

# **Singapore Chemical Industry Council Safety Case Seminar 2026**

## **Technology Innovation Showcase**

## **Industry Applications and Benefits: Digitalization towards Process Safety with Real Implementation Results**

15 July 2026, Wednesday

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Refining Industry Business Development Manager, Asia Pacific

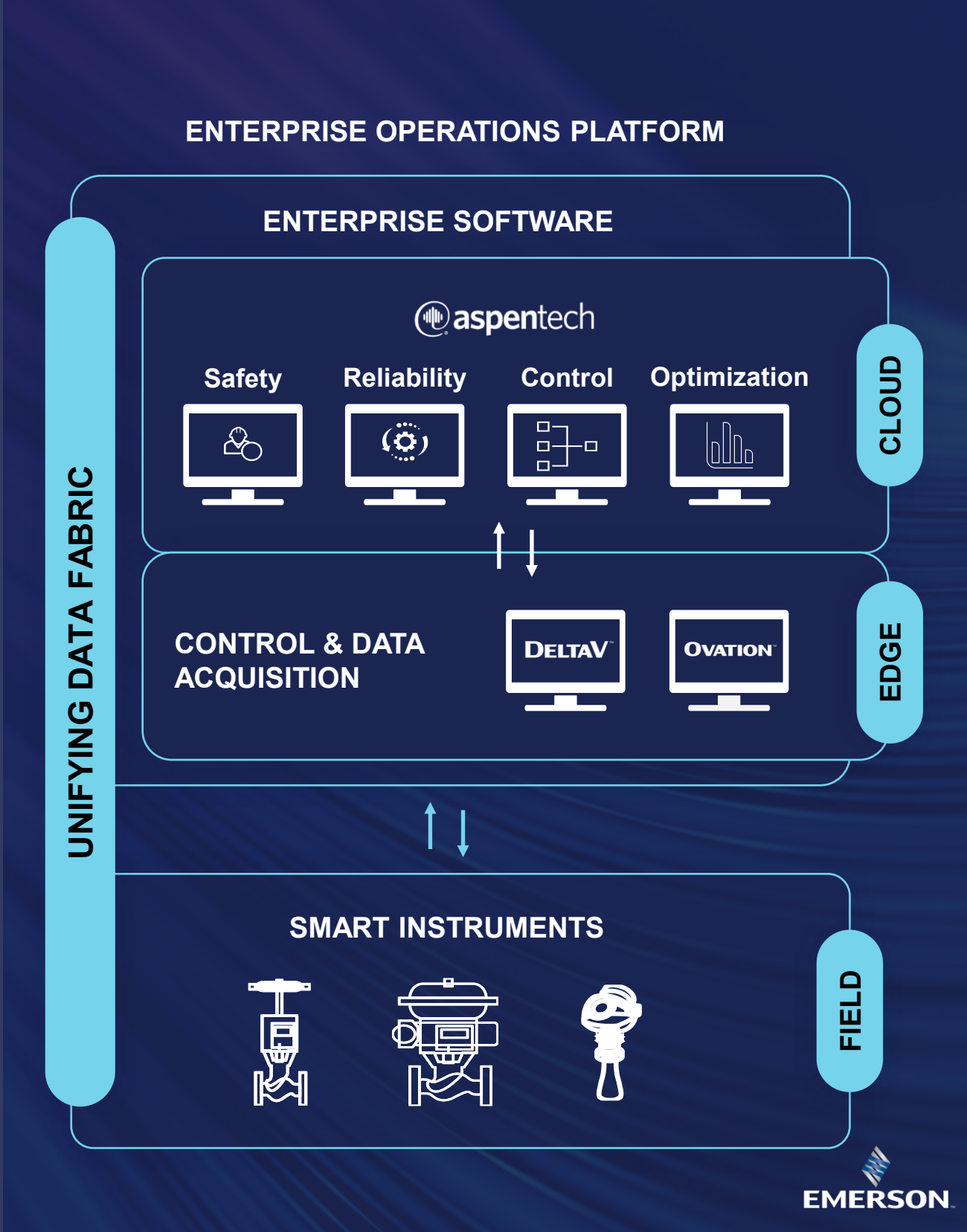
Emerson, Asia Pacific



# Engineering the Autonomous Future

Integrating Workflow Data Enabling Process Safety, Reliability, Control and Optimization into Enterprise Operations Platform starts from Intelligent Devices

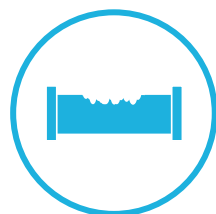
| BARRIERS TO AUTONOMOUS SYSTEMS                                         | EMERSON'S SOLUTION                                                                             |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| <b>DATA SILOS</b><br>Inaccessible data prevents optimization           | <b>DATA FABRIC</b><br>Unified data enables actionable insights                                 |
| <b>CONTEXT</b><br>Devices generate unstructured data                   | <b>CLOUD &amp; EDGE</b><br>Insights generated at the right time for the right user             |
| <b>FLEXIBILITY</b><br>Rigid architecture is expensive to change        | <b>SOFTWARE-DEFINED AUTOMATION</b><br>Architecture is scalable with reduced footprint          |
| <b>AI AT SCALE</b><br>AI Agents lack domain expertise and connectivity | <b>DIGITAL TWINS &amp; AI ORCHESTRATION</b><br>AI agents easily deployed across the enterprise |



*Enable Flexible and  
Autonomous Operations,  
Guarding Performance and  
Safety at Lower TIC*

• Operational safety

# Top Causes of Tier 1 and Tier 2 Safety Issues Arising from a Typical Process Plant



**49%**

Due to piping



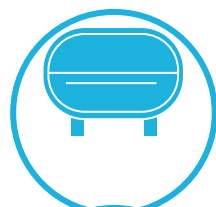
**11%**

Due to tanks



**8%**

Due to pumps



**6%**

Due to heat exchangers



**4%**

Due to fired heaters



**4%**

Due to pressure vessels

## Ways of Mitigation with Available Intelligent Devices Today



### Advanced Pressure and Temperature Measurement

Continuously improve safety, reliability and productivity and sustainability with advanced measurement technologies



