Driving Operational Excellence™

Operational Sustainability, LLC®

2020: The State of Process Safety

What Does the Research Tell Us?

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ORIG 101320

Process Safety Management Overview

Process Safety Management has been continually evolving since it was promulgated as a regulation in the United States in the early 1990s. Initially, it was based upon a model that included 14 elements, all focused on reducing the potential for hazardous incidents. Since then, numerous regulatory updates have been made to PSM.

The American Institute for Chemical Engineering (AIChE) published a book in 2007 on Risk-Based Process Safety (RBPS); their effort was largely driven by significant process safety incidents that continued to materialize.

The American Chemistry Council then launched its Responsible Care® Process Safety Code in 2012 to specifically addressing process safety concepts such as leadership, accountability, and culture in order to drive overall process safety improvement.

Contractor Management (Contractors)
Process Knowledge Management (PSI)
Safe Work Practices (Hot Work)
Training and Performance (Training)
Emergency Management (Emergency Planning & Response)
Auditing (Compliance Audits)

Risk Based Process Safety Element	New Element	Expanded Scope	Improved Practices
Process Safety Culture	●		
Compliance to Standards	●		
Process Safety Competency	●		
Workforce Involvement (Employee Participation)		●	●
Stakeholder Outreach	●		
Process Knowledge Management		●	●
Hazard Identification and Risk Analysis (Process Hazards Analysis)		●	●
Operating Procedures			●
Safe Work Practices			●
Asset Integrity and Reliability (Mechanical Integrity)		●	●
Contractor Management			●
Training and Performance			●
Management of Change		●	●
Operational Readiness (PSSR)		●	●
Conduct of Operations	●		
Emergency Management			●
Incident Investigation			●
Measurement and Metrics	●		
Auditing			●
Management Review and Continuous Improvement	●		

Figure 1 – CCPS RBPS Model

AIChE's Center for Chemical Process Safety (CCPS) launched a program in 2014 called Vision 20/20 to establish the necessary steps a company should enact to go beyond the core objectives of RBPS. Vision 20/20 sets the framework for a more comprehensive management system, addressing some of the gaps in regulatory requirements, and describes how process safety delivers the best results when collectively supported by worldwide industry, regulators, and academia. It looks at the characteristics of companies with best-in-class process safety programs and the societal expectations of companies seeking to achieve similar results.

Figure 2 – CCPS Vision 20/20

These are only a few of the programs that have advanced process safety, *and* there is still disagreement on what constitutes a fully-functional program. Some PSM / RMP programs only address the expressed legislation, leaving gaps in knowledge because there is no regulatory requirement to do more. At Operational Sustainability, LLC® (OS), we think a PSM program should have a basic foundation of the CCPS RBPS to maintain compliance and alignment with best practices, but be enhanced as necessary by other relevant guidelines.

New Threats to PSM Performance

Cutbacks in regulatory staff and compliance activities are always possible in operating facilities. Knowledge retention and management talent also pose significant challenges because of retirement, lay-offs, or departure of the workforce. These situations raise a number of human capital management issues, and companies must be prepared for the elevated risk factors associated with them. This is especially true during the current COVID-19 pandemic, where many compliance activities including audits and inspections have been deferred.

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Previously, Safety Culture was a shared set of values, perceptions, attitudes, and beliefs **based on a training and management system approach** to derive performance outcomes. However, companies are shifting to **competency-centric** cultures that use data to make risk-informed decisions at the point of work. This shift to competency as the key is important because the majority of incidents are still attributable to human error.

Now, Safety Culture **is still** a shared set of values, perceptions, attitudes, and beliefs, but they are usually based on governance and traditional training. Currently we have five generations working together with different values and perceptions. **Digitization is essential** to unifying an organization's safety culture, especially with remote workforces becoming a major trend driven by COVID-19. We think it's unlikely that work practices will return to pre-pandemic paradigms. Younger generations of workers are already digital-first information seekers; companies who wish to attract and retain new talent need to consider digitization as more than a tool for *doing work*. Rather, it is a method of *working* that younger talent expects.

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Process Safety in 2020 By the Research Numbers

OS produced a market research survey focused on benchmarking an organization's existing PSM / RMP maturity. Respondents came from a variety of heavy industries and organizational sizes. This research was conducted in 2020, and the respondent set includes companies who responded to a survey link emailed from OS, and those who chose to participate after seeing the survey on LinkedIn in various industry-related groups or on the OS website.

Figure 3

In what industry sector does your company primarily operate? (check all that apply)

