

# Reimagining Safety in The Connected Enterprise



Harnessing the power of safety and operational data can substantially improve safety compliance and performance. The Connected Enterprise enables this, empowering safety professionals with a real-time understanding of worker behaviors, machinery compliance, causes of safety shutdowns or stoppages, and safety anomalies and trends.

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## The State of Safety

Workplace safety is a multifaceted issue for many manufacturers and industrial operators. It includes both machine and process safety, and is vital to protecting workers, avoiding production interruptions and achieving operational excellence. But it also comes with a number of challenges, including:

**Worker behaviors:** A safety-system design should consider every human-task interaction within the machinery or equipment. Operators may bypass poorly designed safety systems that don't take these interactions into account. And even in a well-designed safety system, workers may not follow standard operating procedures, which can result in unnecessary downtime.

**An evolving workforce:** A major workforce shift is underway worldwide, and the safety implications are significant. Older workers who are nearing retirement but still on the job are at higher risk for certain injuries and can take longer to recover. And the younger, less experienced workers taking their place are more prone to injury and tend to have more serious injuries.

**53 percent** of manufacturing and industrial operations lack real-time visibility into EHS performance data.

*LNS Research*

**Machinery stoppages:** Stoppages can happen for any number of reasons: jams, misfeeds, adjustments, changeovers, maintenance and more. However, companies often have minimal visibility into why or when these stoppages occur. This prevents them from understanding if stoppages can be attributed to specific workers, machinery, lines or shifts. It also limits their ability to remedy issues.

**Regulatory compliance:** Compliance with complex global safety standards is increasingly essential but also challenging. At the same time, these standards allow for the use of more advanced safety technologies that enable companies to address safety and productivity in new ways.

**Data management:** Many safety professionals continue to rely on outdated data-collection and reporting methods. Most often, safety data is manually entered for inspections, compliance logs, incident reports, training and other processes. And the systems in which this data is stored are not connected to plant-floor systems.

This is in sharp contrast to the growing use of real-time data and seamless connectivity in the rest of the production environment. Everyone from operators and technicians to corporate executives are using "smart" capabilities to gain new efficiencies, improve product quality, make operations more responsive, and more. Rockwell Automation calls this The Connected Enterprise.

Machine-generated data will increase to **42 percent** of all data by 2020.

*IBM*

## Rise of The Connected Enterprise

The Connected Enterprise begins with the convergence of enterprise-level information technology (IT) and plant-level operations technology (OT) systems. Merging these historically separate systems into a single, secure network architecture provides a seamless foundation for real-time connectivity and information sharing.

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With this foundation in place, companies can harness the power of enabling technologies, including:

**Industrial Internet of Things (IIoT)** technologies include any device connected via the Internet Protocol. They enable companies to access production, quality, safety and other data that, until now, has been trapped in machines, manufacturing processes and supply chains.

**Big data and data analytics** help manage massive amounts of data and contextualize it into actionable information that is relevant to each worker. This can help improve performance management on the plant floor, such as with predictive analytics, and supports better decision making and frictionless productivity companywide.

**Wireless and mobility** technologies can access, capture and communicate data in new ways. For example, mobile video communications can put an expert based in Chicago on a plant floor in China at a moment's notice.

Altogether, these technologies are helping manufacturers and industrial operators improve:

- Visibility and data management
- Operational efficiencies
- Quality management
- Asset utilization
- Inventory management
- Workforce utilization and knowledge retention

## Smarter Safety

So how can safety professionals use The Connected Enterprise to replicate the benefits already seen on the operations side to drive safety performance improvement?

It begins with the use of contemporary safety technologies that combine machinery and safety control into one platform. These systems are less susceptible to nuisance shutdowns than hardwired safety systems, which can help improve productivity and profitability.

But they also offer another key benefit: access to safety-system data, including:

- Device status
- Operational status
- Error or fault codes
- Event counters or timers
- Event Sequences
- Stoppage codes
- Motion monitoring
- Notification of safety logic changes

## The Connected Enterprise Journey

Rockwell Automation developed a four-stage Connected Enterprise Execution Model to help companies reach their Connected Enterprise goals.