### Non-Intrusive Measurement Solutions

Future measurement solutions such as Non-intrusive Flow and Temperature Sensors designed with safety, performance, minimizing mechanical costs, and smart diagnostics coverage



### Continuous Corrosion and Erosion Monitoring

Get full insight to asset integrity with continuous corrosion and erosion Ultrasonic wall thickness measurements



### Overfill Prevention Tank Level Solutions

Overcoming challenges with traditional level instrumentations with Non-Contact Radar Tank Gauging Technology with redundancy capabilities



### Flame and Gas Detection

Early detection of any hazardous gases and larger footprint coverage



### Wireless Monitoring Solutions

Predictive monitoring with pervasive sensing of asset health

# Case Study 1: Emerson Flame & Gas Solution to secure Tank Farm Safety in Operations

## Customer Pain

- Concern of early leakage flame and gas detection as requirement from insurance company due to a fire incident at storage tank farm area.
- Increase safety and protect surrounding environment in event of LOC.
- Aging storage tank facility, and remote access for human intervention
- High risk of fire from lightning strike can also trigger fire and flame with undetected gas leakage
- Financial impact from fire incident led to management review of flame and gas monitoring solution

## Value to Customer

- Familiar with Emerson installation base mostly for field devices
- Proven technology and result of existing install base performance in other sites
- Acknowledged reliability of Rosemount brand image in Country-wide Refineries
- Collaboration with Emerson as a solution provider to attain SIL-3 SIF requirements according to IEC 61511's Architectural Constraints and Hardware Fault Tolerance (HFT)

## Continuity in Support

- Further collaboration to improve balance of plant in oil movement tank farm and terminal sites
- Technology adoption of improving existing ATG Systems from Servo to Radar technology
- Site Expansion Plan support

## A Major Refinery Customer in South-East Asia



# Emerson Flame & Gas Detection Solutions

Layered protection from continuously evolving hazards.

Comprehensive solutions designed to safeguard personnel, optimize process integrity, and ensure environmental protection where combustible or toxic gases are handled, or fire risks exist.



Flame detection

Point gas detection



Gas leak detection



Open Path gas detection

## Flame detection solutions

- Detection ranges up to **90 m** and wide field of view with low cost of ownership.
- **QuadSense™ IR3 and UV/IR** versions available to meet customer specifications.

## Point gas detectors

- **Continuous**, localized gas detection for a variety of toxic and combustible gases.
- **Time saving features** like optical gas free tester, heated optics, smart sensor modules, remote sensing and advanced interface increase technician efficiency.

## Open path gas detectors

- Accurate **high-speed response** with high immunity to false alarms. Heated optics for use in extreme environments and real time diagnostics optimize performance.

## Ultrasonic gas leak detectors

- Instantaneous response in **high pressure** processes and unaffected by inclement weather.

ROSEMOUNT™

SPECTREX™

NET SAFETY™

# Case study 2: Key Major Refiners Achieve With Continuous Wall Thickness Monitoring Enabling Early Intervention



## A) Biorefinery Protects Assets During Sustainable Feedstock Transition

| Challenge                                                                 | Deployment                                                     | Result                                                              |
|---------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------|
| Accelerated corrosion during feedstock transition with limited visibility | Non-intrusive wall thickness monitoring at high-risk locations | Earlier intervention and improved confidence in integrity decisions |



## B) Refinery Moves from Reactive Maintenance to Digital Asset Integrity

| Challenge                                      | Deployment                                                          | Result                                                    |
|------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------|
| Siloed inspection data and missed IOW breaches | Real-time wall thickness monitoring integrated with process context | Safer decisions, improved planning, reduced reactive work |



## C) Large Petrochemical Complex Achieves Zero Unplanned Shutdowns at Scale

| Challenge                                                                        | Deployment                                                                               | Result                                                                                                               |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Manual inspection/turnaround cadence couldn't support "zero unplanned shutdowns" | 1,000+ Rosemount UT Transmitters deployed across CDU, VDU, FCC, and other critical units | Continuous analytics support planning & regulatory engagement; zero unplanned shutdowns achieved & rollout expanding |

Crude and Vacuum Distillation Unit - Customer Challenges

Importance of Crude Oil Distillation Unit (CDU)

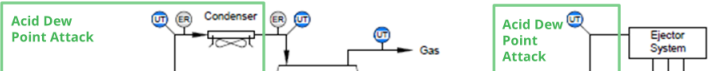
- Entry point of crude in refinery
- First time crude gets temperature corrosive
- Issues here impact all processes

Corrosion customer challenges

- HCl corrosion
- High ammonium chloride in the system
- Amine hydrochloride
- Wet H<sub>2</sub>S damage
- High temperature sulfur
- Naphthenic acid corrosion

Hot circuits with typical temperatures over 662°F (~350°C), such as lines and vacuum units are affected by localized naphthenic corrosion. Overhead system corrosion is affected by desalter performance.

Link to [Application pack - CDU](#)  
Link to: [Application pack - crude](#)



Hydroprocessing (Hydrotreating and Hydrocracking) Unit – Customer Challenges

Importance of Hydroprocessing units

- Adds to refinery's profit margin
- Hydrocarbon products are reacted with hydrogen in presence of a catalyst to remove contaminants and produce value clean and lighter products

Customer challenges

- Corrosion attack caused by naphthenic acid & ammonium bisulphide (REAC)
- Wet H<sub>2</sub>S gas / sour water
- Filming amines optimization required
- Parts of the unit runs at high pressure – increased personnel safety risk



Alkylation Unit – Customer Challenges

Importance of amine units

Converts low-value product into alkylate, a high-value high-octane gasoline component

Customer Challenges

- One of the most dangerous for personnel to enter make manual inspection very challenging
- Corrosion attack caused by acid
- Fluoride scaling
- Water content in circulating phase change or by extractant
- Formation of liquid water at Defluorinator
- Poor acid settler performance
- High temperature corrosion

Amine Unit – Customer Challenges

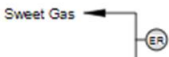
Purpose of amine units

Separation unit to remove H<sub>2</sub>S and CO<sub>2</sub> gases from gasoline and diesel fuels with the help of amines that absorb those gases.

