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Preventing Chemical Accidents

OSHA's Process Safety Management Standard

Process Safety Management Training
from the
NJ Work Environment Council

The BP, Texas City, Texas explosion and fire in March 2005 killed 15 workers and injured 180.

Process Safety Management [PSM – CFR 1910.119] is an OSHA standard intended to prevent chemical disasters. Regardless of the industry that uses specified highly hazardous chemicals, there is a potential for an accidental release any time such substances are not properly controlled. This, in turn, creates a potential disaster for workers and the community.

Process Safety Management is a *performance* oriented standard. It does not prescribe specific hazard prevention methods. Employers and unions, in addition to consulting the complete text of the PSM standard, should review industry-developed standards used by OSHA to determine compliance. The National Fire Protection Association (NFPA), the American Society of Mechanical Engineers (ASME), the American Society for Testing and Materials, and the American Petroleum Institute are among organizations that have developed such standards.

What are the main requirements of PSM?

- Employee participation in hazard evaluation;
- Written process safety information (PSI) including hazard information;
- Updated Process Hazard Analysis with employee participation;
- Worker Training including refresher programs;
- Contractor safety provisions;
- Requirements for Mechanical Integrity and Hot Work Permits;
- Implementation of written procedures to manage changes in operations;
- Investigation of incidents which could have resulted in chemical release ("near misses" or "close calls");
- Internal compliance audits every three years;
- Employee access to trade secrets.

What facilities does PSM cover?

The standard mainly applies to manufacturing industries – particularly chemical plants and oil refineries. PSM may also cover food processors, warehouses, water and sewage treatment plants, and other some other facilities.

The standard covers a process which:

- Contains a threshold quantity or greater amount of a toxic or reactive Highly Hazardous Chemicals (HHC) as specified in Table 1 (at the end of this document); or
- Has 10,000 pounds or greater amounts of flammable liquids and gases and to the process activity of manufacturing explosives and pyrotechnics.

PSM Standard has limited coverage.

One limitation of the PSM standard is its limited coverage. Unfortunately, operations using highly hazardous chemicals may fall under specified thresholds and thus are not currently covered by this standard. Hopefully the standard will be expanded to cover any chemical operation that has the potential to create a catastrophic incident. Union representatives can bargain with management to evaluate and expand the coverage of this standard to make it more protective.

OSHA Process Safety Management Standard 1910.119

SUMMARY

1. EMPLOYEE PARTICIPATION [1910.119(c)]

The employer is required to:

- Have a written plan of action regarding employee participation;
- Consult with employees and their representatives on the conduct and development of process hazard analyses and on the development of other elements of process safety management required under the rule;
- Provide employees and their representatives access to process hazard analyses and to all other information required to be developed under the rule.

WEC TIP

Employee participation should mean that the union and workers are involved in all aspects of PSM from beginning to end. This includes planning, implementation, and review of compliance with the standard.

2. PROCESS SAFETY INFORMATION [1910.119(d)] -

Requires compilation of written process safety information (PSI) including hazard information on highly hazardous chemicals (HHCs) and technology/equipment information on covered processes.

Information on the hazards of the highly hazardous chemicals in the process shall consist of at least the following:

- Toxicity;
- Permissible exposure limits;
- Reactivity data;
- Corrosivity data;
- Thermal and chemical stability data; and
- Hazardous effects of inadvertent mixing of different materials.

WEC TIP

Since MSDSs are written by chemical manufacturers and have often been found to be incomplete and misleading, it is always best to research chemical hazards by looking at independent information source such as New Jersey's Hazardous Substance Fact Sheets. These are available online at http://web.doh.state.nj.us/rtkhsfs/indexfs.aspx

Note: Material Safety Data Sheets (MSDSs) meeting the requirements of the Hazard Communication Standard (20 CFR 1910.1200) may be used to comply with this requirement to the extent they contain the required information.

INFORMATION ON THE PROCESS TECHNOLOGY must include at least the following:

- A block flow diagram or simplified process flow diagram;
- Process chemistry;
- Maximum intended inventory;
- Safe upper and lower limits for such items as temperatures, pressures, flows or compositions; and
- An evaluation of the consequences of deviations, including those affecting the safety and health of employees.

Where the original technical information no longer exists, such information may be developed in conjunction with the process hazard analysis in sufficient detail to support the analysis.

Information on the equipment in the process must include the following:

- Materials of construction;
- Piping and instrument diagrams (P&IDs);
- Electrical classification;
- Relief system design and design basis;
- Ventilation system design;
- Design codes and standards employed;
- Material and energy balances for processes built after May 26, 1992; and
- Safety systems (e.g., interlocks, detection, or suppression systems).