1. **Assess and Plan:** Evaluate existing infrastructure, including controls, networks, information solutions and security.
2. **Secure and Upgrade:** Create a backbone that delivers secure, adaptable connectivity from the plant floor to the enterprise.
3. **Data and Analytics:** Transform data into knowledge to drive business improvements.
4. **Optimize and Collaborate:** Create an environment that improves collaboration across sites and with the entire enterprise, including suppliers and customers.

By harnessing this data and the greater connectivity available within The Connected Enterprise, safety and operations professionals can work together to:

- Improve safety-system visibility
- Better understand safety risks
- Enhance safety
- Reduce safety-related downtime
- Transform operations with safety in mind
- Evaluate safety system use or misuse
- Improve compliance

### Put Safety Data to Use

The ability to access safety system data and convert it into meaningful information has enormous potential to transform how safety professionals monitor and manage safety. A key opportunity: incorporating safety information into EHS management systems to identify discrepancies between how policies and procedures are defined and how they're actually followed in day-to-day operations.

“If you're using intelligent safety controllers such as safety PLCs, then the data is already there. The question is: Are you taking advantage of it?”

*Jeff Winter, Grantek Systems Integration*

For example, e-stop buttons are intended for use only in emergencies. But workers can easily misuse them, such as to clear a jam or stop production at the end of a cycle. Such inappropriate usage can lead to increased scrap and longer machine start-up times.

The data for these actions can't be captured in most plants today. This lack of insight hinders safety professionals from identifying misuse of safety systems and can present vexing challenges for those seeking to drive continuous improvements in their EHS performance. It also limits plant managers from truly understanding and addressing downtime issues.

“Compliance is ripe for automation because it is both rule-based and data-intensive.”

*Julia Kirby and Thomas H. Davenport,  
Harvard Business Review*

But safety-system data can be captured from information-enabled devices in The Connected Enterprise. Attainable data can include an e-stop activation's time stamp, downtime duration, and the line and shift associated with each activation. Stoppage reason codes also can be built in to convey why a machine was stopped, such as for jams, misfeeds, cleaning and more.

Safety professionals can then use their existing alarm-and-events and metrics software to analyze the data and identify if e-stops are being used at an abnormally high rate. From there, they can

investigate the issue's root cause, such as insufficient standard operating procedures or improper machine design. They also can identify if higher activation rates are associated with specific production lines or shifts, which could indicate the need for additional training for a select group of workers.

Similar visibility can be extended to other individual safety functions, including light curtains, safety mats, guard doors or gates, and lockout/tagout (LOTO) procedures. And it can be extended to examine the sequence timing and relationships between multiple safety functions.

These capabilities ultimately allow safety professionals to identify and resolve areas where safety's execution on the plant floor falls short of the safety strategy defined in the EHS management system.

### Better Understand Safety Risks

Risk assessments are vital at the design stage to identify machine safety risks and risk-reduction measures. After the design stage, however, the assessment data is rarely ever used again.

The availability of safety data in a Connected Enterprise brings renewed purpose to risk-assessment data in the form of a risk calculator. This tool can easily be configured as a basic table within the FactoryTalk® VantagePoint EMI (enterprise manufacturing intelligence) software.

Within the tool, safety professionals can enter the anticipated use frequency data from a machine's risk assessment as a baseline for safety performance. They can then compare this against the machine's actual use frequency data. The result is an unprecedented capability to measure anticipated risk against actual risk for each machine access point.



Use frequency that is significantly higher than anticipated could be the result of a product or process change that needs to be addressed. And use frequency that is lower than expected could indicate that a safeguard is being defeated and needs to be re-evaluated.

### Enhance Safety

Connecting people, equipment and worksites creates new opportunities to enhance worker and environmental safety, including:

**Remote access:** Transportation incidents are a top cause of fatal work injuries in the U.S.<sup>1</sup> Remote monitoring of dispersed or isolated operations can reduce worker travel demands, such as the need for oil and gas workers to travel across sites to check on wellheads, pump stations and storage sites.