Customer challenges

- Free acid gas, strong acids
- High temperatures
- High concentration of H<sub>2</sub>S
- CO<sub>2</sub> corrosion
- Accumulation of heat stable salts HSS
- Difficulties in measuring corrosivity reduction processed gas

Link to [Application pack - Amine](#)



Corrosion Issues in Fluid Catalytic Cracking (FCC) Unit

Description And Explanation Of Unexpected Corrosion In A Fcc Overhead System

Matthieu Devallée  
Paper presented at the CORROSION 2010, San Antonio, Texas, March 2010.  
Paper Number: NACE-10360  
Published: March 14 2010

Cite Share Get Permissions

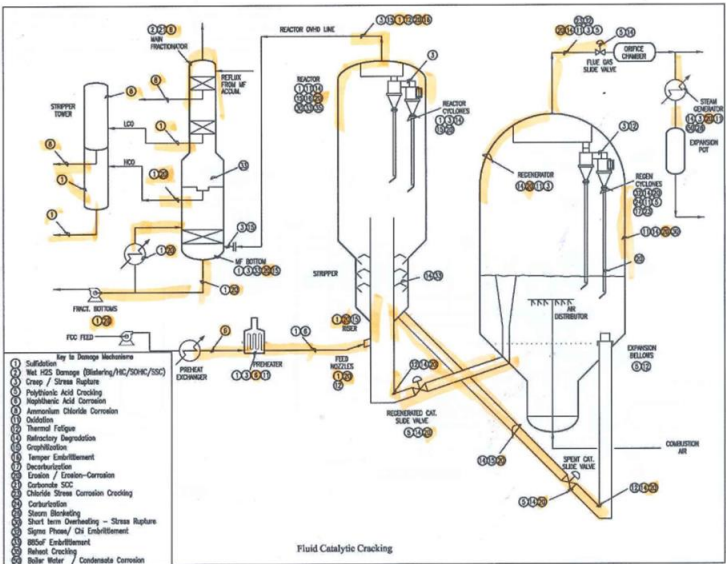
INTRODUCTION

ABSTRACT

A leak occurred in a FCC unit main fractionator overhead line elbow in June 2006. Following this leak, investigations showed acidic corrosion-erosion in the overhead circuit. This type of corrosion was unexpected in this circuit.

Process water analysis revealed that during normal process operations, acidic corrosion was not possible. 2002-2006 unit run analysis highlighted the fact that this unit has been frequently in a transient phase called catalyst recirculation. Water sampled during those periods exhibited a very low pH due to the presence of sulfuric acid. During catalyst recirculation operation sulfur trioxide is formed. SO<sub>3</sub> goes up in the main fractionator overhead and condenses as H<sub>2</sub>SO<sub>4</sub> with the water vapor. This media has corroded carbon steel equipments located after the water dew point.

Source: NACE



Source: API 571

Journeyed with more than 50 Refinery Sites to improve their RBI with Emerson Solutions

## Case Reference in Asia Pacific Refineries

### Refinery A 314 sensors

Manual inspection not reliable, repeatable & involves risk of measurement in hazardous, high & isolated locations.

Permasense sensors installed in CDU, VDU, FCCU, CCR & Hydro-treater.

WT100 – 151

WT210 – 138

ET410 – 24



### Refinery B 71 sensors

Refiners face most challenging corrosion problems, driven by the processed fluids and high temperatures coupled with the uncertainty of the corrosive nature of the specific crude mix.

Permasense sensors installed in CDU, HCU, CDR, HDF units.

WT210 – 68, ET210 - 3



### Refinery C 54 sensors

Monitoring known corrosion problems in their CDU overhead system & other critical locations

Permasense sensors installed in CDU.

WT210 – 48, ET210 - 6



# Rosemount™ Corrosion & Erosion

Monitor both risk and impact to enhance your safety, reliability, and operational efficiency

Emerson's Corrosion and Erosion Monitoring Solutions can help you gain a complete understanding of your corrosion and erosion risks and the effect of those risks on your plant. This data can be used to make better informed decisions - maximizing plant performance, safety, and profitability.



Rosemount SAM42 Acoustic Particle Monitor



Rosemount Wireless Ultrasonic Thickness Transmitters



Plantweb Insight™ Non-Intrusive Corrosion Application

- **Continuously monitor** the health of your assets and the impact of corrosion and erosion with the non-intrusive, permanently-installed **Rosemount Wireless Ultrasonic Thickness Transmitters**
  - Use the Rosemount Wireless WT210 Corrosion and Erosion Transmitter with the **Universal Mount** to monitor for corrosion and erosion on high temperature applications without welding studs
  - Unlock corrosion and erosion monitoring on tanks, vessels, and other large applications with the **Magnetic Vessel Mount**, used with Rosemount Wireless ET210, ET310, and ET310C Corrosion and Erosion Transmitters
- Understand and **detect erosion risks** before damage with the non-intrusive, permanently-installed **Rosemount SAM42 Acoustic Particle Monitor**
- **Receive critical asset health insights** with Emerson's Plantweb Insight Non-Intrusive Corrosion Application to help you to determine predictive maintenance strategies to optimize plant performance



Rosemount Wireless WT210 Transmitter with the Universal Mount



Rosemount Wireless ET210 Transmitter with the Magnetic Vessel Mount

# Case Study 3: Refinery in Singapore Upgraded Crude Fired Heater Inlet Flowmeter to achieve SIL-3 with Emerson Solution



## Process

- Crude distillation unit (after desalter)
- Crude fired heater pass before entering fired heater
- Existing flow technology: DP Flow

