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Process Safety Management for Small Businesses

OSHA 3908-03 2017

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Process Safety Management for Small Businesses

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3908-03 2017

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Contents

Purpose

This guidance document does not cover the entire Process Safety Management standard (PSM), but only focuses on aspects of the standard that may be particularly helpful for small businesses. For a full compliance guide to PSM, please refer to OSHA's Process Safety Management Guide (OSHA 3132)[1] or the full text of the standard at www.osha.gov.[2] Although all elements of the PSM standard apply to a PSM-covered small business, the following elements of the standard are most relevant to hazards associated with small businesses.

- Process Safety Information (PSI)
- Process Hazards Analysis (PHA)
- Training
- Mechanical Integrity (MI)
- Compliance Audits

PSM is critically important to small businesses with highly hazardous chemicals. Implementing the required safety programs help prevent fires, explosions, large chemical spills, toxic gas releases, runaway chemical reactions, and other major incidents. Compliance with the PSM standard will help ensure that employees, contractors, facility visitors, and emergency responders are safe from these hazards. Compliance will also benefit employers by minimizing damage to facility equipment and neighboring structures in the event of an HHC release.

Managing HHCs is required by OSHA standards and a good business practice.[3] Catastrophic HHC release events continue to occur among smaller companies. One study estimates that employers with 1-25 employees are 47 times more likely to have a release and 17 times more likely to suffer an injury, per employee, than facilities with 1500 or more employees.[4]

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1. www.osha.gov/Publications/osha3132.pdf
2. www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9760
3. See "The Business Case for Process Safety", downloadable from www.aiche.org/ccps/about/business-case
4. "Process Safety Issues For Small Businesses" M. Sam Mannan, Harry H. West, Nir Keren and T. Michael O'Connor, Mary Kay O'Connor Process Safety Center, 2004. IChemE

In addition to presenting risk to workers these companies are often located in populated areas, and can pose a risk to the surrounding population and structures.

Many small companies have the potential to realize cost efficiencies and savings through improved safety practices, such as adopting more effective work practices, inventory controls, storage practices, and better handling, use and disposal procedures, and instituting targeted PSM training to improve and ensure employee competence. Where possible and practical, finding alternative materials will help reduce hazards and associated risks. The approaches in this guidance document can help small businesses meet PSM requirements without creating unnecessary or additional resource burdens, and will give both employees and employers a better understanding of the standard.

Many industry organizations have materials that may contain guidance for specific industries and processes. Small businesses may find this guidance helpful in developing a PSM program. Such industries include, but are not limited to:

- Refrigeration – International Institute of Ammonia Refrigeration (IIAR)
- Compressed Gasses – Compressed Gas Association (CGA)
- Petrochemical and Chemical Manufacturers – American Petroleum Institute (API)
- Chemical Manufacturers – Society of Chemical Manufacturers and Affiliates (SOCMA)
- Chemical Distribution/Supply-chain – National Association of Chemical Distributors (NACD)
- Agricultural Wholesalers – Agricultural Retailers Association (ARA) & The Fertilizer Institute (TFI)
- Chlorine users (water/wastewater treatment and others) – The Chlorine Institute
- Explosives Manufacturing – Institute of Makers of Explosives (IME)
- Pyrotechnics – American Pyrotechnics Association

- Composite Manufacturers – American Composites Manufacturers Association (ACMA)
- Petrochemical Manufacturing – American Fuel and Petrochemical Manufacturers (AFPM)
- Dairy Manufacturing – The International Dairy Foods Association (IDFA)
- Paint Coating - American Coatings Association (ACA)

Applicability

The Process Safety Management standard covers processes which involve threshold quantity (TQ) of chemicals listed in Appendix A of the PSM standard.[5] The PSM standard also applies to processes containing 10,000 pounds (4535.9 kg) or more of either a Category 1 flammable gas (as defined in 29 CFR 1910.1200(c)) or a flammable liquid with a flashpoint below 100 °F (37.8 °C) on site in one location, and to the manufacture of explosives or pyrotechnics in any quantity, except for:

- Retail 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 (HHC) covered by the PSM standard
- Flammable liquids with a flashpoint below 100 °F (37.8 °C) stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration. (Note: Atmospheric tanks are storage tanks designed to operate at pressures from atmospheric through 0.5 psig)
- Oil or gas well drilling or servicing operations
- Normally unoccupied remote facilities[6]

5. Calculation of TQ for mixtures is explained in an OSHA Letter of Interpretation at www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=30848

6. Letter of Interpretation: www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=22592

Although OSHA believes PSM will have a positive effect on the safety and health of employees and will offer potential benefits to employers such as increased productivity, smaller businesses with limited resources might consider alternative approaches to decreasing HHC-associated risks at their workplaces. One possible approach is reducing their HHC inventories to below the PSM TQ by improving inventory control and accepting smaller deliveries. Inventory reduction may help reduce the consequences of a catastrophic incident. When reduced inventory is not feasible, the employer might consider dispersing inventory among several on-site locations such that a release/incident in one location will not cause a release in another.

