



WHITE PAPER

Organisational Process Safety: Taking Process Safety to the Next Level

Authors: Scott Stricoff († 14.02.2016) and Hervé Vaudrey

There are many models for process safety management, and these have evolved from the early CCPS process safety management model (1989), OSHA PSM rule (1990), and Responsible Care code (late 1980s) through company-specific approaches, the EU's Seveso I, II, and III directives, to the CCPS 2007 risk-based PSM model.

Each identifies a number of PSM elements that comprise essentially a checklist of activities suggested for organisations wishing to manage process hazards. Most companies involved in manufacture, storage, use, and transportation of highly hazardous chemicals have adopted one or more versions of these models, and yet we continue to see many serious and catastrophic incidents each year.

The fragmented approach reflected in all of the PSM models is a root cause of our limited progress in reducing process incidents. The activities typically identified as PSM programme elements are interdependent and must be tied together by two overarching elements that determine their effectiveness and sustainability.

We characterise the elements of managing process safety as shown below. These seven elements incorporate all of the individual

activities identified by the CCPS 20-element risk-based PSM model, all elements of OSHA's PSM rule, all elements of the Responsible Care Process Safety Code – in fact all elements of whatever traditional PSM model you prefer.

What this model does differently is recognise the critical interrelationship of two elements with each of the others – those being Organisational Culture and Organisational Capability. These are not just additional “check-the-box” aspects of process safety management. Rather they are the glue that integrates an effective system – and often overlooked.

Organisational Capability

Organisational capability refers to having the knowledge, experience, data, and analytical tools to support all elements of process safety. There are two primary aspects of organisational capability: data/information/tools and knowledge/experience.



Data/Information/Tools

We employ many types of information in managing process safety. For example, information on the flammable properties, toxicity, and reactivity of chemical substances, and on the compatibility of chemicals with each other and with the equipment is critical to our understanding of risk and determination of adequate risk control. Information is derived from data, and data must be validly obtained and appropriate to the situation. We should not accept the validity of information without understanding the validity of the underlying data on which it is based.

Data, and therefore information, can change with time and context. Operating conditions, material properties and contaminants, equipment characteristics, and processing sequences can all impact the validity of data for a specific use. Models are employed to take data and information and use them to predict the consequences of incidents. Models are necessarily imprecise – they're attempts to use mathematics to understand complex relationships that occur in physical and chemical phenomena. In using models, questions must be asked such as: What are the limits of a particular model's validity? What are the limits of model accuracy and precision? Which model is best for a given situation? Models are often treated as black boxes, but without understanding capabilities and limitations they can lead to poor conclusions.

Organisational capability depends on having the right data and information; and using the right models in the right ways to reach appropriate conclusions. Having the right data, information, and models is foundational to process safety, but information and tools must be used by people with the right skills, knowledge, and experience.

Knowledge/Experience

The importance of knowledge is generally recognised, but the question should be asked: is one's knowledge deep or superficial? A computer can be programmed to ask **HAZOP** guide questions, but that doesn't mean the computer will produce a thorough and meaningful hazard analysis. Knowing the mechanics of a PHA technique is not the same as understanding the basis of the technique and the underlying objectives of the exercise. Without adequate depth of knowledge, it becomes a "check the box" drill.

Experience is another important contributor to competence, and one that in many organisations is being rapidly lost as the "baby boom" generation retires. What systems are in place to capture institutional knowledge and facilitate its use by less experienced up and coming individuals?

Another consideration is practical knowledge, which is as important as book knowledge. An analysis done by engineers who have never operated a unit is likely to be less valid than an analysis in which the engineers are joined by operators who run the unit daily. The operators know how things are really done and why, and often know which steps are tricky or risky.

What this boils down to is that in implementing each element of **process safety management** we need:

- > People with right knowledge and experience in the right roles/activities
- > Supported by information derived from accurate, relevant, up-to-date data
- > Analysed with models and tools that are properly fit for purpose
- > Drawing upon robust institutional knowledge

A traditional PSM audit will not tell you whether you are addressing these issues. Assessing organisational capability requires a thorough review of how various activities are being conducted and by whom they are being conducted, in addition to the traditional evaluation of the process safety management systems.

Organisational Culture

In the last few years we have seen many people write and speak about process safety culture. Unfortunately, much of this dialogue has come from technical process safety experts whose views about establishing or strengthening culture are either misleading or incorrect.

Organisational culture refers to the underlying, unstated, shared beliefs and values that exist within an organisation. These give rise to behavioural norms, which are often described as “the way we do things around here” or the unwritten rules of the organisation. People joining the organisation quickly learn the behavioural norms, which reflect things ranging from how closely procedures are followed to where people sit in meetings.