3. PROCESS HAZARD ANALYSIS [1910.119(e)] - Specifies that process hazard analyses (PHA's) must be conducted as soon as possible for each covered process using compiled process safety information in an order based on a set of required considerations. Process hazard analyses must be updated and revalidated at least every five years and must be retained for the life of the process.

4. OPERATING PROCEDURES [1910.119(f)] - Must be in writing and provide clear instructions for safely conducting activities involving a covered process consistent with process safety information; must include steps for each operating phase, operating limits, safety and health considerations and safety systems and their functions; be readily accessible to employees who work on or maintain a covered process, be reviewed as often as necessary to assure they reflect current operating practice; and must implement safe work practices to provide for special circumstances such as lockout/tagout and confined space entry.

5. WORKER TRAINING REQUIREMENTS [1910.119(g)] - PSM requires that each employee presently involved in operating a process or a newly assigned process must be trained in an overview of the process and in its operating procedures. The training must emphasize the specific safety and health hazards of the process, emergency operations including shutdown, and other safe work practices that apply to the employee's job tasks. Those employees already involved in operating a process on the PSM effective date [1992] do not necessarily need to be given initial training. Instead, the employer may certify in writing that the employees have the required knowledge, skills, and abilities to safely carry out the duties and responsibilities specified in the operating procedures.

WEC TIP

All aspects of training should be done with union and worker involvement. Peer trainers can be particularly effective instructors for training done to meet the requirements of this section. The union should assure that training is effective.

Refresher Training - Refresher training must be provided at least every three years, or more often if necessary, to each employee involved in operating a process to ensure that the employee understands and adheres to the current process operating procedure. The employer, in consultation with employees involved in operating the process, must determine the appropriate frequency of refresher training.

6. REQUIREMENTS FOR CONTRACTORS [1910.119(h)] - PSM includes special provisions for contractors and their employees to emphasize the importance of everyone taking care that they do nothing to endanger those working nearby who may work for another employer.

PSM, therefore, applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. PSM does not apply, however, to contractors providing incidental services that do not influence process safety, such as janitorial, food and drink, laundry, delivery, or other supply services.

WEC TIP

Contractor safety is a major problem in PSM-covered industries. There were contributing factors related to contractors in major workplace catastrophes. PSM requires both the employer and contractors to meet minimum requirements. Unions and workers can use these minimum contractor safety requirements to improve health and safety for all workers.

Employer Responsibilities

When selecting a contractor, the employer must obtain and evaluate information about the contract employer's safety performance and programs. The employer also must inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the process; explain to contract employers the applicable provisions of the emergency action plan; develop and implement safe work practices to control the presence, entrance, and exit of contract employers and contract employees in covered process areas; evaluate periodically the performance of contract employers in fulfilling their obligations; and maintain a contract employee injury and illness log related to the contractor's work in the process areas.

Contract Employer Responsibilities

The contract employer must:

- Ensure that contract employees are trained in the work practices necessary to perform their job safely;
- Ensure that contract employees are instructed in the known potential fire, explosion, or toxic release hazards related to their job and the process, and in the applicable provisions of the emergency action plan;
- Document that each contract employee has received and understood the training required by the standard by preparing a record that contains the identity of the contract employee, date of training, and the means used to verify that the employee understood the training;

- Ensure that each contract employee follows the facility safety rules including the required safe work practices in the operating procedures section of the standard; and
- Advise the employer of any unique hazards presented by the contract employer's work.

7. PRE-STARTUP SAFETY REVIEW [1910.119(i)] - Mandates a safety review for new facilities and significantly modified work sites to confirm that the construction and process equipment meet design specifications; to assure adequacy of safety, operating, maintenance, and emergency procedures; and to assure completion of process operator training. Also, for new facilities, the PHA must be performed and recommendations resolved and implemented before start up. Modified facilities must meet management of change requirements.

8. MECHANICAL INTEGRITY [1910.119(j)] - Requires the on-site employer to establish and implement written procedures for the ongoing integrity of critical process equipment containing and controlling highly hazardous chemicals in a covered process. The mechanical integrity requirements cover design, installation, and operation.
PSM mechanical integrity requirements apply to:

- Pressure vessels and storage tanks;
- Piping systems (including components such as valves);
- Relief and vent systems and devices;
- Emergency shutdown systems;
- Controls (including monitoring devices and sensors, alarms, and interlocks); and
- Pumps.