However, reducing inventories below the PSM TQs does not relieve employers of their responsibility under the OSH Act to provide safe and healthful working conditions for their employees. Simply reducing inventories has no effect on the properties of the HHCs, which, depending on their use in a process, may still present hazards to workers. OSHA encourages employers handling HHCs who are not subject to the PSM standard to implement safety and health management systems to protect their employees.

Small businesses may contact OSHA's free On-site Consultation Program for help with identifying and mitigating workplace hazards. OSHA's On-site Consultation Program offers free and confidential occupational safety and health services to small and medium-sized businesses in all states and several territories, with priority given to high-hazard worksites. To locate the OSHA On-site Consultation Program nearest you, call 1-800-321-6742 (OSHA) or visit www.osha.gov/consultation.

Examples of Small Businesses with potential PSM-covered processes

The following list contains examples of businesses potentially affected by the PSM standard (NAICS codes are included for clarity, but they are not used to determine the PSM standard's applicability):

- Asphalt Paving/Roofing Materials (NAICS 32412)
- Chemical and Allied Products (NAICS 4246)
- Chemical Products-Misc (NAICS 42469)
- Drugs (NAICS 4242)
- Fabricated Metal (NAICS 332)
- Fabricated Rubber Products, (NAICS 32521)
- Food and Kindred Products (NAICS 31199)
- Industrial Organic Chemicals (NAICS 32519)
- Inorganic Chemical Manufacturing (NAICS 32518)
- Lumber, Wood Products (NAICS 321)
- Natural Gas Liquids (NAICS 2212)
- Paints, Varnishes, Enamels (NAICS 3255)
- Paper and Allied Products (NAICS 32229)
- Plastics Products-Miscellaneous (NAICS 3261)
- Plastics, Rubber, Cellulosics (NAICS 325211)
- Petroleum & Coal Products-Misc (NAICS 32419)
- Petroleum Refining (NAICS 32411)
- Primary Metals Industries (NAICS 331)
- Stone, Glass & Concrete (NAICS 21232, 3272, 3273)
- Textile Mill Products (NAICS 3131)
- Wholesale Trade (NAICS 42)

Process Safety Information

Employers are required to compile written process safety information (PSI) about highly hazardous chemicals and process equipment for all PSM covered processes. Complete and accurate compilation of PSI is critical to the effective implementation of all other aspects of the PSM standard and will help employers and employees involved in operating the process identify and understand the hazards involved in their processes. PSI must include information concerning the hazards of the highly hazardous materials used, produced, stored, or transported on-site by/for the process, the technology of the process, and all the equipment used in the process.

The PSI compiled by the employer must include information on toxicity, permissible exposure limits, physical data, reactivity data, corrosivity data, thermal and chemical stability data, and hazardous effects associated with inadvertent mixing of materials that may occur. Facilities are required by OSHA's Hazard Communication standard (29 CFR 1910.1200) to maintain Safety Data Sheets (SDSs) for hazardous chemicals in their workplaces, which often contain some of the required information. If an employer does not already have SDSs, it must obtain them from its chemical suppliers. Employers should confirm that the SDSs contain all of the information required under PSM.

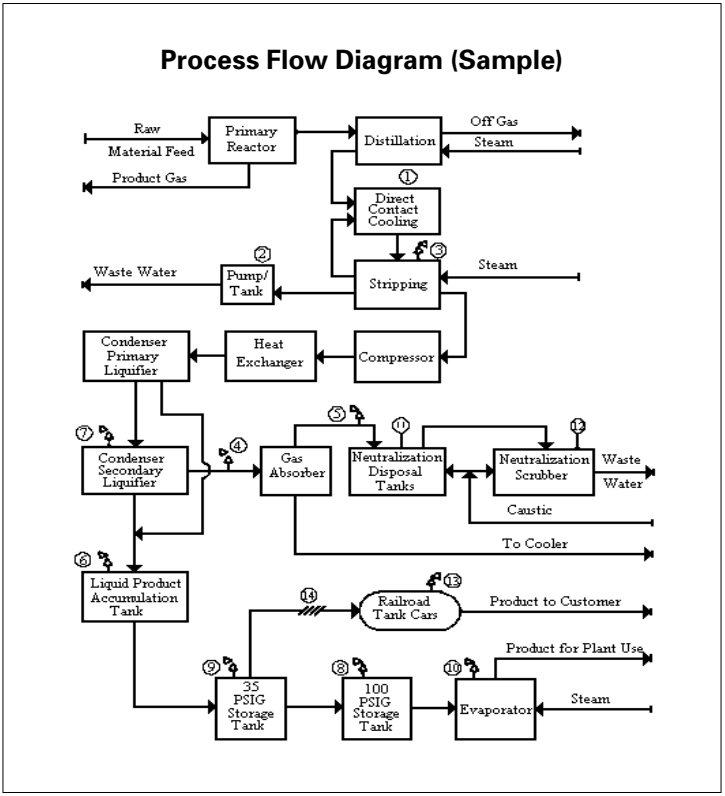
Employers must also understand their reactive hazards, which can include runaway reactions, side reactions, and possible inadvertent interactions. For more information, the CCPS Reactive Material Hazards Alert[7] and the NOAA/EPA/CCPS Chemical Reactivity Worksheet[8] are excellent resources on chemical reactivity hazards.

