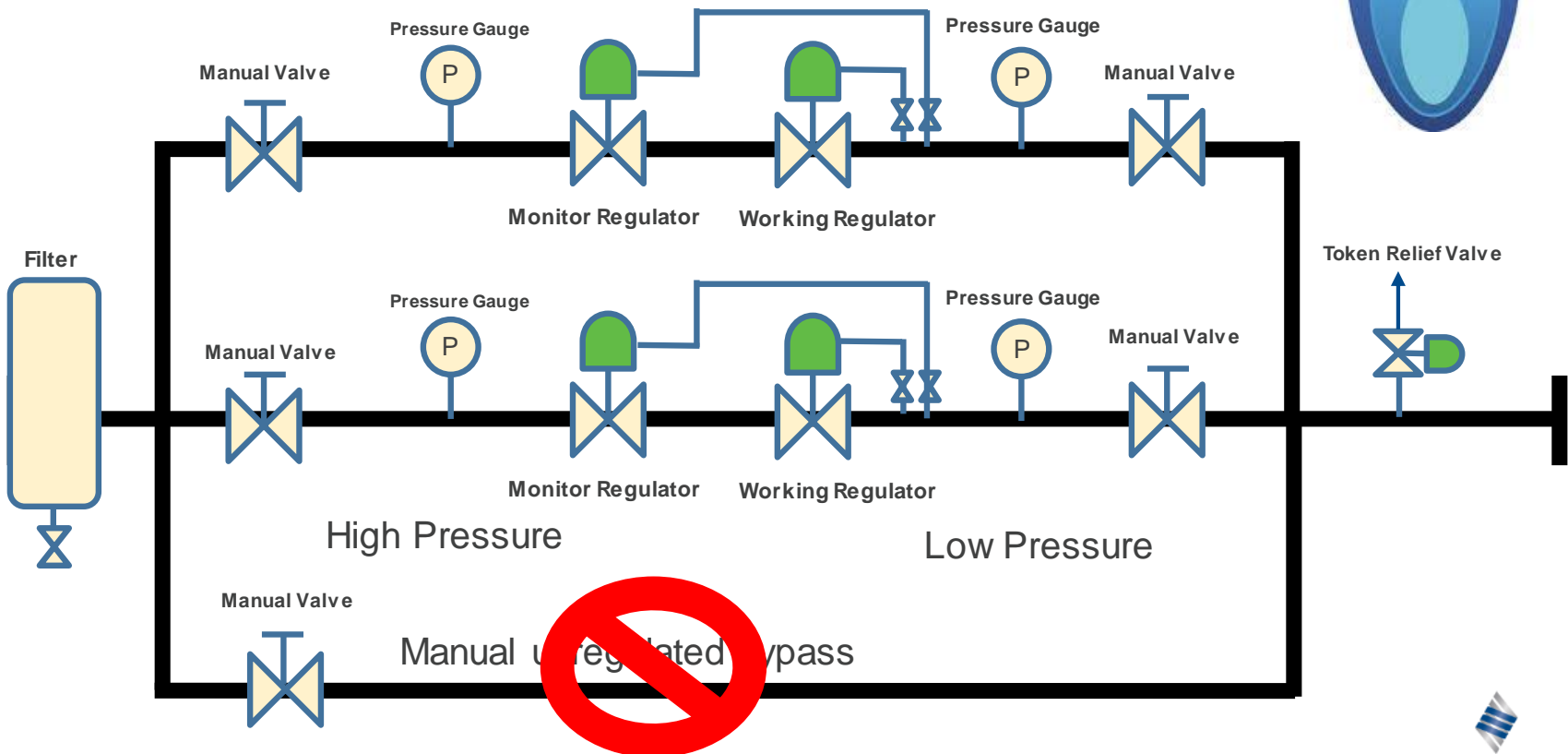


Scenario: Regulator maintenance and technician is on manual bypass. What happens if the operator on the valve breaks or the valve seizes?

