



# Process Safety Report 2024

Sphera Insights 9<sup>th</sup> Annual Report



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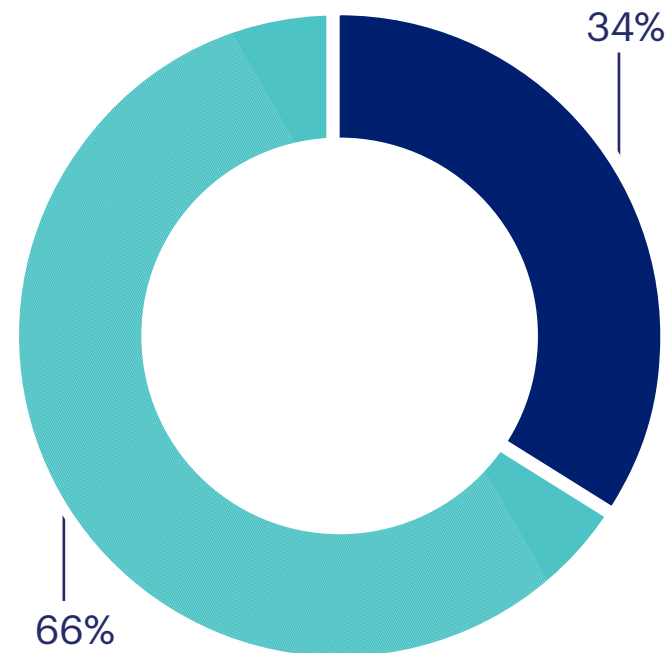


# Executive summary

**Digital tipping point:** *Why now is the time for PSM to evolve*



In this, the ninth year of our process safety survey, **about two-thirds (66%) of respondents still perceive gaps between their companies' process safety goals and reality. This has remained virtually unchanged since early surveys.** Digital tools are now available that can help bridge the gap, yet adoption has stalled.



## Why?

In large part, the gap remains because too few companies have implemented digital solutions for process safety management (PSM). While they desire to streamline these processes, they perceive digital solutions as overly complex and challenging to implement. Other reasons may include a lack of qualified staff or the funding for digitalization.

-  Gaps in process safety goals & reality
-  No gaps in process safety goals & reality

▶ *Embracing digital may have consequences. Avoiding digital may have bigger consequences.*

But data reveals that the tide is changing. Increasingly, PSM practitioners are understanding the vital role digital plays in making their processes safer, more efficient, and more sustainable — not to mention driving the overall profitability of their business. In fact,

**84%** of firms see cost reduction and efficiency improvement programs as significant drivers of digitized plant operations.\*

\*Verdantix, Global Corporate Survey 2023 Operational Excellence Budgets Priorities and Tech Preferences, 09/2023



**With that context in mind, let's look at this year's key findings:**

Despite advances/availability of technology, companies are having a hard time raising the bar for process safety improvements:

- Less than one in four organizations (**23%**) complete all safety-critical maintenance activities on time and on schedule.
- Worse, just one in 10 (**9%**) are confident they are aware of all MAHs.
- As facilities continue to age, more respondents, almost four in 10 (**39%**) are concerned about visibility.

### At the same time, challenges in the workforce exist:

- Human factors are seen as the top challenge to delivering effective PSM [41% training and competency / 40% management involvement]
- Similarly, nearly half of respondents (49%) see loss of/lack of experienced personnel as the top factor to cause risk to increase.
- Through demographics and other job avenues, experience is exiting hazardous industries; however, attracting new field personnel remains difficult.

### Compliance is a driving force in process safety:

- Regulations have helped improve safety, say 74% yet just over half of respondents (56%) believe that organizations have moved beyond compliance as an obligation. PSM is an integral part of ESG.
- Companies include process safety strategies/incidents in annual sustainability reports. Sustainability metrics are considered at the organizational level, as well as in individual roles, for 80% of respondents.

### Over time, there has been a material shift in process safety ownership:

- As plants get older and the probability and consequences of incidents become more significant, process safety has become more important to leadership.
- Compliance obligations and sustainability regulations could be why nearly one-third (32%) now say senior leadership is driving process safety. Additionally, the responses show that risk awareness is growing across all roles.