The employer must establish and implement written procedures to maintain the ongoing integrity of process equipment. Employees involved in maintaining the ongoing integrity of process equipment must be trained in an overview of that process and its hazards and trained in procedures applicable to the employees' job tasks.

Inspection and testing must be performed on process equipment, using procedures that follow recognized and generally accepted good engineering practices. The frequency of inspections and tests of process equipment must conform with manufacturers' recommendations and good engineering practices, or more frequently if determined to be necessary by prior

operating experience. Each inspection and test on process equipment must be documented, identifying the inspection date or test date, person's name who performed the inspection or test, the serial number or other identifier of the equipment on which the inspection or test was performed, a description of the inspection or test performed, and the inspection or test results.

Equipment deficiencies outside the acceptable limits defined by the process safety information must be corrected before further use. In some cases, it may not be necessary that deficiencies be corrected before further use, as long as deficiencies are corrected in a safe and timely manner and when other necessary steps are taken to ensure safe operation.

The employer also must ensure that maintenance materials, spare parts, and equipment are suitable for the process application for which they will be used.

9. HOT WORK [1910.119(k)] - Hot work permits must be issued for hot work operations conducted on or near a covered process.

10. MANAGEMENT OF CHANGE [1910.119(l)] - The work site employer must establish and implement written procedures to manage changes that affect a covered process. The standard requires the work site employer and contract employers to inform and train their affected employees on the changes prior to start-up. Process safety information and operating procedures must be updated as necessary.

WEC TIP

Management, unions, and workers must be vigilant and raise questions when changes are made to covered operations.

11. INCIDENT INVESTIGATION [1910.119(m)] - Requires employers to investigate as soon as possible — but no later than 48 hours after — incidents which did result or could reasonably have resulted in catastrophic releases of covered chemicals. PSM calls for an investigation team, including at least one person knowledgeable about the process involved, (a contract employee when the incident involved contract work) and others with knowledge and experience to investigate and analyze the incident, and to develop a written incident report. Reports must be retained for five years.

The following is OSHA guidance on the components of Incident Investigations from the *Process Safety Management Guidelines for Compliance.* *Incident investigation is the process of identifying the underlying causes of incidents and implementing steps to prevent similar events from occurring. The intent of an incident investigation is for employers to learn from past experiences and thus avoid repeating past mistakes. The incidents OSHA expects employers to recognize and to investigate are the types of events that resulted in or could reasonably have resulted in a catastrophic release. These events are sometimes referred to as "near misses" or "close calls", meaning that a serious consequence did not occur, but could have.*

Employers must develop in-house capability to investigate incidents that occur in their facilities. A team should be assembled by the employer and trained in the techniques of investigation including how to conduct interviews of witnesses, assemble needed documentation, and write reports. A multi-disciplinary team is better able to gather the facts of the event and to analyze them and develop plausible scenarios as to what happened, and why. Team members should be selected on the basis of their training, knowledge, and ability to contribute to a team effort to fully investigate the incident.

WEC TIP

This is a key part of PSM. Most deadly incidents involving chemical releases are preceded by 'close calls' or 'near misses' where a faulty system almost results in worker injury or death. Often these occurrences are not reported and not investigated because of the real fear of individuals being blamed for the problem instead of the faulty system or operation. Use the following OSHA guidelines to urge reporting systems and investigations that are "blameless" for PSM and all Health and Safety Programs.

Employees in the process area where the incident occurred should be consulted, interviewed or made a member of the team. Their knowledge of the events represents a significant set of facts about the incident that occurred. The report, its findings, and recommendations should be shared with those who can benefit from the information. The cooperation of employees is essential to an effective incident investigation. The focus of the investigation should be to obtain facts and not to place blame. The team and the investigative process should clearly deal with all involved individuals in a fair, open, and consistent manner.

Source: Appendix C of PSM Standard.

12. EMERGENCY PLANNING AND RESPONSE [1910.119(n)] - Requires employers to develop and implement a written "emergency action plan" for the entire plant in accordance with the provisions of another OSHA standard, 29 CFR 1910.38. The emergency action plan must include

procedures for handling small releases. Covered employers may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (a), (p) and (q). The plan must be available for inspection and copying by employees and their union (if any).

13. COMPLIANCE AUDITS [1910.119(o)] -

Calls for employers to certify that they have evaluated compliance with process safety requirements at least every three years. Prompt response to audit findings and documentation that deficiencies are corrected is required. Employers must retain the two most recent audit reports.

WEC TIP

Although not mandated, all PSM-related audits should be done jointly with the union and workers. That means the union should be involved in all aspects of the audit including planning, implementation, and follow-up.