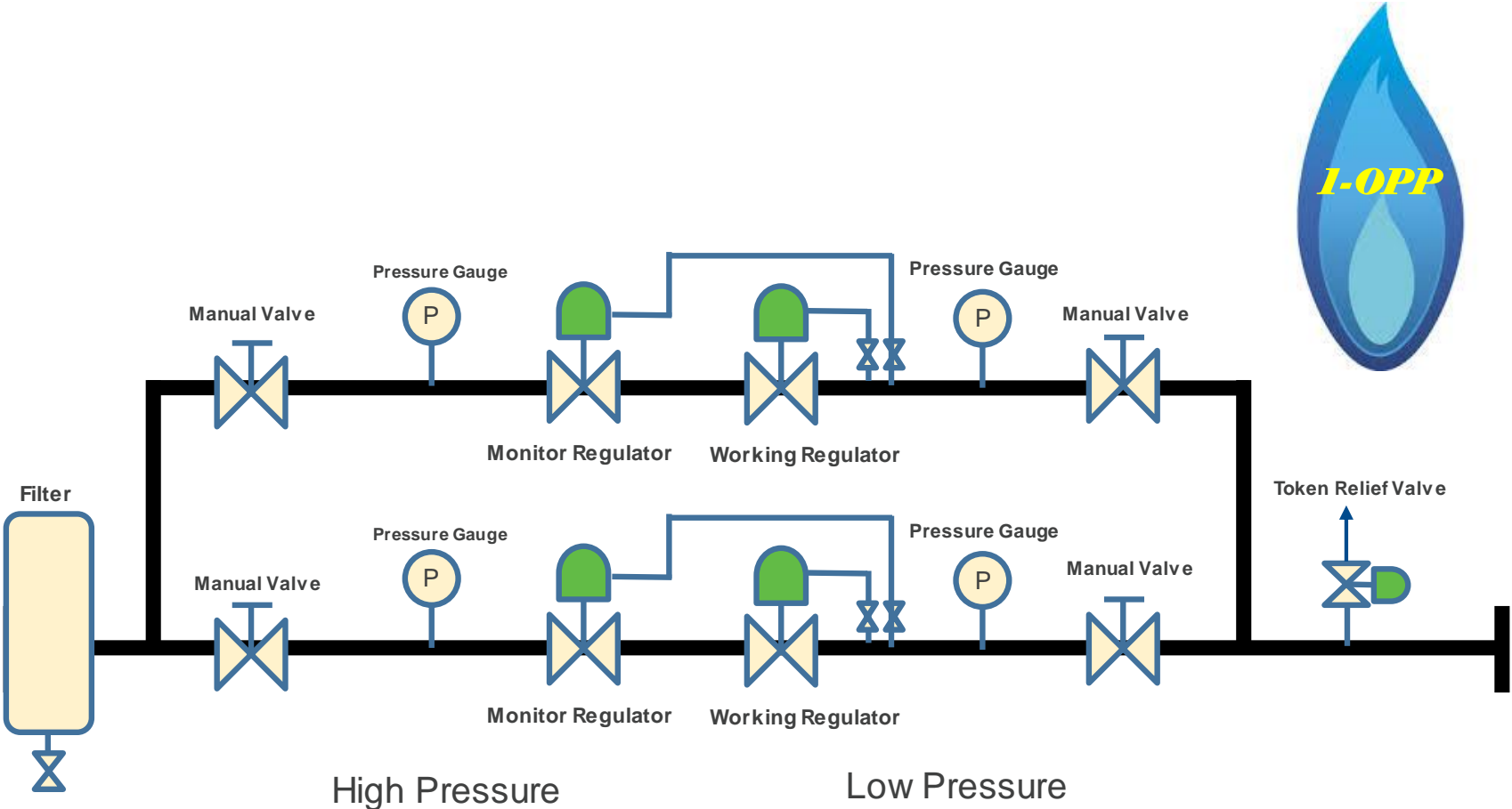


Basic District Station Scenario Today

- Worker/monitor as single layer OPP
- Full capacity redundant standby run
- Token relief valve