## Digital breakthrough

95% of respondents overwhelmingly believe in the power of technology to improve safety



**Digital tools and real-time data are seen as effective.** Just over half (**51%**) point to the reduced vulnerability to MAHs. Many companies have the core pillars for operations and maintenance such as environmental health and safety software (**59%**), management systems (**54%**) and/or asset performance management (**41%**). Furthermore, just over half (**52%**) have invested in solutions to visualize and proactively manage the health of individual safety barriers and safeguards.

How can we as process safety practitioners move from where we are today — hovering at the halfway mark — to a more comprehensive, discipline-wide digital transformation?

Ultimately, PSM practitioners **need a partner that deeply understands the needs and nuances of process safety digitization.** In Sphera’s case, we’ve had our boots on the ground. We’ve worn the hard hats. And for 30+ years we’ve paired companies with subject matter experts who can help you achieve digital resilience in a way that makes sense for your organization — including a roadmap that helps your team adapt.

*Continue reading for the state of process safety management with an eye toward helping PSM leaders understand the path from digital resistance to digital resilience.*



# About the report

Each year the Sphera Process Safety Report gathers insights and opinions from process safety professionals around the world. This year, themes such as aging facilities, exiting expertise and the escalating involvement of senior leadership take center stage. By compiling this diversity of thought, our hope is to illuminate the most pressing challenges facing the process safety discipline — as well as the trends that point to a more promising future.



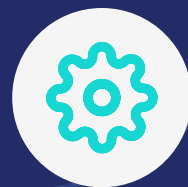
**300**  
Respondents



**17.37**  
Avg. Years of Experience



**6**  
Continents



**10**  
Industries

Oil & Gas  
Food & Hospitality  
Manufacturing  
Mining & Metals  
Utilities & Energy

Services & Engineering  
Education & Training  
Transportation & Logistics  
Public Sector & Government  
Chemicals & Petrochemicals

A group of workers in a dark tunnel, illuminated by their headlamps. The workers are wearing hard hats and safety gear. The tunnel is dimly lit, with the primary light source being the workers' headlamps, creating a dramatic, high-contrast scene. The rock walls of the tunnel are visible, and the overall atmosphere is one of a confined, potentially hazardous environment.

# What matters now

Raising the bar on process safety improvements is difficult. But the stakes are higher: Experienced personnel have exited hazardous industries, facilities continue to age, and visibility into potential incidents remains limited for many organizations lacking digital capacities. Compliance helps but doesn't go the distance in terms of protecting organizations and their people (and the environment) against the full range of potential incidents they face.

- ▶ **The survey paints a clear picture.**  
*Corporate leaders are taking notice and increasingly prioritizing these issues.*



A vertical image on the left side of the slide shows the silhouette of an oil rig worker against a bright sunset sky. The worker is positioned at the bottom, looking up at a large pulley system and rigging structure that extends towards the top of the frame. The sky transitions from a deep orange near the horizon to a teal color at the top.

# Challenges

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Human factors remain the top challenge when it comes to delivering effective process safety management. However, respondents increasingly cite a lack of actionable insights as a key blocker to incident prevention.

Furthermore, as experienced people leave the workforce, companies need standardization for new workers filling the roles (policy to practice). And operators are seeking the increased visibility — and ability — that technology grants in order to optimize allocation of budgets and tasks. Beyond safety, this all adds up to a significant business impact:

- ▶ Without connected systems, companies reactively manage risk, driving inflated costs and labor.

### What factors cause risk to increase on your plant/asset?

1. Lack of experienced personnel **49%**
2. Lack of visibility/aging facilities **39%, up from 35% in 2023**
3. Conflicts between procedures/working practices **41%**

