



White Paper

Process Safety Excellence Beyond PSM: A Smarter Approach for Non-Regulated Sites



For 100 years, DEKRA has been chosen to partner in proactively **keeping organizations safe** around the world as the **largest safety company in the world**.

Abstract

Process safety regulations are important but insufficient to drive excellence. Beyond altruism there is a business case for process safety. Industry groups and technical societies have developed comprehensive models which can drive excellent performance for both regulated and non-regulated sites.

Discussion

Pursuit of Excellence

Most stakeholders of chemical production facilities, pilot plants, and laboratories would love for their operations to be described as excellent. We should all strive to achieve excellence, but what does that mean? Do we need to prioritize our efforts on certain disciplines over others? Is this a zero-sum game? The good news is when you strive for excellence in one area, you see improved performance results in many areas, including profitability, reliability, environmental health and safety (EHS), and especially process safety. Beyond altruism, there is a business case for process safety. A safe plant is a reliable plant which is in turn a profitable plant.

Achieving excellence requires strong systems and strong people. Strong people using weak systems results in a tribal environment where knowledge is lost when experienced

	Weak People	Strong People
Strong Systems	Bureaucracy	Excellence
Weak Systems	Chaos	Tribal

people leave and it’s difficult to train new personnel. Strong systems being executed by people without the necessary skills or knowledge creates bureaucracy and the associated potential for pencil whipping. Inadequate systems and incompetent people create chaos where there is no structure or consistency.

Some examples of good management system models include the American Chemistry Council’s (ACC) Responsible Care® management system; the Center for Chemical Process Safety (CCPS) Risk Based Process Safety (RBPS) model; and any of the ISO models such as ISO-9001 and ISO-14001. What makes these models so effective is that beyond just an execution or operations aspect, they start with culture, leadership, and accountability and then include knowledge, competency, and continuous improvement elements.

Role of Regulation

Adherence to process safety regulations, even if applicable, will not drive excellence.

Most global process safety regulations are list based and subject to threshold quantities. There are several problems with this approach.

First, it is a challenge to list or describe all the hazardous substances, so there are omissions. Sulfuric acid is the most common industrial chemical used in industry. It is a dangerously strong corrosive but is not listed in the Occupational Safety and Health (OSHA) Process Safety Management (PSM) standard 29 CFR 1910.119. Asphyxiants like nitrogen and carbon dioxide are also not listed despite being capable of causing fatalities. This was the case in January 2021 when a nitrogen leak resulted in six fatal injuries at a poultry processing plant in Gainesville, Georgia. The American Petroleum Institute (API) recognized this hazard before the event occurred and they updated their recommended practice API RP-754 Process Safety Performance Indicators for the Refining and Petrochemical Industries to include nitrogen and carbon dioxide in the scope of Tier 1 and 2 Loss of Primary Containment events in the 2016 second edition. Regulators are often late, whereas industry and technical groups are more advanced and “reserve the right to get smarter”.

Second, there are carve outs in the regulation for atmospheric storage of flammable substances. This was highlighted in the 2019 Deer Park, TX terminal fire. This motivated the Texas legislature to amend the Texas Water Code in 2023 to implement their Aboveground Storage

Vessels Safety Program, often referred to as Senate Bill 900, to address the OSHA PSM omission.

OSHA has not promulgated a specific combustible dust rule and manages these only through their general duty clause. Again, industry consensus is ahead of the agency. The National Fire Prevention Association (NFPA) has issued several standards to manage combustible dust hazards and just recently has consolidated them into the single comprehensive standard NFPA 660, Standard for Combustible Dusts and Particulate Solids.

Another flaw with list-based regulation is the potential failure to recognize hazardous scenarios, reactive chemistry or inadvertent mixing is an example. Two relatively innocuous materials, which may not be listed in the regulation, may result in severe consequences if combined in certain situations. The enforcement agencies have not developed a regulatory scheme to address this hazard.

