



PROCESS SAFETY MANAGEMENT PLAN

12 ELEMENTS YOUR ↓

PROCESS SAFETY
MANAGEMENT PLAN

MUST INCLUDE



12 Elements

Your Process Safety Management Plan Must Include

Employees are entitled to safe workplaces. The Clean Air Act Amendments of 1990 required the Occupational Safety and Health Administration (OSHA) to create regulations to protect workers from the risk of incidents involving hazardous chemicals. As a result, OSHA created the Process Safety Management (PSM) standard, which forces facilities that store, process or handle large quantities of hazardous chemicals to define how they will protect employees and the environment from hazards [29 CFR 1910.119].

This PIG Paper will help you determine if you need a PSM plan and outline the 12 required elements that make up a complete plan.

The OSHA PSM standard mainly applies to manufacturing industries — particularly those handling and producing chemicals, transportation equipment and fabricated metal products. Other affected sectors include:

- Natural gas liquids
- Farm product warehousing
- Electric, gas and sanitary services
- Wholesale trade
- Pyrotechnics
- Explosives manufacture
- Contractors working in covered facilities



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OSHA wants to protect every worker from chemical hazards, not just those who work directly with chemicals. The Hazard Communication (HazCom) Standard is a reflection of this and requires all employers to identify and evaluate workplace chemical hazards and to train their employees on those hazards and how to avoid them. There are no lists and no thresholds associated with this standard. The PSM standard shares the same goal as the HazCom Standard, but is not as universally applicable. Facilities that meet at least one of the following criteria are subject to PSM regulations:

- Have a threshold quantity of any of the more than **130 specific toxic and reactive chemicals** listed in the PSM standard
- Have flammable liquids and gases in quantities of 10,000 pounds or more



PSM regulations do NOT apply to:

- Retail facilities
- Oil or gas well drilling or servicing operations
- Normally unoccupied remote facilities
- Hydrocarbon fuels used solely for workplace consumption as a fuel
- Flammable liquids stored in atmospheric tanks kept below normal boiling point

The PSM standard focuses on processing hazardous chemicals safely and preventing unwanted spills and releases that could expose workers to those chemicals. The standard defines a process as “any activity involving a highly hazardous chemical including using, storing, manufacturing, handling or moving such chemicals at the site, or any combination of these activities.”

Like many safety regulations, PSM requires facilities to focus on proactive steps to identify, evaluate, mitigate and prevent chemical releases rather than relying on reactive measures when an incident occurs, as well as emergency planning.



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PSM Plan Requirements

Twelve elements make up a complete PSM plan. These elements document processing steps and establish practices, routines and inspection intervals to remove or minimize the chance of human errors and process failure that could cause chemical releases.

1. Process Safety Information

Facilities with HazCom plans likely have lists of the hazardous chemicals they store and use, as well as the associated Safety Data Sheets that provide basic hazard information. Your HazCom plan is a good place to start gathering process safety information, but you might need more information to satisfy the requirements. You must document the following information for all highly hazardous chemicals:

- Toxicity information
- Safety and health information
- Permissible exposure limit
- Physical, corrosivity and reactivity data
- Thermal and chemical stability data
- Fire and explosion characteristics

You must also identify and evaluate process hazards, equipment and technologies in this section of the plan. Information — including safe operating limits, process chemistry, the consequences of deviating from operating limits, trade secrets and flow diagrams and all applicable design codes and standards — is essential for performing an accurate process hazard analysis (PHA).



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2. Process Hazard Analysis (PHA)

A PHA is a major provision of the PSM standard. It is an organized and systematic method of identifying and evaluating all hazardous processes. A thorough PHA identifies:

- Potential sources of accidental releases
- The hazards the process presents
- Any previous releases that could have had serious health or safety consequences
- The effects or consequences that various types of releases may have on employees and the workplace
- Applicable engineering and administrative controls
- Human factors

The team performing a PHA should have experience with process operations and engineering. At least one member should have knowledge of the processes being evaluated and one member should also be knowledgeable in the specific methods being used to perform the analysis.