### Which factors most negatively impact your company's safety performance?

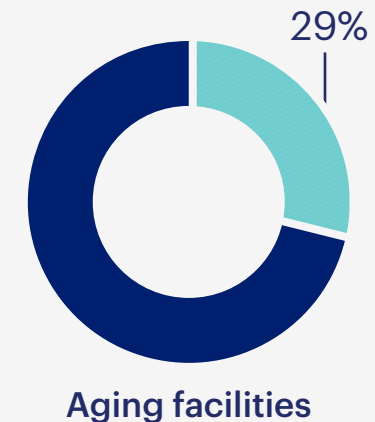
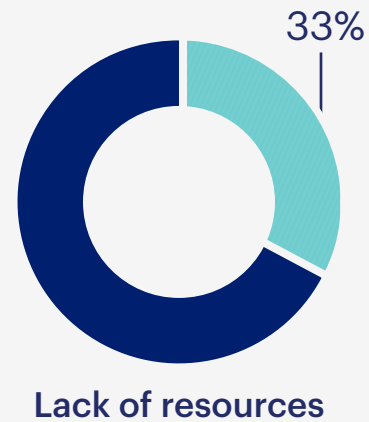
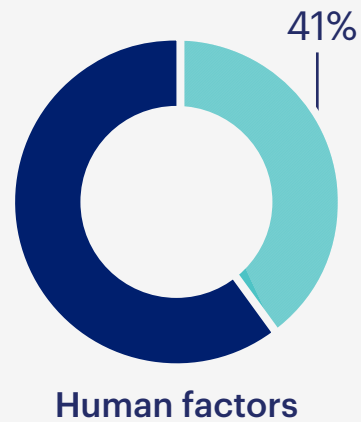
1. Human resources
2. Budgeting
3. Maintenance

*Note: Supply chain/logistics issues rising in significance, climbing to 17% from 12%.*

### Which process safety management system/program does your company follow to develop its process safety management strategy?

Nearly half of respondents (**49%**) report that their organization follows OSHA 14 Elements and **30%** rely on CCPS 20 Elements. Organizations may go beyond these frameworks by using regional or industry specific PSM systems or adapting these in-house.

### What are the main challenges to delivering effective process safety management?



*Note: Respondents citing lack of actionable insights (visibility) increased to 24% in 2024 from 15% in 2023.*



# Real-life process safety incidents and fatalities

Since publication of our first process safety report in 2016, innumerable incidents have taken place around the world. This doesn't include the near misses. At the same time, extreme weather events are increasing, stressing already vulnerable plants.

Process safety management serves to reduce the number of incidents. Fatalities still occur. People still lose their lives. The rate of incidents has slowed in recent years, yet facilities continue to age. Without safety-critical maintenance, potential risk increases significantly.

▶ **Review source:** [Chemical Safety Board, Marsh McLennan, \*100 Largest Losses in the Hydrocarbon Industry\*](#)



# People

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Despite human factors being the biggest challenge of process safety management, **the data shows that people are taking safety more seriously at all levels of the organization** — from organizers who face challenges in coordinating shutdowns and turnaround with on-site contractors and operators to leaders who are taking greater ownership over process safety management.

*Let's take a deeper look:*



**Management**



**Frontlines**

## Management

- **More roles, in particular senior leadership, are driving PSM or actively managing risk.** As plants get older and the probability and consequences of something going wrong becomes more and more significant, PSM is more important to senior management in an organization. There's a golden opportunity: If leadership steps up to take more ownership of strategy and decision-making, those companies stand to maintain and even enhance profitability and competitiveness.
- At an increasing number of global companies, the board of directors plays a key role in developing process safety strategy, setting goals, monitoring performance and reporting on incidents.

## Digital takeaway

Digital solutions offer the only effective way to capture corporate knowledge and lessons learned. Critically, digital systems serve to control risks in operational activities **by facilitating communication and providing standardization at all levels, including senior leadership.** Digital systems command a real-time view of operational reality and provide actionable insights into PSM status of the maintenance activities and plant.

## Frontlines

- At the ground level, virtually all roles seem more risk aware. Engaging the frontlines to improve awareness was noted as one of the top three challenges by **25%**, down from **32%** in 2023. The percentage naming training and competency as a challenge also dropped to **41%**, from **46%** in 2023.
- Workplace challenges remain. As employees retire or leave the industry, experience walks out the door. New hires may not be fully aware of the complexities and consequences of major accident hazard pathways. Someone who has been operating a plant, a facility or a unit for 15 years intuitively reacts to a change in sound. Hearing a pump or compressor running, they suspect that something is different, or perhaps not quite right; temperature pressures or flow rates may no longer be within tolerance.
- A continuing drain of experienced personnel is compounded by difficulty in attracting new employees. Those who enter the field may be less interested in going to the dirty and dangerous physical site.



# Performance

This year we see that **reducing downtime is becoming a bigger driver for improving safety performance**. At its core, business continuity is a financial objective. So if respondents feel that these concerns are driving PSM performance improvement, it's logical to think that senior leadership is playing a bigger role. The reality is that you drive PSM by showing how it helps keep the plant running — and production uptime is an increasing focal point.

