

Process Safety Management (PSM)

Module Two - Overview of the PSM Rule



July, 2010

[Adapted from State of Ohio – Dept. of Commerce, Div. of Labor & Worker Safety]

Purpose of the PSM Standard

- This standard contains requirements for preventing or minimizing the consequences of catastrophic releases of chemicals that are:
 - Toxic,
 - Reactive,
 - Flammable,
 - Explosive
- These releases may result in toxic, fire or explosion hazards
- A number of catastrophic accidents have occurred resulting in loss of life and great property damage.



Impact of PSM Rule

- The Rule affects:
 - 24,939 establishments nationwide
 - 127 industry subgroups
 - 3 million employees including contractors
- First 5 years:
 - 132 deaths avoided
 - 767 injuries/illnesses
- Second 5 years:
 - 264 deaths avoided
 - 1534 injuries/illnesses



PSM Rule – WAC 296-67

(67-001) Application.

(67-005) Definitions.

(67-009) Employee participation.

(67-013) Process safety information.

(67-017) Process hazard analysis.

(67-021) Operating procedures.

(67-025) Training.

(67-029) Contractors.

67-033) Pre-startup safety review.

(67-037) Mechanical integrity.

(67-041) Hot work permit.

(67-045) Management of change.

(67-049) Incident investigation.

(67-053) Emergency Planning and Response.

(67-057) Compliance Audits.

(67-061) Trade secrets.

[Link to DOSH PSM Rule](#)

Scope and Application

- A process which involves a chemical at or above the specified threshold quantities (TQ) listed in Appendix A of the Rule. (TQ amounts vary by chemical)

OR

- 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
 - e.g., 10,000 lbs. of Methane = 223,714 ft³ at STP

[Link to Appendix A](#)

Methane produced in a large wastewater treatment plant is covered if the total amount of methane in the process exceeds 10,000 pounds.



Appendix A Examples

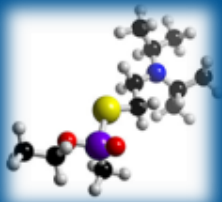


Chemical Name	CAS #	TQ (lbs)
Ammonia, Anhydrous	7664-41-710000	10,000
Chlorine	7782-50-51500	1500
Hydrogen Sulfide	7783-06-4	1500

NOTE: 1500 lbs. of Hydrogen Sulfide = 16,760 ft³ at NTP

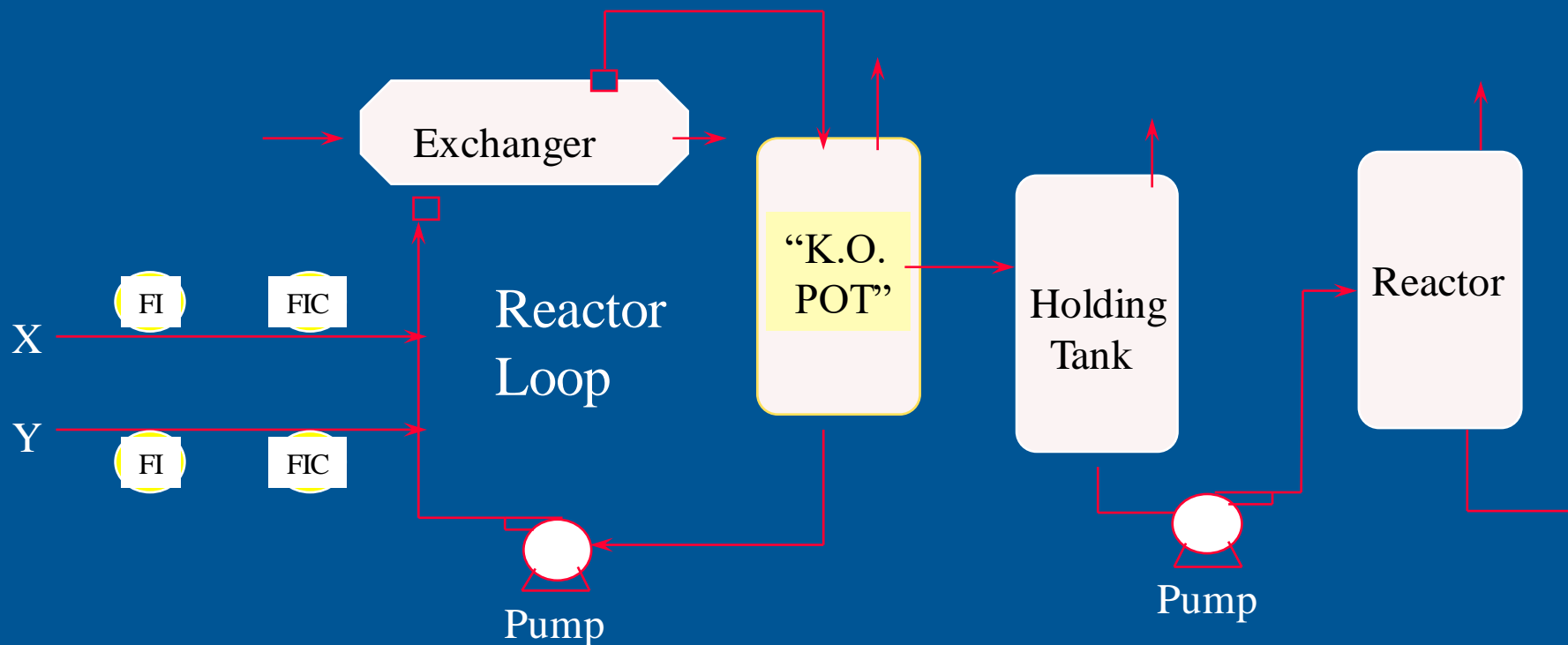
NTP – Normal Temperature and Pressure - is defined as air at 20°C (68°F) and 1 atm (, 14.7 psia, 0 psig, 30 in Hg, 760 torr)

