Driving Sustainability and Efficiency:

The role of PRV Monitoring in Digital Transformation Initiative

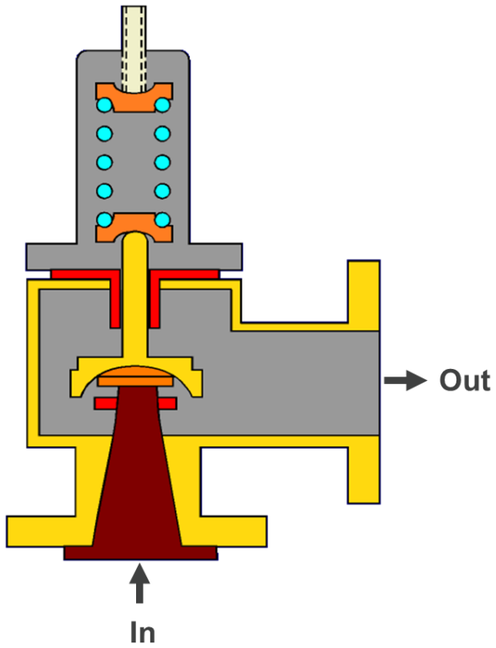
Pressure Relief Valves – The Last Line of Defense

Main Function

- Critical to **protect against** unexpected **overpressure events**
- Need to meet national and local safety **rules & regulations**

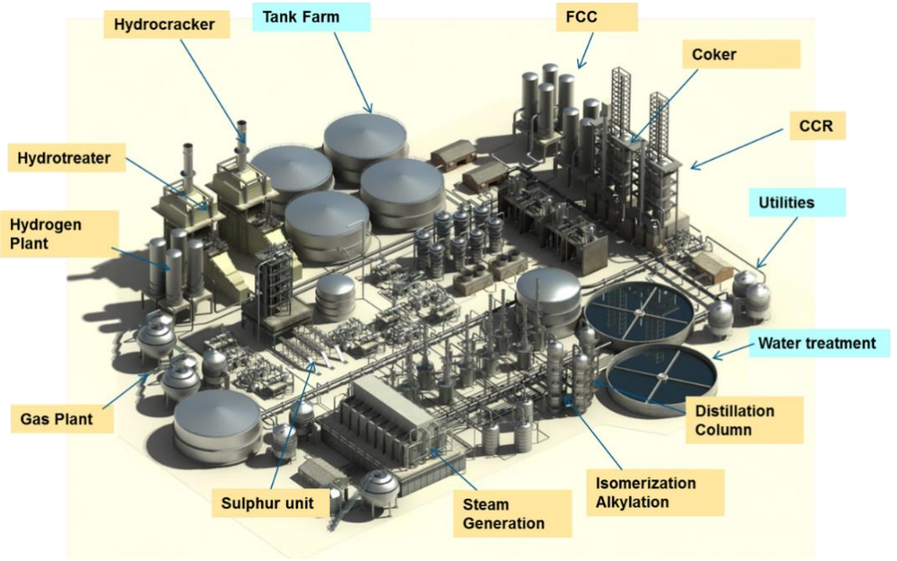
Basic Operation

- Mechanical devices
- Self operated
- Typically “off grid” **not connected**



Importance

- Pervasive across most plants
- Cause emissions and losses
- **Critical for process availability**, can not be “by-passed”



Preventive Maintenance with Service Schedules is the Norm

Undetected Overpressure Events Can Lead to Serious Consequences.