Process technology information must include a block or simplified process flow diagram (as shown below and in Appendix B of the PSM standard). Block flow diagrams and process flow diagrams (PFDs) are used to show the

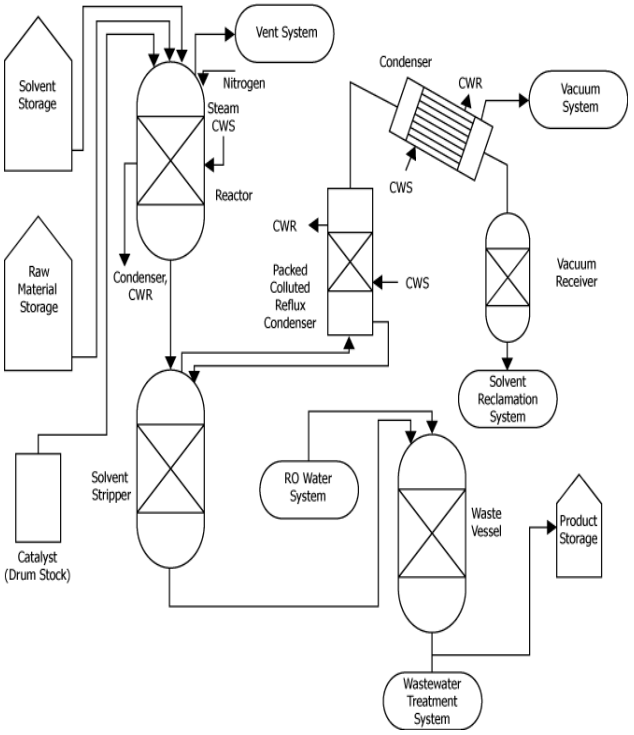
7. www.aiche.org/sites/default/files/docs/pages/reactmat.pdf
8. www.aiche.org/ccps/resources/chemical-reactivity-worksheet-40

major process equipment and interconnecting process flow lines. PFDs may also show flow rates, stream composition, temperatures, pressures, heat exchanger duties, and the process heat and material balance. Employers must also compile information on the process chemistry, establish maximum intended inventory levels for process chemicals, safe upper and lower process limits beyond which would be considered upset conditions, and an evaluation of the consequences of deviation, including those affecting the safety and health of employees, that could occur if operating beyond the established process limits.

Figure 1. Block Flow Diagram and Process Flow Diagram, 1910.119 Appendix B



Block Flow Diagram (Sample)



Finally, employers must compile information on the equipment used in the process. This includes piping and instrument diagrams (P&IDs), materials of construction, electrical classification, relief system design and basis, ventilation system design, safety systems, and for processes built after May 26, 1992, material and energy balances.

Small businesses should find it easy to compile this information from existing sources and doing so will usually require minimal staff time. See Table 1 below for examples of potential existing PSI sources that may be used to fulfill requirements.

Table 1. Existing PSI Sources and Applicability

Potential Existing PSI Sources	Potential applicability to PSI requirements
Chemical shipping and receiving manifests, chemical delivery receipts, and associated SDSs	• Physical data; • Reactivity data; • Corrosivity data; • Thermal and chemical stability data; • Hazardous effects of inadvertent mixing of different materials that could foreseeably occur
Equipment design and operating documents	• Maximum intended inventory; • Safe upper and lower limits for temperatures, pressures, flows or compositions
Manufacturer specifications	• Materials of construction; • Equipment electrical classification (used for electrical classification); • Relief device specifications (used for relief system design and design basis); • Ventilation system design; • Safety Systems
Job hazard analyses and associated SDSs	• Toxicity information; • Permissible exposure limits; • Hazardous effects of inadvertent mixing of different materials that could foreseeably occur; • An evaluation of the consequences of deviations, including those affecting the safety and health of employees
Emergency planning information including assessments from, insurance audits, Fire Marshall inspections, local fire departments, or emergency responders	• An evaluation of the consequences of deviations, including those affecting the safety and health of employees; • Safety Systems
Related process documents	• Electrical classification; • Design codes and standards employed; • Material and energy balances