STP – Standard Temperature and Pressure - is defined as air at 0°C (32°F) and 1 atm (, 14.7 psia, 0 psig, 30 in Hg, 760 torr)



Definition of a Chemical Process

- Any use, storage, manufacturing, handling, or the on-site movement of highly hazardous chemicals, or combination of these activities.



A Single Process is:

- Any group of vessels which are interconnected, and
- Separate vessels which are located such that a highly hazardous chemical could be involved in a potential release



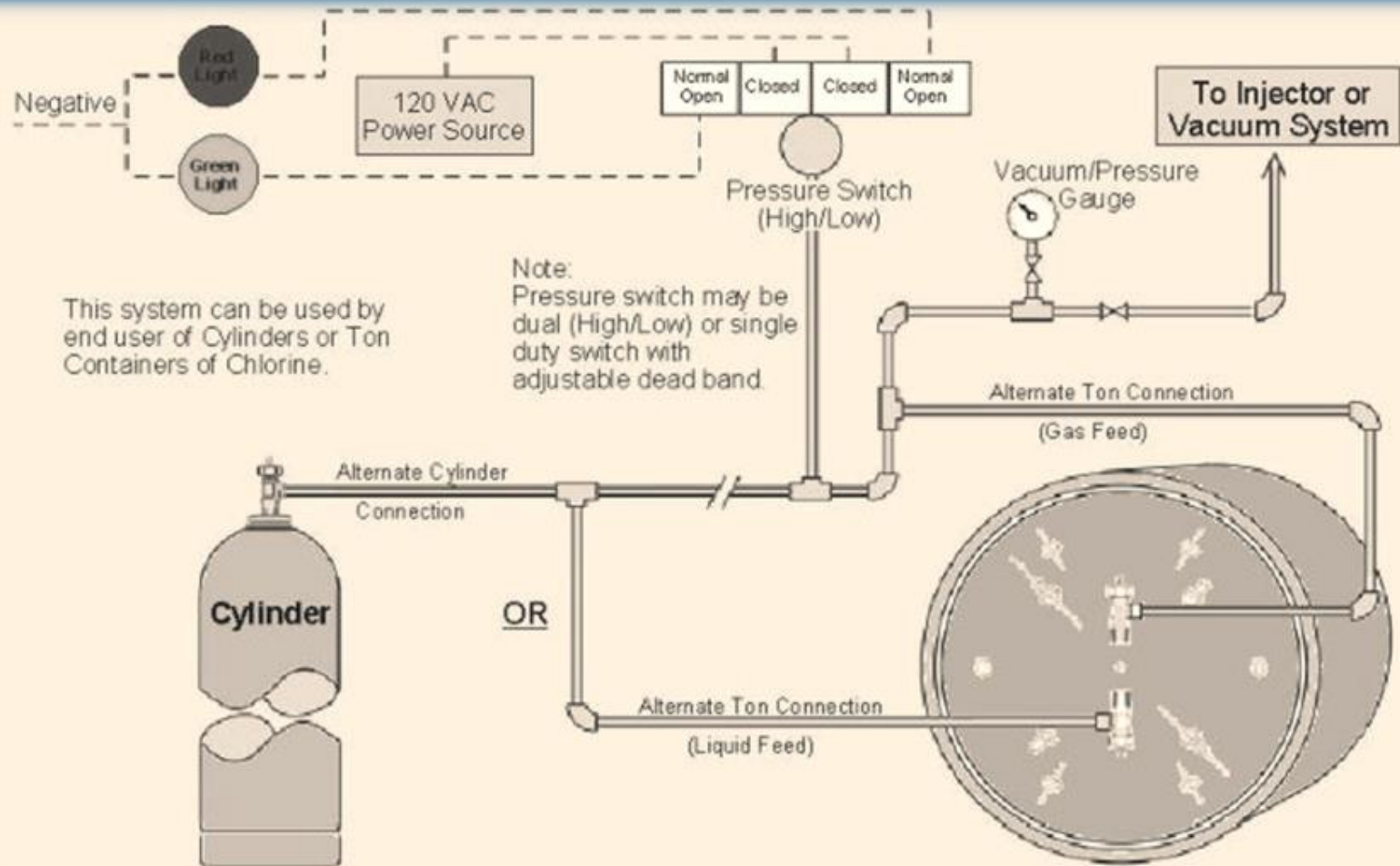
Chlorine Processes

The Threshold Quantity (TQ) for chlorine is 1500 lbs.



The large cylinders will likely exceed the chlorine TQ.

Typical Chlorine Flow Diagram (process)



Exemptions in the Rule

- The Rule does not apply to:
 - Retail facilities
 - Oil or gas well drilling or servicing
 - Normally unoccupied remote facilities

“Normally unoccupied remote facility” means a facility which is operated, maintained, or serviced by employees who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No employees are permanently