14. TRADE SECRETS [1910.119(p)] -

Sets requirements similar to trade secret provisions of the Hazard Communication standard [1910.1200] requiring information required by PSM to be available to employees (and employee representatives). Employers may enter into confidentiality agreement with employees to prevent disclosure of trade secrets.

WEC TIP

Employers may claim Trade Secrets information without much basis for the claim. Unions and workers should question these claims. Safety and health information should be made available without restrictive confidentiality agreements.

Appendix A to § 1910.119 – List of Highly Hazardous Chemicals, Toxics and Reactives (Mandatory)

This Appendix contains a listing of toxic and reactive highly hazardous chemicals that present a potential for a catastrophic event at or above the threshold quantity.

*Chemical Abstract Service Number
**Threshold Quantity in Pounds (Amount necessary to be covered by PSM)

CHEMICAL NAME	CAS*	TQ**
Acetaldehyde	75-07-0	2500
Acrolein (2-Propenal)	107-02-8	150
Acrytyl Chloride	814-68-6	250
Allyl Chloride	107-05-1	1000
Allylamine	107-11-9	1000
Alkylaluminums	Varies	5000
Ammonia, Anhydrous	7664-41-7	10000
Ammonia solutions (>44% ammonia by weight)	7664-41-7	15000
Ammonium Perchlorate	7790-98-9	7500
Ammonium Permanganate	7787-36-2	7500
Arsine (also called Arsenic Hydride)	7784-42-1	100
Bis(Chloromethyl) Ether	542-88-1	100
Boron Trichloride	10294-34-5	2500
Boron Trifluoride	7637-07-2	250
Bromine	7726-95-6	1500
Bromine Chloride	13863-41-7	1500
Bromine Pentafluoride	7789-30-2	2500
Bromine Trifluoride	7787-71-5	15000
Propargyl Bromide)	106-96-7	100
Butyl Hydroperoxide (Tertiary)	75-91-2	5000

CHEMICAL NAME	CAS*	TQ**
Butyl Perbenzoate (Tertiary)	614-45-9	7500
Carbonyl Chloride (see Phosgene)	75-44-5	100
Carbonyl Fluoride	353-50-4	2500
Cellulose Nitrate (concentration > 126% nitrogen	9004-70-0	2500
Chlorine	7782-50-5	1500
Chlorine Dioxide	10049-04-4	1000
Chlorine Pentrafluoride	13637-63-3	1000
Chlorine Trifluoride	7790-91-2	1000
Chlorodiethylaluminum (also called Diethylaluminum Chloride)	96-10-6	5000
1-Chloro-2, 4-Dinitrobenzene	97-00-7	5000
Chloromethyl Methyl Ether	107-30-2	500
Chloropicrin	76-06-2	500
Chloropicrin and Methyl Bromide mixture	None	1500
Chloropicrin and Methyl Chloride mixture	None	1500
Cumene Hydroperoxide	80-15-9	5000
Cyanogen	460-19-5	2500
Cyanogen Chloride	506-77-4	500
Cyanuric Fluoride	675-14-9	100
Diacetyl Peroxide (concentration >700%)	110-22-5	5000
Diazomethane	334-88-3	500
Dibenzoyl Peroxide	94-36-0	7500
Diborane	19287-45-7	100
Dibutyl Peroxide (Tertiary)	110-05-4	5000
Dichloro Acetylene	7572-29-4	250
Dichlorosilane	4109-96-0	2500
Diethylzinc	557-20-0	10000
Diisopropyl Peroxydicarbonate	105-64-6	7500
Dilaluroyl Peroxide	105-74-8	7500

CHEMICAL NAME	CAS*	TQ**
Dimethy Id ich lorosi lane	75-78-5	1000
Dimethylhydrazine, 1,1	57-14-7	1000
Dimethylamine, Anhydrous	124-40-3	2500
2,4-Dinitroanitine	97-02-9	5000
Ethyl Methyl Ketone Peroxide (also Methyl Ethyl Ketone Peroxide; concentration >60%)	1338-23-4	5000
Ethyl Nitrite	109-95-5	5000
Ethylamine	75-04-7	7500
Ethylene Fluorohydrin	371-62-0	100
Ethylene Oxide	75-21-8	5000
Ethyleneimine	151-56-4	1000
Fluorine	7782-41-4	100
Formaldehyde (Formalin')	50-00-0	1000
Furan	110-00-9	500
Hexafluoroacetone	684-16-2	5000
Hydrochloric Acid, Anhydrous	7647-01-0	5000
Hydrofluoric Acid, Anhydrous	7664-39-3	1000
Hydrogen Bromide	10035-10-6	5000
Hydrogen Chloride	7647-01-0	5000
Hodrogen Cyanide, Anhydrous	74-90-8	1000
Hydrogen Fluoride	7664-39-3	1000
Hydrogen Peroxide (52% by weight or greater	7722-84-1	7500
Hydrogen Selenide	7783-07-5	150
Hydrogen Sulfide	7783=06-4	1500
Hydroxlamine	7803-49-8	2500
Iron, Pentacarbonyl	13463-40-6	250
Isopropylamine	75-31-0	5000
Ketene	463-51-4	100
Methacrylaldehyde	78-85-3	1000

