



## NATIONAL SAFETY COUNCIL

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### Position/Policy Statement

#### Process Safety Management (PSM)

Process Safety Management standards and approaches have been effective in promoting methods to improve process safety that are consistent with U.S. and international regulations and association-produced materials. Effective process safety management requires the following:

- People with the appropriate knowledge and experience in the proper roles and activities,
- Data that is accurate, relevant, and up-to-date and analyzed with models and tools that are properly fit for purpose, and
- Robust institutional knowledge

The National Safety Council supports applying a comprehensive approach to process safety that recognizes the need for key stakeholders from industry, government, academia, employers and their representatives, contractors and members of local communities to partner with each other to ensure sustained progress in the improvement of process safety management.

#### Executive Summary

Process safety is a system utilizing a blend of administrative, engineering and management skills focused identifying and mitigating the risks associated with unintentional releases of hazardous materials and highly hazardous chemicals, including potential catastrophic events, serious injuries, deaths, and impact to the environment. The National Safety Council (NSC) believes that continuous improvement in reducing process safety risks can best be achieved through collaborative efforts among key stakeholders, including, but not limited to, industry, government, academia, workers and their representatives, contractors, and members of the local communities. Each, as stakeholders in the improvement process, can influence the future direction of process safety.

**Employers** should develop a strong process safety culture and management systems focused on process safety that include established standards, personnel competency programs and continuous improvement, utilizing lessons learned both internally and externally. Laws and regulations establish only minimum requirements for employers.

**Government** should implement regulations that address root causes of incidents which focus on risk management using a cost-effective approach. While regulations should be clear to provide for certainty of implementation, flexibility in a performance-based approach should be considered to allow for continuous improvement. Governmental entities may also issue advisory and informational “guidelines” that list organization best practices.

**In academia**, chemical engineering programs have a role to play as well. Baccalaureate chemical engineering curricula should provide ongoing training throughout the program on process safety risks and solutions. Trade schools likewise can have an impact in preparing workers for their roles through instruction of process safety programs and risk identification. More broadly, academic institutions should support greater appreciation and understanding of safety management systems and principles as an integrated curriculum element, particularly in the engineering disciplines.

**Workers and their representatives** play a key role in process safety. As the front line workforce, they can identify hazards, near misses and learning opportunities that impact process safety performance. Collaboration in learning, continuous improvement and maintaining process safety performance is essential.

**Contractors**, similar to workers, play a key role in work planning and execution. A ‘one workforce’ model of cooperation and teamwork helps to ensure safety for all.

**Community** partnership in achieving process safety is one of the key elements in a comprehensive approach to process safety management. Listening to and engaging each other in understanding process safety management programs and facility risks is necessary to ensure communities are represented in process safety processes. One of the key areas of community involvement must be in Emergency Planning and Response.

## **Stakeholder Roles**

### **National Safety Council:**

For many years, the National Safety Council has advocated for policies that influence safe behaviors at work, in homes and communities, and in transportation. Safe behaviors can be driven by a positive safety culture.

Since 2003, NSC has maintained an Alliance agreement with the Occupational Safety and Health Administration (OSHA) to save lives and prevent unintentional workplace injuries. Through our work with OSHA and our *Journey to Safety Excellence*<sup>SM</sup> initiative, NSC has come to understand the importance of Leadership and Employee Engagement, Safety Management Systems, Risk Reduction and Performance Measurement. Taken together, they form a basis for improving safety culture and encouraging continuous safety improvement. NSC believes these concepts support the technical approach to process safety regulations and can be the focus of efforts to improve the Process Safety Management standards.

NSC, working with leading world class companies in safety performance in both process safety and non-process safety industries through the Campbell Institute, has further demonstrated the application of lagging and leading indicators in the overall performance model. Continuous improvement following a model similar to “Plan, Do, Check, Act” is a concept employed by these leading companies. High-performing companies in the area of worker engagement and safety

culture demonstrate that safety must be a value, not just a priority, if it is to be firmly embedded within an organization's culture.

NSC believes many of these same principles should be applied in addressing process safety management.