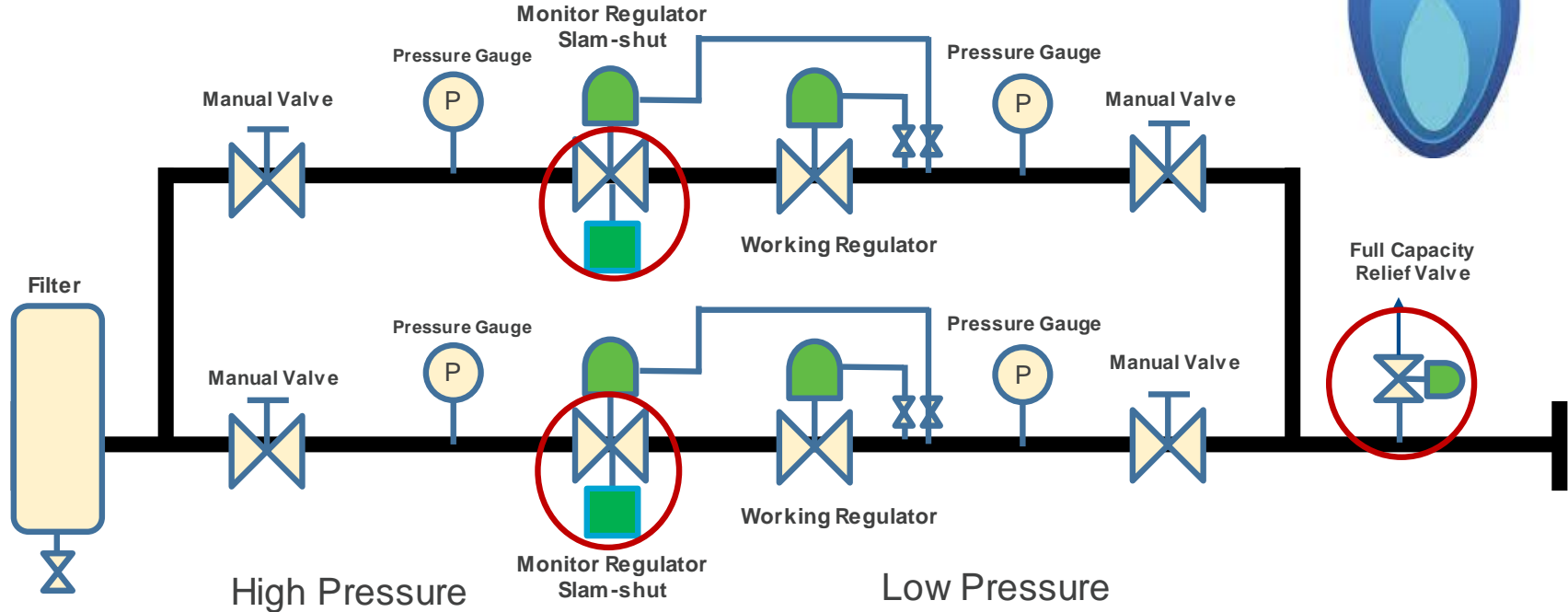


Basic District Station What's Coming Next?