The following methods may be used to evaluate each hazardous process:

- **What If** methodology reviews processes from raw materials to completed products. At each processing or handling step, propose “what if” questions.
- **Checklist** methodology allows team members with expertise in a certain process to develop a list of criteria that addresses process hazards, failure, etc. Checklists are especially effective for processes that have been operating safely for many years.
- **What If/Checklist** methodology focuses on combining creative thinking with prepared checklists. This method is very useful as a training tool, because it forces employees to consider potential scenarios that could happen instead of focusing solely on the parameters established on a traditional checklist.
- **Hazard and Operability (HAZOP) studies** are a formal methodology that investigates how operating parameters can deviate from normal operating procedures and cause problems.
- **Failure Mode and Effects Analysis (FMEA)** studies the ways that each component in a process could fail.
- **Fault tree analysis** is either a qualitative or quantitative graphic representation of events that could lead to an incident or undesirable outcome.

Other appropriate or equivalent methodologies are acceptable, but must be justified in the plan. PHAs must be updated and revalidated by a qualified team every five years, with records documenting applicable resolutions and recommendations kept for the life of the process.



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3. Operating Procedures

Written operating procedures describe how daily tasks are performed. This section also documents testing and inspection frequencies and procedures for correcting process abnormalities. Operating procedures must:

- Be technically accurate
- Be clear to employees
- Be consistent with the known hazards of the chemicals in the process
- Include clear and correct operating instructions with process parameters and limitations identified
- Provide practical instructions on how to carry out job duties safely
- Be reviewed periodically to ensure that they reflect current operations
- Be certified annually to verify accuracy

You should explore good engineering practices when establishing and documenting operating procedures. Industry standards and manufacturers specifications are two sources of good engineering practices that can help identify safety and health considerations, properties of hazards, precautions and control measures.



Operating procedures must include steps for various operating phases, including start-up, normal operation, temporary and emergency operations and shutdowns, operating limits with consequences for limit deviations and steps required to correct or avoid deviations.



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4. Non-Routine Work Authorizations

Hot work permits, confined space entry and other non-routine work can affect process safety. Plans need to identify the potential for these types of occurrences so that practices and authorizations can be developed to address non-routine situations that could affect employee safety.

Like standard operating procedures, having a specified plan for non-routine authorizations decreases the likelihood of releases and employee exposure to hazardous chemicals. Because non-routine work often interrupts processes, plans should include clear instruction on how to restore processes after non-routine jobs are completed.



5. Contractors

Operating procedures become routine for employees who use them every day, but they may not be intuitive to others who aren't familiar with a process. Outside contractors are one example of individuals who can unknowingly affect a process. Any outside contractor who repairs, renovates or completes other specialty work on or near processes covered by PSM needs to be aware of potential hazards.

To help safeguard these contractors and onsite employees, you must provide contractors with appropriate hazard information and training. This training must be documented and ensure that individuals who will work in these areas have the appropriate job skills, knowledge and certifications to perform their tasks safely. Incidental services — such as janitorial, laundry or other similar services — that do not affect process safety do not need to have special training.



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6. Pre-Startup Safety Review

Newly installed equipment, modified processes and new raw materials are all variables that can directly affect process safety. PSM plans must include procedures for performing a PHA and a pre-startup safety review every time significant modifications are made or new chemicals are introduced to a process.

Pre-startup safety reviews must confirm that equipment was installed according to design specifications, all of the required procedures are in place, a PHA has been performed and employees are trained on the changes.