### **Industry:**

Industry must be at the center of improving process safety. Employee, contractor and community safety, company reputation, product quality and efficient operations are all outcomes of a successful focus on process safety.

Company management, employees, and contractors working at or supporting such sites are in the best position to execute the programs needed for achieving the goals of zero process safety incidents.

Several industry associations, some of which are listed below, take a lead role in developing standards, training and programs that focus on process safety management:

- Center for Chemical Process Safety (CCPS)
- American Petroleum Institute (API)
- American Fuel and Petrochemical Manufacturers (AFPM)
- American Chemistry Council (ACC)
- International Council of Chemical Associations (ICCA) Responsible Care®
- Center for Offshore Safety

Many of the current regulations in effect today are based on voluntary standards originally developed by these industry organizations. Companies must avail themselves of the materials and concepts that these organizations produce as they are the collective output of the experts in this field of engineering and management.<sup>1</sup>

NSC supports and encourages companies to, at a minimum, follow the five tenets the Center for Chemical Process Safety has developed for industry to drive toward improved process safety.<sup>2</sup> These tenets include:

- Committed Culture – Executives, managers, supervisors and all employees drive excellent execution of process safety programs every day.
- Vibrant Management Systems – Documented and easily applied management systems that define how design and operations are implemented to improve safety.
- Disciplined Adherence to Standards – Includes design, operation and maintenance standards setting minimum expectations for programs to manage and improve process safety.
- Intentional Competency Development - Ensuring all employees who impact process safety are fully capable of meeting the technical and behavioral requirements for their jobs.
- Enhanced Application & Sharing of Lessons Learned – Promotes learning from incidents, near misses, and successes and embedding learnings into standards and practices.

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<sup>1</sup> Some of these resources include the [Process Safety Beacon \(CCPS\)](#), [Advancing Process Safety Programs](#), networking and training programs (AFPM).

<sup>2</sup> <http://www.aiche.org/ccps/resources/vision-2020/five-industry-tenets>

The Center for Chemical Process Safety expands on this in what they call “Risk-Based Process Safety.” Their “foundational blocks” go beyond commitment and include the need to understand and manage hazards and risks, and learning from experience.<sup>3</sup>

NSC supports a collaborative industry approach, utilizing the resources of industry groups and other stakeholders, in committing to excellence in process safety and a culture within industry that fosters information-sharing and learning from experience on best practices and incidents within companies and industry as a whole.

### **Government:**

In the United States, both OSHA and the Environmental Protection Agency (EPA) provide regulatory oversight in the area of Process Safety Management. Several State agencies also have specific PSM programs.

OSHA originally promulgated its PSM standard (29 CFR 1910.119) in 1992 for on-site employee safety. Additional information and guidance is also found in the [OSHA 3132](#) Process Safety Management document. The EPA followed suit in its Risk Management Program (RMP) in 40 CFR Part 68 under the Clean Air Act Section 112(r) for issues that impact the community at large.

The main objectives of the PSM and RMP standards are to prevent or minimize employee and public exposure to the hazards associated with uncontrolled releases of highly hazardous chemicals. While the standards have been effective in improving process safety in the United States, major incidents have continued to occur.

Several similar regulatory regimes exist both internationally and within other federal agencies and state governments in the United States. These regulatory approaches all strive to implement standards and practices to eliminate or minimize releases from chemical processes so not to cause harm to the employees, environment and public.

Most historic regulatory responses have been to implement additional technical or management requirements such as risk studies, management of change provisions and equipment integrity and training programs. More recently there has been a focus on culture and human performance elements, though these have proven more difficult to implement in a standard regulatory process. Even less emphasis, from a regulatory standpoint, has been placed on continuous improvement and learning from company and industry incidents in a more dynamic manner. Again, this can be difficult to implement in a regulatory process but evaluation and implementation of event learnings can be part of a performance-based approach.

In its investigation and recommendations of significant process safety related events, the U.S. Chemical Safety Board (CSB) has repeatedly commented on the need to focus on process safety culture and continuous improvement programs.

Following the Deepwater Horizon incident in 2010, several investigations and numerous scholarly and business journal articles focused on the safety culture aspects of the disaster.