District Stations of the Future

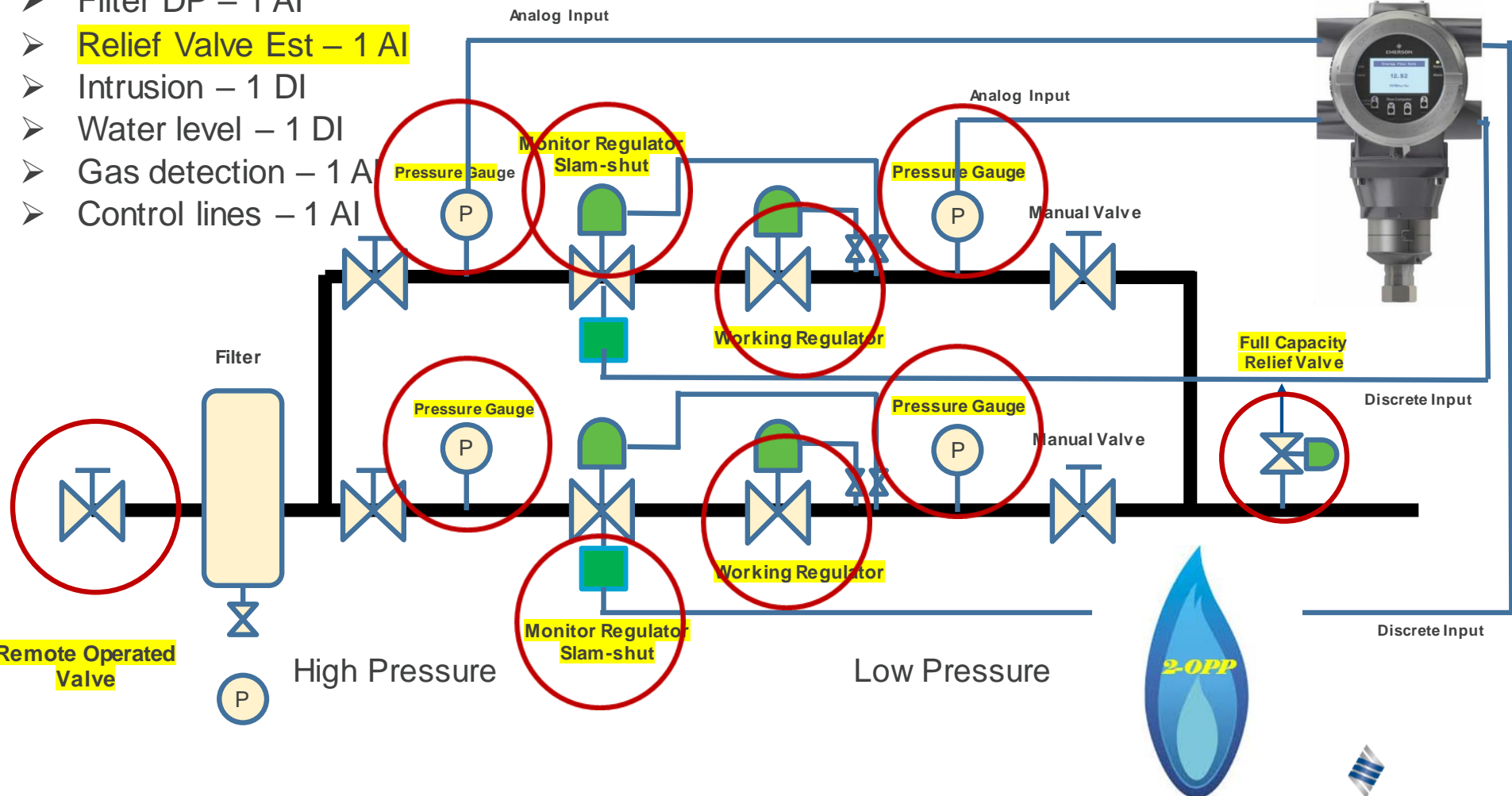
- Double layer OPP achieved 2 ways
 - Slam-shut monitoring regulators
 - Relief valves



District Stations of the Future

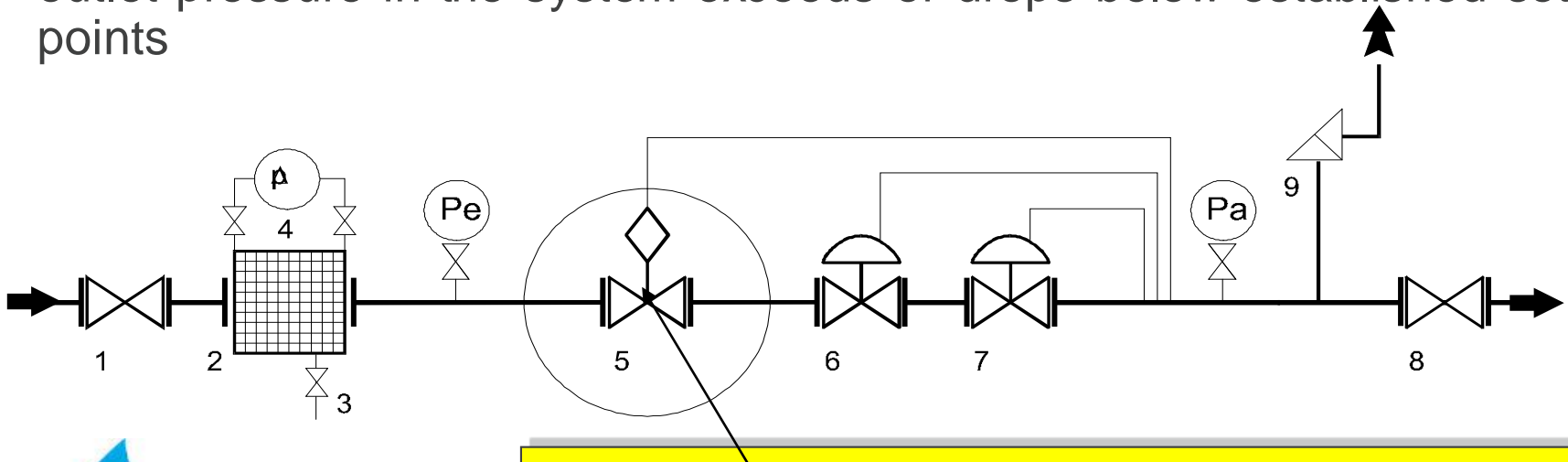
Combination of Devices plus Monitoring/Control

