



Introduction to Process Safety Management (PSM)

The major purpose of process safety management (PSM) of highly hazardous chemicals is to prevent unwanted release of hazardous chemicals, especially into locations that could expose employees and others to serious hazards. This course is intended to introduce students to the basic requirements in the PSM standard, the need for process safety, and the tools used to implement process safety management systems. It covers the 14 elements required by the standard and some of the tools used to address process safety requirements, identify hazards, and manage risks.

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OSHAcademy Course 736 Study Guide

Introduction to Process Safety Management

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 736.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Course Introduction

The purpose for Process Safety Management (PSM)

The major purpose of process safety management (PSM) of highly hazardous chemicals is to prevent unwanted releases of hazardous chemicals, especially into locations that could expose employees and others to serious hazards. OSHA simply states a hazardous chemical is any chemical which is a physical hazard or a health hazard.



An effective process safety management program requires a systematic approach to evaluating the whole chemical process. Using this approach, the process design, process technology, process changes, operational and maintenance activities and procedures, non-routine activities and procedures, emergency preparedness plans and procedures, training programs, and other elements that affect the process are all considered in the evaluation.

This course is intended to introduce you to the basic requirements in OSHA standard CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, the need for process safety, and the tools used to implement process safety management systems. It covers the 14 elements required by the standard and some of the tools used to address process safety requirements, identify hazards, and manage risks. This course does not itself alter or determine compliance responsibilities, which are set forth in OSHA standards themselves and the Occupational Safety and Health Act.

Special thanks go out to the U.S. Dept. of Labor, OSHA, for the content and images within this course.

Module 1: Why We Have Process Safety Management

The Problem

Unexpected releases of toxic, reactive, or flammable liquids and gases in processes involving highly hazardous chemicals have been reported for many years. Incidents continue to occur in various industries that use highly hazardous chemicals which may be toxic, reactive, flammable, or explosive, or may exhibit a combination of these properties.

Regardless of the industry that uses these highly hazardous chemicals, there is a potential for an accidental release any time they are not properly controlled. This, in turn, creates the possibility of disaster.

Recent major disasters include:

- The 1984 Bhopal, India, incident resulting in more than 2,800 deaths.
- The October 1989 Phillips Petroleum Company, Pasadena, TX, incident resulting in 23 deaths and 132 injuries.
- The December 2005 Texas City Refinery explosion with 100 employees injured and 15 confirmed dead.
- The February 2010 Connecticut power plant explosion which resulted in 27 injuries and five deaths.
- The August 26, 2012 Amuay Oil Refinery explosion in Venezuela that wounded dozens and killed at least 39 people, including one child.

Quiz Instructions

Read the material in each section to discover the correct answer to questions. Circle the correct answer. When you're finished go online to take the final exam. This exam is open book, so you can use this study guide.

1. Which of the following industrial disasters was considered historically the worst of all time?

- a. Amuay Refinery, 2012
- b. 1984 Bhopal, India
- c. Texas City Refinery, 2005
- d. Connecticut Power Plant, 2010

A Disastrous Record

Several major disasters involving highly hazardous chemicals drew international attention to the potential for major catastrophes; the public record in the U.S. is replete with information concerning many other less notable releases of highly hazardous chemicals.

Hazardous chemical releases continue to pose a significant threat to employees and provide impetus, internationally and nationally, for authorities to develop or consider developing legislation and regulations to eliminate or minimize the potential for such events.

2. What caused an interest in developing OSHA's process safety management regulations?

- a. Food industry spills of hazardous substances
- b. Disasters involving unexpected releases of hazardous chemicals
- c. Public employee union demands for improved safety
- d. Disclosure of public records involving illegal use of chemicals

Methyl Isocyanate Tank Rupture and Release

Bhopal, India – Dec. 2-3, 1984

On the night of December 2-3, 1984, a sudden release of about 30 metric tons of methyl isocyanate (MIC) occurred at the Union Carbide pesticide plant at Bhopal, India. The accident was a result of poor safety management practices, poor early warning systems, and the lack of community preparedness. The accident led to the death of over 2,800 people (other estimates put the immediate death toll as high as 8000) living in the vicinity and caused respiratory damage and eye damage to over 20,000 others. At least 200,000 people fled Bhopal during the week after the accident. Estimates of the damage vary widely between \$350 million to as high as \$3 billion.

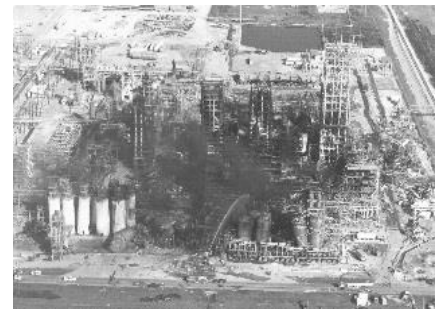
See the Chemical Safety Board video: [Reflections on Bhopal After Thirty Years.](#)

3. What would have prevented the Bhopal, India tragedy?

- a. Common sense by employees
- b. Responsible process safety management
- c. More money to compensate for low pay
- d. More technical employee training

Phillips 66 Houston Chemical Complex Pasadena, Texas – Oct. 23, 1989

On October 23, 1989, at approximately 1:00 p.m., an explosion and fire ripped through the Phillips 66 Company Houston Chemical Complex in Pasadena, Texas. Twenty-three workers were killed and more than 314 were injured. Property damage was nearly three-quarters of a billion dollars.



The accident resulted from a release of extremely flammable process gases that occurred during regular maintenance operations on one of the plant's polyethylene reactors. The evidence showed that more than 85,000 pounds of highly flammable gases were released through an open valve. A vapor cloud formed and traveled rapidly through the polyethylene plant. Within 90 to 120 seconds, the vapor cloud came into contact with an ignition source and exploded with the force of 2.4 tons of TNT. The conflagration, which is a large and destructive fire, took 10 hours to be controlled.

OSHA determined that a lack of process hazard analysis (PHA), inadequate standard operating procedures (SOPs), inadequate lockout/tagout procedures were major contributing root-cause system weaknesses for the tragedy. OSHA issued 566 willful and 9 serious violations with a proposed penalty of over \$5.6 million. Ultimately, after a settlement, Phillips Petroleum Company paid \$4 million in fines and instituted process safety management procedures at a number of its sister facilities.

See the short video: [1989 Pasadena TX Explosion video](#).

4. OSHA concluded that the major causes for the Phillips 66 1989 Texas plant explosion were due to ____.

- e. uncontrollable "acts of God" causes
- f. poor employee communications
- g. the fault of top executives
- h. system weaknesses

OSHA Responds

On July 17, 1990, the U.S. Dept. of Labor, OSHA published in the Federal Register a proposed standard, -" Process Safety Management of Highly Hazardous Chemicals" (PSM) - containing requirements for the management of hazards associated with processes using highly hazardous chemicals to help assure safe and healthful workplaces.