stationed at the facility. Facilities meeting this definition are not contiguous with, and must be geographically remote from all other buildings, processes, or persons.



Other PSM Exceptions

- Hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling):
 - provided such fuels are not a part of a process containing another highly hazardous chemical covered by this standard



- Any flammable liquids stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration



1996 Court Case - MEER Decision

Flammable liquid storage tank exemption

Judge ruled - flammable liquids stored or transferred from atmospheric tanks are exempted regardless of quantity

WAC 296-800-11005 - the "General Duty Clause" is used to regulate stored flammables

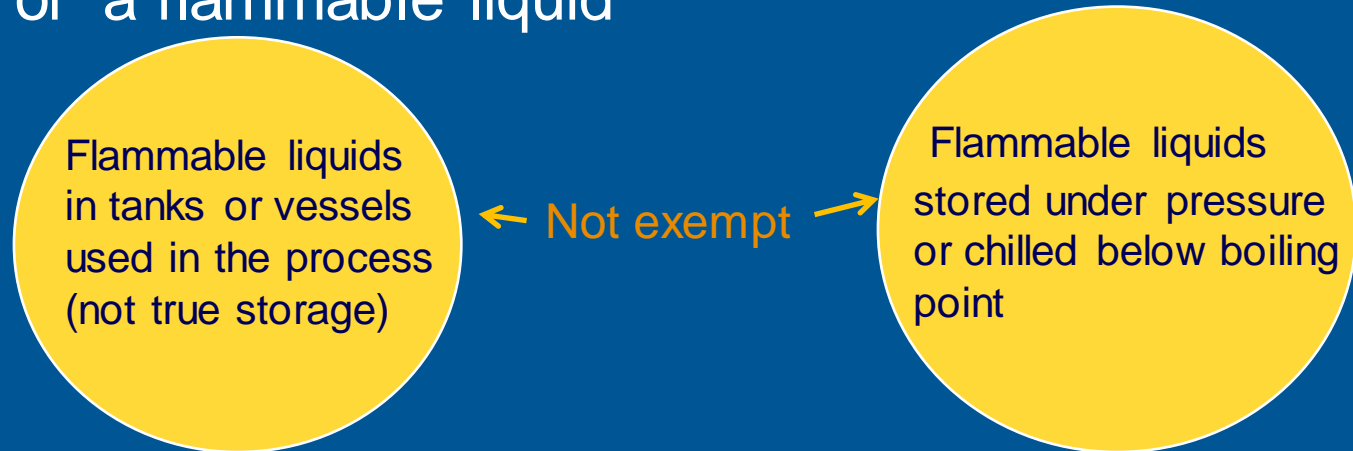


In a 1996 court decision, the judge ruled that coverage under OSHA's Process Safety Management Standard does not extend to stored flammables in "atmospheric tanks," even if they were connected to a "process" within the definition of the standard. DOSH also abides by this decision.