Emissions

Releases and leakages can lead to fines and lawsuits, requiring:

- Meeting equipment leakage standards
- Identify the source of releases to flare
- Reporting emissions during startup and shutdown

Production

Production and energy losses can annualize millions of dollars

- Leakages may remain undetected for years
- Releases and leakages will prevent process optimum performance
- Unplanned service is costly and disruptive

Reliability

PRV releases are often symptoms of Process and operation problems

- Frequent overpressure will wear valves
- Overpressure may also stress adjacent mechanical equipment
- PRV maintenance directly impact process availability and uptime

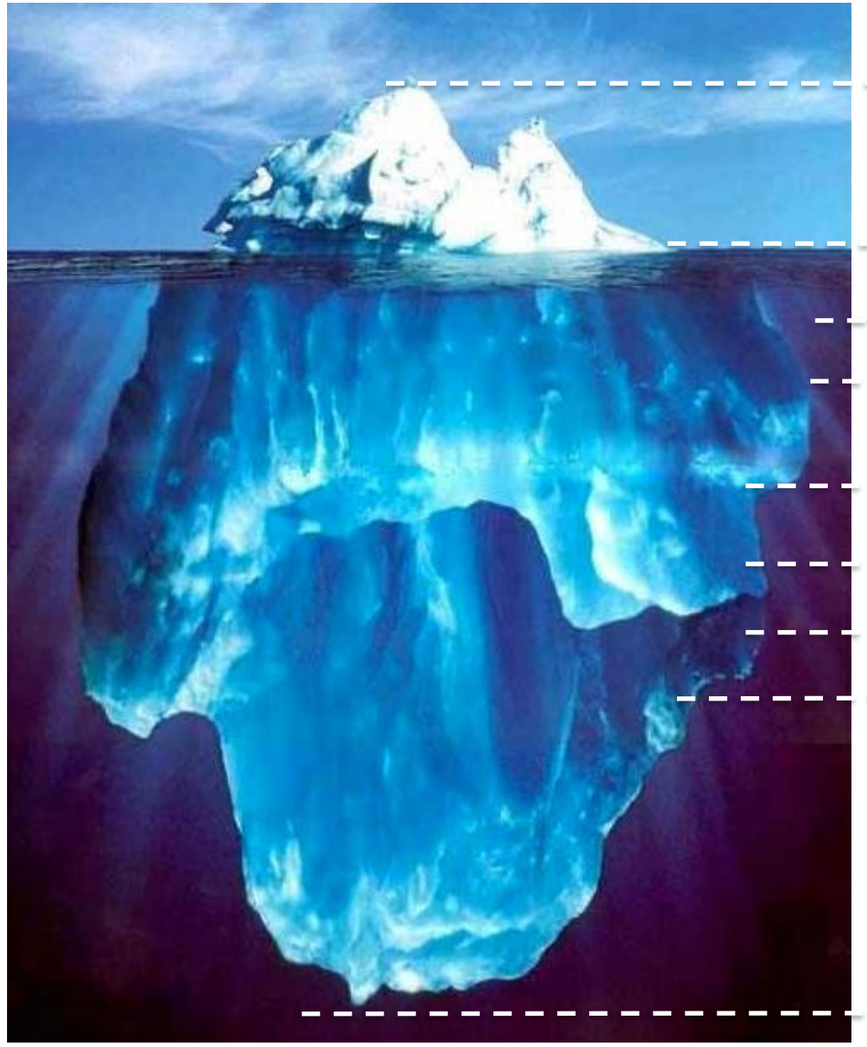
Safety

Undetected releases are unreported “Near Miss” Safety Events

- No process safety root cause failure analysis
- Valves may stay stuck in a closed position, not opening when required
- Checking PRVs on manual rounds is an occupational hazard

PRV Total Cost of Ownership

TNChE Asia 2024



- Initial Product Cost (Engineering/Sizing/Selection/Commissioning)
- Direct PRV Repair Labor
- PRV Repair Parts
- Administrative, Record Keeping and other Transactional Costs
- Transportation (External)
- Inventory Administration Cost
- Rigging/Scaffolding, Pipefitting, etc.