**Operations visibility:** Visibility into manufacturing process states, environmental conditions and other factors can be critical when working with hazardous materials or in harsh conditions. For example, pharmaceutical or chemical companies can use real-time data to be sure hazardous chemicals are not released into the environment.

“With the ability to capture and analyze massive amounts of safety-system and operational data, safety professionals can move from merely describing what went wrong to predicting and preventing incidents in the first place.

*Peter Bussey, Research Analyst, LNS Research*

**Worker locating:** Network connectivity can be a company's only link when its employees are working in isolated locations. For example, wearable sensors can locate workers in underground mines and other hard-to-reach places during an emergency. Video, voice and display technologies also can help monitor and communicate with these employees should a safety incident occur.

**Information delivery:** Especially for older workers nearing retirement, improving ergonomics can help reduce the likelihood of injury and help retain workers with valuable experience. Wireless and mobile technology can support this by delivering information in a convenient way and helping reduce the strain put on older workers.

### Reduce Safety-Related Downtime

Better visibility into safety-system performance and stoppages can help determine root cause of shutdowns. Safety and production data also can be combined to understand the frequency, duration, time and location of safety-related shutdowns.

Armed with this information, safety and operations professionals can work together to develop mitigation plans to improve productivity. This could be as simple as having

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<sup>1</sup> Census of Fatal Occupational Injuries Summary, 2014, Bureau of Labor Statistics, Sept. 17, 2015

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discussions with operators on a single production line or shift where downtime issues are most frequent. It also could involve updating procedures if specific downtime issues are common throughout an operation.

Additionally, improved safety-system diagnostics can alert operators and technicians to where safety-related failures are occurring during runtime operations. This can simplify troubleshooting and lead to faster downtime resolutions. The diagnostics even can be used in predictive analytics to identify leading indicators and address machine issues before they become machine failures.

### Ease Compliance

The safety data required for compliance and reporting purposes is largely collected through manual audits today. This can be a time-consuming process that requires valuable work hours, results in production downtime and can be subject to human error.

By integrating auditing functions into the HMI and controller, organizations can automate and speed up the auditing process, free up personnel to focus on other priorities, and reduce the likelihood of errors. Also, any abnormalities can be annunciated in the HMI dashboard or reports to help plant personnel quickly spot and address potential issues.

### Transform Operations With Safety in Mind

Connected operations present opportunities for companies to create inherently safer operations.

For example, manned topside platforms used in off-shore oil and gas production can be vulnerable to potentially catastrophic events, from explosions to ship collisions. They also often require helicopter transportation for supplies and staff, which can be dangerous.



A Connected Enterprise is typically initiated, developed and executed by operations and engineering. Safety often won't be included unless they make a push for their own involvement, which they absolutely should do.

*Jeff Winter, Grantek Systems Integration*

Ethernet-connected subsea platforms that pump gas directly to onshore production facilities can reduce the need for manned topside platforms.

The growing use of connected, autonomous technologies in mining operations also is creating new opportunities to help minimize safety risks. Mining companies already are using autonomous trucks and trains to transport materials. The driverless vehicles can be tracked and controlled from a central location, resulting in true "pit to port" connectivity.

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## Implementation

While all of these benefits are more easily realized in a fully Connected Enterprise, they also can be achieved in an iterative process as companies become increasingly connected. Regardless of the approach a company takes, some key steps are crucial to making the most of safety in connected, information-enabled operations.

### 1. Active EHS Representation

Connected operations span people, processes and technology. As a result, bringing people together from across an organization is critical when deploying a Connected Enterprise or simply expanding connectivity in a smaller manner. A cross-functional team should be formed to include not only operations and IT stakeholders but also environmental health and safety (EHS) professionals.

Only by having a seat at the table can EHS professionals define their goals as part of a larger, companywide connected strategy. This should come naturally to any company that is committed to the three Cs of safety – culture, compliance and capital – which are part of a holistic safety approach and can be measured using tools such as the Rockwell Automation Safety Maturity Index.

### 2. Assess the Current State

A company's roadmap to improving safety in a connected operation begins with understanding where it's at today. Key questions to ask during an assessment include:

- Are we using contemporary, integrated safety systems?
- Is safety data manually collected or is it automated in a data-collection system?
- What safety data is already available? How is it reported?
- Does equipment or machinery have central network connectivity?
- Could safety data be collected using an existing data-collection platform?