MEER Decision



- Exemption if atmospheric tanks is used solely for storage
- However, process is covered if it involves 10,000 pounds or more of a flammable liquid



* No exemption if the atmosphere tanks are used for purposes beyond storage

49 CFR Transportation Regulations

Department of Transportation Hazardous Materials Act:

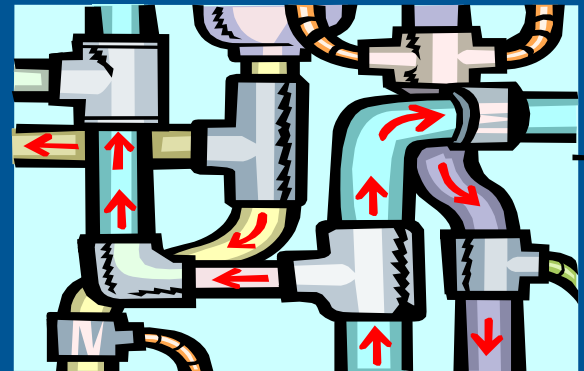
- Gives OSHA authority to regulate worker safety in hazardous materials transportation (called a “reverse federal preemption provision”)
- Hazardous material cargo would not be exempted by DOT Hazmat rules or from OSHA regulation including PSM (e.g., loading and unloading facilities)



Process Safety Information



- Hazards of the process
- Technology of the process; and,
- The equipment in the process.



The required collection of written process safety information enables the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes.



Toxicity Information

Information must include:

- Permissible exposure limits;
- Physical data;
- Reactivity data;
- Corrosivity data;
- Thermal and chemical stability data; and
- Foreseeable hazardous effects of inadvertent mixing of different materials that could occur.

MATERIAL SAFETY DATA SHEET

Trade Name: **ACETONE**

Chemical Family: Acetone

Formula: C₃H₆O

Manufacturer: _____ Supplier: _____

Emergency Phone #'s _____

Transportation EMG. Phone #'s CAN/TEC _____

HAZARDOUS INGREDIENTS

ACETONE: 99% CAS # 67-64-1
Exposure limits: PPM : OSHA-PEL 750 , ACGIH - TLV 750
LD50 Oris rat 9750 MG/KG , Skin rabbit 20 G/KG , LC50 rat 16000 PPM

Note: Material Safety Data Sheets may be used to comply with this requirement if they contain all of the required information.

Trade Secrets

- Employers must make trade secret information available to persons responsible for:
 - Compiling the process safety information
 - Developing of the process hazard analysis and operating procedures;
 - Incident investigations, emergency planning and response, and compliance audits.
- Confidentiality agreements are permitted.



Process Hazard Analysis (PHA)

- PHA (hazard evaluation) must be performed that using one of the following methods:
 - What-If;
 - Checklist;
 - What-If/Checklist;
 - Hazard and Operability Study (HAZOP);
 - Failure Mode and Effects Analysis (FMEA);
 - Fault Tree Analysis; or
 - Appropriate equivalent methodology



Detailed guidance on the content and application of process hazard analysis methodologies is available from the [Center for Chemical Process Safety](#).

Employee Participation in PHA

- Employee participation is mandatory in the hazard analysis process:
 - consult with employees and their representatives on the development of process hazards analyses
 - provide access to process hazard analyses to employees and their representatives



Process Hazard Analysis (Continued)

- PHA must be performed by a team with expertise in engineering and process operations
- One team member must have experience and knowledge specific to the evaluated process
- One team member must be knowledgeable in the specific PHA methodology implemented at the site



Process Hazard Analysis

(Continued)

- The process hazard analysis must address:
 - Engineering and administrative controls applicable to the hazards such as detection of early warning of releases*



*Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as chlorine sensors.