- Inlet pressures – 1 AI
- Outlet pressures – 1 AI
- Filter DP – 1 AI
- Relief Valve Est – 1 AI
- Intrusion – 1 DI
- Water level – 1 DI
- Gas detection – 1 AI
- Control lines – 1 AI
- Slam-shut trip indication - 2 DI
- Remote setpoint control – 1 AI, AO
- Station flow est – 1 AI
- ROV – 2 AO/DO, 2 DI



Slam-shut Valves Purpose & Installation

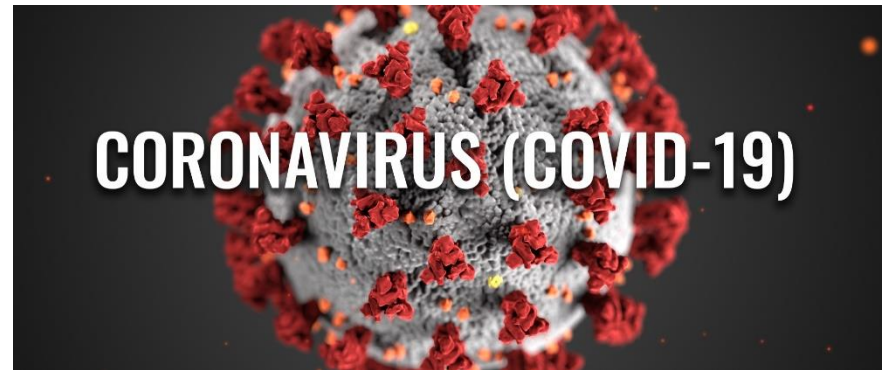
- The slam-shut valves will cut off the gas flow when the inlet and/or outlet pressure in the system exceeds or drops below established set points



The slam-shut is usually installed upstream of the regulators to minimize pressure drop across station or it can be integral to the regulator.