OSHA's proposed PSM standard emphasized the management of hazards associated with highly hazardous chemicals and established a comprehensive management program that integrated technologies, procedures, and management practices.

Since the standard's publication, OSHA has published numerous [Letters of Interpretation](#) in response to public inquiries or field office inquiries regarding how some aspect of or terminology in an OSHA standard or regulation is to be interpreted and enforced by the Agency.

5. OSHA's Process Safety Management standard emphasizes the management of hazards associated with ____.

- a. uncontrollable releases of hazardous chemicals
- b. highly hazardous chemicals
- c. problematic hazardous chemical equipment
- d. safety processes within the energy industry

The Clean Air Act Amendments and the PSM Standard

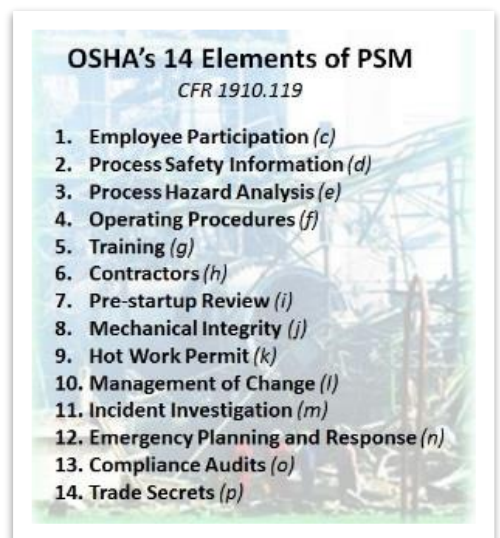
Shortly after the publication of OSHA's proposed PSM standard, Congress enacted the Clean Air Act Amendments (CAAA) which contained revisions to the Clean Air Act of 1990.

Section 304 of the CAAA requires that the Secretary of Labor, in coordination with the Administrator of the Environmental Protection Agency (EPA), promulgate a PSM standard to prevent accidental releases of chemicals that could pose a threat to employees.

The CAAA also requires that the PSM standard include a list of highly hazardous chemicals which includes toxic, flammable, highly reactive, and explosive substances.

CAAA Requirements for the PSM Standard

The CAAA requires that the standard include a list of highly hazardous chemicals which includes toxic, flammable, highly reactive, and explosive substances. These requirements have become widely known as the “**14 PSM Program Elements.**”



6. The Clean Air Acts Amendment (CAAA) requires that the PSM standard include ____.

- a. 14 PSM Program Elements
- b. a prioritized list of chemicals
- c. comprehensive list of all chemicals
- d. list of exception of exempted chemicals

OSHA's PSM Standard

The final PSM standard was promulgated in 1992 and requires the employer to incorporate each of the 14 key elements in a formal PSM program. The key provision of final PSM standard is process hazard analysis (PHA)—a careful review of what could go wrong and what safeguards must be implemented to prevent releases of hazardous chemicals. Employers must identify those processes that pose the greatest risks and begin evaluating those first.

PSM clarifies the responsibilities of employers and contractors involved in work that affects or takes place near hazardous processes to ensure that the safety of both plant and contractor employees is considered.

The standard also mandates written operating procedures; employee training; pre-startup safety reviews; evaluation of mechanical integrity of critical equipment; and written procedures for managing change. PSM specifies a permit system for hot work; investigation of incidents involving releases or near misses of covered chemicals; emergency, action plans; compliance audits at least every three years; and trade secret protection.

PSM clarifies the responsibilities of employers and contractors involved in work that affects or takes place near hazardous processes to ensure that the safety of both plant and contractor employees is considered.

The 14 PSM Key Elements

1. **Employee participation 1910.119(c).** The employer must develop a written plan of action implementing employee participation. Employers must consult with employees and their representatives on the conduct and development of process hazards analyses and on the development of the other elements of process safety management in this standard.
2. **Process safety information 1910.119(d).** The employer must compile written process safety information before conducting any process hazard analysis required by the standard. Process safety information must include information on the hazards of the highly hazardous chemicals used or produced by the process, information on the technology of the process, and information on the equipment in the process.
3. **Process hazard analysis. 1910.119(e).** The employer must perform an initial process hazard analysis appropriate to the complexity of the process and identify, evaluate, and control the process hazards.
4. **Operating procedures 1910.119(f).** The employer must develop and implement written operating procedures that provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information.
5. **Training 1910.119(g).** Each new and current employee involved in operating a process must be trained in an overview of the process and in the operating procedures. The training must include emphasis on the specific safety and health hazards, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks.
6. **Contractors 1910.119(h).** Employers, when selecting contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process must obtain and evaluate information regarding the contract employer's safety performance and programs.
7. **Pre-startup review 1910.119(i).** The employer must perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information.

8. **Mechanical integrity 1910.119(j).** The employer must establish and implement written procedures to maintain the on-going integrity of process equipment.
9. **Hot work permit 1910.119(k).** The employer must issue a hot work permit for hot work operations conducted on or near a covered process.
10. **Management of change 1910.119(l).** The employer must establish and implement written procedures to manage changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures; and, changes to facilities that affect a covered process.
11. **Incident Investigation 1910.119(m).** The employer must investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.
12. **Emergency planning and response 1910.119(n).** The employer must establish and implement an emergency action plan for the entire plant. 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, Hazardous waste operations and emergency response](#).
13. **Compliance audits 1910.119(o).** Employers must certify that they have evaluated compliance with OSHA 1910.119 at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.
14. **Trade secrets 1910.119(p).** Employers must make all information necessary to comply with the standard available to those persons responsible for compiling the process safety information, those assisting in the development of the process hazard analysis, those responsible for developing the operating procedures, and those involved in incident investigations, emergency planning and response, and compliance audits without regard to possible trade secret status of such information.

We will review each of the 14 Elements contained within the PSM standard throughout the remaining modules in this course.

7. The key provision of CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, is ____.

- a. to emphasize the management of hazards
- b. to clarify management responsibilities
- c. integrating technologies
- d. the process hazard analysis (PHA)

What are the benefits of an effective PSM program?

Effective PSM helps ensure the proper development of plant systems and procedures to prevent unwanted releases which may ignite and cause toxic impacts, local fires, or explosions in plants and installations.

PSM can also improve:

- the operability, productivity, stability, and quality of the outputs of hazardous chemical processes; and
- the design and specification of safeguards against undesirable events.

Tangible benefits. Effective PSM results in tangible benefits such as fewer hazards and reduced OSHA citations, lawsuits, liability claims, and workers' compensation insurance premiums.