At Bhopal, India, smaller accidents had occurred at the plant prior to the disastrous methyl isocyanate (MIC) release in 1984, and small MIC leaks had been noted on numerous previous occasions highlighting the need for automatic MIC leak detection. In fact, workers stated that experiencing eye irritation (a symptom associated with low levels of airborne MIC) was not an unusual phenomenon, but these warnings went unheeded.

Process Hazard Analysis

(Continued)

- The process hazard analysis must address:
 - The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace.
 - PHA must be updated and revalidated every 5 years.



For example, warnings existed in several of the recent accidents investigated by EPA and OSHA. Prior to an accident at a Georgia Pacific plant in 1997, the facility had recently experienced a near miss involving similar circumstances to those resulting in the later accident. An operator was observed adding chemicals to a batch resin process at too high a rate. Other alert operators noted the procedural deviation, and were able to prevent an accident. The company investigated the incident and disciplined the first operator. However, no other actions were taken to change the process and prevent a recurrence. As result an large release of chemical occurred later.

Incident Investigation



- Each incident must be investigated that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical in the workplace.
- The investigation must be initiated no later than 48 hours following the incident.
- An incident investigation team that consists of persons knowledgeable in the incident process must be established and the team must thoroughly investigate and analyze the incident.

Incident Investigation

(continued)

- A report must be prepared at the conclusion of the investigation.
- A system must be developed to promptly address, resolve and document the incident report findings, recommendations and corrective actions.
- The incident report must be made available to affected employees as well as contractors; and,
- The report must be retained for at least five years.



At a minimum, the report must contain the following: Date of incident; Date investigation began; A description of the incident; The factors that contributed to the incident; and, Any recommendations resulting from the investigation.

Pre-startup safety review

- A review must be performed for new facilities and for modified facilities when the modification is significant enough to require a change in the PSM information.
- Prior to the introduction of highly hazardous chemicals to a process, the required review must confirm that:
 - Construction and equipment is in accordance with design specifications;
 - Safety, operating, maintenance, and emergency procedures are in place and are adequate.
- New facilities must perform a process hazard analysis and implement recommendations before startup.
- Modified facilities must meet the requirements in the Management of Change, section 67-045.

Operating Procedures

- Develop and implement written operating procedures* consistent with the process safety information and addresses at least the following elements:
 - Initial start-up, normal and temporary operations
 - Normal and emergency shut-down procedures
 - Operating limits and consequences of deviation
 - Hazards presented by the process

*Readily accessible to employees

Operating Procedures

(Continued)

Develop and implement safe work practices* to provide for the control of process hazards during:

- Lockout/tagout;
- Confined space entry;
- Opening process equipment or piping; and
- Control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel



* These safe work practices also apply to contractor employees

Hot Work Permit

- The employer must issue a hot work permit for hot work operations conducted on or near a covered process.
- The permit must document:
 - That the fire prevention requirements in WAC 296-24-68201(a) have been implemented before starting the hot work operations;
 - The date(s) authorized for hot work; and,
 - Identify the object on which hot work is to be performed.
- The permit must be kept on file until completion of the hot work operations.



_____ (company name)

HOT WORK PERMIT

Date _____ Time _____

Name of Person(s) Performing Work _____

Specific Location of Work _____

Yes No

Cutting or welding permitted in an area that has been made fire safe.

All movable fire hazards in the vicinity have been taken to a safe place.

Guards used to contain the heat, sparks and slag if fire hazards cannot be removed.

Floor or wall openings or cracks, open doorways and windows protected or closed.

Fire extinguisher available for instant use.

Fire watch in areas where other than a minor fire might develop such as around combustible material.

Floors swept clean of combustible material for a radius of 35'.

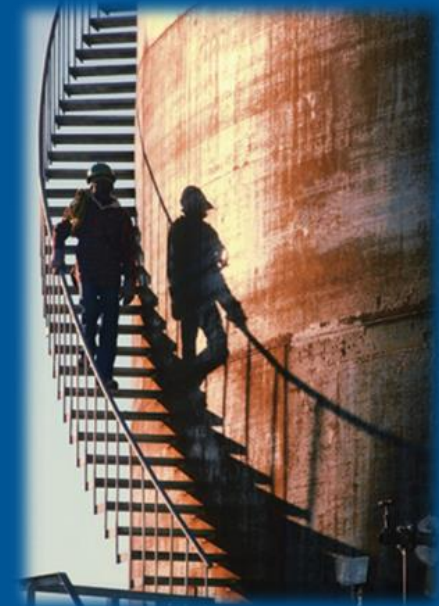
Combustible floors have been kept wet, covered with damp sand or protected by fire resistant shields.