Employers must also document that all equipment complies with recognized and generally accepted good engineering practices (RAGAGEP). For more information on OSHA's interpretation of RAGAGEP see OSHA Memorandum, *RAGAGEP in Process Safety Management Enforcement*.[9] Below is a non-exhaustive list of institutions that publish standards that may contain applicable process equipment RAGAGEP:

- American National Standards Institute (ANSI)
- American Petroleum Institute (API)
- American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- American Society for Testing and Materials (ASTM)
- American Society of Mechanical Engineers (ASME)
- American Welding Society (AWS)
- Center for Chemical Process Safety (CCPS)
- Compressed Gas Association (CGA)
- Chlorine Institute (CI)
- International Institute of Ammonia Refrigeration (IIAR)
- International Code Council (ICC)
- International Organization for Standardization (ISO)
- National Association of Corrosion Engineers (NACE)
- National Fire Protection Association (NFPA)
- Society of Chemical Manufacturers and Affiliates (SOCMA)

Process Hazard Analysis

A process hazard analysis (PHA) is an organized and systematic effort to identify and analyze the significance of potential hazards associated with the processing and handling of highly hazardous chemicals. The PHA analyzes the hazards of the process including potential causes and consequences of fires, explosions, and releases of toxic or flammable chemicals. The PHA must make recommendations for additional safeguards to adequately control identified hazards or to mitigate their effects, or these may be generated

9. www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=30785

by post-PHA evaluations of the team's findings. Safeguards may include inherently safer or passive approaches to hazard control, new engineering controls (e.g., improved fire detection and suppression systems) or administrative controls (e.g., new operating procedures, inventory control measures, separation of highly hazardous chemicals into different storage areas).

Small businesses will often have processes that have fewer quantities of HHCs, and may be less complicated than processes at a large facility. Therefore, OSHA anticipates that often less complex PHA methodologies could be used to meet the process hazard analysis requirement in the standard. These process hazard analyses methodologies can be applied in less time than more complex approaches. For example, a less complex process could mean that less process data, fewer P&IDs, and less equipment information are needed to perform a process hazard analysis. As a result, simpler methodologies, such as What-if/Checklist, may be appropriate for these processes.

However, some small businesses have complex processes. In these instances, employers must use a PHA methodology appropriate to the process, such as a Hazard Operability Study (HAZOP), or Failure Mode and Effects Analysis (FMEA). In such instances, small businesses may find that PHA contractor assistance is beneficial.

OSHA has provided examples of two different PHA methodologies that small businesses can review for information and potential use. These two PHA examples are contained in an OSHA February 1, 2005 letter of interpretation[10] and in APPENDIX B: Examples of PHA Methodology of this document.

Many small businesses have processes that are not unique, such as ammonia refrigeration systems or water treatment facilities. Industry associations have developed template PHAs for common processes used by their membership that can be made site-specific for a particular facility's process. However, any template PHA must be customized to accurately identify and address the hazards of the process.

10. www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=25051

Moreover, small employers who use batch processes may be able to use a generic approach for the PHA that may help to further reduce the cost of compliance. For example, a generic PHA based on a representative batch might be used for other similar batches where there are only small changes in the process chemistry and this is documented for the range of batch processes. Specifically, a paint mixing batch process may differ only in pigment being used or slight variations in solvents used for each pigment. In this case, the employer may not need a separate PHA for every different pigment/color batch, but only one generic PHA that considers the overall paint mixing process, including all the potential amounts of solvent used, and potential chemical hazards of the different pigments (which may be similar, if not the same). However, if the batch processes are dissimilar, or use chemicals with substantially different hazards, a separate PHA would be required. Furthermore, reactive batch processes can be very sensitive to small changes in quantities, compositions, or operating conditions and may require highly individualized evaluations.

Employers must develop systems to promptly address hazards identified and the process hazard analyses' findings and recommendations, document how each item was resolved, and inform affected employees of any process changes made.

PHAs must be updated and revalidated at least every five years to assure that the process hazard analysis is consistent with the current process.

PHA Development Team

An effective and comprehensive process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.

Some companies, particularly smaller ones, may not have the staff expertise to perform such an analysis. The employer, therefore, may need to hire an engineering or consulting company to perform and augment the analysis. Employers may also want to sponsor their employees in taking appropriate training courses or provide opportunities for acquiring professional experience.