Intangible benefits. Intangible benefits include higher employee morale, increased trust between labor and management, and an improved relation with the local community as a responsible corporate citizen.

8. Which of the following is a tangible benefit of an effective PSM program?

- a. Improved corporate citizenship
- b. Higher employee morale
- c. Reduced OSHA citations
- d. Increased employee-employer trust

Module 2: How the PSM Standard Applies

Application

The PSM standard mainly applies to manufacturing industries—particularly, those pertaining to chemicals, transportation equipment, and fabricated metal products. Other affected sectors include natural gas liquids; farm product warehousing; electric, gas, and sanitary services; and wholesale trade. It also applies to pyrotechnics and explosives manufacturers covered under other OSHA rules and has special provisions for contractors working in covered facilities.

The various lines of defense incorporated into the design and operation of the PSM process should be evaluated and strengthened to make sure they are effective at each level. Process safety management is the proactive identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in processes, procedures, or equipment.

What is a “Process?”

To understand PSM and its requirements, employers and employees need to understand how OSHA uses the term “process” in PSM.

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

For purposes of this definition, any group of vessels that are interconnected, and separate vessels located in a way that could involve a highly hazardous chemical in a potential release, are considered a single process.

1. Process safety management is the ____ identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in processes, procedures, or equipment.

- a. preventive – proactive
- b. reactive – corrective
- c. aggressive - short-term
- d. random - regular

What industries does PSM target?

The process safety management standard targets highly hazardous chemicals that have the potential to cause a catastrophic incident.

OSHA's standard applies mainly to manufacturing industries—particularly those pertaining to chemicals, transportation equipment, and fabricated metal products. Other affected sectors include those involved with:

- natural gas liquids
- farm product warehousing
- food processing
- electric, gas, and sanitary services
- wholesale trade
- pyrotechnics and explosives manufacturers

It has special provisions for contractors working in covered facilities.

What does the employer need to develop?

To control these types of hazards, employers need to develop the necessary expertise, experience, judgment, and initiative within their work force to properly implement and maintain an effective process safety management program as envisioned in the OSHA PSM standard.

2. The process safety management standard targets highly hazardous chemicals that have the potential to cause a _____ incident.

- a. fatal
- b. dangerous
- c. catastrophic
- d. planned

PSM Impact

OSHA believes that the PSM requirements has a definite positive effect on the safety of employees and offers other potential benefits to employers, such as increased productivity.

How to Reduce Risk

Employers, including small employers, may establish more efficient inventory control by reducing, to below the established threshold, the quantities of highly hazardous chemicals onsite. This reduction can be accomplished by ordering smaller shipments and maintaining the minimum inventory necessary for efficient and safe operation.

When reduced inventory is not feasible, the employer might consider dispersing inventory to several locations onsite. Dispersing storage into locations so that a release in one location will not cause a release in another location is also a practical way to reduce the risk or potential for catastrophic incidents.

3. Employers may establish more efficient inventory control by reducing the quantities of highly hazardous chemicals to below the ____.

- a. minimum HAZCOM levels
- b. maximum HAZCOM levels
- c. the detectable threshold
- d. the established threshold

Who is not covered by the PSM Standard?

The PSM standard does 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 (e.g. propane used for comfort heating, gasoline for vehicle refueling), if such fuels are not a part of a process containing another highly hazardous chemical covered by this standard

- flammable liquid stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigerating and are not connected to a process

4. The PSM standard does NOT apply to ____.

- a. chemical manufacturing facilities
- b. normally unoccupied remote facilities
- c. farm product warehouse facilities
- d. pyrotechnics manufacturing facilities

**BP American Refinery Explosion – Texas City, Texas
(March 23, 2005)**

At approximately 1:20 p.m. on March 23, 2005, a series of explosions occurred at the BP Texas City refinery during the restarting of a hydrocarbon isomerization unit. Fifteen workers were killed, and 180 others were injured. Many of the victims were in or around work trailers located near an atmospheric vent stack. The explosions occurred when a distillation tower flooded with hydrocarbons and was over pressurized, causing a geyser-like release from the vent stack.



5. A major causal finding by CSB investigators of the BP American Refinery explosion was that BP and similar companies ____.

- a. do not use the data from performance indicators
- b. give lagging indicator data less importance
- c. focus on lagging indicator data
- d. emphasize leading indicator data

Module 3: The PSM 14 Elements

Process Safety Information

Employers must compile written process safety information before conducting any process hazard analysis required by the standard. The written process safety information will help the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes that involve highly hazardous chemicals.

To develop an effective PSM program and Process Hazard Analysis (PHA), it is important to develop and maintain complete and accurate written information on each of the following:

1. process chemicals,
2. process technology
3. process equipment

This information will be used by:

- the team performing the process hazard analysis;
- those developing the training programs and the operating procedures
- contractors whose employees will be working with the process
- those conducting the pre-startup reviews
- local emergency preparedness planners and insurance and enforcement officials

1. To help identify and understand process hazards, employers must first compile written

_____.

- a. OSHA permits and authorizations
- b. safety inspection results
- c. process safety information
- d. hazard communication lists

Hazards of the Chemicals Used in the Process

The information about the chemicals, including process intermediates, needs to be comprehensive and accurate. Information on the hazards of the highly hazardous chemicals in the process shall consist of at least the following:

- toxicity
- permissible exposure limits
- physical data
- reactivity data
- corrosivity data
- thermal and chemical stability data
- the hazardous effects of inadvertent mixing of different materials

Current safety data sheets (SDS) can be used to help gather information about hazardous chemicals, but it must be supplemented with process chemistry information, including runaway reaction and over-pressure hazards, if applicable.

2. Which document can be used to help gather process safety information about hazardous chemicals?

- a. Safety Data Sheets (SDS)
- b. Accident investigation reports
- c. Process hazard analysis results
- d. Operating procedures

Technology of the Process

Process technology information is a part of the process safety information package and should include employer-established criteria for:

- maximum inventory levels for process chemicals;
- limits beyond which would be considered upset conditions; and

- a qualitative estimate of the consequences or results of deviation that could occur if operating beyond the established process limits.

Information on the technology of the process 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
- an evaluation of the consequences of deviations, including those affecting the safety and health of employees

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

Note: Safety Data Sheets (SDSs) 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.

3. Safe upper and lower limits for such items as temperatures and pressures are required information on the _____ of a process.