## What are your main challenges to delivering effective process safety management?

1. Training and competency **41%**
2. Engaging the frontlines to improve awareness **25%**

## Who's responsible for understanding and managing operational risk?

There appears to be a material shift in senior positions driving and managing process safety. Similarly, for all roles, the percentages of those who "actively manage risk" have risen.

## What are the drivers for improving safety performance?



Significantly, although the top 3 drivers were the same as 2023, the biggest increase is the focus on production uptime (reducing downtime), now 36%, up from 29%.

A photograph of an industrial facility, likely a refinery or chemical plant. It features a tall, dark smokestack emitting a plume of grey smoke into a cloudy sky. Below the stack, there is a complex network of metal scaffolding, pipes, and walkways. In the foreground, several large, cylindrical storage tanks are visible, some with yellow safety railings. The overall scene is industrial and somewhat somber due to the overcast sky.

# ESG

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Nine years ago, ESG was not a (collective) concept. Following an incident, the consequences included being taken to court, sued for manslaughter or called out in the press, impacting corporate reputation and share price.

**Now an organization's ESG performance is an essential metric** and is a hot topic in boardrooms around the world. Considering all the reporting requirements (governance), PSM is an integral part of ESG.

## At the corporate level

Asked where PSM fits into their organization's environmental, social and governance (ESG) program, nearly six in 10 (**59%**) see it as governance. Complying with regulatory requirements falls under governance. **If organizations are not compliant, and a process incident occurs, it will have societal and environmental impacts.**

This cause and effect ties back to respondents seeing compliance as a top driver of PSM. It may also be why the level of interest is growing at the senior level in the organization. Today, companies routinely assess their environmental impact.

A standard requirement of sustainability reporting is to include process safety incidents and loss of primary containment. Process safety incidents have a cost to the environment, to the social component (workers and surrounding residents) and to the business governance (poor ESG reporting and share price drops).

### At the individual level

Sustainability metrics are also considered at individual levels. Approximately eight in 10 respondents have some form of measurable priority in job functions and in performance metrics.

### Where do you see process safety management fitting into your company's ESG program?

1. **59%** Governance
2. **55%** Environmental
3. **43%** Social

Only 10% don't see it fitting somewhere.

### When your organization develops scenarios for a process safety incident, which potential business impacts are most concerning?

1. **65%** believe the most significant impacts of a process safety incident scenario are "loss of production capabilities" (affecting profitability)
2. **63%** say "environmental impact" (risking fines and sanctions)
3. **60%** cite "impact on human habitation"

### Throughout your process safety and risk management evaluations, how much consideration is paid to environmental impact?

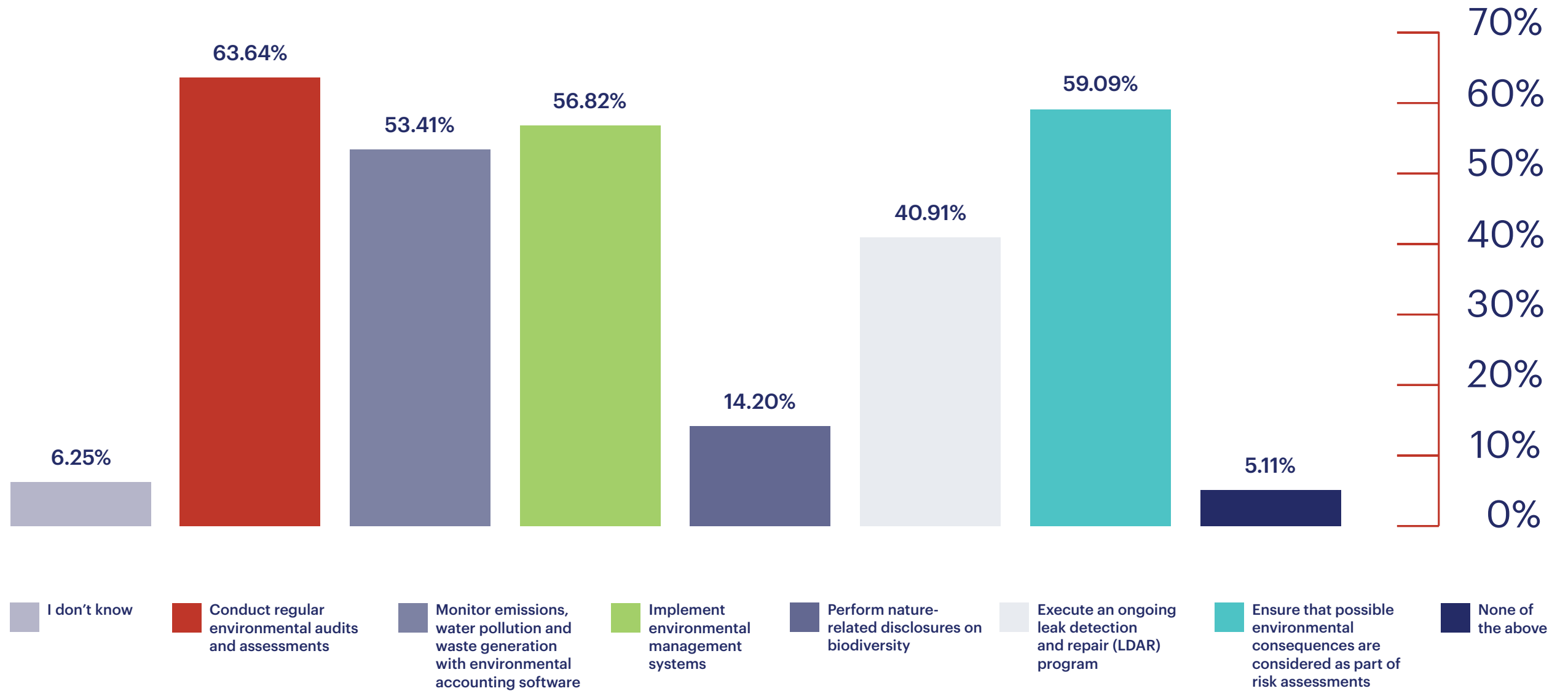
**95%** agree process safety incidents impact the environment