Training

Employers must provide initial and refresher training to every employee involved in operating a PSM-covered process. Training must cover process-specific safety and health hazards, operating procedures, safe work practices, and emergency shutdown procedures. The level of training may vary for each employee. For example, those who work in the area or operate the equipment will receive more extensive training than visitors or other non-operational personnel who are in the general area, who would require awareness training. Employers must also train contractors or temporary employees on known potential fire, explosion, or toxic release hazards associated with their work and the processes. Additional training in subjects such as emergency evacuation and response, routine and nonroutine work authorization activities, and other areas pertinent to process safety and health should be covered by an employer's training program. Training must also be conducted in compliance with 1910.1200, the Hazard Communication standard to help employees to become more knowledgeable about the hazardous properties of the chemicals they work with and better able to read and understand SDSs.

As most small business owners already regularly train their employees, OSHA does not expect that employers will need substantial additional effort to come into compliance with the PSM training requirements. All employers (both operator and contractor) are required to document the training given to their employees and document that each employee has completed and understood that training.

In the training program documentation, employers should clearly identify the employees to be trained and the subjects to be covered. One non-mandatory best practice to consider is to determine clear and measurable learning goals or objectives before the training begins. The employer shall ascertain that each employee involved in operating a process has received and understands the training required by this paragraph. The employer shall prepare a record which contains the identity of the employee, the date of training, and the means used to verify that the employee understood the training. These goals and objectives should be tailored to each of the specific training modules or segments. Employers should describe how the employee will demonstrate competence and knowledge as well as what is acceptable performance.

Employers should periodically evaluate their training programs to ensure the necessary skills, knowledge, and procedures are properly understood and implemented. Training program evaluation will help employers to determine the amount of training their employees understood, and whether the desired results were obtained. If, after the evaluation, it appears that the trained employees are not at the level of knowledge and skill that was expected, the employer will need to revise the training program, provide retraining, or provide more frequent refresher training sessions until the deficiency is resolved. Those who conducted the training and those who received the training should also be consulted as to how to improve the training process. If there is a language barrier, the language known to the trainees should be used.

Mechanical Integrity

The Mechanical Integrity (MI) element of the PSM standard requires employers to implement rigorous and systematic written procedures to ensure that all critical process equipment are properly designed, tested, inspected, repaired, and maintained. Mechanical integrity programs must address pressure vessels, storage tanks, piping systems (including piping components such as valves), pumps, relief and vent systems and devices, emergency shutdown systems, and

controls (including monitoring devices and sensors, alarms, and interlocks). While large chemical manufacturing facilities and petroleum refineries sometimes have hundreds—or even thousands—of such components, small businesses with PSM-covered processes typically have less equipment to maintain, making compliance easier.

For some small businesses, the mechanical integrity section of the PSM standard may appear daunting. MI is often the most resource intensive PSM element once the PSM program is up and running, as components of a successful MI program may include tracking inspections, tests, repairs, and controlling spare parts and materials. In some cases, a small employer may already have a maintenance/inspection program for PSM covered equipment. These employers will simply need to ensure that their existing maintenance program and inspection frequencies are appropriate under PSM. Employers who do not have an MI program will first need to identify all critical equipment that is part of the covered process. This list would include pressure vessels, storage tanks, process piping, relief and vent systems controls, monitoring devices, interlocks, pumps, alarms, and emergency shutdown systems. In addition, some utility piping and equipment, e.g., cooling required to prevent run-away reactions, may be subject to MI requirements. Employers should also consider including loss of containment mitigation equipment, such as fire protection system components, in their mechanical integrity provisions.

In many cases, the equipment that is part of the MI program will have inspection and testing recommendations from the manufacturer. If the covered equipment does not have any MI related manufacturers recommendations, then employers should look for applicable codes/standards or industry best practices.

Inspections and tests must follow Recognized and Generally Accepted Good Engineering Practices (RAGAGEP), and inspection and test frequency must be consistent with manufacturer's recommendations and good engineering practices, or more frequently if indicated by operating experience. Applicable codes and standards such as those

from the American Society for Testing and Materials, American Petroleum Institute, National Fire Protection Association, American National Standards Institute, American Society of Mechanical Engineers, and other groups provide information to help establish an effective testing and inspection frequency, as well as appropriate methodologies. Employers must document each inspection and test it performs on critical process equipment, including the date, the name of the person performing the test, the serial number or other identifier of the equipment, a description of the test or inspection, and its results.

Employers must train each employee involved in the maintenance of the integrity of equipment used in an ongoing process. These employees must be provided an overview of the process, its hazards, and the procedures they must follow in their assigned tasks to ensure they can perform the tasks in a safe manner. This training may be covered in conjunction with other training required by the standard.