Because these norms are based on what is perceived as having led to success, they cannot be changed simply by rewriting roles, responsibilities, policies, or procedures. Strengthening the organisational culture to better support process safety requires addressing Behavioural Reliability and Engagement.

Behavioural Reliability

Behavioural reliability means doing the right things, in the right way, at the right time, every time. This means that the “unwritten rules” in the organisation must be consistent with the objectives of process safety.

Leaders can influence the unwritten rules when the organisation reflects nine general characteristics: management credibility, perceived organisational support, procedural justice, leader/member exchange, teamwork, workgroup relations, organisational value for safety, upward communication, and approaching others. When these characteristics are strong, leaders have the credibility and influence necessary for change, and workers at all levels are open to change.

There are also four process safety-specific characteristics that must be strong in an organisation striving for outstanding performance in process safety. The four process safety-specific characteristics are anticipation, inquiry, execution, and resilience.

Anticipation means having an organisation in which people at all levels are sensitive to the “weak signals” that can be precursors of

increased risk. The organisational culture must encourage the reporting of these weak signals (for example, relatively small process deviations, or unexpected need to change maintenance frequency) even though many are likely not to be significant.

Inquiry refers to having a culture in which people are aware of, and act in ways to minimise, the potentially problematic influence of cognitive bias. We are all influenced by tendencies to, for example, give increased weight to evidence that supports our presuppositions, and be overly influenced by our recent experiences. These are examples of cognitive bias, and they can (and often do) lead to poor decisions that increase risk. We can foster a culture in which awareness and challenging behaviours reduce the influence of cognitive biases.

Execution is about consistently performing as intended. Most organisations have process safety programmes and systems, but are challenged to implement these in a way that produces consistent adherence to the intended practices. There are leadership practices and behaviours that can encourage consistent execution or signal the acceptability of inconsistent execution.

When unwritten rules drive behaviour that supports these characteristics process safety excellence results. Organisations stronger in these characteristics have better process safety performance, and examination of past incidents shows that the four process safety-specific characteristics consistently contribute to major events. When these characteristics are strong there is less chance of negative influence from normalisation of deviance, cognitive bias, and failure to react properly in emergencies.

Barriers to desired behaviour also impact behavioural reliability. Often, we unintentionally make it difficult or even impossible for people to perform in the way we want them to. For example, if process safety information is incomplete or incorrect, verifying the location or condition of an underground pipeline can be difficult or impossible. We need systematic ways of identifying barriers to desired behaviour.

Often when we discuss “behaviour” in the context of safety there is an assumption that the focus is only on behaviour of front-line workers. But as the preceding discussion indicates, the critical influence on safety culture, and ultimately on safety performance, is the behaviour of leaders from the executive office through the first-level supervisor.

Engagement

Engagement is the first major component of culture. To achieve consistently excellent performance, there must be engagement in process safety at all levels from senior executives through front-line workers.

This is because the only way to change unwritten rules is through leadership, exhibited systematically and intentionally at all levels over a sustained period of time and driven by executive management.

What engagement looks like for senior executives is different from what it means for front-line workers, but all levels must be engaged in the appropriate ways.

For senior executives, engagement involves exhibiting both symbolic and substantive leadership behaviours that support process safety. Symbolic behaviours – such as publicly thanking people who make difficult decisions (such as shutting down a unit for safety reasons) or being present when safety milestones are celebrated – are important to reinforce corporate values, but are ineffective unless there are also substantive safety leadership behaviours. For a senior executive, examples of substantive safety leadership behaviour are regularly reviewing critical safety metrics, asking follow-up questions after receiving an incident report, assuring that action items from serious incidents are being closed out in a timely fashion and more importantly asking whether the action items have actually eliminated the exposure, or asking direct reports about their progress on safety-related goals. When an executive lacks an understanding of key concepts and drivers of safety but engages in symbolic behaviours, there is real risk that the effect will be to create cynicism that undermines the desired results. While executives are not expected to be experts in the technical aspects of safety, they should understand the fundamentals of what comprises safety risk, how it is evaluated, and how it is measured just as they understand the fundamentals of financial risk even if they are not finance experts.

Mid-level managers and first-level supervisors play a critical role through their safety-related leadership behaviour. These individuals are the management representatives closest to the actual work, and what they do and do not do, and say and do not say, actively or tacitly endorses or rejects the unwritten rules that arise from culture. For these employees, engagement means adopting safety leadership behaviours that support the 13 organisational functioning characteristics described above.