Welding/cutting done only in areas authorized by management. No welding/cutting in sprinkled building when sprinkler system is impaired or in presence of explosive atmosphere, or in area of storage of readily ignitable material.

Dusts and conveyor systems that might carry sparks to distant combustibles protected or shut down.

Mechanical Integrity

- The employer must establish and implement written procedures to maintain the on-going integrity of process equipment.
- The employer must train each maintenance employee in an overview of the process, its hazards, and in the maintenance procedures to ensure employees can safely perform assigned tasks.
- Deficiencies in equipment that are outside acceptable limits must be corrected to assure safe operation.



Inspections and Testing

- Inspections and tests must be performed on process equipment according to recognized and generally accepted good engineering practices.
- The frequency of inspections and tests must be consistent with applicable manufacturers' recommendations and good engineering practices.
- Prior operating experience may indicate more frequent testing and inspection than manufacturers' recommendations.
- Each performed inspection and test on process related equipment must be documented.



Quality Assurance

- The employer must assure that all new plants and equipment are fabricated and suitable for the intended process application.
- Appropriate checks and inspections must be performed to assure that equipment is installed properly and consistent with design specifications and the manufacturer's instructions.
- The employer must assure that maintenance materials, spare parts and equipment are suitable for the intended process application.



Management of Change

- Written procedures must be implemented to manage changes (except for "replacements in kind") to process chemicals, technology, equipment, procedures, and facilities that affect a covered process.
- Employees and contractors involved in operating or maintaining a process and whose job tasks will be affected by a change must receive training and information about the change prior to start-up.
- If a change affects previously documented PSM information, operating procedures, or practices, then the written PSM plan must be updated.
- The 1998 Equilon Refinery incident was an example of management of changes rules not being followed.

[Link to Chemical Safety Board "Management of Change" Bulletin](#)

Emergency Planning and Response

- An Emergency Action Plan (EAP) must be developed to ensure the safe evacuation of employees
- Plan must address all foreseeable emergency situations (e.g., fire, weather, chemical releases, etc.)
- In addition, an Emergency Response Plan must be developed if employees will respond to the chemical release
- Plan must address the means and methods necessary to protect employees responding to an uncontrolled release of a process chemical



Compliance Audits



- The adequacy of the employer's procedures and practices must be evaluated and certified at least every three years.
- The compliance audit must be conducted by at least one person knowledgeable in the process.
- A report of the findings of the audit must be developed.
- The employer must document an appropriate response and any corrective action for each of the findings in the audit.
- The two most recent compliance audit reports must be retained.

Training

- Emphasis on the specific safety and health hazards of the process
- Emergency operations including shutdown,
- Safe work practices applicable to the employee's job tasks
- Refresher training at least every three years
- Prepare a record which contains:
 - The identity of the employee,
 - The date of training, and
 - The means used to verify that employees understood the training



Contractors*

- Applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process
- Employer responsibilities:
 - Obtain and evaluate information regarding the contract employer's safety performance and programs
 - Inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the



* Does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services...

PSM vs. EPA Risk Management Plans(RMP)

The principal areas in which the requirements of the EPA differ from the OSHA Rule are:



Different chemical list and Threshold Quantities (TQ) for some chemicals. e.g., Chlorine 1500 lbs. (PSM) v. 2500 lbs. (RMP)

EPA requires hazard assessments that include analyses of the “worst case” accident consequences.



EPA requires preparation of written risk management plans to document the risk management program. The plans must be submitted to designated agencies and will be available to the public.

Risk Management Plans must be registered with the EPA.

PSM Summary

- Facilities with a process using a highly hazardous chemical in an amount exceeding the TQ must develop, document and implement:
 - Written hazard information, process analysis, operating procedures, emergency procedures and employee/contractor training.
 - Maintenance procedures, inspections, incident evaluations.
 - Re-evaluation of PSM information, procedures, compliance audits of processes and related equipment, and refresher training every three years.
 - PHA must be updated & revalidated every 5 years.

Additional Information



DOSH PSM Rule

WAC 296-67 – Process safety management of highly hazardous chemicals

For additional assistance, you can call one of our consultants.
Click below for local L & I office locations:

http://www.lni.wa.gov/wisha/consultation/regional_consultants.htm