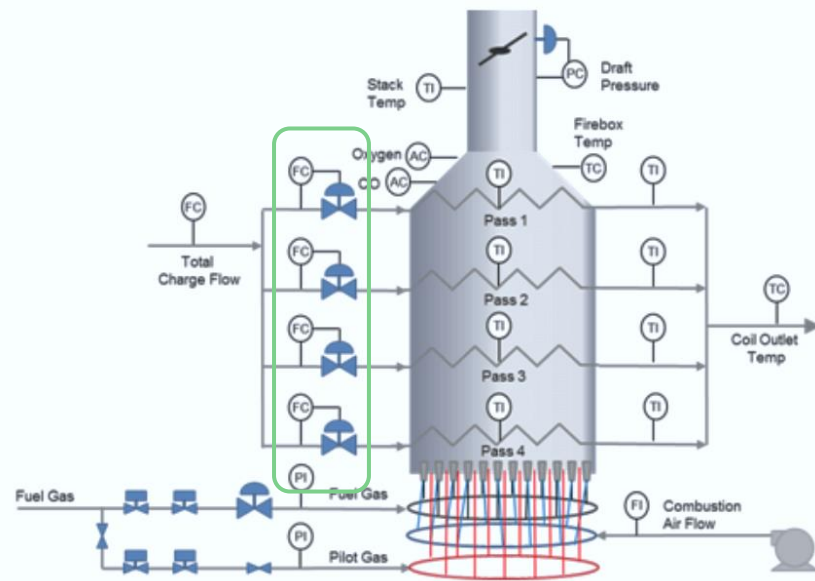


Figure: Typical P&ID for Fired Heater in CDU

## Pain Points

### Maintenance

- Impulse line often partially plugged. Issue could result in odd-hour on-call which incurs maintenance costs.
- Frequent trip results in administrative costs to investigate issue.

### Operations

- Issue caused several process trip on average 3-4 times per year.
- Operational availability decreases.

### Process safety

- Fired heater restoration takes place within 1-2h.
- During rectification, the crude pass 1oo1 trip is temporarily by-passed which increasing risks.

### Commercial

- Production loss during trip which resulted in unplanned downtime.

## Solution & Value to Customer

- Technology conversion of 1x Fired Heater Crude Pass from DP Flow to Quad Vortex
- Installed in parallel with existing DP flow for 1x crude pass as trial, and repeated across refinery once successful

## Desired Outcome

- ✓ Prevent unplanned trips and shutdowns
- ✓ Increased reliability with 2oo3 trip voting capability
- ✓ Increased operational availability with ability to replace sensors online
- ✓ Aim to reduce maintenance cost with elimination of impulse line issue
- ✓ Reducing on-site modification against solution with 4x DP flow/4x single vortex.

## Stakeholders Driving Success

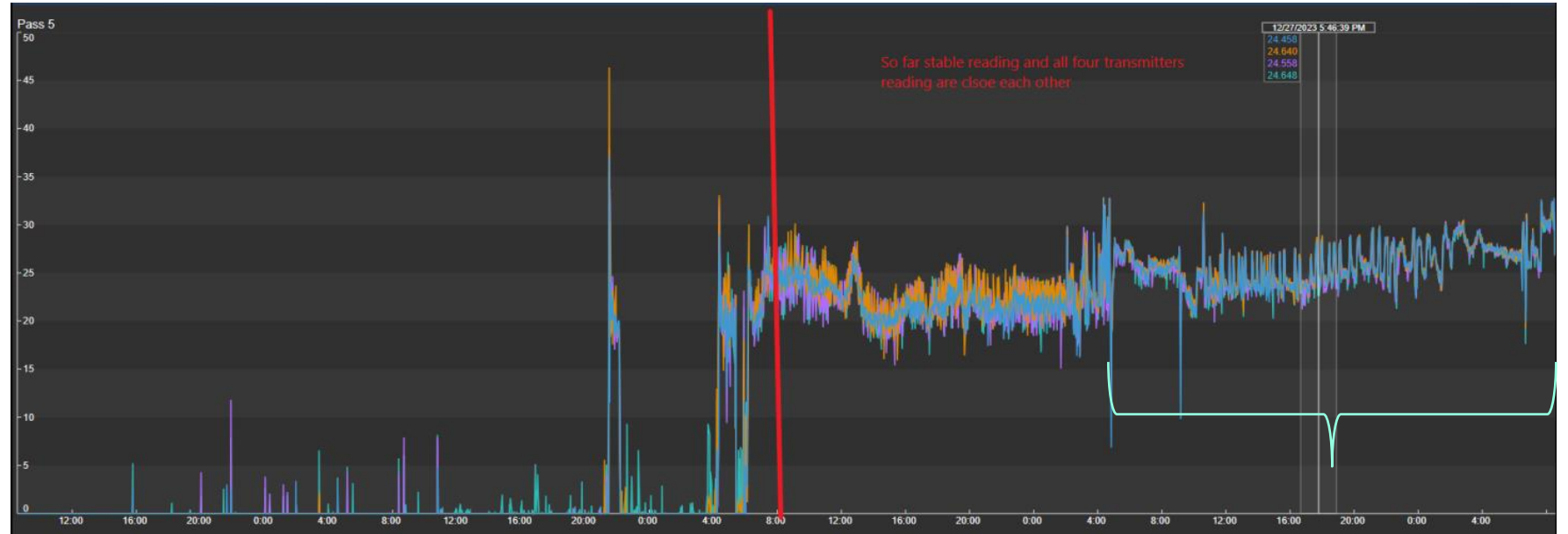
- Maintenance & Reliability Team
- Process & Technical Team
- Projects Development Team



