



A Roadmap for Effective Process Safety Management

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A Fatal and Preventable Lesson

- Immense pressure had built in a pipe that was scheduled for routine maintenance.
- The worker was new to the job and eager to complete his tasks on time.
- Unaware of the risks, he overlooked procedure and loosened the bull plug without checking the pressure gauge upstream.
- The pressure released from the pipe knocked the employee on his back, but without injury. He had a laugh with his coworker, but they did not report the event.
- The company's SOP called for a near miss to be reported and for a risk analysis to be performed. This would have led to a root cause analysis.
- The next month, the same task is performed by a different worker. This time the pressure release knocks the worker off the maintenance truck, resulting in a fatality.
- Separately, a JSA (Job Safety Analysis) at another plant had already identified this risk and put a safeguard in place.
- As a response to this event, the company implemented a high learning value event (lessons-learned) process, implemented the known safeguard at all applicable locations, and launched an initiative to improve its safety reporting culture.

Similar events and missed opportunities occur on a daily basis within operations. How do you ensure that lessons-learned from all sources of exposure are identified and turned into preventive actions to strengthen controls enterprise-wide?

Introduction

Advancements in technology, inherently safe design, and the application of lessons-learned in the Process Safety Management (PSM) domain have led to the reduction in the number of process safety incidents in recent years. Yet, unforeseen catastrophic process safety events (PSEs) continue to occur at a disturbing rate and are increasing in severity.¹ We must continually improve our efforts to ensure safe, reliable operations -- to increase risk visibility, to drive consistent process execution, and to sustain learning. This is a major challenge today in the midst of lower operating margins, aging equipment, increasing regulatory pressure, and an ever-changing workforce. Sphera and its customers are working together to improve PSM programs and reduce the likelihood of significant incidents through a unique combination of software, content, and community.

Increase Risk Awareness & Visibility

In its latest assessment of the top 100 losses in the hydrocarbon industry, Marsh stated that "it was the failure of prevention and mitigation measures that resulted in maximum property damage" and that none of the 100 losses should be considered

Figure 1

SOURCES OF RISK KNOWLEDGE:

- Incidents
- Near Misses
- Risk Assessments
- Management of Change
- Audits & Assessments
- Drills / Exercises
- Safe Operating Limit (SOL) Exceedences
- Primary Containment Inspections
- Testing Results Outside Acceptable Limits
- Demands on Safety Systems
- Safety Systems Activated
- Mechanical Shutdown Systems Activated
- Critical Equipment Inspections
- Spurious Shutdowns
- Process Safety Related Training
- Process Safety O&M Procedure Reviews
- Reviewed Work Permits
- Safety Critical Equipment Inspections
- Fatigue Risk Events

1. American Institute of Chemical Engineers (AIChE; www.aiche.org)

2. The 100 Largest Losses 1974-2013 Large property damage losses in the Hydrocarbon Industry 23rd Edition www.marsh.com

3. Process Safety Performance Indicators for the Refining and Petrochemical Industries, ANSI/API RECOMMENDED PRACTICE 754 FIRST EDITION, APRIL 2010

“black swan” events.² This is a blunt reminder that each of these losses could have been avoided, and it should inspire us to exploit available knowledge about risk in order to avoid future significant incidents in any industry.

We gain this risk knowledge from many sources. There are lessons-learned and corrective actions from external companies, regulatory agency rules and recommendations, expert opinions and so forth. Internally, we accumulate risk knowledge from risk assessments, management of change, incidents, audits, inspections, and other events – planned and unplanned. These events contain valuable information about known risks, safeguards & controls that are in place or have failed, root causes, and risk mitigation activity.

Figure 1 (refer to page 2) lists potential sources of Process Safety risk information. The American Petroleum Institute recommends many of these as sources of leading and lagging process safety indicators.³ The information from these sources should be integrated and easily accessible so that learnings can be applied and controls can be continuously strengthened. Getting your arms around all these risk-related events can seem like a monumental undertaking, but it doesn’t have to be. “First-movers” in this market have already accomplished this and paved the way for “fast-followers.”

