



Achieve Your Safety Goals – Protect People and the Environment

Minimize significant time and cost barriers that keep you from improving overall plant safety.

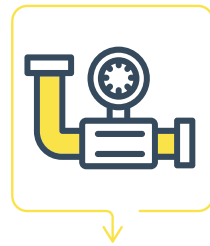


Industry Facts You Need to Know

COMPLY WITH ENVIRONMENTAL REGULATIONS FOR PRESSURE RELIEF EVENTS

- ➔ **Malfunctioning Pressure Relief Valves (PRVs) can be a safety hazard if they don't open and seat when needed.**
 - When we analyzed PRV pre-test service records, we found that 20% of PRVs were leaking below 50% test pressure. On 8%, leaks were so extreme the PRV did not pop, so there was no visual indication of the leaks.

(Source: Emerson study of 10,000 PRV pre-test service records from a large North America customer)



After analyzing PRV pre-test service records, Emerson found 8% of the leaks were so extreme, they did not pop (meaning no visual indication)

MITIGATE RISK – FOCUS ON HIGH-INCIDENT AREAS

- ➔ **Top Causes of Process Safety Events**
 - **49%:** corrosion of internal and external pipes
 - **11%:** tanks
 - **8%:** pumps
 - **6%:** heat exchangers
 - **4%:** fired-heaters
 - **4%:** pressure vessels

(Source: American Fuel & Petrochemical Manufacturers Annual Learnings Report)



Corrosion in internal and external pipes accounts for 49% of safety events.

- ➔ **42% of SIS dangerous failure modes come from sensors**

— Most of the sensors used in SIS installations are traditional instruments

(Source: Offshore Reliability Database)



Goal: Medical services arrive within 3-4 minutes.

RESPOND FASTER TO INCIDENTS

- ➔ **For an operator in distress, every second counts.**
 - Pinpointing the exact location where a safety shower has been activated is challenging. Emergency medical services must be available within 3 to 4 minutes.

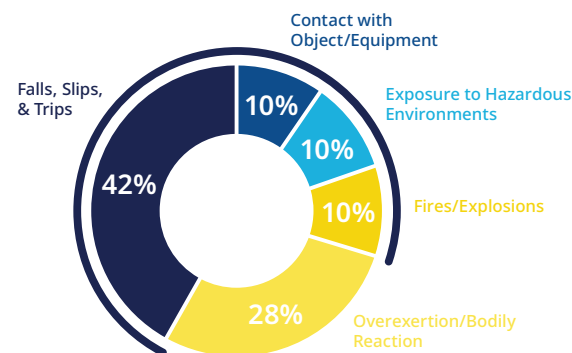
(Source: OSHA Best Practices)

- ➔ **Location technologies can help you respond faster to over 70% of Personal Recordable Accidents.**

— Emerson's digital transformation offerings can help you reduce barriers to the adoption of personnel location technologies.

(Source: OSHA, U.S. Bureau of Labor Statistics, U.S. Department of Labor (2016))

SOURCES OF PERSONAL RECORDABLE ACCIDENTS



Source OSHA, U.S. Bureau of Labor Statistics, U.S. Department of Labor (2016)

Improve Safety While Preserving Financial Health

Safety and protecting the environment are top priorities in chemical plants.

Emerson has a comprehensive set of technologies and services to help you cost-effectively achieve your Health, Safety and Environment (HSE) goals while preserving your financial health objectives.