All Responses: Answered: 64 / Skipped: 0

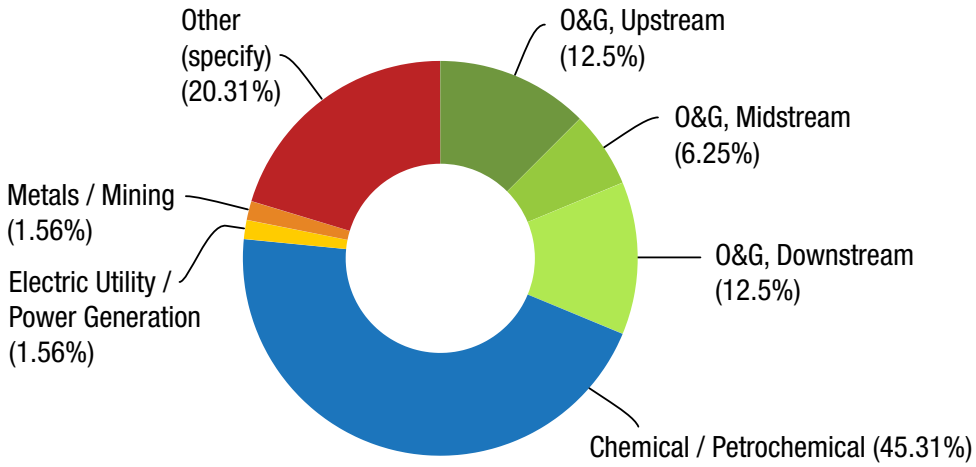
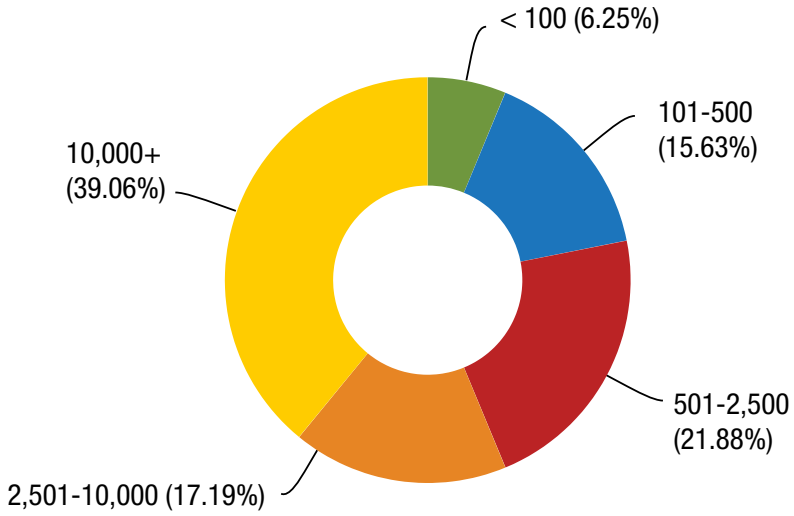


Figure 4

Roughly how many full-time employees does your organization (across all locations) have?

All Responses: Answered: 64 / Skipped: 0

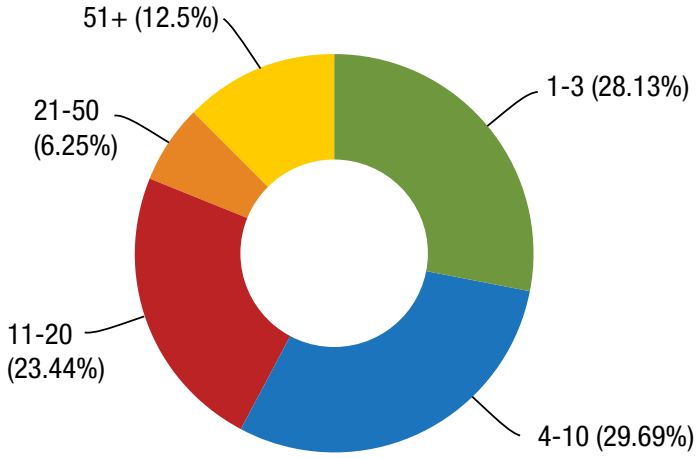


In addition to how many employees an respondent's organization had, we also asked how many PSM covered facilities their company operated.

Figure 5

How many Process Safety Management/Risk Management Plan (PSM / RMP) covered facilities does your company currently operate?

All Responses: Answered: 64 / Skipped: 0

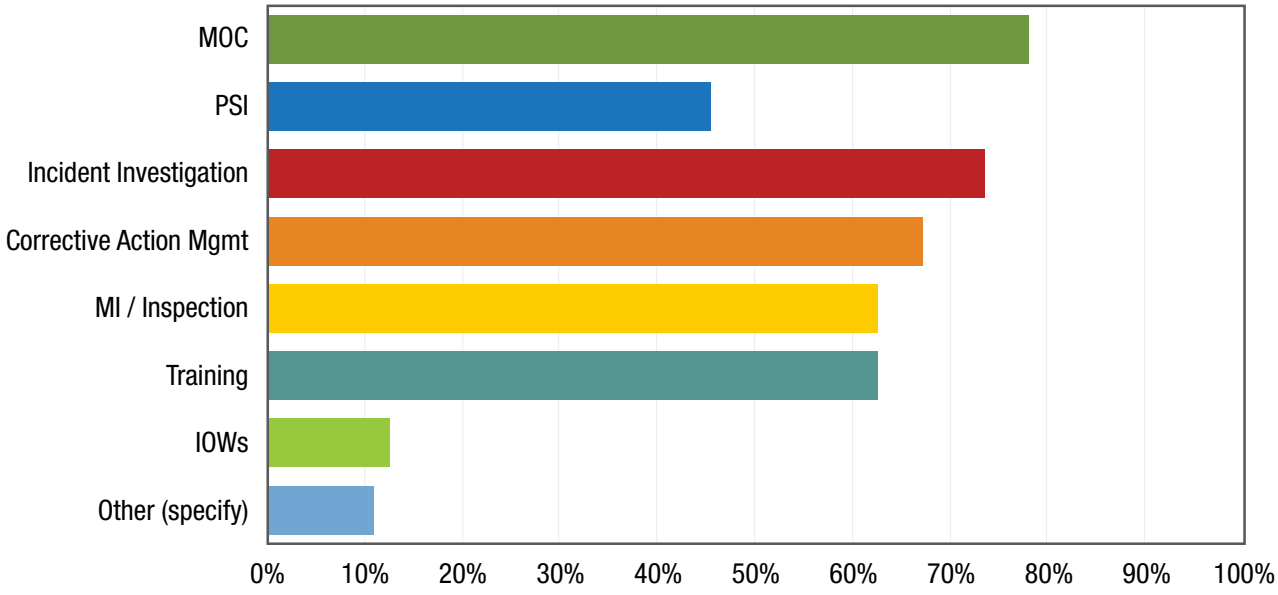


We used the answers regarding number of employees and number of PSM covered facilities to take a deeper look at the answers to other questions. We wanted to know how challenges differed (or if they did) based on the size of the organization overall, or based on how many facilities had to be considered at the corporate level.

