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WHITE PAPER

Becoming a High Reliability Organization: Assessing Organizational Process Safety

Catastrophic Incidents Continue to Happen: Are We Doing Enough?

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On October 21, 2016, the 11,000 residents of Atchison, Kansas, were ordered to shelter-in-place when a chlorine cloud vented from a bleach tank owned by MGP Ingredients. That morning, a truck operated by Harcros Chemicals inadvertently offloaded 4,000 gallons of sulfuric acid to the wrong tank. The two chemicals reacted to form a toxic gas cloud that resulted in a command to shelter-inplace within 10 miles of the release. Over 120 people needed medical attention.[i]

Three years later, a federal grand jury indicted MGPI, stating that the company "did not design and maintain a safe facility consistent with current industry standards, generally accepted good engineering practices and recommendations cited in the chemical material safety data sheets that would have prevented or minimized the consequences of accidental releases of extremely hazardous substances."[ii]

MGPI later pled guilty to violating the EPA's Clean Air Act and agreed to pay a $1 million fine.[iii]

It's easy to assign blame and think "that can't happen here." However, hundreds of decisions are made every day in industries that have the potential to harm workers and damage facilities. Catastrophic incidents continue to occur despite the best of intentions. How can we know we are doing enough to prevent these incidents from impacting our workers, our facilities and ultimately our communities?

Beyond Systems: Fostering Organizational Culture and Capability in a Process Safety Program

Industry has established practices to manage catastrophic risk. Various government authorities and standards boards within North America have adopted versions of Process Safety Management (PSM) program strategies to try to prevent catastrophic events such as fires, explosions and chemical releases. Three stand out:

- US-OSHA 1910.119 Process Safety Management (PSM) of Highly Hazardous Chemicals
- American Chemistry Council's Responsible Care Management System (including the Process Safety Code)
- US-EPA's Risk Management Plan (RMP) 40 CFR part 68

Several organizations have established similar Process Safety strategies, including:

- API RP 1173 Pipeline Safety Management Systems (SMS)
- NFPA 652 Standard on the Fundamentals of Combustible Dust (Chapter 8, Management Systems)
- API RP 750, Management of Process Hazards

Even NFPA 45, the Standard on Fire Projection for Laboratories Using Chemicals, includes management system requirements. These address Process Safety management elements, such as emergency planning, hazard analysis and installation and maintenance of mitigation.[IV]

Process Safety program strategies are similar in that they often establish a performance-based, not prescriptive, framework that includes several management systems working together to help reduce risks associated with rare but catastrophic events. Each strategy contains multiple elements with individual requirements.

Effective Process Safety programs ensure the elements adapt with changes within the organization's technology, design, workforce composition and business procedures. Differences between Process Safety strategies are often noted within their scope of application (i.e., where facilities or industries need to comply) and the extent of how they are applied (i.e., what management system elements must be applied for a robust system).

Introduced in the 1990s and refreshed again in the 2000s, the Center for Chemical Process Safety (CCPS) took on that challenge by launching "Risk Based Process Safety," a project recognized globally as the gold standard model for organizations to address risk. The current model describes 20 elements and is based on the idea that all organizations have limited resources. DEKRA has further refined the CCPS model, highlighting 7 elements that manage catastrophic risk effectively. They include culture and capability.

All hazards are not equal. The effort required to control hazards should be proportionate to the complexity of the situation and the magnitude of the risk. Since the strategy scales well, it can be applied to organizations that do not have large quantities of chemicals that are traditionally regulated by US-OSHA or the EPA (RMP).

A facility's resources should be applied proportionately to the risk that exists among their several management systems. When the management systems work together effectively, they are more successful at managing risk. Several companies have adopted many of the tenets of CCPS Risk-Based Process Safety, as has the Canadian Society of Chemical Engineering (CSChE) via their PSM Guide.

Understanding Organizational Culture and Capability

Organizational Culture and Capability represents two critical components inherent to managing catastrophic risk effectively. First, culture is what people do in response to deeply held values of the organization. Capability represents the combined skills, experience and expertise that people have in the organization.