7. Mechanical Integrity of Equipment

The adage “if it’s not broken, don’t fix it” doesn’t apply to PSM planning because equipment that breaks down can cause a variety of safety hazards. Installing and operating critical process equipment correctly helps minimize the chance of unexpected breakdowns. Preventative maintenance is also essential. PSM mechanical integrity requirements apply to:

- Pressure vessels and storage tanks
- Piping systems
- Relief and vent systems and devices
- Emergency shutdown systems
- Controls
- Pumps

Maintenance protocols for processing equipment include having written procedures, conducting employee training, performing appropriate inspections and regularly testing equipment to ensure its integrity.



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8. Employee Training

Employees who understand the safety and health hazards of the chemicals and processes they work with are in a better position to take steps to protect themselves and others. Employees must be trained on process hazards. Plans should describe learning goals and objectives, and have a measurable means of gauging whether or not training has been effective.

Training should cover:

- Operating procedures
- Safe work practices that are specific to the processes they will be exposed to
- Emergency evacuation
- Emergency response and shutdown procedures
- Routine and non-routine work authorization activities

Employees must be able to demonstrate proficiency before working with a hazardous process. Training must also take place when there are changes to any process. Refresher training must take place at least every three years.

9. Management of Change

PSM plans must include a way to identify both temporary and permanent changes to existing processes. Changes can include equipment modification or replacement, an adjustment in operating conditions or the introduction of a new raw material. Process changes must be evaluated before implementation to ensure they don't affect employee safety.



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10. Incident Investigation

Incident investigations allow facilities to learn from past mistakes. Any event that caused an injury, large chemical release or near miss is considered an “incident” and must be investigated. When an incident investigation team can identify the cause of an incident, they can take steps to avoid it in the future.

In-house teams investigating incidents should be properly trained, including how to conduct interviews, assemble documentation and write reports. At least one person should also have knowledge of the process. The goal of the team should be to obtain facts, not place blame.

Incident teams must investigate all incidents within 48 hours. The team’s written report should document factors that contributed to the incident, as well as recommendations for changes to prevent the incident from reoccurring. Reports must be kept for five years.



11. Emergency Preparedness, Planning and Response

Performing PHAs and establishing operating procedures for processes involving hazardous chemicals will help minimize the chance of unintentional spills. Being prepared for emergencies and incidental chemical releases is an additional line of defense. An Emergency Action Plan (EAP), designed in accordance with 29 CFR 1910.38, is a required PSM planning element that outlines the procedures and actions to take when there is a chemical release.

Facility planners need to determine what specific actions they want employees to take when there is an unexpected chemical release.

At the very minimum, an EAP must document emergency evacuation routes, describe how to use alarms and how all employees — including employees with physical limitations — will evacuate to a safe zone.

The EAP must document steps for employees who will aid in spill response. Pre-planning response actions, training and regular drills will help employees prepare for releases and spill response.

Response plans need to address both incidental and emergency releases. Incidental releases are small spills that do not pose a significant risk to the responder or an immediate threat to worker safety and the environment. In most instances, responding to incidental spills does not require specialized training and procedures can be incorporated into general operating directives.

Employees who will respond to emergency releases that pose an immediate risk to human life or the environment may need to be trained to an appropriate skill level under OSHA’s Hazardous Waste Operations and Emergency Response Standard [29 CFR 1910.120]. If outside response is needed, such as a county hazmat team or an independent spill response contractor, mutual aid agreements should be established in advance and included in the EAP.





12. Compliance Audits

It's important to audit or review processes, training and other plan elements to ensure that they are still adequate, accurate and in compliance with the standard.

An experienced, knowledgeable team must perform audits and include a review of the documentation in the plan, an inspection of the physical process and interviews with personnel involved in the process. Team members must be able to document non-compliances and make recommendations for implementing any corrective actions.

The PSM standard requires an audit at least once every three years. You must keep the two most recent audit reports on file with the PSM plan.

Planning for Every Day

Identifying hazardous processes, having procedures in place to maintain safe operations and being prepared for spills won't guarantee that an incident will never happen. A well-designed PSM plan that includes all of the required elements can greatly minimize the chances of large-scale incidents and help improve employee health and safety at your facility.



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