Figure 6

What Process Safety processes currently use significant automation and/or technology in your organization? (check all that apply)

All Responses: Answered: 64 / Skipped: 0



When looking at the data from all respondents, MOC and Incident Investigation are the leading areas when it comes to automation or technology. Note that Process Safety Information (PSI), is not, with 45% responding yes to that item. We feel that the correlation between Incident Investigation and corrective action management (CAPA) is nearly identical because CAPA is the follow-up mechanism that is generally implemented as part of or to support a corporate incident reporting tool. In other words, CAPA and Incident Management are one of the few inherently integrated components of PSM data management. Challenges arise in other areas of PSM since every element will also create corrective actions that must be managed and closed-out once resolved. It is helpful to have all corrective actions directly integrate to MOC and a single corrective action tracking solution. Another challenge is re-integrating individual outputs via a feedback loop. One example of this is learnings created by incident management that might need integration into multiple subject areas such as LMS, Asset Management, PSSR, etc.

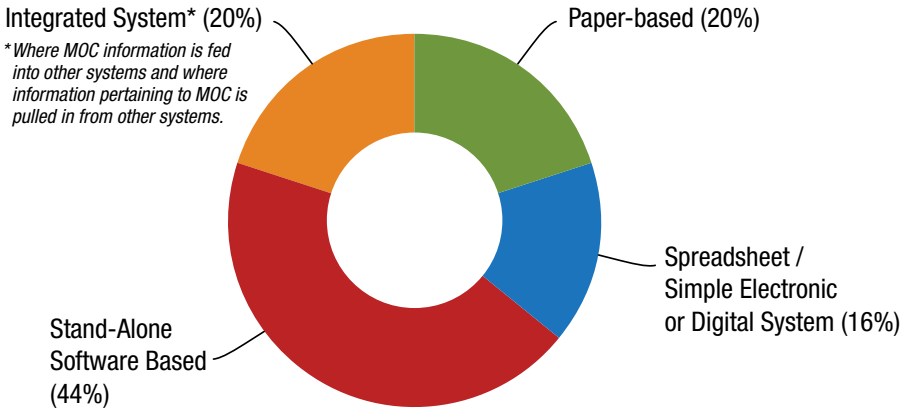
Most companies have inspection data management software for time-based inspection per API 510, 520, and 653, but again, that data may remain siloed and separate from other PSM systems. Integrity Operating Windows (IOW) are a newer concept, and very few companies have developed IOWs to date, let alone implemented an IOW solution. The data bears this out.

Our **2020 MOC research survey** covered the maturity of data management as it pertains to MOC and what we found is the majority of organizations use spreadsheets and standalone point solutions to manage change, another indicator of the overall lack of integration between PSM functions.

Figure 7 – Data from the OS 2020 Primary Research survey on MOC

What kind of system do you currently use to manage your MOCs?

All Responses: Answered: 50 / Skipped: 0

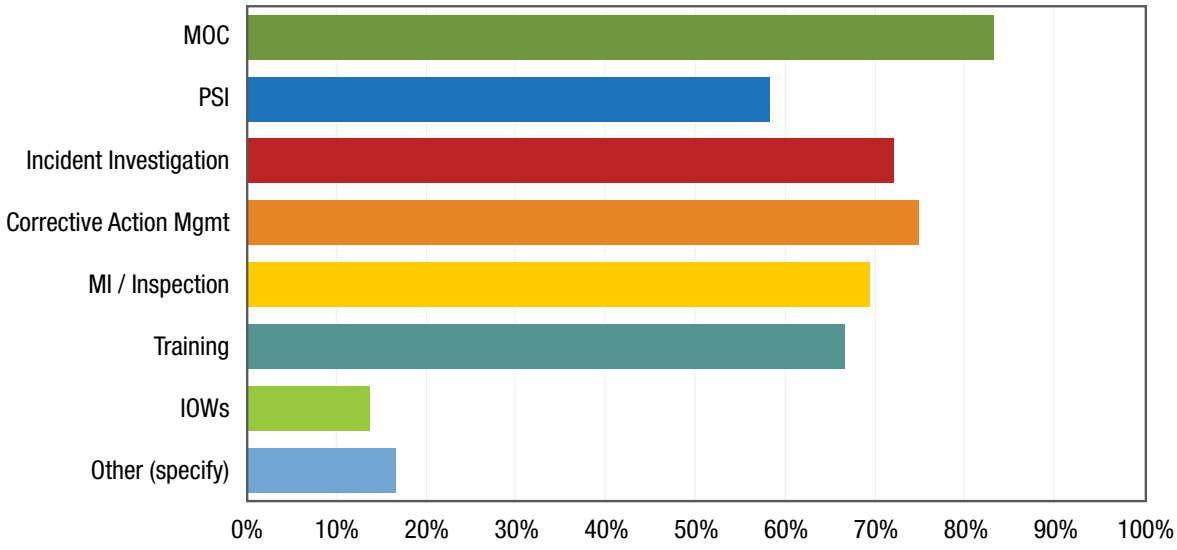


We see the MOC survey data borne out in our Process Safety survey data, as well, as MOC is the leading response category when we asked companies about automation. This is true for larger (2500+) companies, but incident management leads for those companies with 10 or fewer PSM covered facilities (see Figure 9).