Using Slam-Shuts

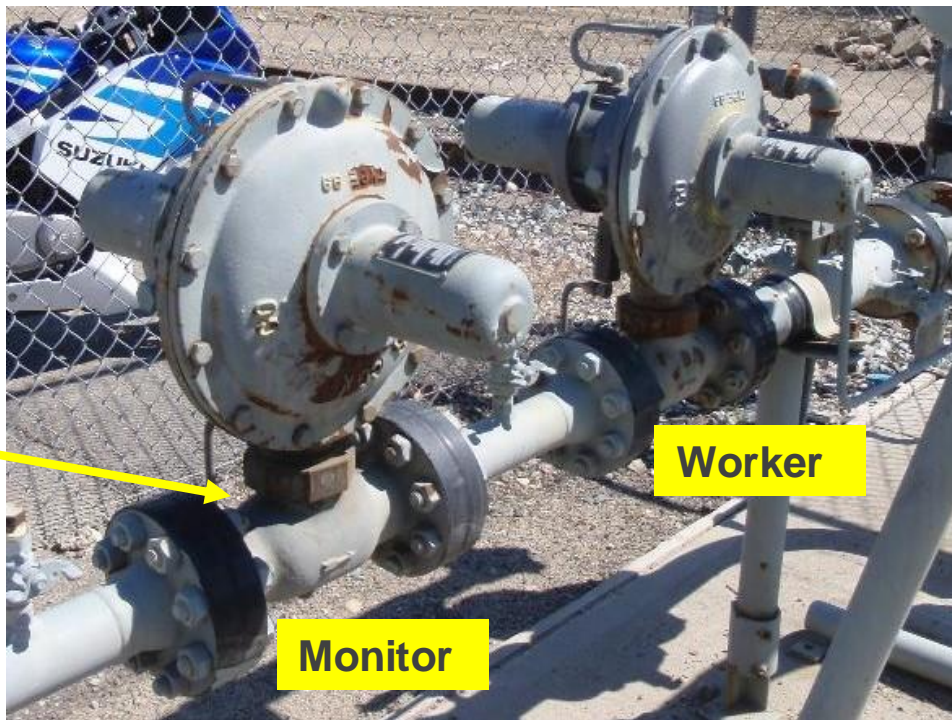
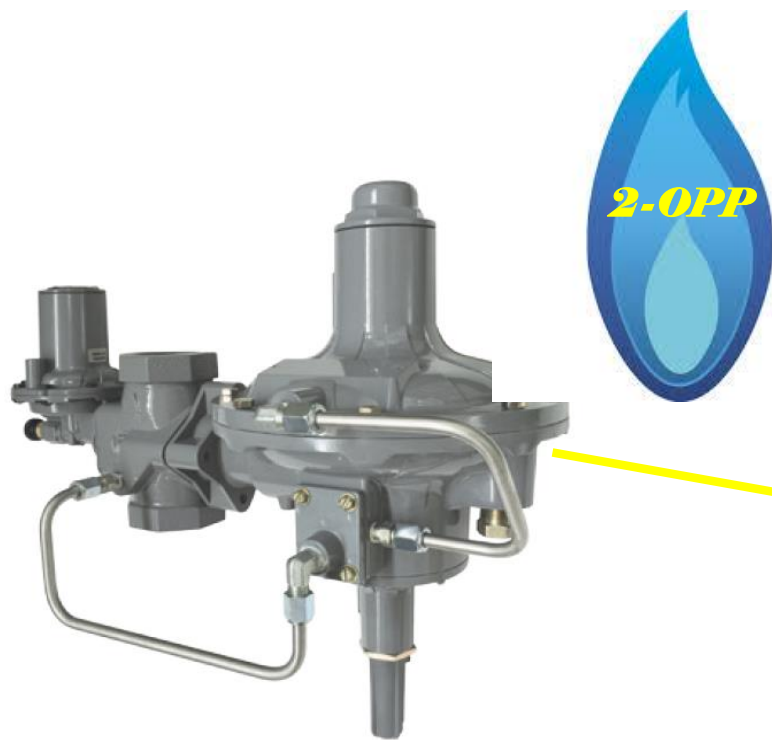
- Slam-shuts in a COVID world
 - Relights would be required and that would mean entry into homes and businesses
 - The correct PPE would be required
 - Cost considerations of relight vs relief or other redundant forms of OPP



<https://empoweringmichigan.com/new-ppe-safety-precautions-prioritize-health-and-safety-during-the-pandemic/>

The new paradigm...

Upgrading Existing Stations to 2 Level OPP

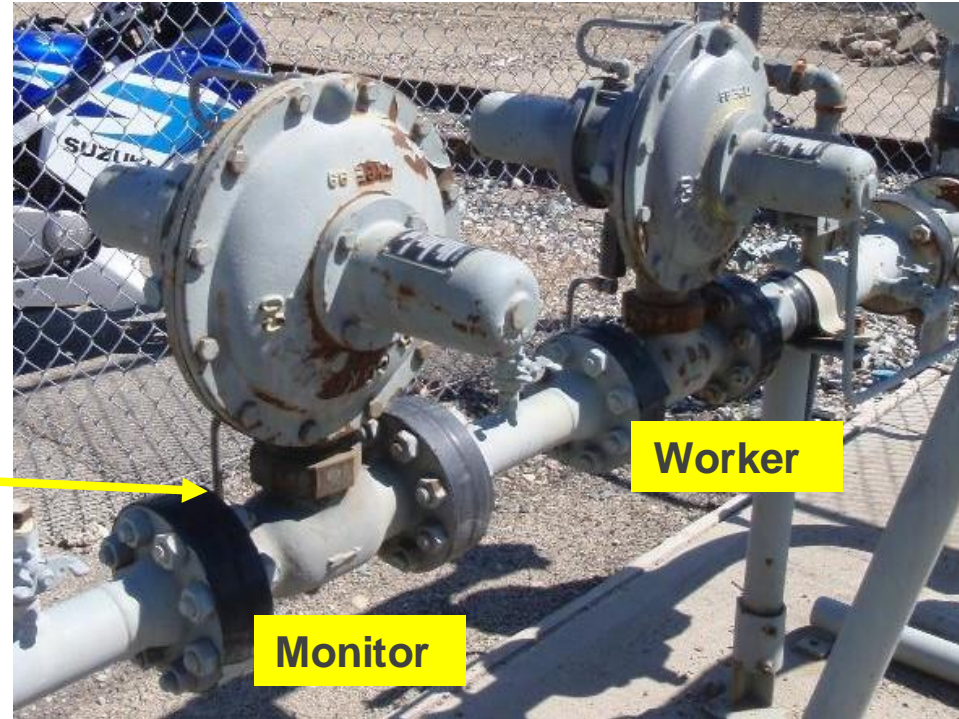


- 299HV but use flanged body (not pictured)