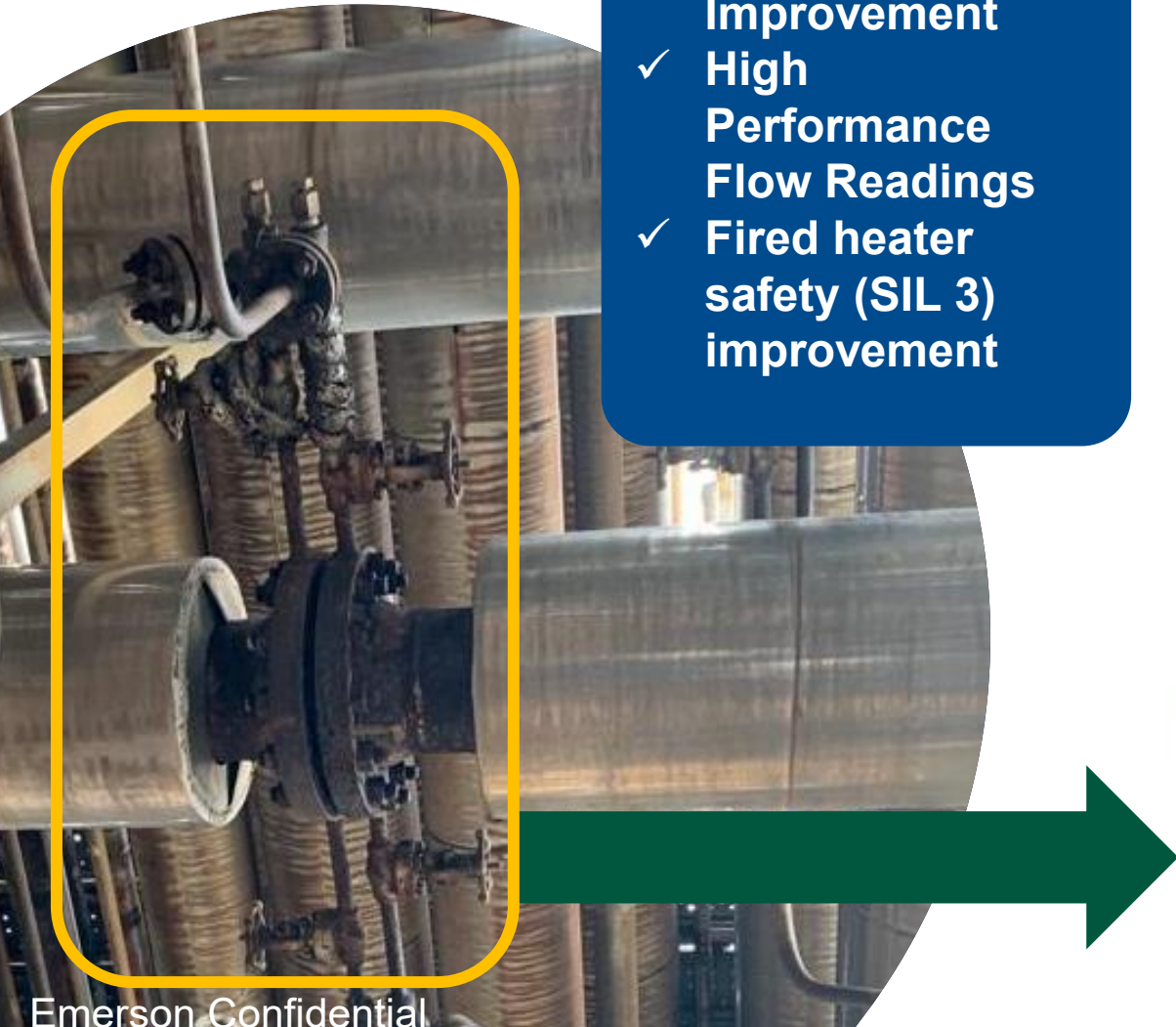
# Case Study 3: Refinery in Singapore Upgraded Crude Fired Heater Inlet Flowmeter to achieve SIL-3 with Emerson Solution

## Quantified Business Results

- ✓ Reliability of Instrument Improvement
- ✓ High Performance Flow Readings
- ✓ Fired heater safety (SIL 3) improvement

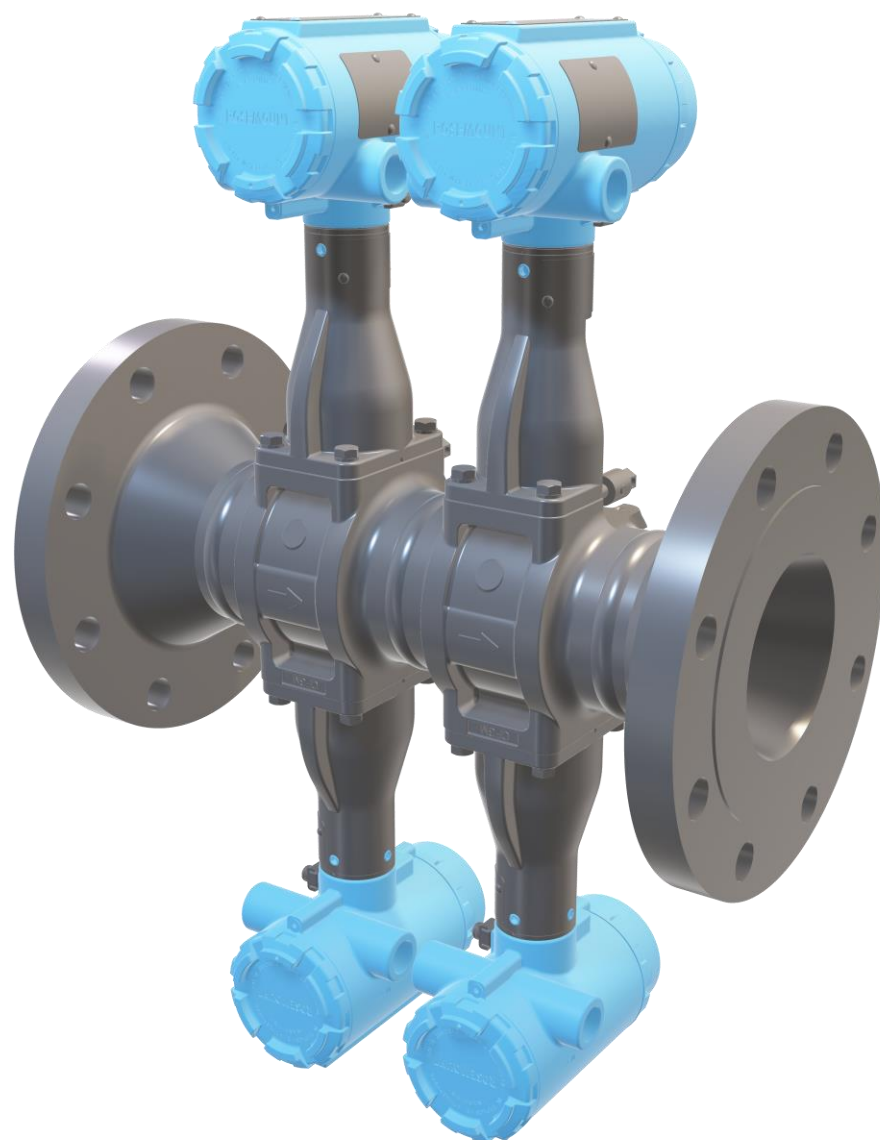


- ✓ Upon start-up, customer feedback all 4-flow data were congruent with each other
- ✓ Quad Vortex flow measurement was stable
- ✓ Customer expressed confidence in Rosemount Quad Vortex performance
- ✓ Less trips, extended MTBF, improved operational and mechanical availability