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<sup>3</sup> [http://www.aiche.org/sites/default/files/docs/embedded-pdf/risk\\_based\\_process\\_safety\\_overview.pdf](http://www.aiche.org/sites/default/files/docs/embedded-pdf/risk_based_process_safety_overview.pdf)

The Department of the Interior Bureau of Safety and Environmental Enforcement (BSEE) developed a Safety Culture Policy in 2013.<sup>4</sup>

Several of the incidents that have prompted the modernization of PSM standards were found to have had underlying root causes concerning organizational safety culture, failures in learning from incidents, and lack of a cycle of continuous improvement. As a result, implementation effectiveness, measuring and adjusting performance, use of lagging and leading indicators in performance measurement and the overall safety culture of continuous improvement may be areas for improvement.

As lawmakers and regulators seek to enhance PSM regulatory programs, the aspects of culture, continuous improvement and learning from company and industry incidents should be considered in their approach. Regulatory approaches should address the root cause of incidents. As investigations have evolved into the evaluation of the human factors and culture, several findings have suggested additional focus in these areas. Additionally, regulatory approaches to improving process safety should apply clear regulations that allow for risk-based application and provide for certainty in implementation.

NSC supports a regulatory approach that builds on learnings from prior incidents so that identified root causes and performance issues are addressed.

#### **Academia:**

In a report from a 2007 explosion in Jacksonville Florida,<sup>5</sup> the U.S. Chemical Safety Board cites issues associated with the low number of chemical engineering departments in universities that require process safety education as a core of their curriculum.<sup>6</sup>

From this, CSB went on to make recommendations in the final report to both the American Institute of Chemical Engineers (AIChE) and the Accreditation Board for Engineering and Technology to work together to “add reactive hazard awareness to baccalaureate chemical engineering curricula requirements.”

A further study by AIChE of its members shows a significant gap between what the AIChE members thought new graduates’ knowledge should be in several areas of process safety and what knowledge the graduates actually did possess. The goal of the academic and industry organizations should be to close this gap so that the study of engineering and management of process safety hazards takes place throughout the academic process. The same can be said for trade schools that provide education for process operators, welders and similar skilled workers that are engaged in process safety program execution. As discussed in the five tenets from the Center for Chemical Process Safety, all levels of the organization play key roles in ensuring process safety. The early development of a process safety understanding and a process safety

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<sup>4</sup> <http://www.bsee.gov/Safety/Safety-Culture-Policy/>. BSEE defines safety culture as the “core values and behaviors of all members of an organization that reflect a commitment to conducting business in a safe and environmentally responsible manner.” BSEE further defines their view of a positive safety culture as one that would focus on continuously appraising hazards during various activities while adequately directing resources to minimizing the highest risks in order to best enhance safety.

<sup>5</sup> T2 Laboratories, Jacksonville Florida, made specialty chemicals for gasoline. In December 2007, it suffered a fire and explosion that resulted in the deaths of four people and injured fourteen others.

<sup>6</sup> In 2006, the Mary Kay O’Connor Process Safety Center surveyed 180 chemical engineering departments at U.S. universities to determine whether process safety was part of their chemical engineering curricula. Of the universities surveyed, only 11 percent required process safety education in the core baccalaureate curriculum. An additional 13 percent offered an elective process safety course.”

culture, beginning in the various academic settings has potential for long lasting impacts on process safety program execution.

Various industry, government and academic partnerships are already in place. In the petrochemical industry, some of these groups include the Texas A&M Mary Kay O'Connor Process Safety Center and the Ocean Energy Safety Institute (OESI).<sup>7</sup> Other industry groups include International Institute of Ammonia Refrigeration (IIAR), Refrigerating Engineers and Technicians Association (RETA), and Industrial Refrigeration Consortium (IRC). These organizations should be leveraged not only by academia, but also by industry and government to improve process safety education for all career paths that impact process safety.

NSC supports the inclusion of process safety principles in university and trade level trainings. NSC recommends that all baccalaureate and graduate chemical, mechanical and other engineering curricula requirements include ongoing training throughout the program on process safety risks and solutions.