Figure 8 - Returning to the data from our 2020 Process Safety survey, we asked about automation and / or technology

What Process Safety processes currently use significant automation and/or technology in your organization? (check all that apply)

Responses from 2,500+ employee companies: Answered: 36 / Skipped: 0



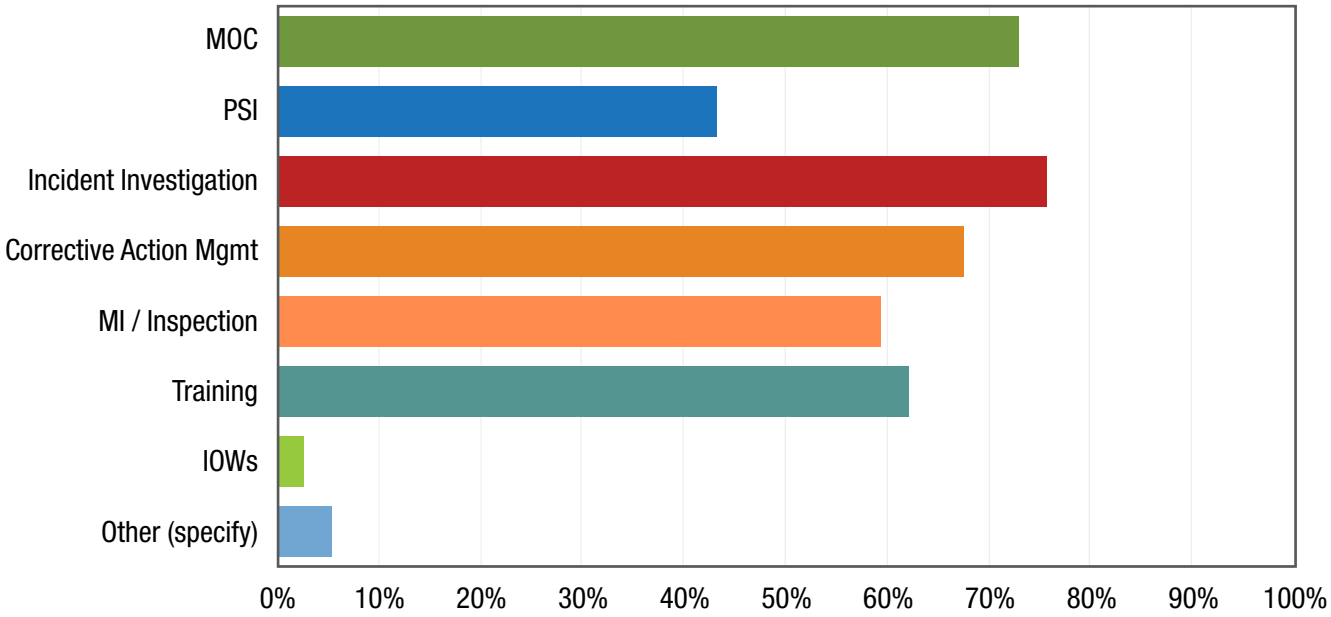
When comparing Figure 6 to Figure 8, we can see the data is relatively the same when looking at only companies with more than 2,500 employees, though it's clear more automation or technology is being used by larger companies. PSI still lags behind MOC, CAPA, Incident Investigation, Mechanical Integrity, and Training.

Given the reality of COVID-19, computer-based training will likely become the preferred training delivery mechanism in the near future. We expect companies to make more pronounced investments in Learning Management Systems (LMS) over the coming years. In addition, we expected the Connected Workforce to start augmenting training as companies deal with the realities of the remote workforce for the foreseeable future.

Figure 9

What Process Safety processes currently use significant automation and/or technology in your organization? (check all that apply)

Responses from 10 or fewer PSM covered facilities: Answered: 37 / Skipped: 0



Companies with 10 or fewer PSM covered facilities show lower utilization of automation or technology overall, with PSI still the lagging area of those with any significant investment.

For reasons stated previously, IOWs show far less automation or technology utilization than any other core part of Process Safety, yet they are a key piece of data for maintaining Mechanical Integrity and ensuring assets are operating as designed – as efficiently as possible in addition to as safely as possible. We expect companies will start investing more in the future in this area given that feedstock variability and process upsets are prevalent in certain industries.

PSI is a hodgepodge of solutions ranging from spreadsheets to PDF files on a file server. One observation by OS is that SharePoint tends to be quite pervasive as a means to attempt to manage PSI. There are other PSI point solutions like relief device design information that are found in specialized desktop software. One thing that stands out is that PSI is typically managed as qualitative information, when in reality it also consists of chemical and equipment information. One company OS worked with had 57 disparate IT systems for PSI for a single refinery. In reality, PSI is a junction box that should be treated as a interoperable framework.

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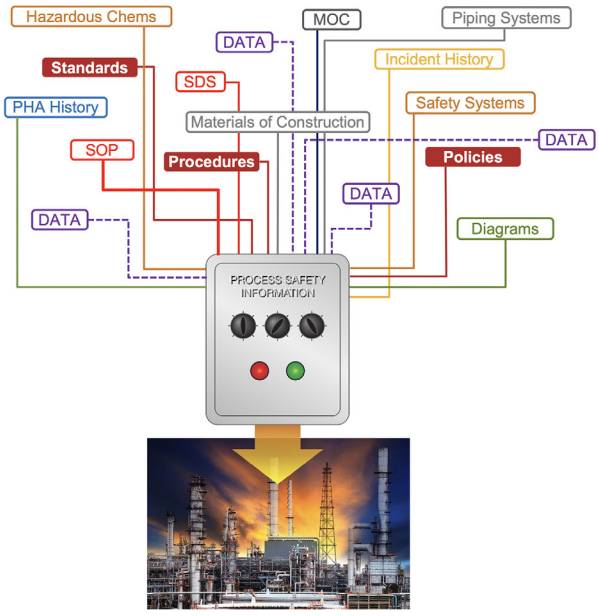