What have the “First Movers” done?

- They have integrated the most critical PSM processes and event types onto a common, company-wide platform;
- They’ve used the platform to engage the workforce;
- They’ve educated employees and contractors about what should be reported;
- They’ve removed the technical and cultural barriers to reporting risks, hazards, findings, issues, non-conformances, incidents, and near misses; and
- They’ve held individuals accountable for the corrective and preventive actions.

that could be used for preventive actions in multiple additional areas. They follow a common risk management pattern from risk identification to causal analysis and to the strengthening of controls across the organization. Integrating these onto a single enterprise system increases visibility from the bottom up and from the top down. An incident at one facility can quickly be turned into a lesson-learned and preventive action at all others. Multiple hazards identified on the front lines can build risk control libraries and roll up into a corporate risk register. Major issues, root causes, regulatory findings, and lapses in workforce engagement can be highlighted and corrected company-wide. The risk information from multiple sources can be used to specifically allocate resources to strengthen controls that will prevent future incidents. All of this activity can be efficiently monitored so that improvements can be made.

Figure 2

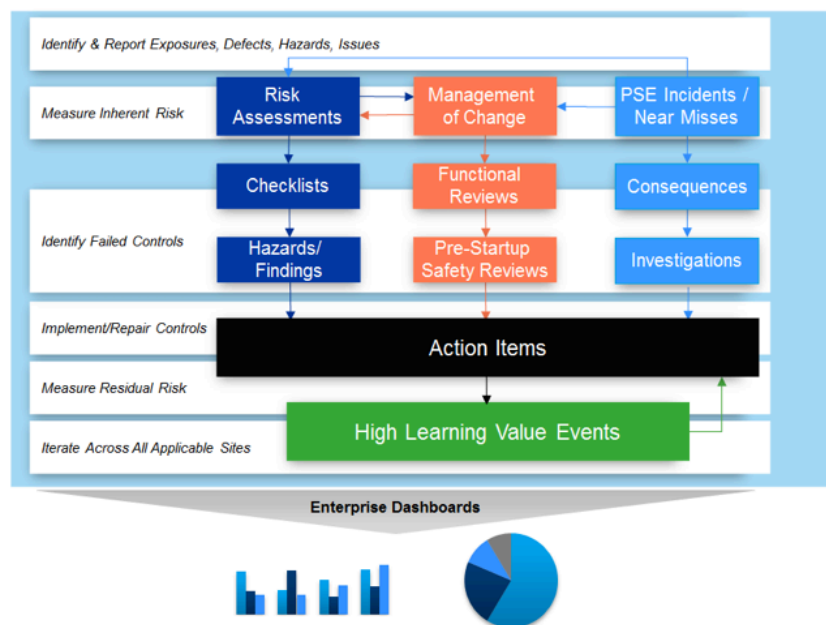


Figure 2 shows a visual integration of essential PSM event types: risk assessments; management of change events; incidents & near misses; High learning value events include any events -- planned or unplanned, internal or external to the company -- that contain valuable lessons or risk information that could be used for preventive actions in multiple additional areas; and action items. These event types were identified as the “top critical processes” in assessments of Sphera customers, and are often prioritized as the most important elements of a PSM management system. High learning value events include any events -- planned or unplanned, internal or external to the company -- that contain valuable lessons or risk information

Improve Process Execution

Expanded risk visibility is a foundational step on the journey to effective process safety management, but integration alone is not enough. Engaging the workforce to capture a broad set of risk data on a common platform increases the quantity and efficiency of data, but the quality will be lacking in many areas if our efforts stop there. To support effective decision-making, we need complete and reliable information about these all-important risk processes and the way they are being performed. This is accomplished by using the platform to drive consistency in the way these processes are executed.