### **Workers and their Representatives:**

One approach to improving process safety is proposed by the Center for Chemical Process Safety, and they note the need for responsible collaboration, described as working together on a common goal, seeking to understand and respecting each other's perspectives and removing barriers to sharing, learning and maintaining effective process safety. "Everyone working towards the same process safety goal is more efficient and effective."

Workers and their representatives play a key role in these areas. They are in an effective position to communicate hazards, report near misses, engage in problem-solving and assist in learning opportunities for performance improvement. Collaboration in learning, continuous improvement and maintaining process safety performance is essential.

NSC supports strong engagement and collaboration of workers and their representatives and others in the common goal of improving process safety.

### **Contractors:**

Contract companies and their workforce are an integral part of plant activities. Similar to the aspects noted for employees and their representatives, contractors and their workers are part of the front line in ensuring effective implementation of process safety programs. Work planning and execution requires effective attention to process safety programs and principles. A 'one workforce' model of cooperation and teamwork helps to ensure safety for all.

NSC supports the recognition of the role of contractors and their workforce in effective process safety and their inclusion the overall collaborative model. Research undertaken by the Campbell Institute at the National Safety Council suggests that organizations and their associated contractors utilize an integrated approach to ensure seamless collaboration, including pre-qualification and expectation setting, strong orientation and training activities, thoughtful pre-job

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<sup>7</sup> OESI was established to facilitate research and development, training of Federal workers on identification and verification of Best Available and Safest Technology (BAST), and implementation of operational improvements in the areas of offshore drilling safety and environmental protection, blowout containment and oil spill response. The OESI will be a collaborative initiative involving government, academia and scientific experts.

planning, regular on-job monitoring of work with open communication, and a rigorous post-job debrief process in order to capture lessons learned.<sup>8</sup>

### **Local Communities:**

The value of a community partnership in achieving process safety is one of the key elements in a comprehensive approach to process safety management. Listening to and engaging each other in understanding process safety management programs and facility risks is necessary to ensure communities are represented in process safety processes.

One of the key areas of community involvement must be in Emergency Planning and Response. In OSHA's 'Process Safety Management Guidelines for Compliance', it is recommended that close cooperation and coordination between facility and local community emergency preparedness managers in the form of drills, training, exercises or simulations be a regular part of a PSM program. Regarding the release of specific site information, overall facility and community security needs to be considered. Efforts to strengthen coordination in these areas is central in ongoing efforts to improve process safety.

The ongoing dialog and training make the community a partner in the process, thus enhancing process safety for all community stakeholders.

NSC supports the robust engagement of the community stakeholders in the process safety improvement programs.

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<sup>8</sup> Best Practices in Contractor Management,  
<http://www.thecampbellinstitute.org/file/download.php?id=20150923f9bd932e4ac8724a2266ddb89c81e0f>.

## BACKGROUND INFORMATION

An example from the Petrochemical industry:

Safety and Chemical Engineering Education Program (SACChE) Recommendations for ABET (Accreditation Board for Engineering and Technology, Inc.),<sup>9</sup> Safety Content in Chemical Engineering<sup>10</sup>