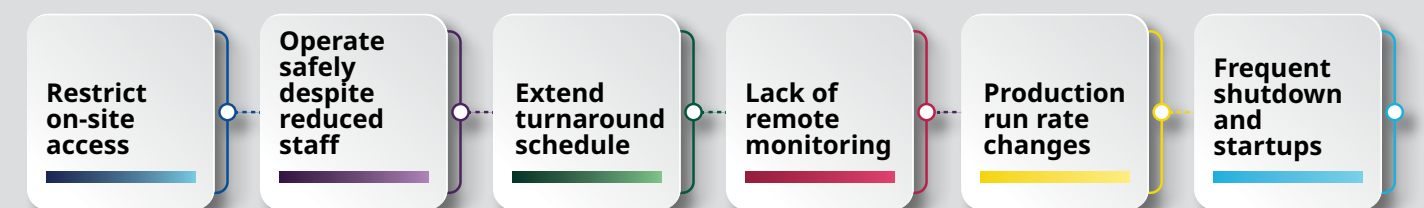
You can keep your people safe by leveraging technology that keeps them out of the plant, provides early detection of any hazards and leaks, and reduces response time to emergencies. Environmental protection can be achieved by avoiding leaks, spills, and releases with reliable tank management solutions, corrosion monitoring, and pressure-relief device monitoring. Incident prevention is key and by increasing visibility to process issues and data with wireless devices and advanced diagnostics, abnormal process conditions can be detected before they create an incident.

With a comprehensive portfolio of industry-leading devices which have low dangerous undetectable (DU) failure rates and remote partial proof-testing capability, you can ensure you are exceeding your safety integrity levels and extending proof test intervals.



APPLICATION CHALLENGES

Protecting your plant, your people and your community is your safety goal. We can specifically help you with these major challenges so you can achieve your safety goals.



The Value of Emerson's Comprehensive Solutions

Emerson has a comprehensive set of technologies and services to provide early detection and avoidance of potential safety incidents and mitigate the consequences.

With Emerson's solutions you can:

- Manage and reduce the potential for fires, explosions, and other process incidents
- Ensure you can easily meet the safety integrity level (SIL) requirements of your plant with our portfolio of SIL-rated devices
- Proactively detect leaks, spills, and releases with reliable tank management solutions, corrosion monitoring, and pressure-relief device monitoring
- Achieve reduced emergency response time and a safer work environment

Please contact your Emerson sales representative to discuss solutions to meet your goals.



Product Solutions

Emerson believes in strong, collaborative partnerships. Our team works along with you to help meet your safety and regulatory goals.

On the next few pages, see how our product solutions have helped customers meet their goals to keep people safe, protect the environment & community, increase visibility to process issues & data, and ensure safety instrumented system (SIS) integrity.

Let's start a conversation on how our team can work with you.



KEEP PERSONNEL SAFE



PROTECT THE ENVIRONMENT & COMMUNITY



INCREASE VISIBILITY TO PROCESS ISSUES & DATA



ENSURE SAFETY INSTRUMENTED SYSTEM INTEGRITY



GOAL: KEEP PERSONNEL SAFE

Issues

Risk of extended response times during an emergency

Solutions

Real-time location with emergency event alerts



Featured Products

Emerson™ Location Awareness -

- enabled by Personnel/Asset Tags and WirelessHART® Location Anchors
- helps to reduce the industrial environment barriers of existing location technologies
- provides a solution for the main use cases of geofencing, safety mustering and safety alerts, and streamlines them into an easy-to-use interface



TopWorx™ Safety Shower & Eyewash Station Monitoring Kits - provides instant notification and location when safety showers and eyewash stations have been activated, improving first responder response time

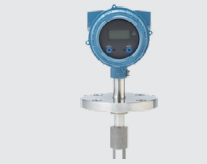
Sending people into the plant for routine maintenance, manual rounds and sampling can increase the risk of injury

Keep people out of the plant for manual rounds with real-time measurements and remote connectivity



Emerson Wireless Pervasive Sensing™ Solutions -

- cost effectively automate manual rounds
- improve insight to process measurement data on applications such as utility gas pressures, seal oil levels, filter differential pressures and bearing temperatures
- keeps operators out of process areas that may expose them to unnecessary risk



Micro Motion™ Fork Viscosity and Density Meters & Rosemount pH and Conductivity Sensors -

- Emerson's broad portfolio helps reduce personnel exposure to volatile organics and hazardous chemicals
- reduces personnel time in the field associated with manual sampling along with limiting lag times between lab sampling that can cause dangerous operating conditions