- a. consequences
- b. safety
- c. sequence
- d. technology

Types of Process Flow Diagrams

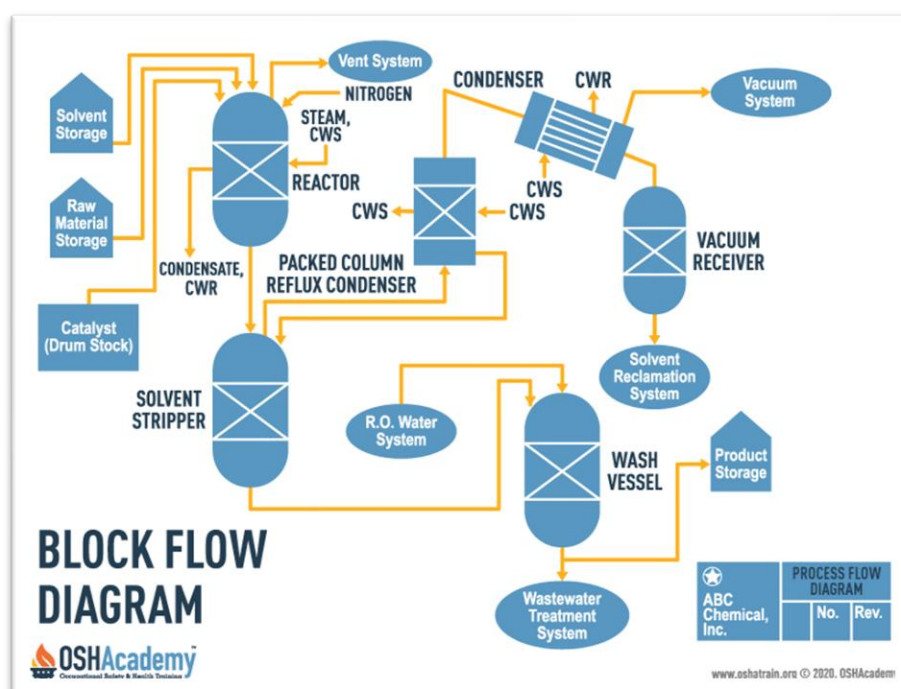
There are different types of diagrams that describe the flow of a process to help employees understand the process in chemical industry or any other industry. Each type of diagram provides specific details of the production process.

Block Flow Diagrams

A block flow diagram can be used to show the major process equipment and interconnecting process flow lines and flow rates, stream composition, temperatures, and pressures when necessary for clarity.

- A block flow diagram may show the more important operating parameters, such as flow rates and temperature.
- The process flow consists of chemical process equipment shown as rectangles and squares and the process flow described with arrows.
- Block flow diagrams do not include pipes, valve, interlock, etc., but only the flow of the process through equipment.

See the sample block flow diagram below:



4. Which type of diagram shows only the flow of the process through equipment?

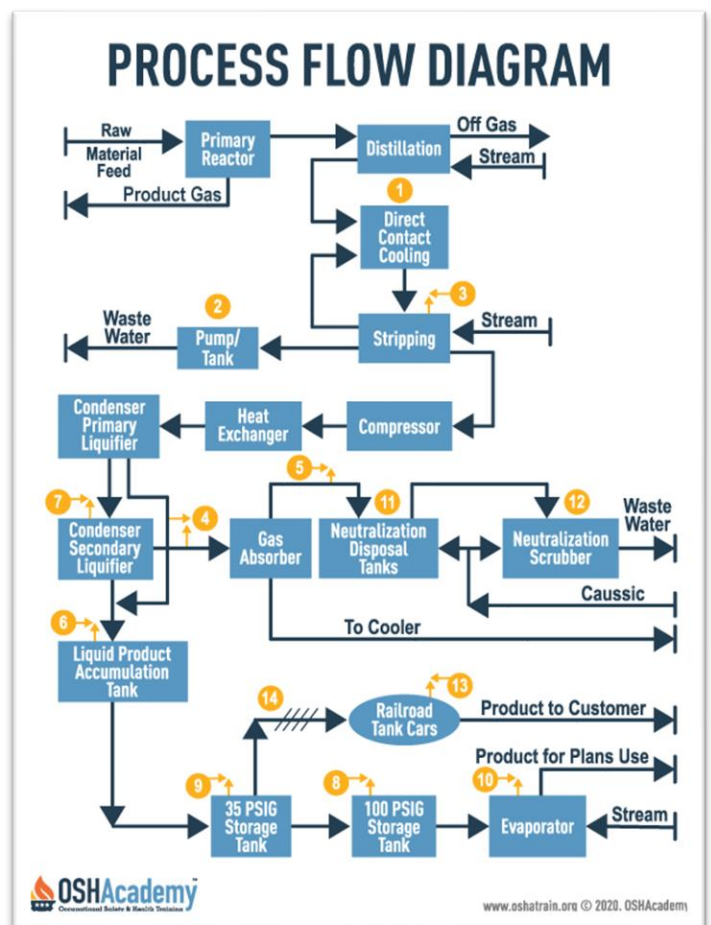
- Block flow diagram (BFD)
- Process flow diagram (PFD)
- Pareto chart (PC)
- Piping and instrument diagram (PID)

Process Flow Diagrams

PFDs, also called process flow charts, are a step up from the BFD in the amount of information and data it contains. The PFD contains most of the data necessary for the design of a process. They show all main flow streams including valves to help understand the process as well as pressures and temperatures on all feed and product lines within all major vessels and in and out of headers and heat exchangers, and points of pressure and temperature control.

- Information on construction materials, pump capacities and pressure heads, compressor horsepower, and vessel design pressures and temperatures are shown when necessary for clarity.
- Process flow diagrams usually show major components of control loops along with key utilities.

For more information on process flow diagrams see: The Engineering ToolBox.



5. Which type of diagram is more complex and shows main flow streams, valves, pressures, and temperatures within vessels?

- a. Block flow diagram (BFD)
- b. Process flow diagram (PFD)
- c. Pareto chart (PC)
- d. Piping and instrument diagram (PID)

Equipment in the Process

Piping and instrument diagrams (P&IDs) may be used to describe the relationships between equipment and instrumentation as well as other relevant information that will enhance clarity.

Computer software programs that create P&IDs or other diagrams useful to the information package may be used to help meet this requirement.

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
- safety systems (e.g., interlocks, detection, or suppression systems)

6. Which of the following tools may be used to describe the relationships between equipment and instrumentation as well as other relevant information to enhance clarity?

- a. Block flow diagram (BFD)
- b. Process flow diagram (PFD)
- c. Pareto chart (PC)
- d. Piping and instrument diagram (PID)

Equipment in the Process

The employer must document that equipment complies with recognized and generally accepted good engineering practices.

For existing equipment designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer must determine and document that the equipment is designed, maintained, inspected, tested, and operated in a safe manner.

Compiling and maintaining this information is important to:

- to provide the basis for identifying and understanding the hazards of a process
- to develop the process hazard analysis
- comply with other provisions of PSM such as management of change and incident investigations

For existing equipment designed and constructed many years ago, the employer must:

- document which codes and standards were used
- certify the design and construction along with the testing, inspection, and operation are still suitable for the intended use

Where the process technology requires a design that departs from the applicable codes and standards, the employer must document that the design and construction are suitable for the intended purpose.