Rosemount

## 8800 Quad Vortex Meter



[<](#)  
BACK

### 4 Independent Sensors and Transmitters

- No need of additional transmitters for a redundant flow measurement
  - Compact design

### Safety Certified

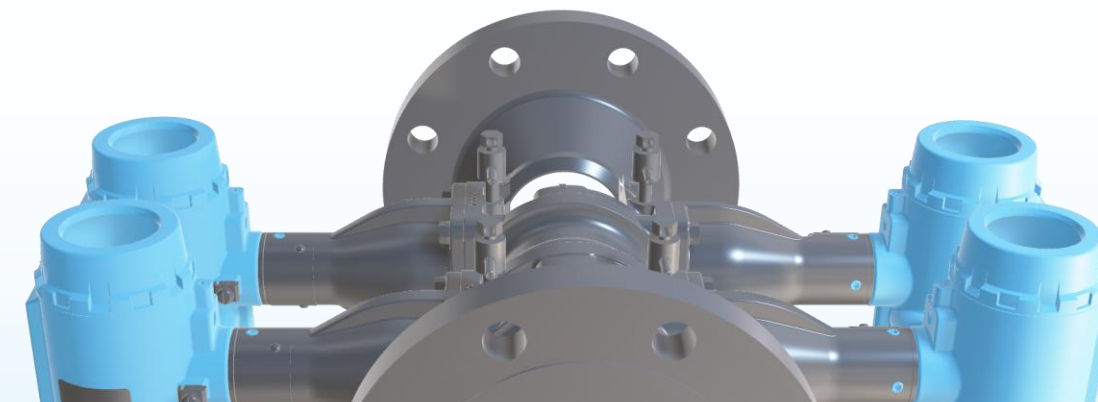
- SIL 3 capable
- 2oo3 voting, fourth transmitter for control

### All-welded Design

- No gaskets, low leak potential
- No impulse lines to plug and clog

### Compact Solution

- 4 transmitters and sensors in one meter body
  - Standard straight run



# Case Study 4: Overcoming H2S with Continuous Toxic Gas Monitoring at a Wastewater Treatment Site in Singapore

THE STRAITS TIMES

## 1 worker dead, 2 in ICU after inhaling poisonous fumes at PUB's Choa Chu Kang Waterworks

Published May 23, 2024, 05:12 PM

Updated May 23, 2024, 10:14 PM



### Areas with H<sub>2</sub>S Concern

- Raw sewage
- Holding tanks
- Interceptors
- Mechanical dewatering
- Sludge drying beds
- Force mains
- Lift stations

Place H<sub>2</sub>S Sensors low near sludge-drying beds and digestion equipment

Wireless gas monitors may be moved to different locations to provide personnel protection and asset integrity

\*Pre-treatment tanks where degreasing or sedimentation occur may be a likely location for H<sub>2</sub>S

Biological treatment tanks and equipment may release toxic concentrations of H<sub>2</sub>S

*\*Pre-treatment processes in Waterworks processes alike a typical Wastewater Treatment Plant (WWTP) found in both Refinery and Chemical complex with wastewater by-products in Singapore*

*About H<sub>2</sub>S Safety Exposure Limits..*

- At concentrations above 100 parts per million (ppm) → Loss of smell
- At 500-1,000 ppm → Rapid unconsciousness and death within minutes.

### Official statement by Ministry for Sustainability and the Environment, Singapore

3 On 23 May 2024, during routine cleaning of a water treatment process tank at Choa Chu Kang Waterworks, three contractor workers were found to have collapsed. Initial investigations indicated that they had inhaled hydrogen sulphide. Hydrogen sulphide is a gas that is typically emitted when sludge is being drained from the tank. At the time and location of the incident, hydrogen sulphide levels were higher than normal based on the hydrogen sulphide sensors installed.