<u>Cost of Non-Conformance:</u>

- Unplanned Outages
- Late Delivery of Repair Valves
- Misapplication of PRVs
- Emissions
- Inventory Utilization
- Incorrect Maintenance Intervals

Total Cost of Ownership

PRVs are Difficult to Access

TNChE Asia 2024

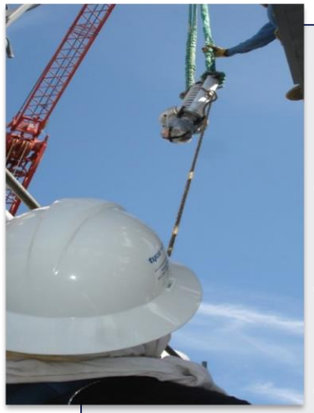
Operations

Inspection with portable tester

- Frequently required if flare rates are high
- Costly with hundreds of PRVs
- Challenging to locate in the field

New environmental and safety regulations require operations to record and report PRV releases and leakages

Service



Needs removing and reinstalling

- Basic: 4 man hours/valve
- Scaffolding: 6-8 man hours/valve
- Crane: 8-10 man hours/valve

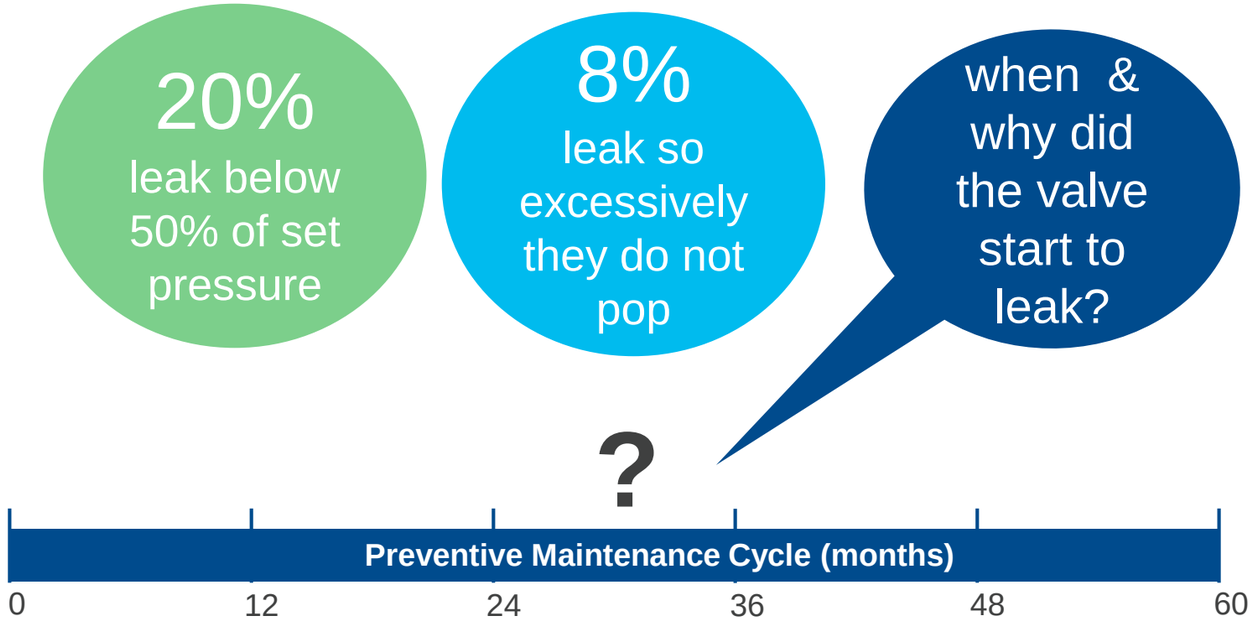
Testing and inspection cycles may be required by outside organizations including local or federal jurisdictions, insurers…etc.

