PRVs - Best Practices and New Technologies to Address Vented and Fugitive Emissions

Adam Attig Marcelo Dultra



2022



FUGITIVE

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 ٠
- Self operated •

5 Bray

Typically, "off grid" not connected •

→ Out

Importance

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



SPONSORED BY:



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.



2022

2022

Undetected and Unreported Relief Events Often Occur

Service Records Data Analysis (Multiple PRV Brands)

FUGITIVE EMISSIONS

SUMMIT

AMERICAS



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

Limited Root Cause Failure Analysis



SPONSORED BY: 5 Bray EMERSON. MRC Global States and Greater Tomation





Monitoring PRVs Will Make Relief Events Visible

2022

Many Potential Causes for Releases

Blocked Discharge	
Overfilling	
Thermal Expansion	
External Fire	
Operating Close to Set Pressure	

Monitored PRV Case Example







Example: New EPA Regulation for Basic Chemical Manufacturing – August 12, 2023

40 CFR Part 63 - Subpart FFFF – Miscellaneous Organic Chemicals (MON) (§ 63.2480(e)(3)(i)) (3) Pressure release management. ...

(i) You must equip each affected <u>pressure relief device</u> with a device(s) or use a <u>monitoring</u> system that is capable of:

(A) Identifying the pressure release;

(B) Recording the time and duration of each pressure release; and...

40 CFR § 63.2520 – "What reports must I submit and when?"...

(iii) If any affected <u>pressure relief device</u> releases to atmosphere as a result of a <u>pressure release</u> event, You must also calculate the quantity of <u>organic HAP</u> released during <u>each pressure release</u> event and report this quantity ...

40 CFR § 63.2445 – "When do I have to comply with this subpart?"

(g) All affected sources that <u>commenced</u> <u>construction</u> or <u>reconstruction</u> on or before December 17, 2019, must be in <u>compliance</u> with the <u>requirements</u> listed in paragraphs (g)(1) through (7) of this section upon <u>initial startup</u> or on August 12, 2023, ...





Digital Transformation Solution AMERICAS PRV Monitoring: Emerson 708 Wireless Acoustic Transmitter

FUGITIVE EMISSIONS





Pilot Operated PRVs = Fewer Releases

Spring PRVs



Spring force controls valve operation.

Pilot Operated PRVs

System pressure controls valve operation. Seat tightness increases as pressure increases

Pilot PRVs = Fewer Releases

Slide 8





In



Modulating Pilot PRVs = Less Volume At Each Release

2022



5 Brav



SPONSORED BY:



Digital Transformation Solution Pilot Operated PRV with Differential Pressure Transmitter



WirelessHART Communication

PRV Relief Detection Pilot Operated PRVs Lift, time and duration of event detected with 2051/3051 Differential Pressure Transmitter

Wireless and Wired Options Full range of Rosemount Differential Pressure transmitters with *Wireless*HART or wired 4 to 20 mA configurations

Volumetric Release Calculated with PRV lift measuring the differential pressure between inlet and dome and valve capacity

Long Operation Range Power Module:

- From 1 to 60 sec. update:
- 5.8 year @16Second
- 10 year @ 32 Second

Solution for Modulating Pilot PRVs High and Low Pressure configurations. Calculates volumetric release when PRV modulates not at full lift









2022

PRV Bellows Failure and Fugitive Emissions

FUGITIVE

SUMMIT

AMERICAS



2022

FUGITIVE EMISSIONS SUMMIT AMERICAS PRV Bellows Leak Detection Enhancing Safety, Reliability and Redu





- Improved Safety: Guaranteed balanced operation with Backup Piston in the event of failure
- Reduced Emissions: Reduced risk of failure and minimum leakage through bonnet vent – up to 94% reduction
- Enhanced Reliability: Immediate time stamped notification of bellows rupture & monitoring of volumetric emission



Bellows Rupture

-Back Pressure -Bellows Chamber Pressure

EMERSON MRC Global

Time (0.01 second

Detects Small Ruptures D orifice: 0.0009in²

T orifice: 0.018in²



Pressure re (psig)

Sellows Chamber & Bonnet Pressul

Bonnet Pressure

Detection of Actual Failure

SPONSORED BY:

FUGITIVE EMISSIONS **Correlating Real Time PRV Releases** SUMMIT with Process Data & Maintenance Records AMERICAS

2022

Detect and report all PRV releases (near miss events)



Enhance Safety, Reliability, Operation and Meet Environmental Compliance

- - Monitor active relief events, keeping employees safe
 - Recording release events for process safety root cause failure analysis
 - Analytics to increase availability optimizing overhaul scheduling
- (\mathbf{S})

 \checkmark

A

- Adjust operating pressures to improve plant performance
- Immediate notification of events to reduce severity of releases