7. When process technology requires a design that departs from the applicable codes and standards, the employer must ____.

- a. document suitability for the intended purpose
- b. state that the technology complies with CAAA
- c. document the technology has been approved by OSHA
- d. obtain the related permits for installation

Module 4: Process Hazard Analysis (PHA)

What is a PHA?

A PHA is required by OSHA for any industrial process that makes use of hazardous chemicals. It identifies and analyzes data to provide information that will assist employers and employees in making decisions for improving safety and reducing the consequences of unwanted or unplanned releases of hazardous chemicals. Its purpose is to identify the significance of scenarios that could result in fires, explosions, chemical spills and the release of toxic fumes or chemicals.

- It analyzes potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals, and major spills of hazardous chemicals.
- It focuses on equipment, instrumentation, utilities, human actions (routine and non-routine), and external factors that might affect the process.

1. A _____ is an organized and systematic process to identify and analyze the significance of potential hazards when handling hazardous chemicals.

- a. Job Hazard Analysis (JHA)
- b. Process Hazard Analysis (PHA)
- c. Change Analysis (CA)
- d. Potential Hazard Analysis (PHA)

Steps in the PHA Process

The employer must perform an initial PHA on all processes involving [highly hazardous chemicals covered by the PSM standard](#). Use the following steps in conducting the PHA process:

1. set a priority order for analyses;
2. conduct analyses according to a required schedule;
3. use an appropriate method to determine and evaluate process hazards;
4. address process hazards, previous incidents with catastrophic potential, engineering and administrative controls applicable to the hazards, consequences of failure of controls,

facility siting, human factors, and a qualitative evaluation of possible safety and health effects of failure of controls on employees;

5. perform the PHA using a team with expertise in:
 - engineering and process operations,
 - the process being evaluated, and
 - the PHA methods used;
6. establish formal procedures to: promptly address findings and recommendations, assure recommendations are resolved and documented, document actions taken, schedule for completing actions, and communicate actions taken to affected employees;
7. update and revalidate PHAs at least every 5 years; and
8. retain PHAs and updates for the life of the process.

2. PHA team members should have expertise in ____.

- a. safety management systems
- b. the OSHA 191.119 standard
- c. engineering and process operations
- d. job hazard analysis and planning

Prioritizing PHAs

First, employers must determine and document the priority order for conducting process hazard analyses. Priority should be given to processes with the potential of adversely affecting the largest number of employees. Other considerations include:

- the extent of the process hazards;
- the number of potentially affected employees;
- the age of the process; and
- the operating history of the process.

Together, these factors would suggest a ranking order using either a weighting factor system or a systematic ranking method.

The use of a preliminary hazard analysis will assist an employer in determining which process should be of the highest priority for hazard analysis resulting in the greatest improvement in safety at the facility occurring first.

3. PHA priority should be given first to processes ____.

- a. that are most complex
- b. that affect the most employees
- c. with the highest cost
- d. with the least complexity

Methods for Conducting the PHA

The employer must use one or more of the following methods, as appropriate, to determine and evaluate the hazards of the process being analyzed:

- what-if
- checklist
- what-if/checklist
- hazard and operability study (HAZOP)
- failure mode and effects analysis (FMEA)
- fault tree analysis
- an appropriate equivalent method

Different methods for various parts of the process may be used. For example, a process involving a series of unit operations of varying sizes, complexities, and ages may use different methods and team members for each operation. Then the conclusions can be integrated into one final study and evaluation.

An expanded discussion of these methods of analysis is contained in [OSHA Publication 3133, Process Safety Management Guidelines for Compliance](#).

4. Which PHA method is a systematic study of component failures using a diagram of an operation?

- a. What-if Study
- b. Hazard and Operability Study (HAZOP)
- c. Fault Tree Analysis
- d. Failure mode and Effects Analysis (FMEA)

Deciding Methods to Use in a PHA

The process hazard analysis method selected must be appropriate to the complexity of the process and must identify, evaluate, and control the hazards involved in the process.

The selection will be influenced by many factors including how much is known about the process.

- Is it a process that has been operated for a long period of time with little or no innovation and extensive experience has been generated with its use?
- Is it a new process or one that has been changed frequently by the inclusion of innovation features?

Also, the size and complexity of the process will influence the decision as to the appropriate PHA method to use.

It's appropriate to use different methods and team members for various parts of the process. The conclusions of the different methods and teams can be integrated into one final study and evaluation.

5. The process hazard analysis method selected must be appropriate to the ____.

- a. expertise required by the process
- b. complexity of the process
- c. number of steps in the process
- d. duration of the process

Minimum PHA Method Requirements

No matter which PHA method you use, it must meet the following minimum requirements to be effective. Each method must:

- address the hazards of the process;
- identify any previous incident that had a potential for catastrophic consequences in the workplace;
- determine engineering and administrative controls applicable to the hazards and their interrelationships, such as appropriate application of detection methods to provide early warning of releases (acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors);
- identify the consequences of failure of engineering and administrative controls;
- address facility siting;
- address human factors; and
- conduct a qualitative evaluation of a range of the possible safety and health effects on employees in the workplace if there is a failure of controls.

6. It is a minimum requirement for the PHA to identify any previous incident that ____.

- a. resulted in an injury or illness
- b. had a potential for catastrophic consequences
- c. could have resulted in serious injuries
- d. caused property damage and/or injuries

The PHA Team

OSHA believes that the process hazard analysis is best performed by a team with expertise in engineering and process operations. The team conducting the PHA needs to understand the method that is going to be used. The PHA team should include:

- at least one employee who has experience with and knowledge of the process being evaluated; and
- one member (preferably the team leader) knowledgeable in the specific PSM analysis methods and proper implementation of methods being used in the evaluation.

Team Expertise

- Process technology
- Process design
- Operating procedures and practices
- Alarms
- Emergency procedures
- Instrumentation
- Maintenance procedures
- Routine and non-routine tasks
- How tasks are authorized
- Procurement of parts and supplies
- Safety and health
- Any other relevant subjects

The ideal team will have an intimate knowledge of the standards, codes, specifications, and regulations applicable to the process being studied. The selected team members need to be compatible and the team leader needs to be able to manage the team and the PHA study.

The team needs to be able to work together while benefiting from the expertise of others on the team or outside the team to resolve issues and to forge a consensus on the findings of the study and recommendations.

7. One member of the PHA team (preferably the team leader) should be knowledgeable in _____.

- a. elimination, substitution, and engineering controls
- b. the basic principles of management
- c. specific PSM analysis methods
- d. occupational safety and health

Employer Response to PHA Team Findings

In response to the PHA Team's findings and recommendations, the employer must establish a system to:

- address promptly the team's findings and recommendations
- ensure that the recommendations are resolved in a timely manner and that the resolutions are documented;
- document what actions are to be taken;
- develop a written schedule of when these actions are to be completed;
- complete actions as soon as possible; and
- communicate the actions to operating, maintenance, and other affected employees.