Reducing the Frequency and Duration of Field Activities Will Reduce Cost & Improve Safety

Undetected and Unreported Relief Events Often Occur

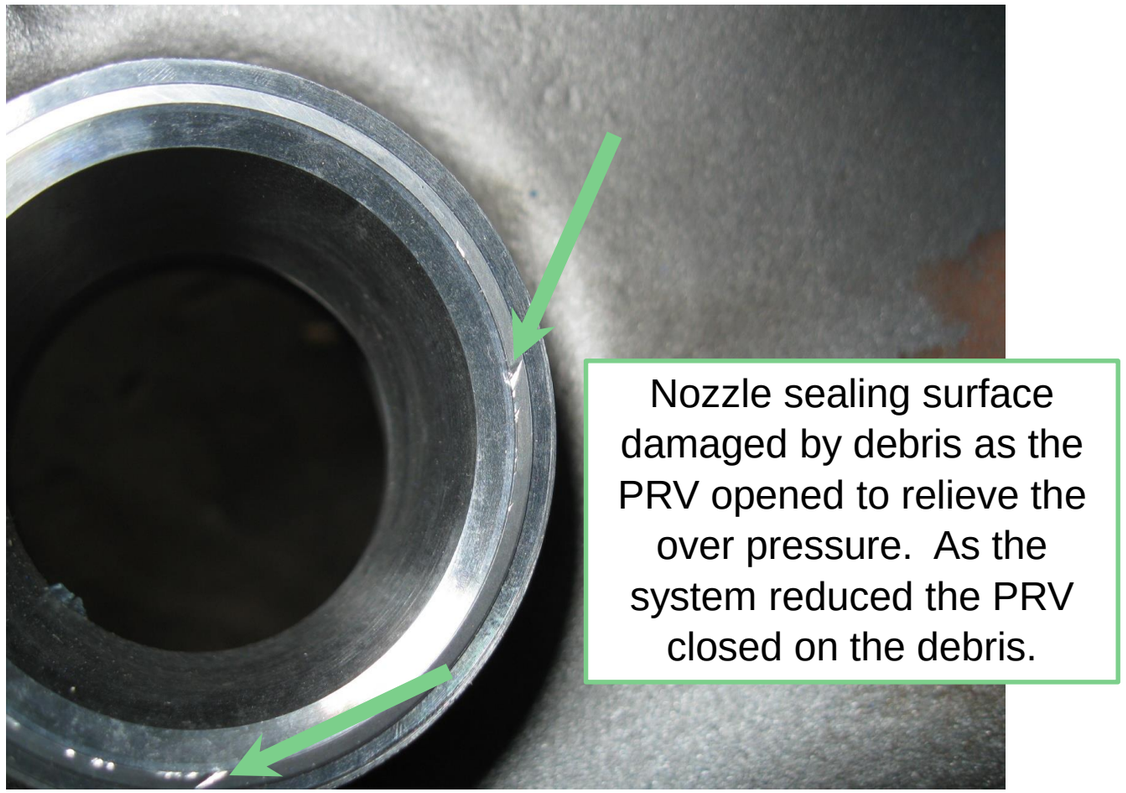
TNChE Asia 2024

Service Records Data Analysis (Multiple PRV Brands)



***10,000 PRV pre-test service records from Large North America Refining Complex**

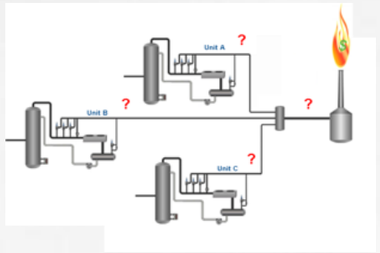
Limited Root Cause Failure Analysis



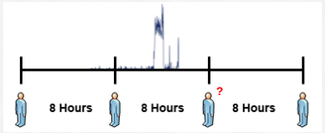
Nozzle sealing surface damaged by debris as the PRV opened to relieve the over pressure. As the system reduced the PRV closed on the debris.