# Installations Case Reference to enable continuous H2S Monitoring through Emerson's Industrial Wireless-HART Network

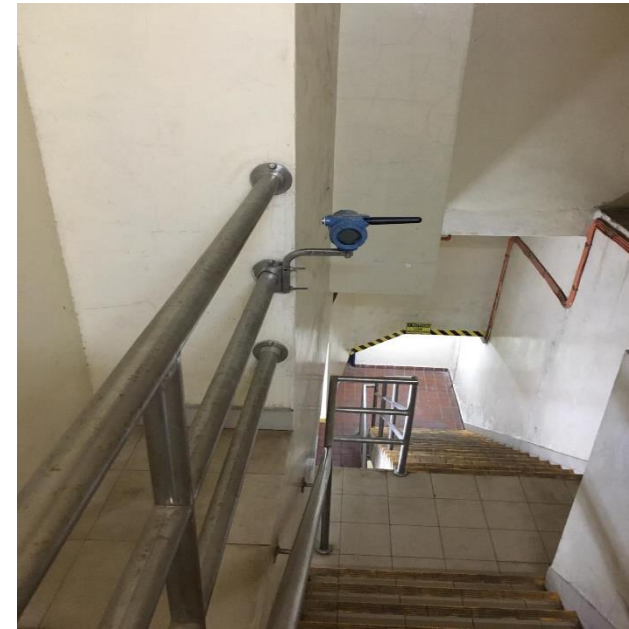
GATEWAY AT CONTROL ROOM ROOF



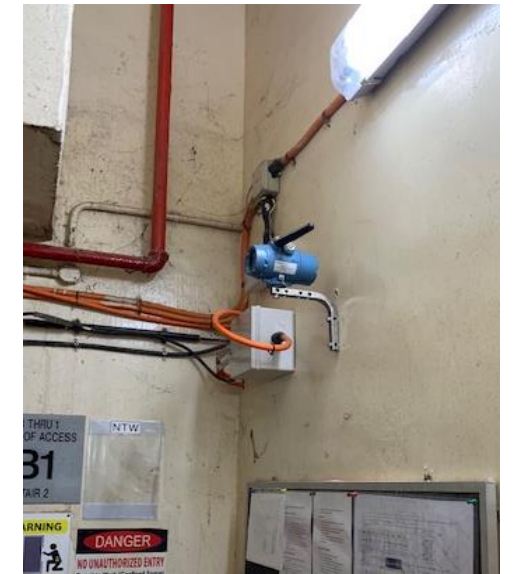
REPEATER OUTSIDE BUILDING



REPEATER ALONG STAIRS



REPEATER AT BASEMENTS



**Rosemount™ 928**  
**Wireless Gas**  
**Monitor**

## Built for Harsh Environments

- Operating temperature: -40°C to 50°C
- Ingress protection: IP66
- Housing available in low-copper aluminum or stainless steel

## Multiple Outputs

- WirelessHART standard
- Clear LCD provides local indication
- Optional discrete output available to actuate local alarms or indicators

## High Performance Monitoring

- Accuracy:  $\pm 3$  ppm or 10 % of reading, whichever is greater
- T20 < 8 seconds, T50 < 10 seconds, T90 < 45 seconds
- H2S: 0-100ppm
- Options: O2, CO, LEL

## Certifications

- Intrinsically safe
- FM / CSA Div 1
- ATEX / IECEx Zone 0
- Shipboard approvals

# Rosemount™ Pervasive Sensing

Enable continuous visibility and improve plant reliability with wireless technology

Emerson's Rosemount™ Pervasive Sensing portfolio delivers plant-wide measurement and diagnostics without intrusive wiring. These solutions help you enhance safety, reliability, and efficiency by turning previously unmonitored assets into actionable insights.



**Accelerate deployment** with a complete WirelessHART® portfolio for fast, flexible sensing across the plant.



**Cut installation costs by up to 60%** by removing the need for wiring with WirelessHART® technology as per IEC 62591.



**Eliminate blind spots and mitigate risk** through continuous visibility backed by self-organizing mesh reliability and secure gateways.



**Automate manual rounds** with real-time monitoring to improve workforce efficiency and safety.



**Prevent failures and optimize performance** using Plantweb™ Insight analytics for steam traps, pumps, PRVs, and more.



*Enable Flexible and  
Autonomous Operations,  
Guarding Performance and  
Safety at Lower TIC*

- Non-intrusive measurement

# Non-Intrusive Measurement Eliminates Leak Points and Enables On-Stream Installation for Monitoring

## X-Well Technology

*Non-intrusive temperature measurement*



### Product Feature

- No penetration into process piping
- Patented algorithm makes it comparable to traditional thermowell assemblies
- Universal pipe mount design with cut to fit banding

### The Results

- 70% reduction in engineered hours and installation time
- Ease of redesign
- Reduction in piping and components which reduces engineering complexity and leak points
- 65% reduction in total install costs

## Flexim

*Clamp-on ultrasonic flow meter*



### Product Feature

- No penetration into process piping
- Meters can be applied to a large range of pipe sizes
- Unaffected by pressure or erosive conditions

### The Results

- No more leakage points and flange
- Extreme wide turn-down ratio
- Improved insight to operating conditions with detailed diagnostic functions
- Low maintenance as the meter stays outside the harsh process conditions
- Reduction in pipe length

## Permasense

*Non-intrusive corrosion & erosion*



### Product Feature

- No penetration process into piping
- Simplified design
- Reduced engineering efforts
- Non-intrusive wireless sensor

### The Results

- 79% reduction in engineering effort—no mechanical hookups
- Faster installation and commissioning
- Lower project risk—drastically reduced BOM
- Lower material cost—reduced I/O, no cabling, no barriers, not cable, resulting 53% cost savings

# Industry Leading Rosemount 4051S Pressure Transmitter Technology with Added Safety Capabilities Enabled by Performance and Reliability



The image shows a Rosemount 4051S Pressure Transmitter. It has a blue top section with a circular display showing '248.5 mbar' and 'Bluetooth: Enabled'. The top section is labeled 'IN EXPLOSIVE ATMOSPHERE' and 'KEEP TIGHT WHEN CIRCUIT ALIVE'. The bottom section is silver and labeled 'ROSEMOUNT TRANSMITTER'. It has various ports and connectors at the bottom.

### HCD User Interface

- Quick service buttons
- Setup-by-application

### Enhanced Display

- Larger size
- Hi-res, hi-contrast
- Graphical, backlight
- Multilingual

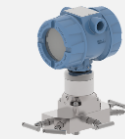
### New Electronics

- Increased capabilities enabling additional innovations

### New SuperModule

- Faster response
- Less power

## Broad Portfolio Available at Launch



HART Transmitter



Diagnostics Capabilities



Level Transmitters



Flow Meters

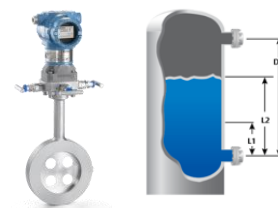
## Improved Ease of Use Device Interfaces



Bluetooth® Configuration



Backlit Graphical Display

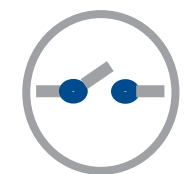


Flow and Level Configuration



Optimized User Interfaces

## Increase Safety with Switch Output, Logging, Diagnostics



Safety Certified Switch

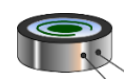


Guided Partial, Comprehensive, and In-Situ Proof Tests with Logging



Loop Integrity, Plugged Line, Process Intelligence, and Process Alerts with Logging