Equipment deficiencies outside the acceptable limits defined by the PSI must be corrected before further use. In some cases, however, it may not be necessary that deficiencies be corrected before further use, as long as the deficiencies are corrected in a safe and timely manner, when other necessary steps are taken to ensure safe operation. When equipment is determined to be deficient, a management of change (MOC) procedure must be established and implemented prior to continuing operation of the deficient equipment outside of established operating limits. The MOC procedure must include a determination of the safety and health impacts of continued operation of the deficient equipment.

Employers must have a quality assurance system to ensure that equipment, maintenance materials, and spare parts are suitable for the process applications in which they are used. Employers must make appropriate checks and inspections to insure that equipment is installed property and consistent with design specifications and the manufacturer's instructions. "As built" drawings, together with documents

containing testing, certification, construction, materials and other pertinent information should be retained in the quality assurance documentation.

Compliance Audit

PSM compliance audits are used to gather sufficient facts and information to verify compliance with the requirements specified in the PSM standard. A PSM compliance audit must be conducted at least every three years.

Employers must select at least one individual who is knowledgeable about the process to be audited. For some complex and/or larger processes, OSHA believes that a team of individuals would be beneficial for conducting an audit. However, for less complex and/or smaller processes an employer may need only one knowledgeable person to conduct an audit.

The audit must include an evaluation of the compliance with the provisions of PSM and to verify that the procedures and practices developed are adequate and are being followed. The audit should be conducted or lead by a person knowledgeable in audit techniques and who can be impartial towards the area being audited. The essential elements of an audit program include planning, staffing, conducting the audit, evaluation and corrective action, follow-up and documentation.

Planning is essential to the success of the auditing process. It is helpful to establish the format, staffing, scheduling and audit methods prior to conducting the audit. The format should be designed to provide the lead auditor with a procedure or checklist that details the requirements of each section of the PSM standard. The checklist, if properly designed, should provide the auditor with the necessary information to expedite the review and ensure that no requirements of the standard are omitted. This checklist would also identify PSM elements that will require evaluation or a response to correct deficiencies. This checklist could also be used for developing the follow-up and documentation requirements.

An effective audit includes a review of the relevant documentation and process safety information, inspection of the process, and interviews with employees. Using the audit procedure and checklist developed in the planning stage, the auditor can systematically analyze compliance with the provisions of the PSM standard. For example, the auditor will review operator training as part of the overall audit. The auditor will typically review the employer's training program for adequacy of content, frequency of training, and effectiveness of training in terms of its goals and objectives as well as to how it fits into meeting the standard's requirements. Through interviews, the auditor can determine the operator's knowledge and awareness of the safety procedures, duties, rules, and emergency response assignments. During the inspection, the auditor can observe the operator's actual implementation of practices such as safety and health policies, procedures, and work authorization practices. This approach enables the auditor to identify deficiencies and determine where corrective actions or improvements are needed.

The auditor must document the areas that require corrective action. This provides a record of the audit procedures and findings, and serves as a baseline for future audits. It will help future auditors determine changes or trends from previous audits.

Corrective action is one of the most important parts of the audit. The corrective action process normally begins with a management review of the audit findings. The purpose of this review is to determine what actions are appropriate, and to establish priorities, timetables, resource allocations and requirements and responsibilities. In some cases, corrective action may involve a simple change in procedure or minor maintenance effort to remedy the concern. Management of change procedures must be used, when required, even for what may seem to be a minor change. There may be instances where no action is necessary and this can be a valid resolution to an audit finding. However, all findings and corrective actions taken, including an explanation where no action is

taken, must be documented. Many employers have found that establishing a common system for addressing findings and recommendations from PHAs, Incident Investigations, and Compliance Audits is a cost-effective approach.

APPENDIX A: Frequently Asked Questions

This appendix documents many PSM-related questions that small businesses commonly ask of OSHA. These questions are meant to provide small business owners with helpful responses that can be used in your workplace.

"What is the Process Safety Management standard?" OSHA issued the Process Safety Management of Highly Hazardous Chemicals standard (29 CFR 1910.119), which contains requirements for the management of hazards associated with processes using highly hazardous chemicals. The standard is intended to help prevent or minimize unexpected releases of toxic, reactive, or flammable liquids and gases associated with these processes by emphasizing the establishment of a comprehensive management program that integrates technologies, procedures, and best management practices.

"Why is the PSM standard necessary?" Regardless of the industry using highly hazardous chemicals, there is a potential for a release of these chemicals any time the processes is not properly controlled. Properties of these chemicals may be toxic, reactive, flammable, or explosive, or they may exhibit a combination of these properties. These releases have the potential to cause significant damage to property and to severely or fatally injure individuals in the workplace.