Pressure Relief Valve Monitoring Solution

Improve Safety and Reduce Emission through Real Time PRV event detection



Most of the PRV relieving and events are mostly **unnoticed** or **unable to identify the source**



should this occur

Hundreds of thousands worth of valuable **product loss** due to unnoticed relieving event

Dangerous emissions which can be **toxic** and/or **flammable**

Unable to achieve optimum performance and costly **unplanned maintenance** requirement

Real time monitoring with event logging from Control Room **Safely**

Reduce any emission to a **minimum?**

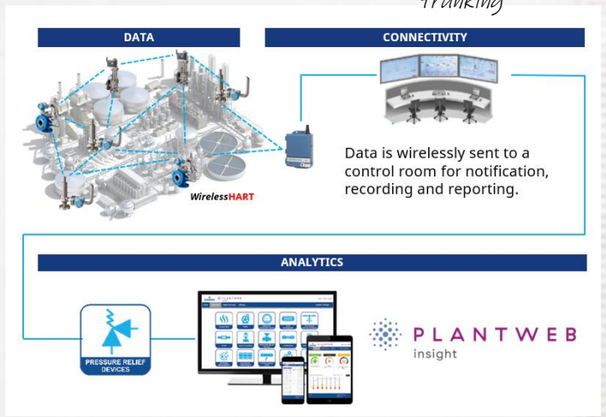
Know immediately when relieving event occur?

Able to **quantify the produce losses** during the relieving event?

What if you could?

Pressure Relief Valve Monitoring
Reduces product loss/emissions & provides instant notification relieving event or leakage

1. *Actionable & Quantifiable Insight*
2. *Wireless option to reduce cabling & trunking*