## Digital takeaway

At the corporate level, **digital tools help safety professionals** audit, assess and learn to reduce incidents, accidents and ESG risk exposure.



### How does your organization assess the environmental impact of its operations?



**How does your organization engage with local communities and stakeholders regarding safety and environmental concerns?**

Approx. **80%** have some form of contact.

**Which of the following resource conservation practices are specific, measurable priorities within your job function?**

Approx. **80%** have some form of priorities in job role.

Relatively high numbers, indicate the importance of ESG at corporate level and individual (PS professional)

**How often is performance in your function measured by specific sustainability metrics, for example energy consumption, water use or sustainable sourcing?**

Approx. **80%** have some form of performance measurement.

17% of respondents have "no sustainability performance measurement."



# Compliance

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Regulatory frameworks support the goals of process safety management, and three in four respondents say regulatory compliance has reduced vulnerability to MAHs.

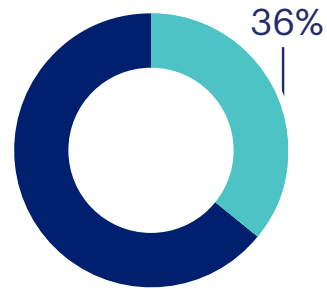
Furthermore, roughly one-third of respondents say their organization does what is necessary to achieve PSM and ORM compliance. The other two-thirds go beyond compliance, using technology to improve EHS and improve predictive decision-making.

## Digital takeaway

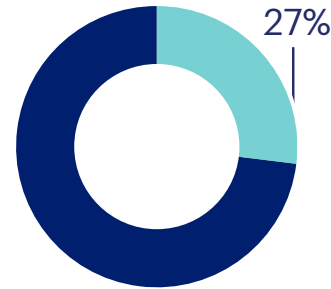
Organizations need to ensure corporate safety standards are adhered to at the site. This is **inefficient and difficult** to police with paper-based processes and workarounds.



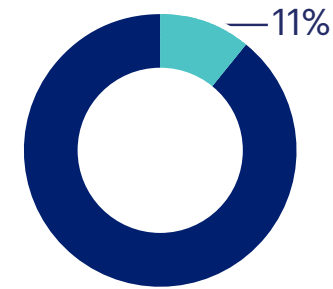
How much do you think industry regulations and safety (governance) reporting requirements have helped companies reduce their vulnerability to high-potential incidents?