8. In response to the PHA team's findings and recommendations, the employer must _____.

- a. complete actions within six months
- b. reach consensus on actions to be taken
- c. communicate actions to all affected employees
- d. submit recommendations for OSHA approval within 30 days

Review and Revalidation

At least every five years after the completion of the initial process hazard analysis, the process hazard analysis must be updated and revalidated by a team meeting the standard's requirements to ensure that the hazard analysis is consistent with the current process.

Employers must keep on file and make available to OSHA, upon request, process hazard analyses and updates or revalidation for each process covered by the PSM standard, as well as the documented resolution of recommendations, for the life of the process.

9. The employer's PHA update and revalidation documents must be ____.

- a. reviewed at least every 2 years
- b. completed annually and as needed thereafter
- c. reviewed as needed or requested by OSHA
- d. kept on file for the life of the process

Module 5: Operating Procedures

Employer Requirements

The employer must develop and implement written operating procedures that provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information.

For example, operating procedures that address parameters will include instructions about:

- pressure limits,
- temperature ranges,
- flow rates, what to do when an upset condition occurs, and
- what alarms and instruments are pertinent if an upset condition occurs.

Another example of using operating instructions to properly implement operating procedures for process start-up and shut down. Different parameters will be required from those of normal operation. In this example, operating instructions need to:

- clearly indicate the distinctions between startup and normal operations, such as the appropriate allowances for heating up a unit to reach the normal operating parameters.
- describe the proper method for increasing the temperature of the unit until the normal operating temperatures are reached.

1. Which of the following Process Safety Management (PSM) program elements provides specific instructions on the steps to take in a process?

- a. Process hazard analysis
- b. Operating procedures
- c. Mechanical integrity
- d. Management of change

Operating Procedure Elements

The procedures must address at least the following elements:

Elements of the Operating Procedures

The procedures must address at least the following elements:

1. Steps for each operating phase:

- initial startup
- normal operations
- temporary operations
- emergency shutdown, including the conditions under which emergency shutdown is required, and the assignment of shut down responsibility to qualified operators to ensure emergency shutdown is executed in a safe and timely manner
- emergency operations
- normal shutdown
- startup following a turnaround, or after an emergency shut down

2. Operating limits:

- consequences of deviation
- steps required to correct or avoid deviation

3. Safety and health considerations:

- properties of, and hazards presented by, the chemicals used in the process
- precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment
- control measures to be taken if physical contact or airborne exposure occurs
- quality control for raw materials and control of hazardous chemical inventory levels

- any special or unique hazards
- safety systems (e.g., interlocks, detection or suppression systems) and their functions

2. Which of the following should be addressed when determining operating limits?

- a. Emergency shutdown procedures
- b. Steps required to correct or avoid deviation
- c. Quality control of raw materials
- d. Properties and hazards presented by chemicals

Operating Procedure Requirements

PSM operating procedures should describe:

- tasks to be performed,
- data to be recorded,
- operating conditions to be maintained,
- samples to be collected, and
- safety and health precautions to be taken.

The procedures need to be technically accurate, understandable to employees, and revised periodically to ensure that they reflect current operations.

The process safety information package helps to ensure that the operating procedures and practices are consistent with the known hazards of the chemicals in the process and that the operating parameters are correct.

Operating procedures should be reviewed by engineering staff and operating personnel to ensure their accuracy and that they provide practical instructions on how to actually carry out job duties safely. OSHA believes that tasks and procedures related to the process must be appropriate, clear, consistent, and most importantly, well communicated to employees.

3. According to OSHA, the most important requirement for process tasks and procedures is that they should be ____.

- a. appropriate
- b. clear
- c. well communicated
- d. consistent

Operating Procedures Review

Operating procedures should be reviewed and updated as changes occur to ensure that they reflect current operating practices, including changes in process chemicals, technology, and equipment, and facilities. They should be reviewed by engineering staff and operating personnel to ensure their accuracy and that they provide practical instructions on how to actually carry out job duties safely.

The employer must develop and implement safe work practices to provide for the control of hazards during work activities such as:

- 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.

Safe work practices must apply to both employer and contractor employees. They must be readily accessible to employees who work in or maintain a process:

- to make sure that a ready and up-to-date reference is available, and
- to form a foundation for needed employee training.

4. How often should operating procedures be reviewed and updated to ensure they reflect current operating practices?

- a. As changes occur
- b. At least monthly
- c. Quarterly or more often
- d. Annually prior to deployment

Module 6: Employee Participation and Training

Employers duty to involve employees

Employers must develop a written plan of action to implement and ensure employee participation required by PSM.

Under PSM, employers must consult with employees and their representatives on the:

- conduct and development of process hazard analyses and
- development of the other elements of process management.

They must provide to employees and their representatives access to process hazard analyses and to all other information required to be developed by the standard.

1. According to the PSM standard, employers must consult with employees and their representatives on which of the following?

- a. Conduct and development of process hazard analyses
- b. Development of accident and incident investigations
- c. Results of process hazard initial testing
- d. Results of OSHA complaint inspections

Initial Training

The implementation of an effective training program is one of the most important steps that an employer can take to enhance employee safety.

Accordingly, 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
- in its operating procedures

The training must include:

- emphasis on 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 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 (KSA's) to safely carry out the duties and responsibilities specified in the operating procedures.

2. Employees already involved in operating a process do NOT have to attend initial PSM training on the process if ____.

- a. the employer will assume responsibility for each employee's performance
- b. employees have passed an oral exam given by the employer
- c. the employer can certify in writing that they have necessary KSAs
- d. employees have had at least one year experience on the process

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 operating procedures of the process.

The employer, in consultation with the employees involved in operating the process, must determine the appropriate frequency of refresher training.

3. PSM refresher training must be provided ____.

- a. every two years or less
- b. every three years or as necessary
- c. every four years
- d. annually or more often

Training Documentation

The employer must determine whether each employee operating a process has received and understood the training required by PSM.

A record must be kept containing the identity of the employee, the date of training, and how the employer verified that the employee understood the training.

Employees should also be able to demonstrate adequate knowledge, skills, and abilities (KSAs) needed to safely complete PSM procedures.

4. How does each employee involved in a PSM process verify they are properly trained in the operating procedures?

- a. They must certify that they completed PSM training
- b. They must demonstrate adequate knowledge, skills, and abilities
- c. They must pass a proctored written exam
- d. They must have completed the OSHA 10-Hour training course for general industry

Module 7: Contractors

Application

Many categories of contract labor may be present at a jobsite. Some workers may actually operate the facility or do only a particular aspect of a job because they have specialized knowledge or skill. Others work only for short periods when there is need for increased staff quickly, such as in turnaround operations.