Unlike other components within a risk-based program model, Organizational Culture and Capability are incapable of operating in a silo. Both exist and interact with each element, whether the facility recognizes them or not. Think of Culture and Capability as the glue that holds a Process Safety program together.

For example: An explosion at the University of Hawaii in 2016 caused extensive damage to a laboratory. A doctoral student lost her arm from flying debris. On the surface, the cause of the event was simple: A spark from a digital pressure gauge ignited the flammable atmosphere within a 13-gallon portable tank. Yet upon closer look, there were indications that the laboratory staff lacked the capability (knowledge, skills, expertise) to work with flammable hydrogen.

One researcher bought and assembled the equipment, including the digital gauge that was not electrically rated for the hazardous area. Despite widely available information on how to control ignition sources when handling flammable gas, the assembly was not grounded. The researcher previously experienced static shock incidents, but did not stop work to make changes to the apparatus.

There was also indication that the lab group had a poor Process Safety culture. The day before the incident, the student researcher reported sound, smell and visual indications of combustion within a gallon set of equipment. She directed her concerns to a more senior researcher, but they did not shut down operations or investigate. Neither researcher fully recognized the hazard.

If the research laboratory had a risk-based Process Safety program with stronger Culture and Capability elements, the catastrophic explosion might have been prevented.[vvivii]

Beyond Compliance: Process Safety Outside of Traditional Chemical Processing Industries

In addition to ensuring that Organizational Culture and Capability are a part of a robust Process Safety program, an increasing number of organizations are implementing Process Safety principles beyond the scope of traditional regulation. Rather than waiting for a chemical to be regulated and then applying a Process Safety program, companies are taking risk-based Process Safety principles and applying them outside the traditional chemical industry.

Industries like pulp and paper, food and beverage, hazardous materials transportation and mining recognize that rare but catastrophic events can occur within their facilities. They also understand that these hazards are not managed well using traditional occupational health and industrial hygiene principles. Large fires, dust explosions, chemical releases, unintended chemical reactions including thermal decomposition, release of mechanical energy (from large machinery) and catastrophic electrical arc flash events pose significant risk. Risk-based strategies that apply Process Safety principles scaled to the complexity of the technology are proven as effective.

As the world becomes more connected through the internet and global trade, the boundary where corporate responsibility begins and ends is becoming blurred. Cooperation among organizations to ensure sustainable and responsible behaviors that extend throughout the lifecycle of the products that go to market is now expected.