Helped Generally

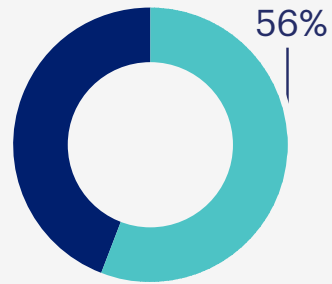


Helped Significantly

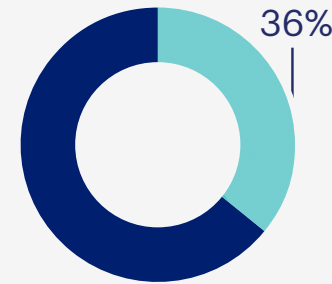


Vitaly Essential

In your experience, do organizations manage process safety proactively or as a compliance obligation?

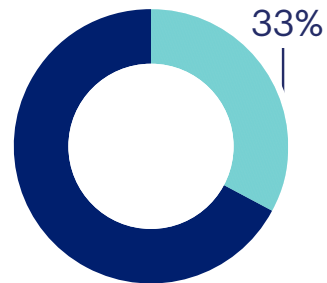


Compliance Obligation

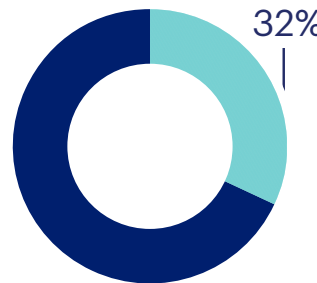


Proactively

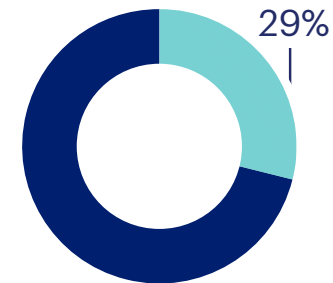
Which best describes your organization's level of maturity on operational risk and process safety management?



Compliant



Efficient



Optimized



# Risk

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Companies lack the ability to confidently identify all risks of a major process safety incident across assets. Less than one-quarter of respondents say that all or nearly all safety critical maintenance is reliably achieved in a typical month. Digital tools can help bridge the gap, yet inertia still exists.

There may be competing priorities (production downtime versus routine maintenance to avoid breakdowns). Understanding what is safety-critical versus what is production-critical, which procedures can make the biggest impact and what matters most can help operators achieve more of the safety goals. **Using digital solutions to manage master data and achieve transparency in supply chains helps ensure that the right spare parts are available at the right time and thus avoid safety-critical maintenance delays.**

**Are there gaps between your company's process safety goals and your process safety reality (what actually happens)?**

**66% Yes**

**Typically, how much does your operational risk change between process safety reviews (for example, PHAs, HAZOPs, HAZIDs and LOPA)?**

**42%** of the respondents say noticeable (**28%**) or definite (**14%**) change; it's hard to put an ROI on risk, but this is a nice way to sum it up.

**In a typical month, what percentage of scheduled safety-critical maintenance is achieved?\***

Only about one in four (**23%**) respondents report achieving all or nearly all safety-critical maintenance; 43% say one-half or less; 56% two-thirds or more.

Even completing 80% of tasks leaves professionals worrying about the 20% that haven't been completed. It's also not a badge of honor if maintenance has completed two-thirds of necessary activities.