Emerson Wireless Gateway, Wi-Fi and Bluetooth®-enabled Transmitters -

- use Emerson's wireless gateways to remotely configure and troubleshoot devices
- Wi-Fi and Bluetooth allows the field technician to connect to the device to perform configuration, run diagnostics and download historical files without the need of a hot work permit or equipment to access the device if it was installed in a difficult-to-reach location



GOAL: KEEP PERSONNEL SAFE - CONTINUED

Issues Solutions Featured Products

Exposure to undetected leaks of flammable and toxic chemicals increases risk of injury

Leverage toxic and flammable gas detection technologies



Rosemount™t 935 and 936 Open Path Combustible Gas Detectors - detects large-scale toxic and combustible gas leaks that might occur anywhere along the line-of-sight of the detector



Net Safety™ Millennium II BASIC Single Channel Transmitter - protects workers from toxic gases and detects presence of combustible gases to identify leaks and prevent fires

Quickly respond to fires including fires invisible to the naked eye

Install optical flame detecting technologies



Rosemount 975MR Multi-Spectrum Infrared Flame Detector - optical flame-sensing technologies utilizing UV, UV/IR and multi-spectrum infrared to detect flames of differing fuel sources
- uses line-of-sight detection of the radiation emitted in the spectral bands to determine if a flame is real



GOAL: PROTECT THE ENVIRONMENT & COMMUNITY

Issues Solutions Featured Products

Tank overfills damage the environment, risk injury and are costly to clean up

Improve tank level and automated overfill prevention systems



Rosemount 3408 Level Transmitter - Non-Contacting Radar and Rosemount 5300 Level Transmitter - Guided Wave Radar - Rosemount 3408 delivers ideal level measurement for corrosive fluids
- Rosemount 5300 provides both level and interface measurement to prevent tank overfills



Rosemount 2160 Wireless Level Detector - Vibrating Fork - fully integrated, wireless level detector provides a more cost-effective, easier and safer way to detect a high level for the safety shutdown system

Limited insight into pipe, tank, vessel integrity increases risk of containment breaches and hazardous leaks caused by corrosion or erosion

Real-time corrosion and erosion monitoring to reduce risk of system integrity failures



Rosemount Wireless Permasense ET310C Corrosion and Erosion Transmitter - wireless battery powered non-intrusive ultrasonic measurement with magnetic mounting is easy to install and monitors wall thickness
- early detection is critical to avoiding a loss of containment and helps ensure process safety



Roxar™ Retrievable Electrical Resistance (ER) Probes - intrusive corrosion and erosion monitoring technology ideally suited for high-sensitivity (nanometer range) applications and fast response when used with Roxar CorrLog range of instruments

Undetected gas leaks and pressure relief events risk personnel exposure and costly environmental fines

Implement PRV monitoring and gas leak detection



Rosemount 708 Wireless Acoustic Transmitter, Rosemount 4390 Series Corrosion and Erosion Wireless Transmitter, and Plantweb™ Insight Software - enables the immediate identification and response to release events
- documents the release duration and volume for regulatory purposes



Incus Ultrasonic Gas Leak Detector - detects pressurized gas leaks with the industry's fastest response time, for any chemical composition, that can be leaking from a small hole or rupture



GOAL: INCREASE VISIBILITY TO PROCESS ISSUES & DATA

| Issues | Solutions | Featured Products |
|--------|-----------|-------------------|
|--------|-----------|-------------------|

Undetected abnormal process conditions risk safety incidents

Utilize measurement device diagnostics capable of detecting unusual process conditions



Micro Motion Coriolis Flow Meters -

- detect abnormal situations or process upsets such as entrained air or gas with Coriolis' density measurement and drive gain
- entrained gas could be an indication of a seal failure and process leak
- reduce safety risk of process upsets due to mis-measurement with Smart Meter Verification and coating detection



Rosemount 3051S Pressure Transmitter -

- proactively monitor and detect abnormal conditions with Statistical Process Monitoring
- get insight to dynamic and critical process issues including furnace flame out, pump cavitation, column flooding and entrained air