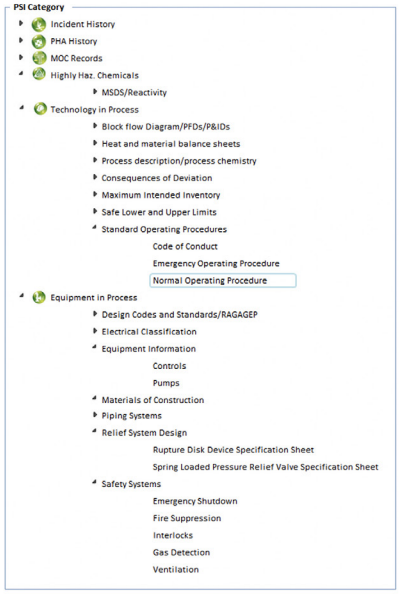


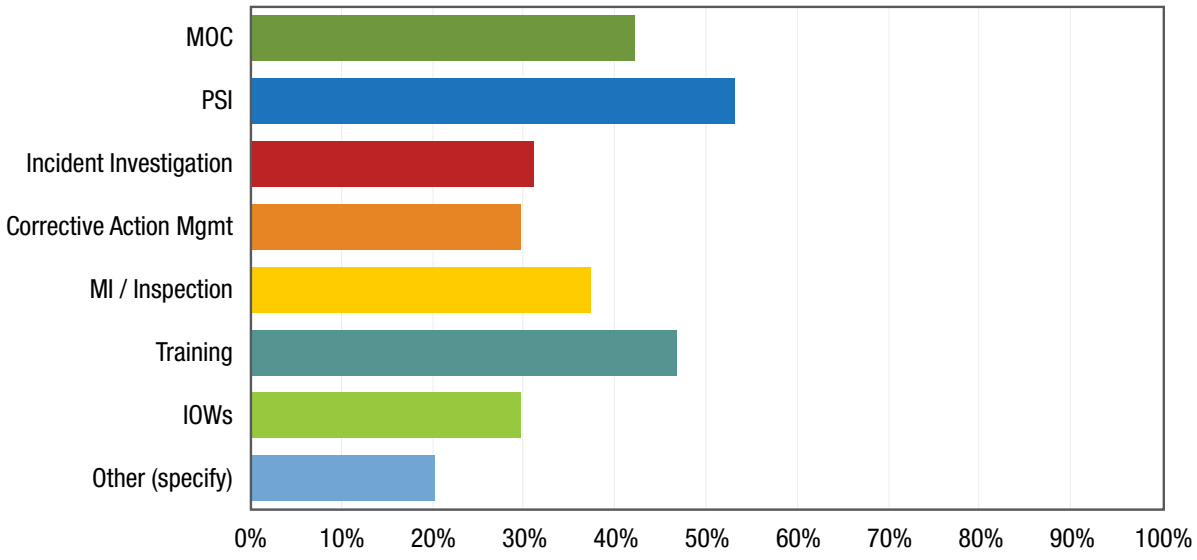
Figure 10 – An example of an holistic PSI framework

Next, we asked what processes were likely to see increasing needs for automation in the next three years. PSI and IOWs were areas named, along with Training, MOC, and MI. Given that many companies reported already using significant technology in some of these same areas, it seems clear that current systems are not delivering the desired results in many cases. For example, nearly 80% of companies in our MOC survey claimed to have fairly mature MOC processes, yet 40% of our Process Safety survey respondents said they were undertaking efforts to further automate them over the next three years. We believe this is highly reflective of the lack of integration and interoperability companies thought they had, when in reality there is likely a veritable list of PSM point solutions. For example, most companies today still use proprietary desktop PHA software which has no ability to integrate to a corrective action or MOC solution without significant effort via custom programming, arduous manual data scrubbing or both. Interoperability between corrective action, MOC and all other software that generates action items is critical. There is the obvious efficiency impact but also accuracy that is a risk from re-keying technical information replete with tag numbers, technical terminology and lingo.

Figure 11

Thinking about your own facility or organization, do you anticipate an increasing need for automation of any these processes within the next 3 years? (check all that apply)

All Responses: Answered: 64 / Skipped: 0



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OS believes that in many implementations, organizations are using point solution software without **interoperability** – multiple systems and business processes all reading from the same data set and returning information to the same data set. Many technology tools promise *integration* with existing systems, or custom *configurations* for a company's needs.

Configuration + integration does not equal transformation. Without interoperability, there is no transformation.

Historically, automating processes have been driven by the organizational hierarchy. Generally, PSM Software Systems were broken up into camps as follows:

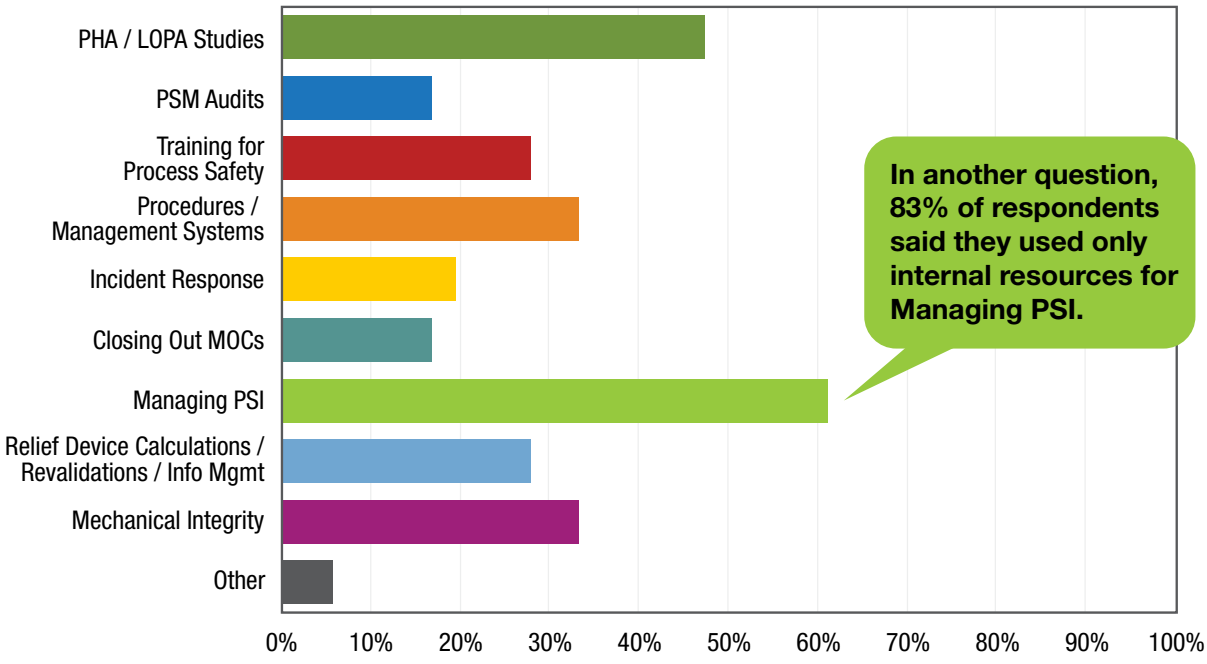
- Audit, Incident Investigation, Corrective & Preventative Actions (CAPA) – Basic EHS compliance starting point focusing on safety with EHS vendors
- PHA, MOC, PSSR, Organizational Change – Core PSM focus
- Mechanical Integrity – Inspection and EAM software focus area
- PSI, Relief Devices – Engineering Content vendors
- Procedural Automation – Boutique Vendors
- Training, LMS, Competency Management – LMS Vendors
- LOPA, SIS, Alarm Management – Safety Lifecycle Vendors
- Work Permitting – LOTO software vendors, EHS vendors

This produces significant challenges in building a unified data structure to holistically address Process Safety. Our research survey showed that for 61% of companies having 10 or fewer PSM covered facilities, "Managing PSI" was their biggest struggle to automate (see Figure 12).

Figure 12

In your opinion, what elements of Process Safety are the hardest to provide adequate resources for, whether internal or external? (check all that apply)

Answered: 36 / Skipped: 0



OS believes respondents are encountering the truth that **PSI is a framework** of supporting processes that encapsulates nearly a dozen disparate systems, not just file management or document management. This is why we recommend that companies focus on PSI as a Phase 4 maturity point.

To move forward, companies need to realize PSM crosses numerous departmental boundaries making it difficult to get to one source of truth. In reviewing Figure 13 to the right you'll notice significant program areas that are often difficult to access in most organizations. Often SIS, RBI, alarm, audit, PHA and others are handled by desktop applications with no integration or wide scale visibility via an enterprise software interface.

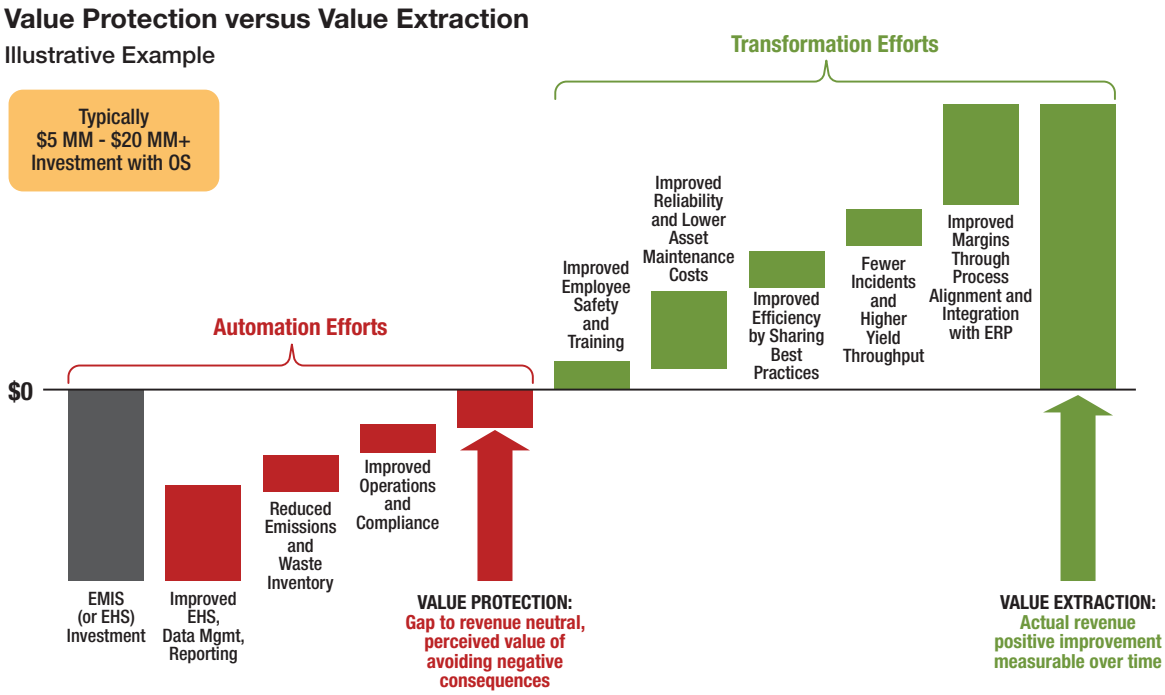
Phase 1	**"Basic PSM"** **CAPA, Incident, Process Risk / PHA**
Phase 2	**"Intermediate PSM"** **MOC, PSSR, Document Management, Training, LOPA, Audit**
Phase 3	**"Advanced PSM"** **Inspection, Organizational Change, Relief Device Management, Task Management, CoW / LOTO**
Phase 4	**"Mature PSM"** **IOWs, RBI, Alarms, SIS, Procedures, PSI, Competency, Production Loss**