Indeed, if the processes from our PSM management system, such as process hazard analysis (PHA), management of change, and incident investigation, were correctly and consistency executed throughout our organizations, the world would be a safer place. The reality is that many management systems are well-defined and certainly well-intentioned, but they are poorly implemented and executed. The agreed-upon rules, activities, and behaviors set forth in binders and on websites are never fully brought to life in field operations. Training, communications, and publications are not enough to successfully implement and sustain management systems, especially for a workforce that is ever-changing. A well-executed management system can transform a business, yet there is no business transformation without a system implementation to sustain it. The management system must be embedded in the organization's culture and underpinned by an information system that organizes, enables, drives, and sustains the related activities at the local levels.

Figure 3 shows the cascade from management systems to local behaviors. The management system defines the framework that will be used to complete the organization's objectives. Standard operating procedures (SOPs) are the “how-to” guides that describe the activities necessary to complete those objectives, the responsibilities of those involved, and the rules and regulations that apply.

The business process information is closely related to the SOP, and includes the steps, business rules, and systems that must be followed and used when completing the activities. Local practices refer to the facility or field-level interpretations of the business processes. They represent how these important directions are actually carried out throughout the organization.

***A strong, safety-oriented culture
will execute the process consistently well.***

Figure 3



For instance, a common objective is to perform critical equipment changes without incident. This objective is defined in the management of change (MOC) element of the management system. For this objective to be realized, the local practice of managing changes should correctly and consistently adhere to the MOC SOP and business process definition. As an example, Figure 4 (refer to page 5) shows a summary view of an MOC process. Each step in this process was designed for a reason – to ensure safe changes – and that reasoning flows from the management system to the SOP to the process. The challenge is to ensure that the workforce fully adopts the process and performs it with appropriate discipline each time a change is made. The right information system can help to achieve this by applying automation that engages the right people to perform the right steps at the right time – every time. Automation systematizes the process and embeds it into the local culture, and relieves the pressure from the workforce to memorize process steps, responsibilities, and business rules.

Now, imagine if each critical PSM process was enabled in this way, and executed and reflected in the system in real-time. New workers can step into a process and get up to speed quickly. If activities are bypassed, cut short, never closed, or completed by the wrong people, the system will highlight these issues as opportunities for process improvement. Over time, this process information provides insights into the behaviors and the culture of the sites using the process. A strong, safety-oriented culture will execute the process consistently well. A weaker culture may only comply with certain aspects, such as documentation, but view the end-to-end process as unnecessary or burdensome. By monitoring risk processes in this way, metrics from the processes can be studied and used as leading indicators of future process safety performance.⁴

4. Unlocking the Value of Operational Data - Introducing Progressive Leading Indicator, Dr. Mei-Li Lin, Sr. Director Operational Excellence Solutions, IHS, Inc.

Figure 4

Enhance & Sustain Learning

When critical PSM processes are consistently performed enterprise-wide on a common platform, a broad, deep, and high-quality set of data is inherently generated. This presents a tremendous opportunity for learning. If learning is then fully embraced and utilized, it can become the driver for continuous improvement, and thus, operational excellence.

Give People the Permission and Support to Learn

People want to learn, and learning – unlike training – is often initiated by individuals. Make information available to these individuals, and endorse their time spent learning. This may involve an update to their job responsibilities to allow more time for learning. One of the benefits of enabling key processes via enterprise software is the time that is saved when certain tasks are automated. For example, a recent Excellence award winner reduced their time of creating enterprise-wide reports from 15 days to about 15 minutes.⁵ This made time available that could be used for learning. Step into opportunities like these and designate learning responsibilities. Give people the permission and possibility to explore the available information. Recognizing that this information can be complex and scattered over many sources, it is also critical to provide intelligently built overviews in dashboards or prebuilt reports, with the ability to further investigate and drill-down from these predefined reports.

When you begin to identify the learning-minded individuals in your organization and provide them the support and tools they need, you can focus their efforts on closing the information gaps that typically exist between risk assessments, audits, MOCs, incidents, external events, and other activities. Risk registers, risk control libraries, and investigation results can be leveraged to identify trends and thematic issues. Risks identified and controls implemented at some locations, but not others, can be addressed. PSM processes can be monitored to ensure the proper risk reduction steps are consistently being taken.