Unable to determine if a potentially dangerous process measurement is valid or the instrument is faulty

Use instrument health diagnostics to ensure measurement integrity

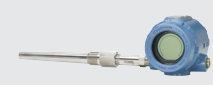


Rosemount 3051S Pressure Transmitter -

- continuously monitor for electrical loop issues that can cause dangerous on-scale failures and create hidden brownouts with the Loop Integrity diagnostic
- proactively identify process connection issues that can leave you vulnerable and blind to what is truly going on in the process with the Plugged Impulse Line diagnostic



Micro Motion Coriolis, Rosemount Magnetic Flow Meters, and Rosemount 3408 Level Transmitters - Non-Contacting Radar - Smart Meter Verification continuously monitors transmitter and sensor health ensuring measurement integrity without removing the instrument from the process



Rosemount 3144P Temperature Transmitter - Hot Backup™ capability, sensor drift alert and T/C degradation diagnostics reduce the risk of measurement loss resulting in dangerous temperature excursions

High cost of adding devices for timely process data limits insight increases safety risks

Use simple to install devices and wireless technology to lower installation cost



Emerson Pervasive Sensing Solutions - cost effectively add more measurement points to improve insight to process measurement data on unmonitored applications to reduce safety risks



GOAL: ENSURE SAFETY INSTRUMENTED SYSTEM INTEGRITY

| Issues | Solutions | Featured Products |
|--------|-----------|-------------------|
|--------|-----------|-------------------|

Lack of access to required instrument FMEDA (Failure Modes, Effects and Diagnostic Analysis) data makes it difficult to calculate probability of failure on demand (PFD) to ensure adequate safety integrity level (SIL) is met

Select instruments with publicly verified third-party FMEDA data



Emerson's portfolio includes solutions for measurement of pressure, temperature, level, flow, tank gauging and flame & gas detection

- Emerson has millions of field-proven devices installed worldwide with billions of safe operational hours supported by products certified to IEC 61508
- includes extensive documentation to support Probability of Failure on Demand (PFD) calculations and Prior Use justification to IEC 61511
- Emerson's diverse range of measurement instrumentation is designed for safety, with specific consideration to ensure very low numbers of dangerous undetected (DU) failures and advanced diagnostics coverage to extend proof test intervals for increased safety and reliability

Frequent proof testing to maintain safety integrity level (SIL) is time consuming and costly

Use device partial proof testing diagnostics to extend the time between full proof testing



Micro Motion Coriolis, Rosemount Magnetic Flow Meters, Rosemount 2160 Wireless Level Detector - Vibrating Fork and Rosemount 3408 Level Transmitter - Non-Contacting Radar - Smart Meter Verification continuously monitors transmitter and sensor health and advanced diagnostics enable partial remote proof testing ensuring safety while reducing proving cost

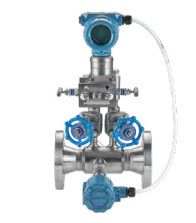
Redundant measurement system architectures are costly and complex to implement

Leverage measurement devices with built in redundancy



Rosemount 8800 Dual and Quad Vortex Flow Meters -

- reduce maintenance and false trips of safety systems with online replaceable sensors and measurement redundancy in a single meter body
- up to SIL2 for 1oo1 or 1oo2 voting for Standard and Dual Meters and up to SIL3 for Quad meters with 2oo3 voting per IEC 61508



Rosemount 9295 Process Flow Meter -

- simplify SIS compliance with multiple independent transmitters on the same spool section with conditioning orifice technology greatly simplifies the installation
- all-welded design reduces potential leak points
- ruggedized isolation valves improve process safety



Rosemount 5900S Radar Level Gauge, Rosemount 2410 Tank Hub and Rosemount Level Switches -

- Emerson's 2-in-1 system (two radar gauges in one housing) is an SIL-certified solution and provides independent level measurement and overflow prevention

Measurement Instrumentation

The broadest range of measurement and analytical technologies for the chemical industry.

To learn more about Emerson's solutions for the chemical industry



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