There have been numerous high severity incidents including fatalities where federal process safety regulations were not applicable. These are just a few examples:

- Hydroxylamine Explosion in 1999 at Concept Sciences in Allentown, PA resulting in four fatalities
- Reactive Chemical Explosion in 2007 at T2 Laboratories in Jacksonville, FL resulting in four fatalities and multiple injuries
- Dust Explosion and Fire at Imperial Sugar in Port Wentworth, GA resulting in fourteen fatalities and 38 injuries

Even when a facility is regulated, mere compliance with the regulations is unlikely to drive excellence. A focus on compliance can result in a loss of focus on managing process safety risks whether they are covered by the regulation or not. As a result, incidents do occur at regulated facilities too, and here are a few:

- Refinery Explosion in 2005 at BP America in Texas City, TX resulting in fifteen fatalities and 180 injuries
- Toxic Chemical Release in 2014 at DuPont in LaPorte, TX resulting in four fatalities
- Olefins Plant Explosion in 2013 at Willians Olefins in Geismar, LA resulting in two fatalities
- Explosion and Fire in 2019 at TPC Group in Port Neches, TX, although there were no fatalities Jefferson County issued a four-mile radius evacuation order and usage of the Sabine-Neches Waterway was reduced. There was extensive on-site and off-site property damage, as well as criminal fines and civil penalties.

In addition to the human tragedy, some incidents result in entire companies going out of business, as was the case with Philadelphia Energy Solutions following the 2019 explosion in the HF alkylation unit at their Philadelphia refinery.

A Better Approach

Every chemical operation, **regardless of regulatory requirements**, would benefit from employing an integrated



risk-based management system. The rigor of the system should be commensurate with hazards, complexity, and organization in place.

The ACC Responsible Care® Process Safety Code is one option. The key elements include:

- **Leadership, Culture & Accountability:** Leadership demonstrates a visible and ongoing commitment to continually improving process safety performance. Process safety roles and responsibilities are documents and maintained within the organization.
- **Knowledge, Expertise and Training:** Education and training of companies and their employees on the mitigation of process risks.
- **Identification and Prioritization of Risk:** Utilization of processes to systematically understand process safety risks

throughout the organization, prioritize actions and allocate resources.

- **Comprehensive Process Safety Management System:** Design of systems to manage and mitigate identified risks with adequate safeguards.
- **Information Sharing:** Active sharing of process safety knowledge and lessons learned across the organization, and with stakeholders.
- **Monitoring and Improving Performance:** Implementation of systems to monitor, report, review and improve process safety performance

Another is the CCPS Risk Based Process Safety model which is the application of a more detailed approach to ensure that the rigor of process safety management element design and implementation is “proportional to need.” The model includes four pillars and twenty elements. The pillars and

elements, which align with the ACC Responsible Care® Process Safety Code, are:

- Commit to Process Safety
 - o Process Safety Culture
 - o Compliance with Standards
 - o Process Safety Competency
 - o Workforce Involvement
 - o Stakeholders Outreach
- Understand Hazards and Evaluate Risk
 - o Process Knowledge Management
 - o Hazard Identification and Risk Analysis
- Manage Risk
 - o Operating Procedures
 - o Safe Work Practices
 - o Asset Integrity and Reliability
 - o Contractor Management
 - o Training and Performance Assurance
 - o Management of Change

Let's talk Strategy:



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Consultation*

Don't wait for a regulation to drive improvement. Let DEKRA help you build a safer, more resilient operation, starting now.

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- o Operational Readiness
- o Conduct of Operations
- o Emergency Management
- Learn from Experience
 - o Incident Investigation
 - o Measurements and Metrics
 - o Auditing
 - o Management Review and Continuous Improvement

In both cases, the systems go beyond the fourteen elements of the OSHA PSM regulation, but they do so in a comprehensive manner which supports effectiveness and efficiency and addresses the criticality of leadership and culture. Integrated systemic thinking and understanding the inputs and outputs of each element will deliver superior results when compared to mere regulatory compliance. This approach can embrace the principle of criticality to ensure finite resources are applied judiciously to deliver the best possible results.

Think about the failures in regulated areas beyond just chemical processing and ask yourself if regulation alone, or the lack of it, will deliver the performance you desire and that you and your fellow workers deserve.

▶ References

- *American Chemistry Council Responsible Care® **Process Safety Code Process Safety Code** - American Chemistry Council*
- *Center for Chemical Process Safety Guidelines for Risk Based Process Safety, John Wiley & Sons, Copyright 2007 American Institute of Chemical Engineers. Publicly available summary: **Risk Based Process Safety***