**Is it practical to achieve 100% of safety-critical maintenance?**

**58%** say it's achievable - but so few get there - why?

**What are the top 3 challenges to achieving 100% of safety-critical maintenance and asset integrity inspection?**

- 1. 58%** Resources
- 2. 56%** Priorities
- 3. 37%** Planning

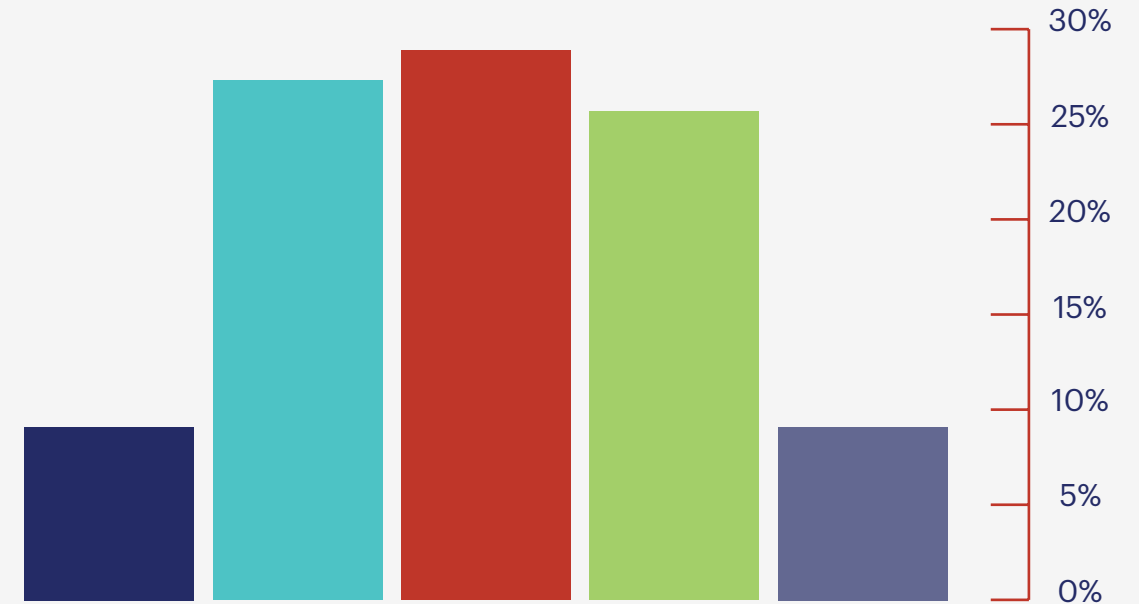


## Are you confident that you're fully aware of your assets' exposure to a major accident hazard?

Just **(9%)** of respondents are very confident. Twenty-seven percent are slightly confident; **54%** are confident or mostly confident.



*Notes: Respondents say they want access to real-time (digitized) process safety risk indicators, but haven't invested in solutions to visualize and proactively manage the health of individual safety barriers/safeguard yet and 36% are not at all confident of their awareness of their asset's exposure to a MAH. And at the other end of the spectrum, another 36% are mostly or very confident they are fully aware. If professionals are not mostly confident or above, there is a lot of work to be done. This is an all-or-nothing activity-one incident can have disastrous consequences.*



**Process safety is about managing the most critical hazards.** Professionals can better prioritize by effectively identifying and attending to the top 10-15% of hazards that could lead to a major accident. Digital solutions for hazard and operability study (HAZOP) and process hazard analysis (PHA) offer guardrails for employees and contract workers. By helping identify and mitigate MAH risk and manage task risk in operations, digital systems serve to keep people, assets and the environment safe.

# How we got here

## The evolution of process safety

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While PSM practitioners agree that indicators and metrics can improve performance, determining exactly what those metrics are has proven difficult. The regulatory standards and best practices in this area highlight what has happened historically, but fail to predict what will happen in the future.

In the oil and gas industry, for example, process safety as a discipline was formed decades ago, with standards provided by the American Petroleum Institute, in conjunction with other organizations such as Dupont and the Mary Kay O'Connor Process Safety Center. The role of technical safety developed

and process engineers designed the vessels, the pipe work, the pressures, the flows and so on — as well as the safety protocols. They focused on ensuring an appropriate response if something went wrong. The combination of safer design and prepared response is what we're increasingly seeing become standard as the role of process safety evolves.

Process safety as an individual discipline has evolved as well. The marriage of digital innovation and process safety is quickly evolving and maturing this domain as both a function and expertise.

# Next steps

## The path to digital resilience



Organizations with mature PSM recognize the value of a unified **visualization of all simultaneous operations, maintenance** activities and **safety critical equipment impairments**. *“Change management is difficult, but avoiding negative consequences is imperative.”*

Respondents overwhelmingly believe in technology, with **95% saying it enables effective PSM. Eighty-seven percent say it enables better risk awareness, and 80% agree that it slightly, noticeably or greatly reduced vulnerability to MAHs**. Real-time data streams from integrating sources of operational risk are most commonly used for tracking and monitoring SCEs and displaying safeguards/barrier impairments.

So, the question remains: If everybody believes in digitalization, and the digital solutions are available, why haven't more organizations implemented enterprise process safety solutions?

Put simply, throwing technology at the problem does not solve it. Change management needs to accompany an introduction of new systems/processes, as the lift to change behaviors and processes is too heavy for digital tools alone.