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.

It 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.

1. The PSM standard applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work ____.

- a. on or adjacent to a covered process
- b. only when union contractors are involved
- c. during the PHA phase of the construction
- d. prior to the start of construction

Employer Responsibilities

When selecting a contractor, the employer must obtain and evaluate information regarding 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
- Maintain a contract employee injury and illness log related to the contractor's work in the process areas.

2. The employer is responsible for developing safe work practices to control the ____ of PSM contractors.

- a. presence, entrance and exit
- b. quality and quantity
- c. number and type
- d. training and qualifications

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, the date of training, and the means used to verify that the employee understood the training;
- ensure that each contract employee follows the safety rules of the facility including the required safe work practices required in the operating procedures section of the standard; and
- advise the employer of any unique hazards presented by the contract employer's work.

3. The contract employer must ensure that contract employees are instructed in the known potential _____ release hazards related to their job.

- a. chemical, explosion, or electrical
- b. chemical, biological, or radiological
- c. fire, explosion, or toxic
- d. chemical, biological, or fire

Pre-Startup Safety Review

It is important that a safety review takes place before any highly hazardous chemical is introduced into a process.

PSM, therefore, requires the employer to perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information.

Prior to the introduction of a highly hazardous chemical to a process, the pre-startup safety review must confirm that the following:

- construction and equipment are in accordance with design specifications
- safety, operating, maintenance, and emergency procedures are in place and are adequate
- a process hazard analysis has been performed for new facilities and recommendations have been resolved or implemented before startup, and modified facilities meet the management of change requirements
- training of each employee involved in operating a process has been completed

4. The PSM standard requires the employer to perform _____ for new facilities and significantly modified facilities.

- a. a follow-up safety inspection
- b. safety training orientation
- c. a pre-startup safety review
- d. an audit of the PSM program

Module 8: Mechanical Integrity and Hot Work Permit

Mechanical Integrity

OSHA believes it is important to maintain the mechanical integrity of critical process equipment to ensure it is designed and installed correctly and operates properly.

PSM mechanical integrity requirements apply to the following equipment:

- pressure vessels and storage tanks;
- piping systems (including piping 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.

Training

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 the procedures applicable to the employee's job tasks.

The employer must train each employee involved in maintaining the on-going integrity of process equipment in an overview of that process and its hazards and in the procedures applicable to the employee's job tasks to assure that employees can perform their jobs in a safe manner.

1. PSM mechanical integrity requirements apply to ____.

- e. personal protective equipment, fall restraint systems, mechanical lift systems
- f. pressure vessels, storage tanks, piping systems, vent systems
- g. pressure vessels, electrical sub-stations, fire-suppression systems
- h. personal protective equipment, storage tanks, mechanical lift systems

Inspection and Testing

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 be consistent with and conform to applicable manufacturers' recommendations and good engineering practices, or more frequently if determined to be necessary by prior operating experience.

The employer must document each inspection and test that has been performed on process equipment. The documentation must include:

- the date of the inspection
- name of the person who performed the inspection or test,
- the serial number or other identifier of the equipment inspected or tested,
- a description of the inspection or test, and
- the results of the inspection or test.

2. Each inspection and/or test on process equipment must be ____.

- a. randomly performed
- b. able to meet the ANSI ISO 28000 standard requirement
- c. limited to problematic equipment
- d. documented

Equipment Deficiencies and Quality Assurance

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, when other necessary steps are taken to ensure safe operation.

In constructing new plants and equipment, the employer must ensure that equipment as it is fabricated is suitable for the process application for which it will be used. Appropriate checks and inspections must be performed to ensure that equipment is installed properly and is consistent with design specifications and the manufacturer's instructions.

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

3. In the equipment deficiencies outside the acceptable limits _____ must be corrected before further use.

- a. identified by EPA guidelines
- b. defined by EPA and OSHA regulations
- c. as required by HAZWOPER rules
- d. defined by the process safety information

Hot Work Permit

A permit must be issued for hot work operations conducted on or near a covered process. The permit must:

- document that the fire prevention and protection requirements in OSHA regulations (1910.252(a)) have been implemented prior to beginning the hot work operations;
- it must indicate 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.

4. What document is used to ensure all safety requirements have been met prior to beginning hot work operations?

- a. Welding authorization permit
- b. Hot work permit
- c. Entry permit
- d. Fire watch permit

Optional Exercise

Scenario:

Art and Ray were sent to the Tank Farm to replace bearings on an isopropanol pump located on the alcohol pad. They found the bearings “frozen” in place. When Art told his supervisor they would have to pull the pump, he said, “Let’s see if we can’t pull those bearings in place; we’ve got too much downtime in that area already.” First they tried to loosen the bearings with a bearing heater, a powerful electric heat gun, without success. Ray then called a welder who heated the casing with her torch until the bearings came free. While the welder was there, the supervisor had her weld brackets on an I-beam so he could install a “Warning-Flammable Area” sign.

A piece of slag from the welding rolled into a nearby pile of damp wooden shims. After the mechanics and the welder left the area, the wood began to smolder and then burst into flames. At the same time an operator began to charge ethanol to his unit by remote computer control. The ethanol transfer pump started to leak around its mechanical seal creating a pool of alcohol on the pad. The vapors from the pool traveled towards the fire, which then ignited them.

The fire spread instantly to the pump and grew in intensity as the heat increased the size of the leak. The tank farm operator saw the fire, sounded the alarm and attacked the fire with an extinguisher. She was overcome by vapors and fell unconscious. Quick response by the in-plant emergency response team saved her life and stopped a potentially disastrous fire.

Task:

Discuss the incident and, based on your experience, answer the following questions.

1. What could have been done to prevent this fire? List the factsheet(s) you used to back up your answer.

2. Now, think about the hot work program in your plant, are there any changes or improvements that should be made to improve the program? Please list and explain.

Module 9 – MOC, Investigation, Emergency Response and Trade Secrets

Management of Change (MOC)

Many of the catastrophic accidents over the past few decades can be traced, in large part, to a management of change system that was not in place or was not functional.

OSHA believes that contemplated changes to a process must be thoroughly evaluated to fully assess their impact on employee safety and health and to determine needed changes to operating procedures. To this end, the standard contains a section on procedures for managing changes to processes.

Written procedures to manage changes (except for “replacements in kind”) to process chemicals, technology, equipment, and procedures, and change to facilities that affect a covered process, must be established and implemented.

Written PSM procedures must ensure that the following considerations are addressed prior to any change:

- The technical basis for the proposed change,
- Impact of the change on employee safety and health,
- Modifications to operating procedures,
- Necessary time period for the change, and
- Authorization requirements for the proposed change.