## Improved Capabilities Increase Application Flexibility



800:1 DP Rangedown



<50 ms Response Time

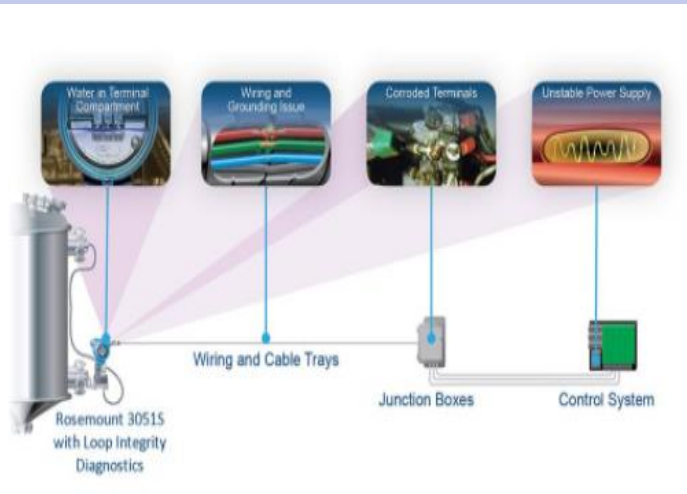


Extended Stability and Warranty

# Diagnostics that Improve Safety Leveraging Diagnostics for Early Detection of Sensor Failures or Trips

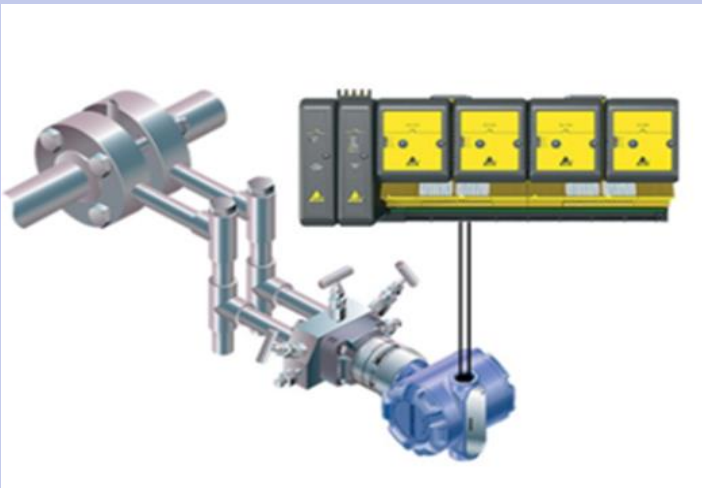
## Loop Integrity

Continuously monitors for problems throughout the entire electrical loop



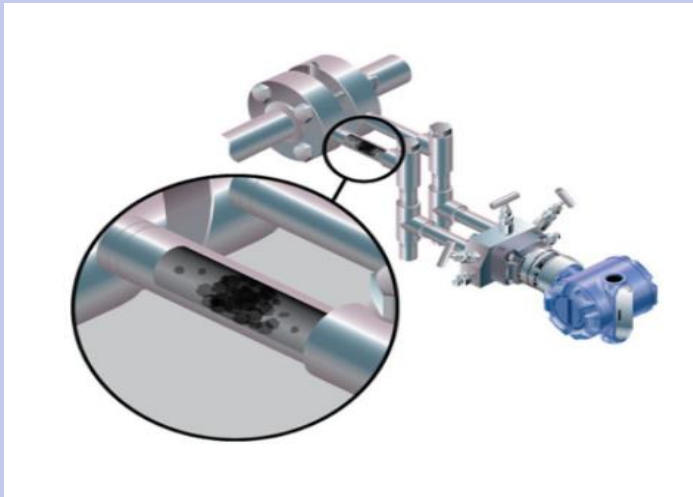
## Safety Certified Diagnostics

Detects internal transmitter failures as well as previously undetectable process and electrical loop failures, reducing the Safety Instrumented Function Probability of Failure on Demand.



## Process Connection

Detects plugged impulse lines



## Process Intelligence

Tracks process standard deviation, mean, and coefficient of variation to detect changes in process noise early indicating abnormal conditions sampling 22 times per second



Common across Emerson's Measurement Solutions

Exclusive to Rosemount Pressure Transmitter with Advanced Diagnostics

Diagnostic capabilities included across Emerson's level, flow, temperature, and pressure safety certified instruments

Emerson Confidential

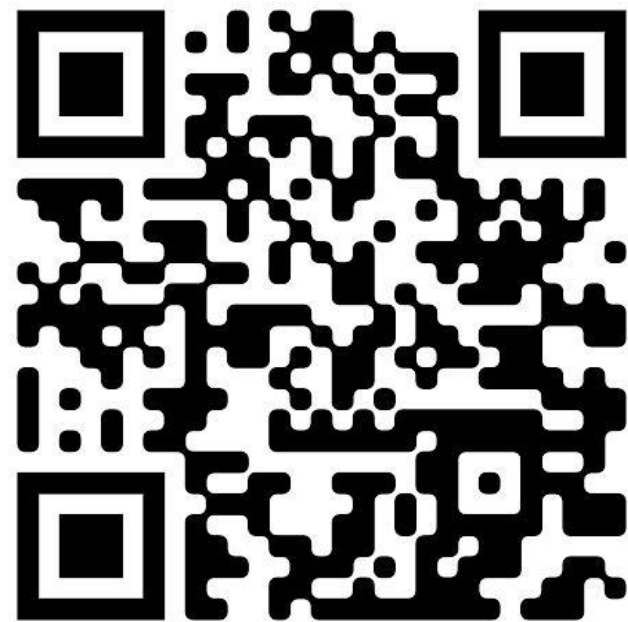
Singapore Chemical Industry Council (SCIC) Safety Case Seminar 2026

15 Jul 2026



## Keys to Improving Safety in Refining

*How to protect your facilities, personnel and the environment using the right technologies and strategies for reducing process, occupational, functional and loss of containment safety risks.*



**Download  
our latest  
Process  
Safety  
Playbook  
now!**

## Playbook suggests Emerson Innovation Smart Sensors to improve your Process Facility Today



**1 Functional Safety**



**2 Occupational Safety**



**3 Process Safety**



**4 Containment Safety**



**EMERSON™**

**Partnering you to enable  
your plant operations and  
process safety**

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# Backup

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