Implement a Lessons-learned Process

Turning a lesson-learned into a corrective or preventive action doesn't happen automatically. Start by defining what a "lesson-learned" is to your company, and create the criteria that can be used to identify one. Assign responsibilities to review events and apply these criteria. Create a process for sharing, distributing, and implementing the needed improvements from lessons-learned. Identify roles at the facility and site level that will receive lessons-learned, and hold them accountable for

reviewing them and taking action where required. Learning-minded sites and departments will review the lessons-learned when they receive them, and create preventive actions to implement the controls at their locations. If the lesson-learned is not applicable, they can decline it with an explanation. Unlike email alerts or lessons-learned that are posted on a wiki or document management site, this is a process that can be monitored and improved. Implementing a lessons-learned process could literally be a life-saving practice.

Engage Leadership to Assess Process Quality

Finally, an important learning & continuous improvement activity is to assess the quality of a process or processes. This can be done by applying a process quality questionnaire to a sampling of events that have followed a process, such as the ones described above. The information system gives leaders visibility to the process resources and activities performed, and seamlessly enables this assessment so they can review and validate the process steps taken. Leaders are automatically notified via email, can link directly to a record, and can complete their review of the process using a simple checklist, which produces a calculated score for the process. This not only produces high value content for learning, but provides a means for leaders to get involved, provide feedback, and improve the process and the way it's executed. The workforce in turn realizes the importance of the process when they see leaders monitoring and reviewing in this manner. Engaging leadership in this activity has also been proven through Sphera studies to be a significant performance predictor. Business units that performed well on process quality assessments conducted by appropriate leaders had fewer significant incidents when compared to their peers.⁶

5. "Total Petrochemicals Unifies Global EHS Reporting to Drive Down Operational Risks, Drive Up Excellence", IHS SPECTRUM EXCELLENCE AWARD WINNER

6. HS OE&RM Advisory Services Group conducted a multiple-company study using its proprietary tools and analytic approach. The study examined multiple companies in the energy industry covering over 1.2 billion work hours with more than 84,000 incidents.

Closing

Improving process safety is a journey, certainly not a destination. With that in mind, this roadmap is not intended to be used as a “silver bullet” to solve all problems. The recommendations are designed to come alongside other efforts you are making to ensure safe, reliable operations. At Sphera, we’ve observed that some best-laid plans never achieve the desired results due to poor implementations, and ultimately, a lack of proper execution in the field. Limited risk visibility, poor process execution, and a lack of learning activity can leave your organization exposed to significant risks. Sphera solutions are embedded with risk concepts that can be used to improve process execution, help drive the discovery of possible failure points, and enable improvements in controls across the organization to prevent incidents.

ROADMAP FOR EFFECTIVE PROCESS SAFETY MANAGEMENT:

Increase Risk Awareness & Visibility

- Integrate critical PSM risk sources onto a common platform
- Use the Platform to engage the workforce to report issues and strengthen controls

Improve Process Execution

- Bring management systems to life via automation at local levels
- Drive consistency in the way PSM processes are executed company-wide

Enhance & Sustain Learning

- Give people the permission, support, and tools to learn
- Implement lessons-learned process and hold people accountable for it
- Engage leadership to assess process quality and continuously improve

To learn more about Sphera’s PSM recommended practices, visit sphasolutions.com

References

1. American Institute of Chemical Engineers (AIChE; www.aiche.org)
2. The 100 Largest Losses 1974-2013 Large property damage losses in the Hydrocarbon Industry 23rd Edition www.marsh.com
3. Process Safety Performance Indicators for the Refining and Petrochemical Industries, ANSI/API RECOMMENDED PRACTICE 754 FIRST EDITION, APRIL 2010
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About Sphera

Sphera is the largest, global provider of software and information services in the operational risk, environmental performance and product stewardship markets. For more than 30 years, we have helped over 2,500 customers and 100,000+ users in 70 countries optimize workflows and navigate the complex and dynamic global regulatory structure.



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