Figure 13 – OS PSM IT Maturity Model

Value Protection vs. Value Extraction

From a financial and performance perspective, Process Safety provides **Value Protection**. Value protection focuses on compliance and reporting to avoid negative consequences, so it tends to deliver a **return** to a zero baseline because it promises to mitigate possible financial impacts of the future negative outcomes avoided. The actual value is revenue neutral and the perceived value is dependent upon avoidance of negative outcomes. In many organizations, **automation** efforts are often value protection initiatives.

Figure 14 – Value Engineering Model



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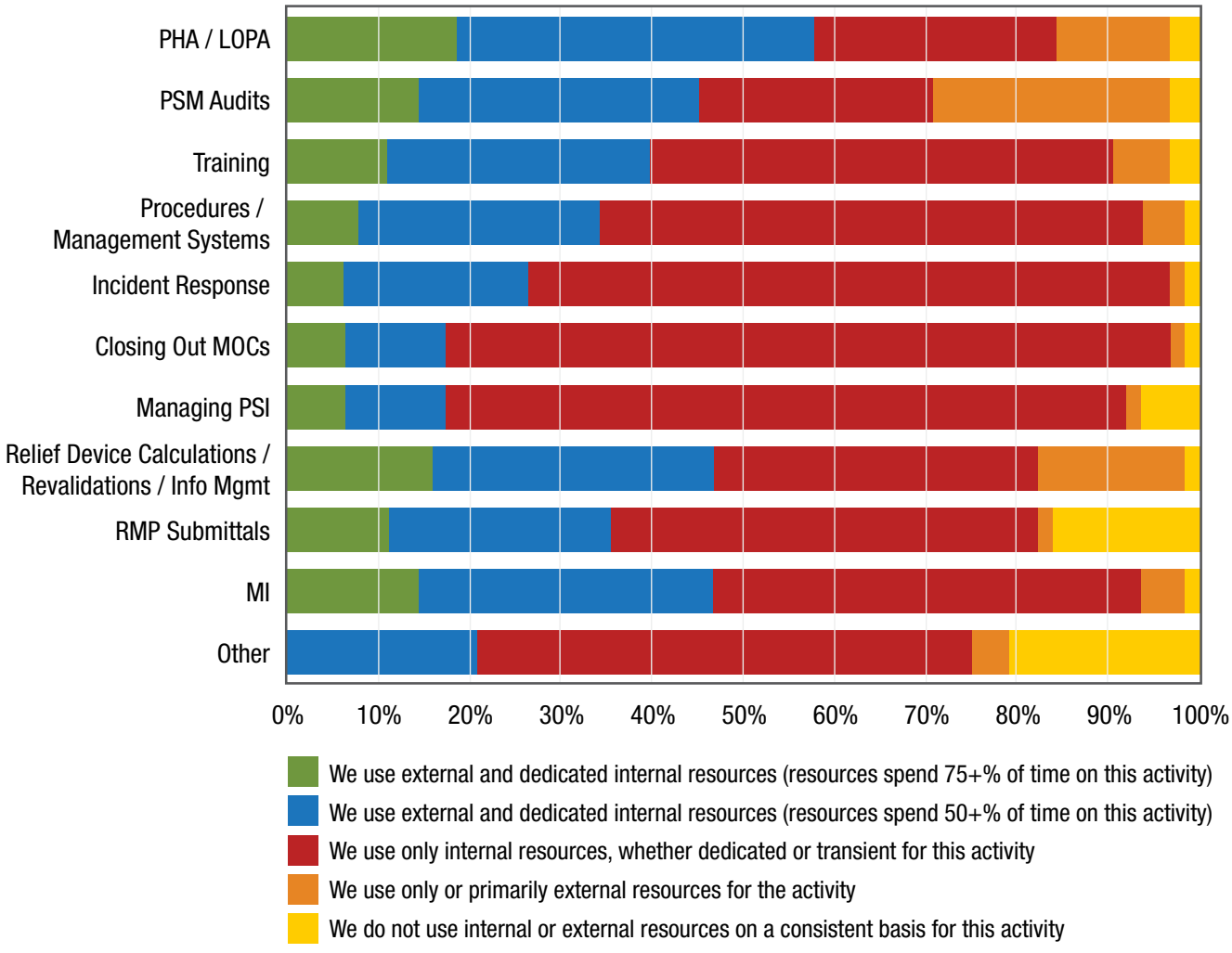
Since PSM software applications are complex and costly to develop and support from the ground up, many companies turn to commercial off-the-shelf alternatives. However, tools such as spreadsheets and custom database solutions only create additional concerns regarding security and scalability, and as we saw in the answers around PSI, create further obstacles to transformation of an organization's process safety journey.

Figure 15

Considering process safety activities within your organization, think about what level and type of resources your organization commits to these activities. Please rank the following activities based on company-wide resources committed, to the best of your knowledge. You may use each ranking more than one time.

