

Process Safety Management of Highly Hazardous & Explosive Chemicals

*Brian Elmore, CSP
444 Regency Parkway Drive, Suite 303
Omaha, NE 68114
402.553.0171
800.642.8963
elmore.brian@dol.gov*



29 CFR 1910.119

Why Did OSHA Develop PSM?

- Bhopal, India (1984)
 - 2,000 deaths
 - Isocyanate release
- Pasadena, TX (1989)
 - 23 deaths, 132 injuries
 - Petroleum explosion
- Cincinnati, OH (1990)
 - 2 deaths
 - Explosion
- Sterlington, LA (1991)
 - 8 deaths, 128 injuries
 - Chemical release



Why Did OSHA Develop PSM?

In 1991, OSHA and EPA respectively, Released the Standards, PSM & RMP that Applies to Those Companies that are Affected by The Standards.



Why Did OSHA Develop PSM?

Process Safety Management is a regulation, promulgated by OSHA, intended to prevent an incident like the 1984 Bhopal Disaster

And...to Prevent Release of:

- Toxic,
- Reactive,
- Flammable, or
- Explosive chemicals



Department of Labor/Occupational Safety and Health Administration (OSHA)

In 2011, OSHA launched its **Chemical Plant National Emphasis Program (NEP)** to conduct focused inspections at randomly-selected facilities among worksites likely to have highly hazardous chemicals in quantities covered by the PSM standard. Under this program, OSHA has corrected serious safety issues through approximately 350 inspections and the issuance of 1,325 violations.

Executive Order on Improving Chemical Facility Safety and Security

On August 1, 2013, the [Executive Order on Improving Chemical Facility Safety and Security](#) (EO 13650) directed the federal government to:

- improve operational coordination with state and local partners;
- enhance Federal agency coordination and information sharing;
- modernize policies, regulations and standards;
- and
- work with stakeholders to identify best practices.

Not Only PSM, But RMP



A great many industrial facilities must comply with OSHA's Process Safety Management (PSM) regulations as well as the quite similar EPA Risk Management Program (RMP) regulations (Title 40 CFR Part 68).

PSM vs. RMP - What's the Difference?

- PSM - Like HAZCOM
 - Protects the Workforce
 - Protects Contractors
 - Protects Visitors to the Facility
 - Basically Protects the Workplace
- RMP-Like Sara Title III
 - Protects the Community
 - Protects the General Public Around the Facility
 - Protects Adjacent Facilities Such as Schools & Hospitals

What Facilities are Covered

- Those Who Use Chemicals in Appendix A: A List of highly hazardous chemicals, toxics and reactive (Mandatory). Contains a listing of toxic and reactive highly hazardous chemicals which present a potential for a catastrophic event at or above the threshold quantity

- Examples

Chemical

- Anhydrous Ammonia
- Chlorine

Threshold Quantity (TQ)

10,000 lbs

1,000 lbs

What Facilities are Covered

- A process which involves a flammable liquid or gas on-site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more



What Types of Industries?

- Industries that Process Chemicals Such As:
 - Industrial Organics & Inorganics
 - Pharmaceuticals
 - Petrochemical facilities
 - Paper Mills
 - **Food Processing with Anhydrous Ammonia over the TQ**

PSM Foundation

- Form a Team
 - Process Engineers
 - Operators
 - Safety
 - Maintenance
 - Management
 - Consultants



PSM Foundation

- Form a Plan & Determine:
 - Responsibilities
 - Duties
 - Reporting
 - Document Control
 - Progress Reports
 - Tracking Changes



PSM Foundation

- Review Scope of Project:
 - Process Safety Information
 - Equipment in the Process
 - Process Hazard Analysis

PSM Foundation

- Review Scope of Project:
 - Operating Procedures
 - Employee Training
 - Training Contractors

PSM Foundation

- Review Scope of Project:
 - Pre-Startup Safety Review
 - Mechanical Integrity of Equipment
 - Management of Change

PSM Foundation

- Review Scope of Project:
 - Incident Investigation
 - Emergency Preparedness
 - Compliance Audits

Process Hazard Analysis (PHA's)

- Arguably the Most Difficult Part of Performing the Standard
- Performed by Your PSM Team
- Takes Significant Time & Effort

PHA Process Method

- Must select a process hazard analysis (PHA) method
 - What-If;
 - Checklist;
 - What-If/Checklist;
 - Hazard and Operability Study (HAZOP);
 - Failure Mode and Effects Analysis (FMEA);
 - Fault Tree Analysis

The PHA Must Address:

- Equipment in the process
- Hazards of the process
- Identification of previous incidents
- Engineering and administrative controls
- Consequences of failure

The PHA Must Address:

- Facility siting
- Human factors
- Qualitative evaluation of S and H effects
- Consequences of deviation
- Steps required to correct or avoid deviation

What Do We Do With the PHA's Developed?

- Using the Risk Analysis:
 - Review Defense Designs
 - Warning/Alarms to Warn of Deviations
 - Relief Systems
 - Ventilation Systems

Process Hazard Analysis Summary

- The Process Hazard Analysis is the Backbone of the Process Safety Management Program.
- It Provides the Structure Upon Which PSM is Built
- It Makes Available Pertinent Data & Safety Information to Design an Effective PSM Safety Program

Case Study #1

- MeatPacking Plant
- Inspection CHEM NEP
- PSM Finding
 - Ammonia System too close to ignition source
 - Not identified in PHA

Case Study #2

- MeatPacking Plant
- Inspection CHEM NEP
- PSM Finding
 - Ammonia system not protected from struck-by hazards
 - Not Identified in PHA

Case Study #3

- Chemical Plant
- Inspection media referral
- PSM Finding
 - Contractor not following host contractor safety rules for lockout

Resources

- GTRI - <http://www.oshainfo.gatech.edu/index.html>
- OSHA PSM Compliance Guidelines - <http://www.osha.gov/Publications/osh3133.html>
- OSHA PSM for Construction 1926.64 - <http://www.osha.gov/doc/outreachtraining/htmlfiles/psm.html>