### 3. Determine Meaningful Data and Information

This is where safety, operations and other team members specify the safety-system data they need to support their goals. Important considerations at this stage include identifying:

- What data must be captured
- Where and how it will be collected
- How it will be contextualized and delivered as actionable information
- Who will receive the information
- What actions will result from the information

### 4. Implement or Upgrade Safety Systems

Safety-system data is already available in an integrated safety controller. Implementing changes merely involves specifying the right data coming out of the controller by creating new tags for each access point. This data can then be contextualized within a plant's existing EMI software and delivered to safety and operations personnel in the form of relevant, actionable information via EMI dashboards.

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**Top 10 Alarms by Frequency**  
5/15/2016 9:48:21 AM - 5/16/2016 6:48:21 AM

Source	Occurrences	
		Total
		<b>395</b>
RNA://\$Global/InstantFizz/HMI_Area/FTAE_History:Tank1Jam		<b>170</b>
RNA://\$Global/InstantFizz/HMI_Area/FTAE_History:PaperOut		<b>164</b>
RNA://\$Global/InstantFizz/HMI_Area/FTAE_History:FillerD EStop Activated		<b>20</b>
RNA://\$Global/InstantFizz/HMI_Area/FTAE_History:FillerD Light Curtain 2 Tripped		<b>17</b>
RNA://\$Global/InstantFizz/HMI_Area/FTAE_History:FillerD Light Curtain 1 Tripped		<b>14</b>
RNA://\$Global/InstantFizz/HMI_Area/FTAE_History:FillerD Light Curtain 3 User Tripped		<b>10</b>

Safety data also can be incorporated into other existing software, such as FactoryTalk Alarms and Events. Operators can create alarms and events for a wide range of safety scenarios, including light-curtain faults, opened panel doors and triggered e-stops. They can then track and analyze this information right alongside the other machine or fault data they're already monitoring.

Incorporating safety data into FactoryTalk Metrics can provide insights into machine or equipment performance in relation to safety events. For example, a plant manager can pinpoint a machine that has experienced multiple light-curtain faults as the source for excessive downtime and missed production targets during a specific production period. Meanwhile, a safety professional can look at the same data and identify those faults as a safety abnormality that needs to be addressed.

A library of preconfigured faceplates is available for each safety controller and component within the software programs. They provide detailed status information for each device and links to help information. Additionally, the software supports mobile capabilities, giving safety and operations professionals the freedom and flexibility to view safety information while they're roaming the plant floor, at a conference or at home.

## 5. Analyze and Optimize

Getting information to workers is important, but so is getting workers to act on the information.

That's why incorporating safety-system information into daily operations is critical. For example, analytics should be included in daily production meetings, and standard procedures should be developed for collecting, analyzing and interpreting data.

With these elements in place, safety professionals can monitor and refine all aspects of safety in a Connected Enterprise as part of a continuous-improvement program. This could include expanding the amount of data collected, or it could include setting higher goals in areas such as improved visibility, fewer incident rates and reduced downtime. Safety professionals also can use the safety-system data to better measure and meet their corporate safety goals.

It's important to remember that a Connected Enterprise is an ongoing journey. The technologies and opportunities within it will continue to evolve. Companies should be mindful of this and constantly seek opportunities to improve their future state.

## Summary

The ability to access, analyze and act on safety-system data in a Connected Enterprise represents a turning point for safety compliance and productivity. It creates opportunities to better understand risks and safety-system usage, enhance worker and environmental safety, reduce safety-related downtime, and even reimagine operations as innately safer.

## Resources

The Connected Enterprise:

<http://www.rockwellautomation.com/global/innovation/connected-enterprise/overview.page>

Rockwell Automation machine safety solutions:

<http://www.marketing.rockwellautomation.com/safety-solutions/en/MachineSafety>

Rockwell Automation Safety Maturity Index:

<http://www.rockwellautomation.com/global/products-technologies/safety-technology/safety-maturity.page>

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### **Power, Control and Information Solutions Headquarters**

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846