"How do I know if my worksite is covered by the PSM standard?" You are required to comply with the PSM if you use, manufacture/produce, store, handle, or are involved in the on-site movement of chemicals that are on the List of Highly Hazardous Chemicals (29 CFR 1910.119 Appendix A) at or above the threshold quantity set by OSHA; have a process which involves a flammable liquid or gas in a quantity

of 10,000 pounds or more; or manufacture explosives or pyrotechnics in any quantity. However, OSHA exempts three types of facilities from the PSM standard: retail facilities; oil or gas well drilling or servicing, and normally unoccupied remote facilities. Additionally, hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling); and flammable liquids with a flashpoint below 100 °F (37.8 °C) stored in atmospheric tanks or transferred and kept below their normal boiling point without benefit of chilling or refrigeration, are also exempt from PSM if such fuels are not a part of a process containing another highly hazardous chemical (HHC) covered by the PSM standard.

"What industries does the rule cover?" OSHA's standard applies to a wide range of industries–particularly those pertaining to chemicals, transportation equipment, and fabricated metal products. Other affected sectors include those involved with natural gas liquids, chemical warehousing, food processing, electric, gas, sanitary services, and wholesale trade. The standard also applies to pyrotechnics and explosives manufacturers.

"Does PSM apply to non-manufacturing facilities?" Yes, the PSM standard can apply to non-manufacturing processes such as in the refrigeration industry, and services industries such as food and sanitation, and chemical warehousing and distribution industries. In fact, many PSM-covered processes involve a non-manufacturing application of HHCs.

"What does the PSM standard require?" The PSM standard starts with a compilation of process safety information, followed by a process hazard analysis (PHA). A PHA consists of a careful and thorough review of what could go wrong and what safeguards must be implemented to prevent releases of highly hazardous chemicals. In addition to the PHA, the standard also mandates development of written operating procedures, completion of relevant employee training, encouraging and ensuring employee participation (according to a written plan), pre-startup safety reviews, evaluation of the mechanical integrity of critical equipment, contractor requirements, and

a written management of change process. It also requires a permit system for hot work, investigation of incidents involving releases of covered chemicals or "near-misses," emergency action plans, compliance audits at least every three years, and allows for trade secret protection as long as the relevant information remains available to applicable parties.

"Why do I need a written Process Safety Management program?" A written PSM program assists employers and their workers in the development and uniform implementation of PSM activities across their organization. EPA's Risk Management Program rule also mandates that covered employers submit a "Risk Management Plan" to their agency. OSHA's PSM standard requires written documentation for a number of elements, including employee participation, process safety information, process hazards analysis, operating procedures, operator training, contractor training, hot work permits, mechanical integrity, management of change, incident investigations, emergency planning and response, and compliance audit elements.

"What are the design and maintenance standards I will have to follow at my facility?" The PSM standard references recognized and generally accepted good engineering Practices (RAGAGEP). Businesses must be able to demonstrate that their PSM-covered processes are designed and constructed to meet requirements of the applicable engineering standards (e.g., ASME, API, ANSI). The facility is responsible for selecting the RAGAGEP, and demonstrating how its processes are built to the appropriate design standards and have been maintained in accordance with those standards. See OSHA's Regional Administrators Memorandum on RAGAGEP enforcement.[11]

"Who should receive PSM training?" The PSM standard requires specific training for all employees involved in operating a PSM-covered process. Operating employees must complete initial training followed by refresher training at least every three years. Training of operators and contract

11. www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=29414

employees must be documented to demonstrate that the employee has received and understood the applicable information. Maintenance personnel and contractors also must receive training under the standard.

"I am a contractor on a PSM-covered worksite. Do I need PSM training?" Yes. Contract employees and their employers must meet the applicable requirements under the PSM standard, including training. The standard outlines specific responsibilities for both the employer and contract employer to ensure the safety of the contract employees and the proper operation of the process.

"Can small businesses receive help developing, initiating and instituting a PSM program?" Yes. OSHA's On-site Consultation Program offers free and confidential occupational safety and health services to small and medium-sized businesses in all states and several territories, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing and improving safety and health programs. To locate the OSHA On-site Consultation Program nearest you, call 1-800-321-6742 (OSHA) or visit www.osha.gov/consultation.

"Where can I learn more about the PSM standard and its requirements?" In addition to this publication, you may refer to 29 CFR 1910.119 for specific requirements of the PSM standard, which is available on the OSHA website (osha.gov). OSHA offers two other publications that provide information about the PSM standard and its application: Process Safety Management (OSHA 3132) and Process Safety Management–Guidelines for Compliance (OSHA 3133); both are available, on the OSHA web site. Small businesses may contact OSHA's free On-site Consultation Program for help with identifying and mitigating workplace hazards. OSHA's On-site Consultation Program offers free and confidential occupational safety and health services

to small and medium-sized businesses in all states and several territories, with priority given to high-hazard worksites. To locate the OSHA On-site Consultation Program nearest you, call 1-800-321-6742 (OSHA) or visit www.osha.gov/consultation.