Drop in monitor with slam-shut to upgrade to 2 level OPP

Upgrading Existing Stations to 2 Level OPP

- Flanged wide open upstream monitors can easily be retrofitted with minimal piping changes
- Following ANSI face to face dimensions for flanges accommodates this change
- Integral device avoids capacity reduction



Drop in monitor with slam-shut to upgrade to 2 level OPP

OPP Gate Station/District Station

- Two level OPP wide open monitor with integrated slam-shut
 - Worker/Monitor is a flexible element
 - Slam-shut is a metal plug
 - Token relief
 - Set at monitor pressure



Two levels will add another piece of equipment for OPP

Considerations for OPP in Vaults at District Stations

- State requirements for separation of devices
- Explosions and fire prevention
 - Boot style or metal plug regulators
- Water in vaults
 - Float switches
- Control line placement to prevent excavation damage
- Intrusion alarms
- Gas detection
- Slam-shut monitoring
- Remote setpoint control
- Remote shutdown of regulators
- Remote operated valves

OPP at District Stations Using Section VIII Reliefs

- Two level OPP monitoring regulator station with low differential pressure full capacity relief valve
 - It is a modulating design that opens as much as necessary to keep the downstream pressure at a safe value
 - Remote trip indication should be considered to know when the relief valve has opened

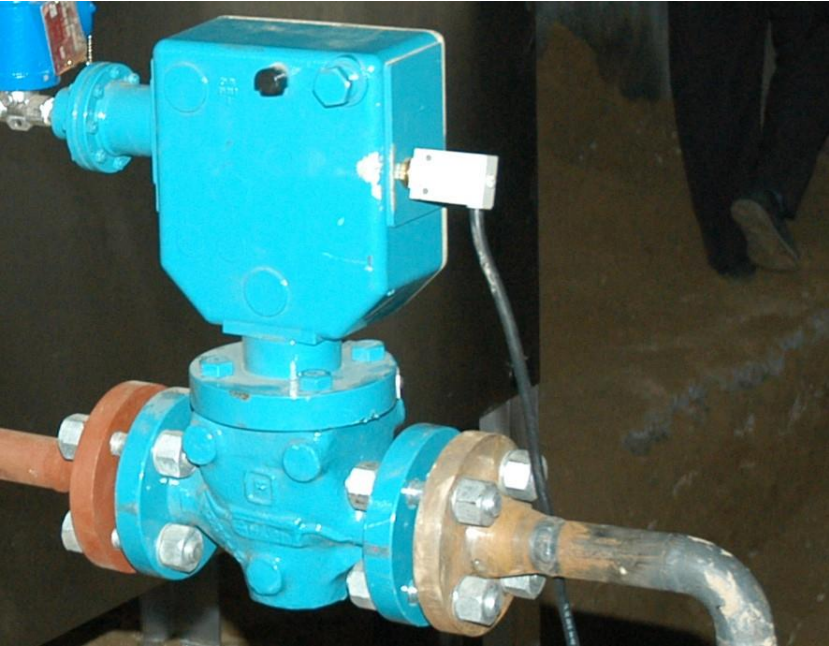


Main valve operator
discrete indication



Low Pressure Reliefs

Slam-shut Trip Indication



OSE discrete switch



VSX8 reed switch

Real Time Pressure Relief Valve (PRV) Monitoring

- Immediate detection of relief events is extremely important when exhausting gas to atmosphere in populated areas
- Real-time PRV monitoring
 - Timestamp and duration
 - Calculated flow rates possible during relief events for EPA reporting
 - Set pressure verification