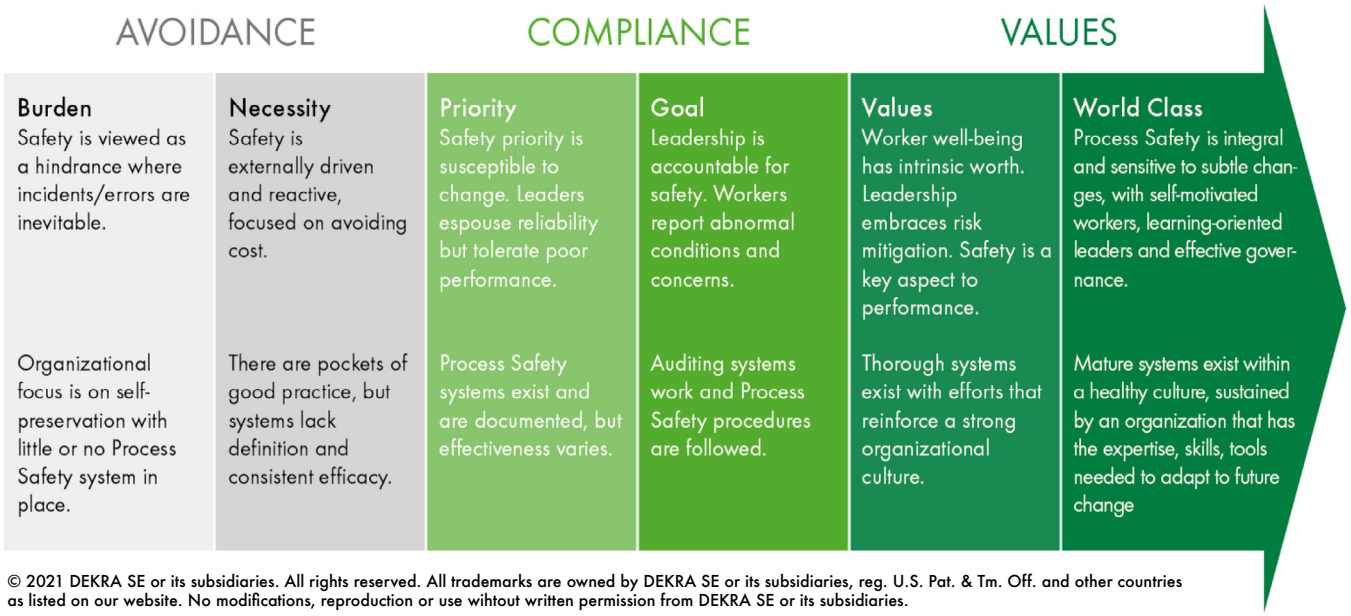
As in the case of the chlorine release in Kansas, multiple companies can be involved in the simple act of loading or unloading a container of material. Both regulators and the public expect all organizations involved to accept the responsibility of managing hazards. In 2013, when a train of crude oil derailed in Lac-Mégantic, Quebec, killing 47 people, the Canada TSB concluded that the tragedy "was not caused by one single person, action or organization. Many factors played a role, and addressing the safety issues will take a concerted effort from regulators, railways, shippers, tank car manufacturers and refiners in Canada and the United States."[viii]

Organizations need to remember the "big picture" in managing their supply chain and how Process Safety risk can be incurred beyond traditional plant boundaries.

Similarly, industries like agriculture and mining that are not required to follow chemical processing regulations are taking a harder look at their operations to manage fire and explosion risks:

- The agricultural industry is aware of the need to create a combustible dust program based on Process Safety principles. Data collected in partnership between the National Feed and Grain Association and Purdue University shows that operations located primarily in the Midwest continue to experience serious events (including fatalities) associated with combustible dust explosions.[ix]
- Grain handling operators frequently collaborate to discuss safety practices to identify and mitigate combustible dust explosion risk. The industry is not content to wait for regulators to tell them what to do. Instead, they are acting to protect their workers.
- The mining industry has made sweeping changes to include aspects of Process Safety within their operations. These changes are made as a result of the April 2010 coal dust explosion at the Upper Big Branch Mine-South in West Virginia that became the worst mining disaster recorded in the U.S. in 40 years.
    - An initial explosion from an ignited accumulation of methane lofted coal dust located throughout the mine. The subsequent explosions from the coal dust resulted in 29 fatalities. A subsequent Mine Safety and Health Administration (MSHA) report showed that the cause of the event included poor asset integrity practices, inadequate hazard mitigation practices (e. g., ventilation), and inadequate self-inspections to find and address hazards.[x] There are symptoms throughout the report that show the operation had a poor safety culture.
- On January 28, 2021 the community of Gainesville, Georgia was devastated by a nitrogen release that resulted in the deaths of six workers at a poultry plant operated by Prime-Pak Foods. Nine other people were transported to the hospital and the Chemical Safety Board (CSB) announced they would investigate the accident.[xi] The facility used liquid nitrogen as part of a cryogenic freezing system in a plant that cooked, seasoned and packaged chicken. At this time it is still not clear what caused this catastrophe; although there is indication the event may have been linked to unplanned maintenance on a newly constructed part of the facility, it may take years to uncover all causes and factors involved.[xii] However, it is clear that this facility is just one of many high-profile catastrophic incidents that have occurred outside the

traditional chemical industry.