Employees who operate a process and maintenance and contract employees whose job tasks will be affected by a change in the process must be informed of, and trained in, the change prior to startup of the process or startup of the affected part of the process.

If a change covered by these procedures results in a change in the required process safety information, such information also must be updated accordingly.

If a change covered by these procedures changes the required operating procedures or practices, they also must be updated.

1. Which of the following considerations must be included in written PSM procedures prior to any change?

- a. The ability of the employer to make reasonable changes
- b. Timelines for employer compliance
- c. Impact of the change on employee safety and health
- d. Necessary time required by OSHA for reporting

Incident Investigation

A crucial part of the process safety management program is a thorough investigation of incidents to identify the chain of events and causes so that corrective measures can be developed and implemented.

The PSM standard requires the investigation of each incident that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical in the workplace.

Such an incident investigation must be initiated as promptly as possible, but not later than 48 hours following the incident. The investigation must be by a team consisting of at least one person knowledgeable in the process involved, including a contract employee if the incident involved the work of a contractor, and other persons with appropriate knowledge and experience to investigate and analyze the incident thoroughly.

An investigation report must be prepared including at least:

- Date of incident,
- Date investigation began,
- Description of the incident,
- Factors that contributed to the incident, and
- Recommendations resulting from the investigation.



Equilon Enterprises oil refinery fire caused six fatalities.

A system must be established to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions must be documented, and the report reviewed by all affected personnel whose job tasks are relevant to the incident findings (including contract employees when applicable). The employer must keep these incident investigation reports for 5 years.

2. The PSM standard requires the investigation of each incident that resulted in workplace _____.

- a. a catastrophic release of a highly hazardous chemical
- b. serious illnesses and environmental impacts
- c. near misses, injuries, and illnesses
- d. OSHA violations and citations

Emergency Planning and Response

If, despite the best planning, an incident occurs, it is essential that emergency pre-planning and training make employees aware of, and able to execute, proper actions.

- An emergency action plan for the entire plant must be developed and implemented in accordance with the provisions of other OSHA rules (29 CFR 1910.38(a)).
- The emergency action plan must include procedures for handling small releases of hazardous chemicals.
- Employers covered under PSM also may be subject to the OSHA hazardous waste and emergency response regulation (29 CFR 1910.120(a), (p), and (q)).

3. Under the PSM standard, which of the following must be developed for handling releases of hazardous chemicals in the workplace?

- a. Emergency Evacuation Plan
- b. Incident Investigation Plan
- c. Community Continuity Plan
- d. Emergency Action Plans

Compliance Audits

PSM compliance auditing is a unique and evolving process in each company. An experienced auditor should scrutinize the Standard Operating Procedures (SOPs) at a facility looking for PSM Program discrepancies in content and format. Special attention should be given to process safety information, mechanical integrity, and contractor qualifications.

To be certain process safety management is effective, OSHA requires employers to certify that they have evaluated compliance with the provisions of PSM at least every three years. To a degree, this will verify that the procedures and practices developed under the standard are adequate and are being followed. However, to be more certain that the PSM Program is effective, Tim Williams, Senior Project Manager (PSM) at Stellar.Net recommends employers follow this auditing timeline:

- Self-Audit - Every six months. This is recommended, but not required.
- Standard Operating Procedures Certification – Annually.
- PSM Compliance Audit – Every three years. Required by OSHA.
- PHA and Mechanical Integrity Inspection – Every five years. Update PHAs when a major change is made.
- Management of Change – Anytime a process change is made.

A common mistake in a compliance auditing program is using an company employee who is responsible for the PSM program at the facility. An internal auditor is typically too familiar with the program components, documentation, and implementation methods which may lead to a false sense of security in the effectiveness of the PSM program.

- The compliance audit must be conducted by at least one person knowledgeable in the process and a report of the findings of the audit must be developed and documented noting deficiencies that have been corrected.
- The two most recent compliance audit reports must be kept on file.

4. When conducting a PSM compliance audit, which of the following elements should receive special consideration?

- a. Mechanical integrity
- b. Trade secrets
- c. Training
- d. Reporting procedures

Trade Secrets

Employers must make available all information necessary to comply with PSM to those persons responsible for:

- compiling the process safety information,
- developing of the process hazard analysis and operating procedures, and
- incident investigations, emergency planning and response, and compliance audits.

Information must be made available without regard to the possible trade secret status of such information. Nothing in PSM, however, precludes the employer from requiring those persons to enter into confidentiality agreements not to disclose the information.

The Future of PSM

In December 2014, the U.S. Chemical Safety Board (CSB) formally announced that to “Modernize U.S. Process Safety Management Regulations” is the Board’s newest Most Wanted Safety Improvement, concluding that implementation of key federal and state CSB safety recommendations will result in significant improvement of Process Safety Management (PSM) regulations in the United States. The CSB recommended that OSHA make the following PSM improvements:

- Expand the rule’s coverage to include the oil and gas exploration and production sector
- Cover reactive chemical hazards

- Add additional management system elements to include the use of leading and lagging indicators to drive process safety performance and provide stop work authority to employees;
- Update existing Process Hazard Analysis requirements to include the documented use of inherently safer systems, hierarchy of controls, damage mechanism hazard reviews, and sufficient and adequate safeguards; and
- Develop more explicit requirements for facility/process siting and human factors, including fatigue.

5. According to the PSM trade secret requirement, employers must make available all information to which of the following?

- a. Representatives of the local community impacted by PSM
- b. EPA and OSHA consultation representatives
- c. Persons responsible for compiling process safety information
- d. Employees and their representatives exposed to chemicals

Final words of PSM wisdom!

Process Safety is a team effort. Know your role and work with your fellow employees to protect yourself and others.

Know the hazards associated with mixing, separating, or storing process materials, including:

- Which chemicals are reactive or able to cause a runaway reaction.
- Toxic, fire, or explosive hazards associated with your process chemicals.
- What to do during an incident or unusual process condition.

Be aware of equipment operation and maintenance requirements, including:

- Signs of corrosion, leakage, or other signs of equipment problems.
- Who to alert when you see a problem.

Know your process:

- Follow operating, safety, and emergency procedures.
- Keep up-to-date with changes to procedures, equipment, and chemicals.
- Provide feedback – report all incidents and near misses.

Finally, there's no magic formula that makes a PSM program effective and successful. It takes education, planning, hard work and dedication to keeping employees safe and healthful. PSM must be a full-time job lead by a team of professionals in every company that manages hazardous processes.

6. Process safety ____.

- a. is required by the EPA, OSHA, and DOT
- b. only applies to the oil and gas industry
- c. is a team effort
- d. is unlimited in scope