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## Process Safety Management of Highly Hazardous Chemicals – Part 1

By Jerry Lacatena

### Overview

A dreaded scenario for any company that works with highly hazardous substances is an incident that results in death, injury, and/or economic loss. Several catastrophes have occurred in recent years, such as the accidents in Bhopal, India (1984), Norco, LA (1988), Pasadena, TX (1989), and Texas City, TX (2005) to mention a few.

The US Chemical Safety Board's (CSB) investigations of several recent US process industry incidents, many of which resulted in loss of life, addressed the following contributing factors:

- Consistent lack of safe process designs and risk reduction targets
- Risks of major accidents are not being reduced to "As Low As Reasonably Practicable (ALARP)"
- Regulatory standards often are weak or obsolete
- Industry standards are overly permissive
- Not effectively identifying likely piping damage mechanisms and the possibility of catastrophic rupture
- Inadequate leak response guidance or formal protocol to refer to when determining how to handle a process leak

So based on CSB's findings, although companies have generally recognized the importance of addressing process safety considerations in their operations, there still appears to be considerable room for improvement.

### Upcoming Training Courses

- Course 910  
*Process Plant Piping System Design and Maintenance*  
May 4-7, 2015 in Canada
- Course 1302 Seminar  
*Pressure Relief Systems Design and Operation Seminar*  
May 5-7, 2015 in Texas

For more information, see our website at [www.carmagen.com](http://www.carmagen.com).

### Work Highlights

#### Materials Engineering

- *Performing review of inspection data for piping and equipment items of a crude oil production facility located in Alaska. Summary reports with recommendations based on the data are provided to the Owner quarterly.*

#### Mechanical Engineering

- *Mechanical and materials engineering evaluation done of reactor internal baffle failure that damaged both the baffle and internal mixer blades. Concluded that attachment welds between the baffle support and reactor shell were inadequate for the imposed liquid loads generated by the mixer rotation.*

#### Process, Operations & Safety

- *Providing first line operations and fired equipment health audit consulting onsite at two different Canadian refineries. Two additional assessments are also being considered at domestic refinery locations.*
- *Provided technical consulting regarding specific questions associated with proposed Delayed Coker modifications based on client information provided. Cold Eyes review of selected areas of the unit are also scheduled to follow later.*

Local governments, operating companies, and other technical experts have developed systematic approaches focused on reducing the probability of future events and protecting the workplace. In the US, the OSHA Standard 1910.119, *Process Safety Management of Highly Hazardous Chemicals*, is a regulation that gives employers a methodology intended to manage highly hazardous chemicals, and ultimately try to prevent catastrophic incidents and release of toxic, reactive, flammable, or explosive chemicals. While OSHA Standard 1910.119 only applies in the US, companies located elsewhere may also consider using its framework for guidance, and to complement local regulatory requirements, as appropriate.

This brief article highlights some of the basic elements of OSHA Standard 1910.119, who is covered by it, and some technical information that processing companies should be aware of that were largely obtained from the source documentation. The intent is to provide more information in later articles.

## Process Safety Management

OSHA recognizes that each company and process may be unique, and there is a need to integrate technology, operating procedures, and standard management protocols. They want all applicable businesses to follow specific steps in order to identify factors in each process that have the potential for catastrophe, and to take action to eliminate or minimize the potential release of highly hazardous substances to achieve a safe working environment.

Process Safety Management (PSM) is a framework for identifying potential hazards and managing the serious risks associated with processes that involve highly hazardous chemicals. OSHA defines the standard's purpose as preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals that may result in toxic, fire, or explosion hazards. The regulation further defines a catastrophic release to mean a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to people in the workplace. OSHA expects companies to manage any activity in which they use, manufacture, handle, store, or transport a highly hazardous chemical.

OSHA's PSM regulation covers employers in a number of industries, with emphasis on manufacturing, particularly chemicals, transportation equipment, and fabricated metal products. The size of the company is irrelevant; what counts is the quantity of hazardous materials being used or stored. Thus, a "small" company with limited internal technical resources must still comply with the regulation.

Requirements contained in the PSM standard generally fall into the following main categories:

- Written programs, plans, and procedures to implement the regulation and each of its parts (e.g., operating procedures, emergency planning, etc.)
- Detailed information about the chemicals, technology, and equipment being used in a regulated process
- Hazards analysis of each regulated process
- Documented training of the workforce, both employees and contractor personnel
- Procedures for pre-startup safety reviews, mechanical integrity, non-routine work authorizations, change management, incident investigation, and compliance audits

Companies can also meet certain PSM requirements as a result of their compliance with other regulations.



## Elements of the PSM Standard

The standard covers the following elements (refer to OSHA Standard 1910.119 for details):

<ul style="list-style-type: none"><li>• <i>Application</i></li><li>• <i>Exclusions</i></li><li>• <i>Definitions</i></li><li>• <i>Employee Participation</i></li><li>• <i>Hazards of the Process</i></li><li>• <i>Toxicity</i></li><li>• <i>Technology of the Process</i></li><li>• <i>Equipment in the Process</i></li><li>• <i>Mechanical Integrity</i></li><li>• <i>Inspection &amp; Testing</i></li><li>• <i>Quality Assurance</i></li></ul>	<ul style="list-style-type: none"><li>• <i>Process Hazard Analysis</i></li><li>• <i>Management of Change</i></li><li>• <i>Operating Procedures</i></li><li>• <i>Safe Work Practices</i></li><li>• <i>Training</i></li><li>• <i>Contractor Management</i></li><li>• <i>Emergency Planning &amp; Response</i></li><li>• <i>Incident Investigation</i></li><li>• <i>Compliance Audits</i></li><li>• <i>Trade Secrets</i></li></ul>
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### What Facilities are Covered?

So far, OSHA listed 137 highly hazardous chemicals, toxics, and reactive substances in its Appendix A. This list gives the chemical name, Chemical Abstract Service (CAS) Number, and Threshold Quantity in Pounds (TQ) for each substance. Companies that have or use at least the specified quantity of the substance are covered by the regulation. Please refer to the OSHA standard for this list.

The regulation also applies to any process that involves a flammable liquid or gas on-site in one location, in a quantity of 10,000 pounds or more. OSHA interprets "on-site in one location" to mean an area under the company's control. The regulation also applies to any group of vessels that are interconnected, or in separate vessels that are close enough in proximity that the highly hazardous chemical could be involved in a potential catastrophic release. The regulation also provides some exclusions (e.g., if your flammable liquids or gases are used only for fuel).

Additional information on this subject will follow in future brief articles.

### About the Author

*Jerry Lacatena has over 35 years of process engineering experience in a broad range of design applications and technologies. He is a proficient and organized multi-tasker, having extensive plant design experience on numerous revamp and grassroots projects throughout the world, with projects ranging from feasibility studies, technology evaluation, FEED, EPC development, to plant performance testing. Jerry has excellent presentation, communication, coordination, and interpersonal skills utilized to develop strong working relationships with team members, clients, vendors, sub-contractors, and technical licensors.*

*Please contact Jerry Lacatena ([jlacatena@carmagen.com](mailto:jlacatena@carmagen.com)) if you'd like more information on Carmagen's expertise in this area. Carmagen Engineering, Inc. is an engineering consulting company with experienced staff that can support clients' efforts associated with the various PSM activities necessary for safe operation and compliance of their facilities.*