- Long-time workers may resist the workplace change from familiar systems.
- On the other hand, new hires may feel more comfortable in a control room than going to the dirty or dangerous site. Digital solutions support but do not replace human validation.
- Also, companies may struggle with the idea of how to manage too much data, or over-reliance on digital interfaces. Data-driven decision-making must still be supported by frontline, on-site controls.
- Companies can standardize and guide behaviors through digitalization. Yet the effort has to focus on involving all three elements: technology, process and people—especially at multi-site companies where new protocols can contradict what’s always been done.



**In your experience, has technology helped companies reduce their vulnerability to high potential near misses and major hazard events?**

**51%** say it noticeably **(35%)** or greatly **(16%)** reduced vulnerability

**Which sources of real-time data streams do you use in your process safety management strategies?**

1. Status of SCE **(52%)** + SCE deviations **(33%)**
2. Barrier impairments **(35%)**
3. Risk calculations **(26%)**
4. Dynamic risk pathways **(18%)**
5. Predicting MAH risk exposure **(18%)**

**Which types of technology does your organization currently use or plan to use to support safe operations strategies?**

Top 3: **EHS, EAM, APM**

**Do you agree that technology (digitalization) enables effective process safety and operational risk management?**

**95%** Yes





Do you think risk awareness and safety would be improved if the workforce and management had access to real-time (digitized) process safety risk indicators on the plant?

87% Yes

Has your organization invested in solutions to visualize and proactively manage the health of individual safety barriers/safeguards?

52% Yes, 44% No

# 5 Key takeaways

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- 1. Professionals are increasingly concerned about the lack of risk visibility and insights.** According to 39%, lack of visibility of operational risk within aging facilities is now among the top three factors contributing to risk increase, up from fifth place in 2023. Also, lack of actionable insights is a challenge to process safety, say 24%, up sharply from 15% in 2023.
- 2. Risk exposure remains high.** Only 23% say that all or nearly all safety-critical maintenance is achieved in a typical month. Just 9% of respondents are very confident that they're aware of their assets' exposure to MAH.
- 3. Across all roles, active risk management has risen.** Now 32% say senior leadership drive PSM leadership, up from 29% in 2023. Reducing asset downtime (36%) and business continuity (33%) are trending upward as drivers for improving process safety performance.
- 4. Process safety is tied to compliance and ESG.** Regulatory compliance belongs to the top three drivers for improving process safety performance, say 41%. Yet more than half (56%) believe organizations manage PSM as a compliance obligation. Nearly 80% have measurable sustainability priorities and performance metrics in their roles.
- 5. Digital tools improve safety.** Technology enables effective process safety and operational risk management, say 95% of respondents. Access to real-time process safety risk indicators improves safety and risk awareness, say 87%.

# Conclusion

## Building resilience, one step at a time



In 2016, when Sphera conducted our first survey, an advanced digital discipline of process safety was still developing, and no coherent, ready-to-adopt solution existed in the marketplace. Companies customized their own systems or adapted what was available.

Now process safety management has evolved and matured. Most organizations have done enough to reduce loss-of-containment hazards. Increasingly, leadership is aware that with aging facilities, the probability and the consequences of incidents are higher. Today, these conditions combine with a less-experienced workforce to brew a perfect storm of increased risk in terms of productivity, reputation and pure margins.

**Yet companies remain stuck.** What is the next thing companies can do to reach the next level

of reducing operational risk and improving process safety?

Companies have invested in basic risk assessment software. Yet many still lack the systems that join the dots in terms of predicting major accident hazard potential. Systems that help control and avoid or mitigate risks are not being sufficiently adopted. That's the gap between process safety goals and reality.

This is why **going digital is the next opportunity for PSM**. Implementing a unified and standardized platform for PSM provides real-time visibility and communication across all levels. Digital tools that are simple to deploy and easy for everyone to adopt help employees to reduce incidents, accidents and ESG risk exposure. Through digitalization, PSM becomes predictive and preventative, standardized, streamlined and efficient.

Implementing out-of-the-box solutions can help overcome the inertia in achieving operational risk and process safety goals. Digitalization

of process safety processes enables companies to build resilience, improve safety and reduce incidents and production downtime. With compliance and sustainability requirements, management interest in driving PSM is growing. **In addition, mobile device usage is high with the new generations of workers, and this trend can be leveraged to better manage PSM digitally.**

By going digital, companies improve safety, improve production and operate sustainably while cutting costs and driving business continuity. All of this adds up to benefit the bottom line.





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Sphera provides market-leading software, data and consulting services that enable organizations to proactively manage their performance and achieve their enterprise sustainability goals.