All Responses: Answered: 64 / Skipped: 0

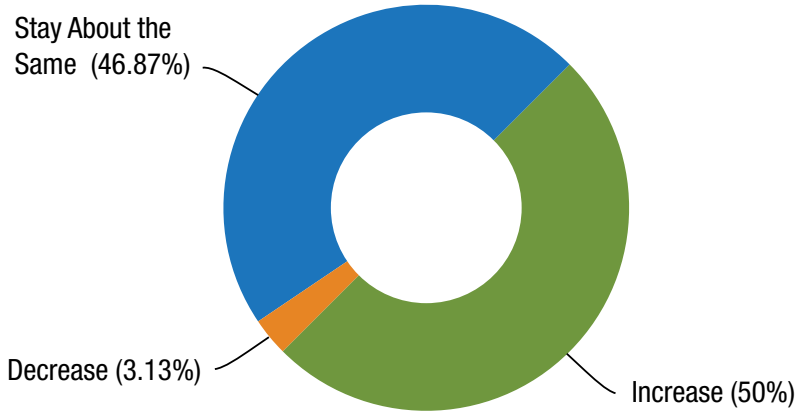


When looking at the data for all respondents, it's clear that some of the areas where respondents struggle (PSI, for instance) are also areas where only internal resources are used to address needs.

Figure 16

Based upon your PSM / RMP program status today, how do you think your company's resource requirements on currently planned activities will change over the next 18 months?

All Responses: Answered: 64 / Skipped: 0



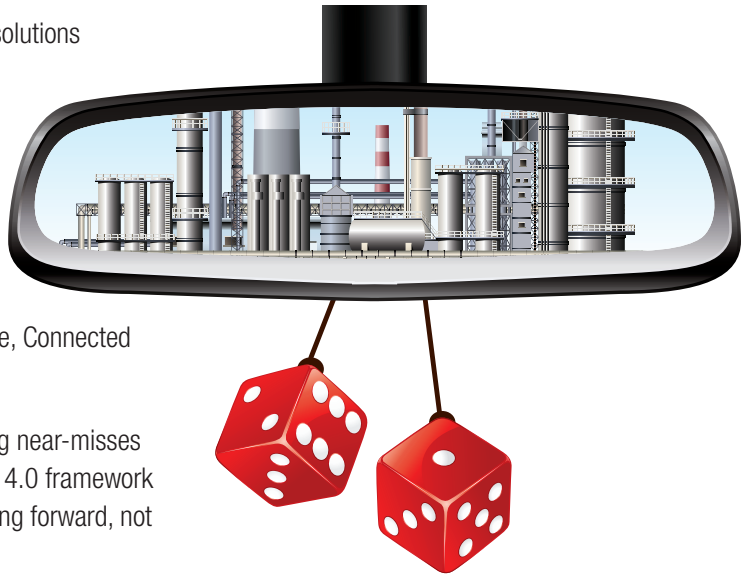
Even in a year of uncertainty and challenge, companies believe they will have to continue to devote new resources to Process Safety initiatives.

Figure 17

When asked how PSM could be better supported, respondents, as shown in Figure 17, wanted better PSM training programs, more understanding and support across the organization of PSM needs, and improved culture.

How Do Companies Move Forward?

The majority of companies today lack a comprehensive PSM system strategy. With the possible exceptions of a corporate-wide incident management and corrective action management solution, the majority of PSM applications are generally heavily siloed. Without re-architecting, the majority of companies will continue to have human intensive solutions for managing their process safety data. As a result, companies won't achieve an interoperable management system outcome, which leads to more efficient execution and actionable insights rather than lagging indicators.



As always, new regulatory challenges loom on the horizon. Interoperable solutions drive out inefficiencies and can robustly address emerging areas, while helping companies to standardize and enhance their safety culture. Data-driven decisions at every level – possible with a Connected Workforce approach informed by an interoperable PSM system – can move companies from hindsight to foresight. OS has a perspective on the Connected Workforce that is available. In addition, OS has a separate PSM IT brochure which concludes that PSM IT today goes beyond the 14 traditional elements to encapsulate Connected Culture, Connected Workforce, and Conduct of Operations.

To achieve top quartile performance, and to make further gains in reducing near-misses and incidents, companies need to move to an Operational Excellence (OE) 4.0 framework for managing Process Safety. Process Safety Health is dependent on looking forward, not backward to detect emerging threats.

In other words, companies need be looking ahead, rather than always seeing their operations through the rear view mirror of lagging indicators. Clearing the way for a true, forward-facing outlook requires investing PSM resources in the right ways to not only protect lives and value, but also to move a company forward from the workforce and operational excellence perspectives. Adopting this type of PSM framework will provide regulatory compliance along with a positive impact to the bottom line.

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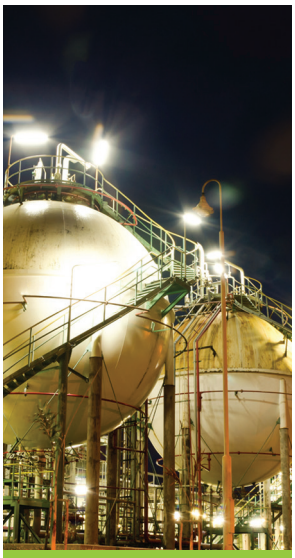
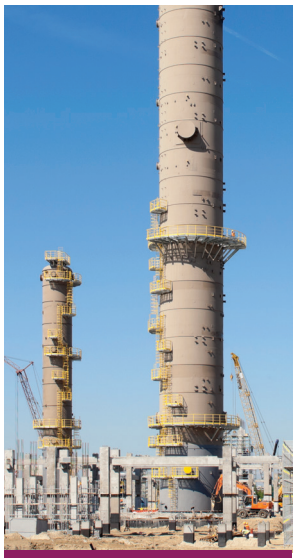
Workforce


Assets


Operations


Compliance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