Building a Roadmap: Assessing Organizational Maturity To Become a High Reliable Organization

Catastrophic toxic releases, fire and explosions usually occur after a series of early warning signals, often subtle, are overlooked. Some organizations are very successful in avoiding catastrophic events, even in environments with high risk factors and complex operations. Known as Highly Reliable Organizations (HROs), these operations have developed cultures that embrace the understanding of hazards and risk, and drive proper management of risk and value learning from experience.

How can a facility know how well they are implementing their Process Safety program to move their organization towards becoming a HRO? Fundamentally, leaders drive their safety programs to the next level through a blended cultural and technical process. Leaders must establish the expectation that attention to Process Safety is an ongoing learning process that never stops. It applies beyond the boundaries of regulatory compliance. Process Safety principles can be applied to all technologies and processes within the organization. At the same time, they must also assure that organizational and technical systems support continuous learning.

Several practices can help an organization move to the next level of organizational Process Safety maturity:

1. Conduct an unbiased, field-centric Process Safety Program Maturity Assessment. Identify how the facility's Process Safety program is performing with current management systems and work practices. Rather than looking at incident rates (which are poor indicators of actual exposure) or Process Safety Compliance Audits (which often solely indicate compliance aspects), an unbiased assessment of each risk-based Process Safety element helps assess the state of the current program. Benchmark measures can fall into a maturity matrix or scale, like the one shown in the figure below.

2. Develop a Process Safety Improvement Roadmap. Based on the findings from the Maturity Assessment, develop improvement plans paced to meet organizational risk resolution timelines and resource capacity. Too often, Process Safety improvement plans fail because the vision is too lofty without specific details to make it reality. Leaders must instead be sensitive to offer a roadmap that is attainable and offer the resources needed to meet goals. Roles and Accountabilities must be assigned to assure engagement at each level of the organization, and that details are not being missed.

3. Maintain an organizational sense of vulnerability and adopt a learning orientation. Continuously learning organizations are vigilant about preserving organizational memory and assuring that hard lessons are not forgotten or repeated. Take measures to ensure that even the newest worker knows the story of where the organization came from and where it is going. Establish an oversight board that includes a thorough review of leading and lagging indicators, including oversight of progress that each facility is making with their improvement roadmap. After significant organizational change, or after 3-5 years of improvement activities, challenge facilities to undergo another unbiased maturity assessment and take actions to share learnings so they can be embraced as a part of a continuously learning culture.

4. Be diligent to identify and address organizational silos. Take care to look for variants in work practices at a facility or within the organization. For example, a pilot plant located on site may have a different maturity level than the full-scale production unit located at the same site. Similarly,

understand the difference between highly regulated facilities (e.g., those that are covered by US-OSHA PSM or EPA RMP) versus the less regulated ones (e.g., less hazardous warehousing or blending operations).

Assessing Organizational Process Safety: Let Us Be Your Trusted Advisor

The DEKRA Organizational Process Safety solution suite enables leadership to understand and address the underlying factors that contribute to process safety risk, to uncover organizational blind spots and to identify cultural and leadership factors that contribute to exposure being ineffectively controlled.

As a starting point, DEKRA assesses the critical factors that influence the level of organizational risk, effectiveness of risk mitigation and sustainability of exposure control. The assessment results allow leadership to identify targeted solutions that address the most impactful issues facing their organization.

DEKRA's approach combines our world-renowned technical expertise in Process Safety with our industry-leading scientific perspectives on Organizational Safety & Reliability. DEKRA provides a comprehensive solution set and organizational change model with a focus on culture change, governance, leadership development, employee participation, management and risk control system and portfolio of technical Process Safety consulting.

The result is a Learning Organization where risks are systematically identified, controls sustainably implemented, and performance is monitored – developing the attributes of a Highly Reliable Organization (HRO) that reduces the potential for catastrophic incidents.

Contact us to learn more about setting up an Organizational Process Safety assessment today!

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