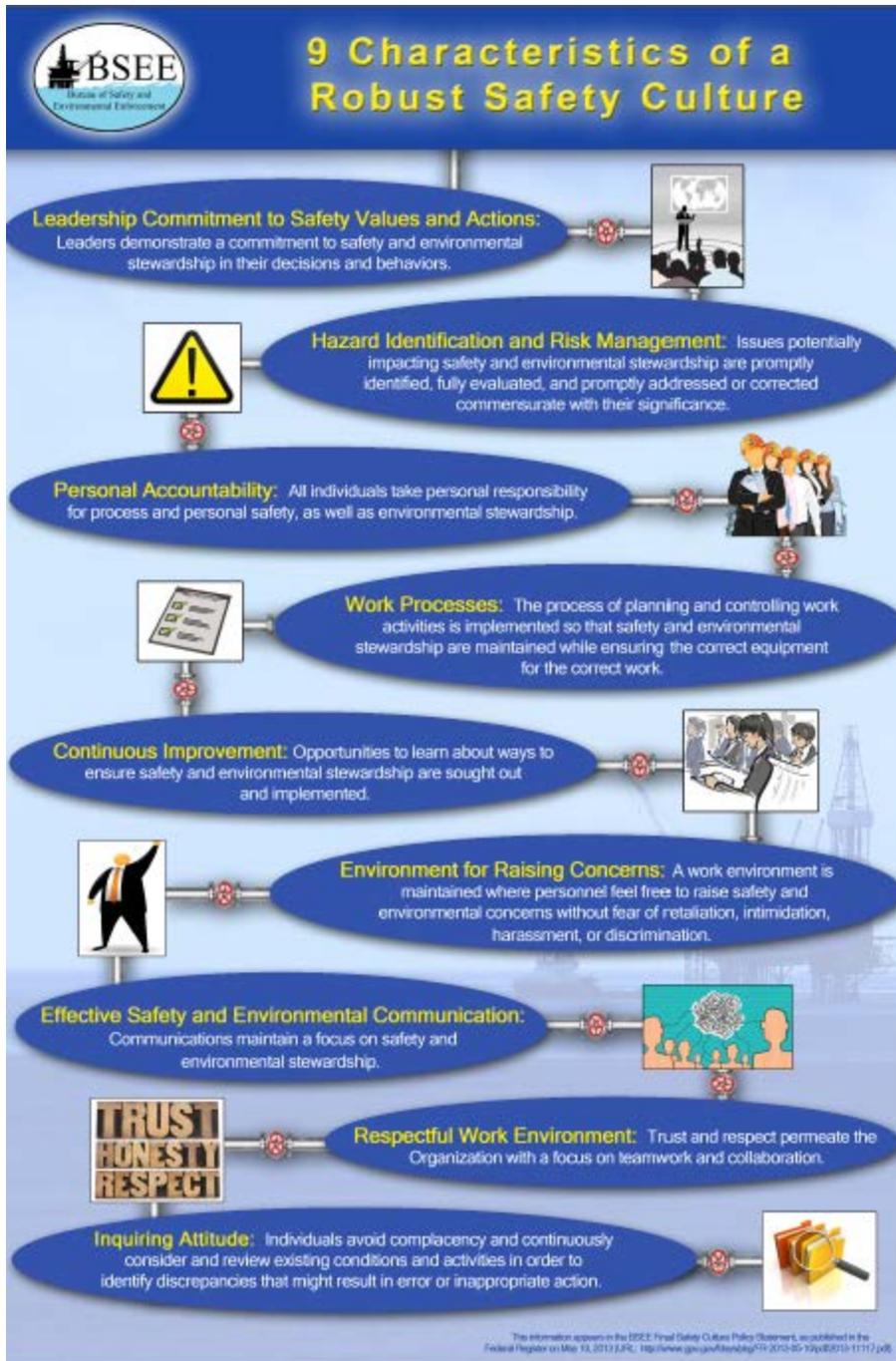
February 18, 2010

1. The graduate must understand the importance of process safety and the resources and commitment required. This should include the important incidents that define process safety, and how these incidents affected the practice of chemical engineering.
2. The graduate must be able to characterize the hazards associated with chemicals and other agents. This must include toxic, flammable, and reactive hazards.
3. The graduate must understand and be able to apply concepts of inherently safer design.
4. The graduate must understand how to control and mitigate hazards to prevent accidents. This should include generally accepted management systems, plant procedures and designs to prevent accidents.
5. The graduate should be familiar with the major regulations that impact the safety of chemical plants.
6. The graduate should understand the consequences of chemical plant incidents due to acute and chronic chemical releases and exposures.
7. The graduate should be reasonably proficient with at least one hazard identification procedure.
8. The graduate should have an introduction to the process of hazard evaluation and risk assessment.

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<sup>9</sup> ABET accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology at the associate, bachelor, and master degree levels.

<sup>10</sup> [www.sache.org/SACHEGuidelinesForABET.pdf](http://www.sache.org/SACHEGuidelinesForABET.pdf)



<http://www.bsee.gov/uploadedFiles/BSEE/Safety/Robust%20Safety%20Culture%20Poster.pdf>

*This position statement reflects the opinions of the National Safety Council but not necessarily those of each member organization.*

Adopted by the National Safety Council, 2016