3. *Real time insight on valve activities*
4. *Reliability based maintenance*

Industries & Applications

Chemical
Refining
Petrochem
Tank Farms
Oil & Gas

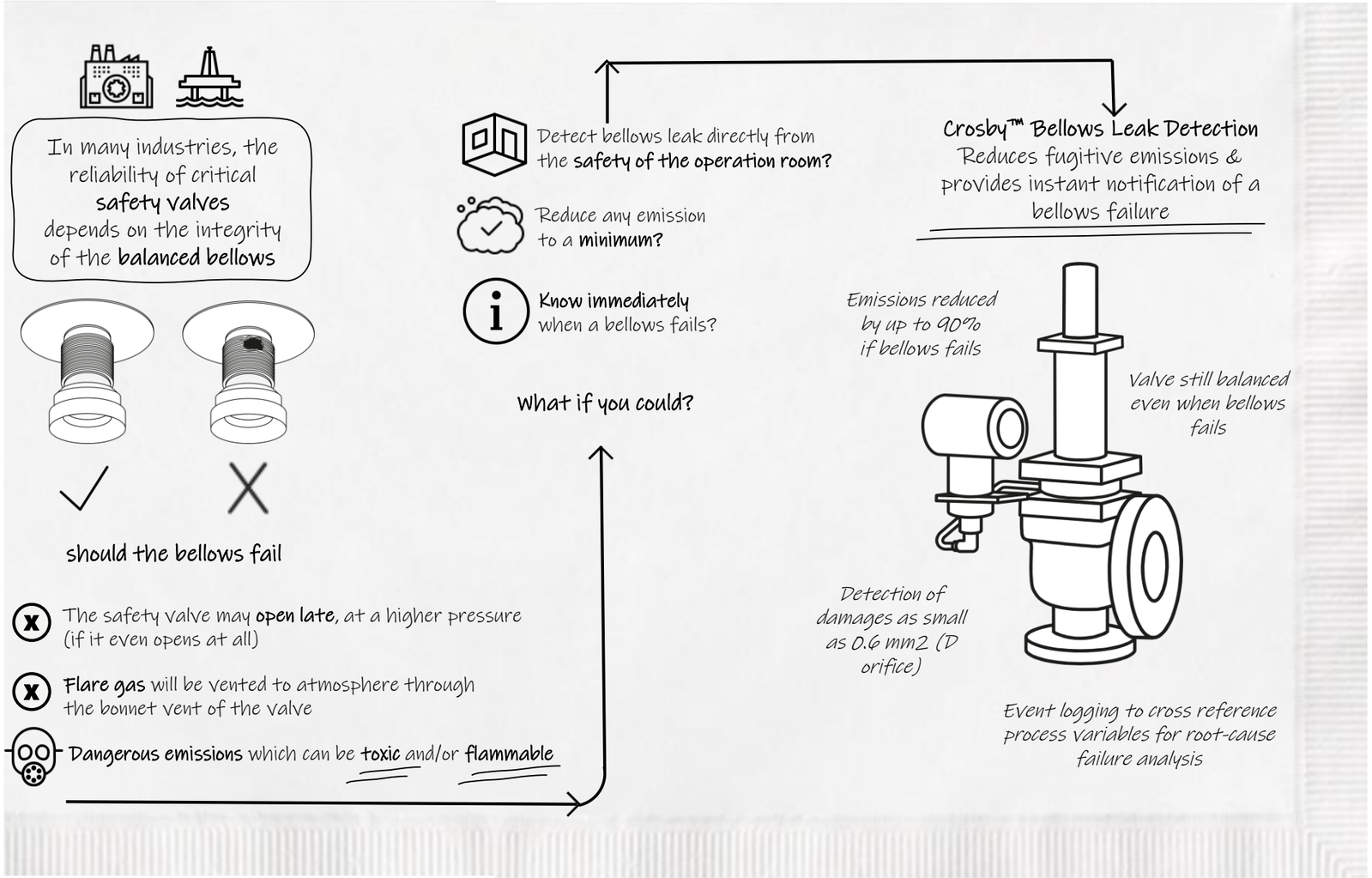
End User Benefits

Enhanced Safety
Reduced Emissions
Improved Maintenance Protocols

Solutions available

Crosby™ Bellows Leak Detection

Reduces fugitive emissions & provides instant notification of a bellows failure



- Industries & Applications

Oil & Gas · Refining · Petrochem · Tank Farms · Chemical

End User Benefits

Enhanced Safety · Reduced Emissions · Improved Maintenance Protocols

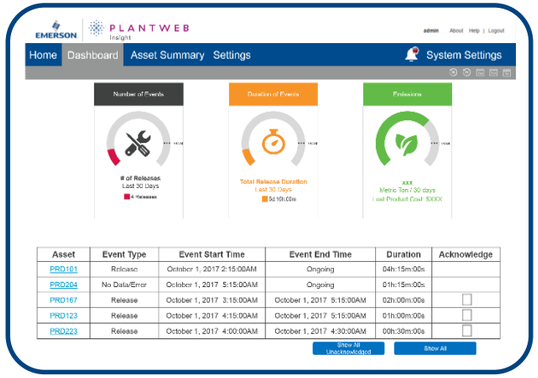
Launch & Availability

2023

The **Crosby™ Bellows Leak Detection** technology has been launched and is already available for order.

Monitoring Solutions for Any PRV Application

TNChE Asia 2024



Balanced Bellow PRVs

Bellow Leak Detection

- Instant bellow rupture indication
- Back up balanced piston
- Reduced leakage
- Volumetric release

Direct Spring PRVs

Position Monitor

- Valve opening indicator
- Event Timestamp and Duration
- Volumetric Release

Pilot-Operated PRVs

Differential Pressure Transmitter

- Valve opening indicator
- Event Timestamp and Duration
- Volumetric Release

Connectivity and User Interface

WirelessHART ® Interface

- Modbus® RTU/TCP, OPC and EtherNet/IP™
- DeltaV™, AMS™, Plantweb™ Insight, and More

Solution to PRV Monitoring Challenges

TNChE Asia 2024

Analytic tools create ***actionable insights*** for informed decisions and maintenance prioritization

Continuous monitoring approach leads to the most effective and successful results

WirelessHART provides a cost-effective approach with high reliability

Wireless transmitters make installation and maintenance quick and easy