Front-line employees' engagement is manifested through the sense of ownership they exhibit in actions that support safety. Reporting small deviations, providing reinforcement to one another when safety procedures are followed, assisting someone who is struggling with following the safety practices, and ensuring that safety-critical activities occur are all examples of things engaged employees do regularly. Engagement of front-line employees occurs when the employees understand the importance of these (and other) actions, feel that their immediate managers want these actions to occur, and feel supported in their work by their immediate managers and supervisors.

Engagement is also encouraged by appropriate use of metrics and monitoring. Many organisations do not have or use either leading or lagging metrics for process safety. In the absence of performance metrics, people do not know whether performance is good or bad. Because major process safety incidents are relatively infrequent, it is important to use metrics that indicate the occurrence of precursors to process events. Such metrics should be shared widely to encourage engagement and should be regularly reviewed by management to provide feedback to the organisation and to identify when new or added focus is required.

As is true with all other functions in an organisation, it is important to hold people accountable for fulfilling their roles in safety. Safety accountability is not just about outcome measures; each level of the organisation should have a clear understanding of the safety-related actions, activities, and behaviours expected of them, and should be held accountable for performing these.

In summary, organisational culture for process safety requires:

- > Creating an environment in which the key organisational characteristics are strong
- > Senior executives having a basic understanding of safety risk and regularly exhibiting both symbolic and substantive process safety leadership behaviours
- > Mid-level managers and supervisors regularly exhibiting safety leadership behaviours that reinforce the desired safety behaviours
- > Front-line workers demonstrating a sense of ownership for safety-supporting actions
- > Effective use of both leading and lagging metrics to create accountability and to communicate progress
- > Each level being held accountable for appropriate safety-related actions, activities, and behaviours

As with organisational capability, a traditional PSM audit will not tell you whether you are addressing these issues. Assessing organisational culture requires a careful examination of key organisational characteristics and the leadership behaviour that drives those characteristics.

Each of the last 15 independent investigations of major process safety incidents performed by the US Chemical Safety Board has shown capability and culture to be important causes of the incidents. Understanding your organisations strengths and weaknesses in these areas is critical to avoiding process safety incidents.

SCOTT STRICOFF († 14.02.2016)

Scott Stricoff was one of DEKRA Process Safety senior leaders. With a 35-year legacy, he was eager to impact the new safety generation. He published articles and contributed to books on a wide range of topics, such as behaviour-based safety, performance measurement and process safety management. Moreover, he taught and guest lectured at universities. His work had a considerable impact on many industries, from utilities to chemicals and metals. He consulted with varied U.S. administrations to help develop innovative programmes to bolster workplace safety and was involved in the organisation's most significant projects with NASA, Amtrak, and the USMC.



HERVÉ VAUDREY

Hervé Vaudrey is currently the Director of the DEKRA Group's Process Safety Branch for the Europe, Middle-East and Africa zone. He worked for 10 years in the chemical industry, and particularly in process safety, before joining the Chilworth Group in 2004. His areas of expertise include the explosive potential of powders, electrostatic hazards, thermal runaway reactions and the assessment of industrial accidents. He has been a trainer for more than 15 years with extensive experience in a wide field of process safety specialties, having conducted over 100 training courses throughout the world (France, England, Spain, the Netherlands, India, and China). He is based in Lyon (France) and can be contacted at herve.vaudrey@dekra.com.



DEKRA Organisational & Process Safety

DEKRA Organisational and Process Safety are a behavioural change and process safety consultancy company. Working in collaboration with our clients, our approach is to assess the process safety and influence the safety culture with the aim of 'making a difference'.

In terms of behavioural change, we deliver the skills, methods, and motivation to change leadership attitudes, behaviours and decision-making among employees; supporting our clients in creating a culture of care and measurable sustainable improvement of safety outcomes is our goal.

The breadth and depth of expertise in process safety makes us globally recognised specialists and trusted advisors. We help our clients to understand and evaluate their risks, and work together to develop pragmatic solutions. Our value-adding and practical approach integrates specialist process safety management, engineering and testing. We seek to educate and grow client competence to vide sustainable performance improvement; partnering with our clients we combine technical expertise with a passion for life preservation, harm reduction and asset protection.

We are a service unit of DEKRA SE, a global leader in safety since 1925 with over 45,000 employees in 60 countries and 5 continent. As a part of the world's leading expert organisation DEKRA, we are the global partner for a safe world.

We have offices throughout North America, Europe, and Asia.

For more information, visit www.dekra-uk.co.uk/en/dekra-organisational-and-process-safety/

To contact us: dekra-ops.uk@dekra.com

To contact us: +44 (0) 23 8076 0722

Would you like to get more information?

Contact Us