CHEMICAL NAME	CAS*	TQ**
Methacryloyl Chloride	920-46-7	150
Methacryloyloxyethyl Isocyanate	30674-80-7	100
Methyl Acrylonitrile	126-98-7	250
Methylamine, Anhydrous	74-89-5	1000
Methyl Bromide	74-83-9	2500
Methyl Chloride	74-87-3	15000
Methyl Chloroformate	79-22-1	500
Methyl Ethyl Ketone Peroxide (concentration >60%)	1338-23-4	5000
Methyl Fluoroacetate	453-18-9	100
Methyl Fluorosulfate	421-20-5	100
Methyl Hydrazine	60-34-4	100
Methyl Iodide	74-88-4	7500
Methyl Isocyanate	624-83-9	250
Methyl Mercaptan	74-93-1	5000
Methyl Vinyl Ketone	79-84-4	100
Methyltrichlorosilane	75-79-6	500
Nickel Carbonly (Nickel Tetracarbonyl)	13463-39-3	150
Nitric Acid (945% by weight or greater)	7697-37-2	500
Nitric Oxide	10102-43-9	250
Nitroaniline (para Nitroaniline)	100-01-6	5000
Nitromethane	75-52-5	2500
Nitrogen Dioxide	10102-44-0	250
Nitrogen Oxides (NO; NO2; N204; N203)	10102-44-0	250
Nitrogen Tetroxide (also called Nitrogen Peroxide)	10544-72-6	250
Nitrogen Trifluoride	7783-54-2	5000
Nitrogen Trioxide	10544-73-7	250
Oleum (65% to 80% by weight; also called Fuming Sulfuric Acid	8014-94-7	1000

CHEMICAL NAME	CAS*	TQ**
Osmium Tetroxide	20816-12-0	100
Oxygen Difluoride (Fluorine Monoxide)	7783-41-7	100
Ozone	10028-15-6	100
Pentaborane	19624-22-7	100
CHEMICAL name CAS* TQ** Peracetic Acid (concentration >60% Acetic Acid; also called Peroxyacetic Acid)	79-21-0	1000
Perchloric Acid (concentration >60% by weight)	7601-90-3	5000
Perchloromethyl Mercaptan	594-42-3	150
Perchloryl Fluoride	7616-94-6	5000
Peroxyacetic Acid (concentration >60% by Acetic Acid; also called' Paracetic Acid)	79-21-0	1000
Phosgene (also called Carbonyl Chloride)	75-44-5	100
Phosphine (Hydrogen Phosphide)	7803-51-2	100
Phosphorus Oxychloride (also called Phosphoryl Chloride)	10025-87-3	1000
Phosphorus Trichloride	7719-12-2	1000
Phosphoryl Chloride (also called Phosphorus Oxychloride	10025-87-3	1000
Propargyl Bromide	106-96-7	100
Propyl Nitrate	627-3-4	100
Sarin	107-44-8	100
Selenium Hexafluoride	7783-79-1	1000
Stibine (Antimony Hydride)	7803-52-3	500
Sulfur Dioxide (liquid)	7446-09-5	1000
Sulfur Pentafluoride	5714-22-7	250
Sulfur Tetrafluoride	7783-60-0	250
Sulfur Trioxide (also called Sulfuric Anhydride)	7446-11-9	1000
Sulfuric Anhydride (also called Sulfur Trioxide)	7446-11-9	1000
Tellurium Hexafluoride	7783-80-4	250

CHEMICAL NAME	CAS*	TQ**
Tetrafluoroethylene	116-14-3	5000
Tetrafluorohydrazine	10036-47-2	5000
Tetramethyl Lead	75-74-1	1000
Thionyl Chloride	7719-09-7	250
Trichloro (chloromethyl) Silane	1558-25-4	100
Trichloro (dichlorophenyl) Silane	27137-85-5	2500
Trichlorosilane	10025-78-2	5000
Triflurochloroethylene	79-38-9	10000
Trimethyoxysilane	2487-90-3	1500