Remote Setpoint Controller

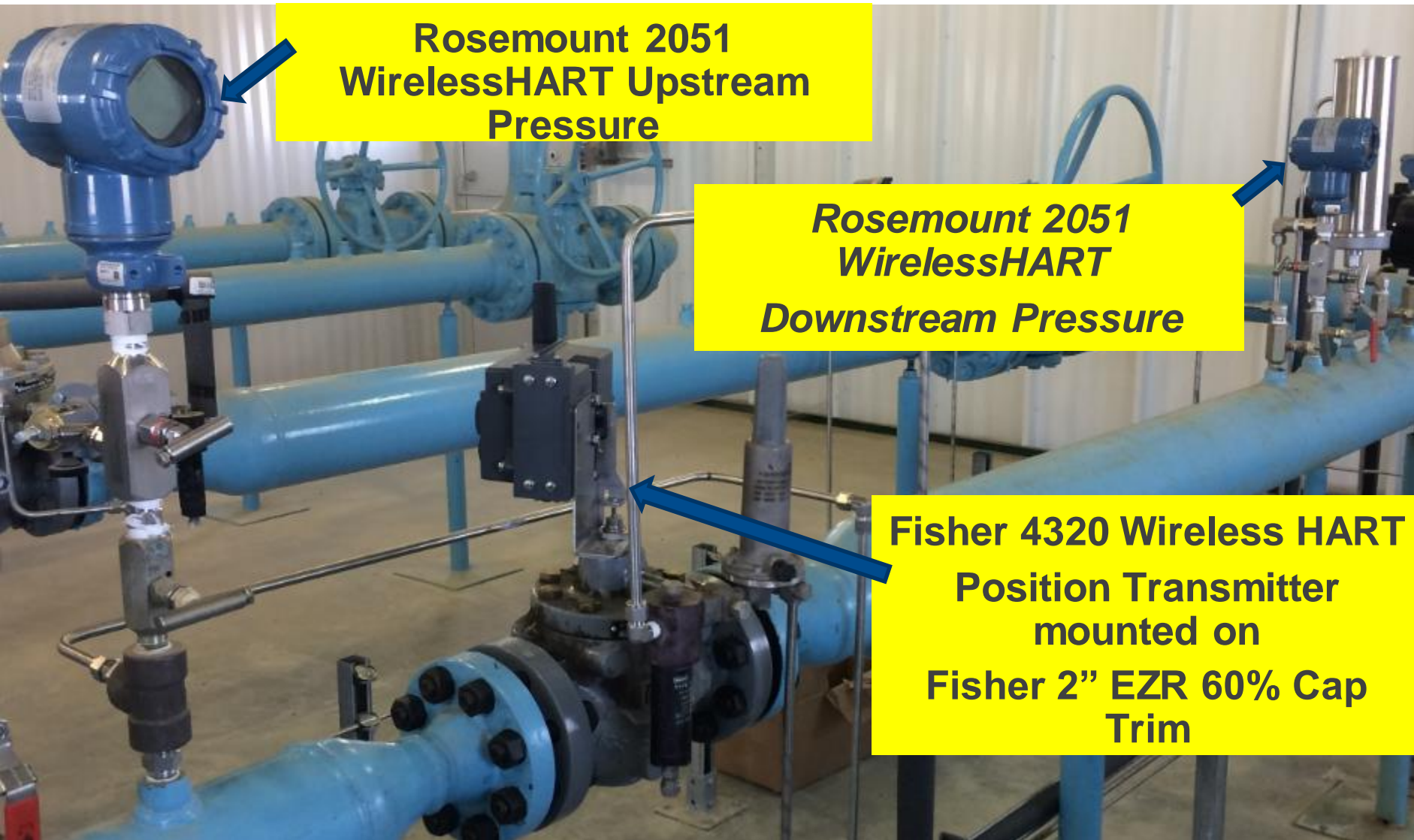


Rotork with Linear Actuation for Remote Setpoint



New model Rotork with linear actuation which will eliminate adjusting screw wear...

District Station Flow Estimation - Wireless



**Rosemount 2051
WirelessHART Upstream
Pressure**

**Rosemount 2051
WirelessHART
Downstream Pressure**

**Fisher 4320 Wireless HART
Position Transmitter
mounted on
Fisher 2" EZR 60% Cap
Trim**

District Station Flow Computer/Controller



RTU - FB107

Wireless transmitter and receiver

Remote Shut-off Valves

- 3 way solenoid valve in pilot operated regulator's pilot supply line (loading) and in bleed line if an unloading regulator
- Traditional control valve with pneumatic or electric actuator
 - Can be shut off remotely or automatically by local RTU



What is the best way to shut in the system?

The Final Questions :

Which part of the system should we protect?

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Where Will The Future Regulations Take Us....