"What are a few key safety management practices all employees should know?" All potentially affected employees should know the hazards related to storing, mixing or processing chemicals. Employees should know how each of their processes work. They should also know when equipment is operating improperly or outside safe limits. If equipment is not operating properly or an emergency occurs, they should know how to respond and who to contact.

"What is the EPA Risk Management Plan (RMP)?" EPA regulations and guidance for chemical incident prevention at facilities that use certain hazardous substances are contained in the RMP rule (40 CFR Part 68). The information required from facilities under RMP helps local fire, police, and emergency response personnel prepare for and respond to chemical emergencies. Making RMPs available to the public also fosters communication and awareness to improve incident prevention and emergency response at the local level.

"Who must submit an RMP and how often?" Facilities using more than a threshold quantity of any chemical found in the List of Regulated Substances (40 CFR 68.130) in a process are required to comply with EPA's Risk Management Plan regulations. The regulations require owners or operators of covered facilities to implement a risk management program and to submit an RMP to EPA. RMPs must be revised and resubmitted to EPA every five years.

"How is RMP different from PSM?" The requirement for development of RMPs is established by the *Clean Air Act* (as is the requirement for PSM), and is primarily intended to protect the population outside a facility. PSM is intended to protect employees at the facility. The RMP rule is administered and enforced by the EPA, while PSM is administered and enforced

by OSHA. The RMP rule requires facilities to submit plans to the EPA and local emergency responders so that they are aware of potential environmental and exposure risks when responding to an incident. Otherwise, the standards are nearly identical.

"What chemicals must be reported under RMP?" Any chemical identified by EPA's RMP List of Regulated Substances (40 CFR 68.130) that is present in more than a threshold quantity must be reported under RMP. Many of the chemicals on this list are also found on OSHA's List of Highly Hazardous Chemicals (29 CFR 1910.119 Appendix A).

APPENDIX B: Examples of PHA Methodology

2/1/2005 Letter of Interpretation to Mr. Roygene Harmon

Appendix

Example Application of 1910.119(e)(3)(vii)

Below are excerpts from two different PHA methodologies [What-If Checklist (Figure 1) and HAZOP (Figure 2)]. Each PHA excerpt identifies one hazard/deviation as well as its corresponding engineering and administrative controls, safeguards, recommendation/actions and a quantitative description of consequence, likelihood and the risk priority for the identified hazard. An example (e.g. ❸) of the application of the specific OSHA 1910.119(e)(3) "consequence" requirements are identified on the example PHA worksheets. After the PHA worksheet examples, other examples are provided to illustrate how some employers utilize a risk matrix to comply with the "qualitative evaluation" requirement (1910.119(e)(3)(vii)). As noted earlier, PSM is performance standard, and that these examples may or may not be applicable to your specific situation.

The following is an example of the development and use of a risk matrix. First, a qualitative description of consequence and likelihood/frequency of the hazard based on a failure of engineering and/or administrative controls is established. Figure 3 is the Consequence Table. It is a qualitative description of the range of degrees of consequences related to the identified hazard and its associated failure of controls. These consequences range from 1 – 4, with 4 being the most severe Consequence Class. Figure 4 is the Likelihood Table, it is a qualitative description of the range of likelihood/frequency that an identified engineering or administrative control might fail. The likelihood ranges from 1 – 4, with 4 being the most likely to fail.

Using the Consequence and Likelihood Class numbers a Risk Priority Matrix (Figure 5) can be constructed. The Risk Priority Matrix is used to identify the Risk Class. Once the Risk Class (e.g. C) is determined from the Risk Priority Matrix, the Risk Class can be correlated to the Risk Priority Legend (Figure 6) which prioritizes the hazard as identified by the PHA team. In this case, the PHA team enters the evaluated Consequence Class, Likelihood Class, and Risk Class on the PHA worksheets, Figures 1 and 2.

In the following example PHA worksheets the abbreviations and symbols mean:

C = Consequences Class
L = Likelihood Class
R = Risk Priority Class

❶ - 1910.119(e)(3)(i): address the hazards of the process
❷ - 1910.119(e)(3)(iii): address engineering and administrative controls applicable to the hazards...
❸ - 1910.119(e)(3)(iv): address consequence of failure of engineering and administrative controls
❹ - 1910.119(e)(3)(vii): address a qualitative evaluation of a range of possible safety and health effects of failure of controls...

1

Figure 1 - Example Worksheet Excerpt from What If/Checklist PHA Methodology
C= Consequence Class, L= Likelihood Class, R = Risk Class

What If...	Consequences/ Hazard	Safeguards	C	L	R	Recommendations/ Action
Emergency Shutdown Valve 23 (ESD - 23) fails to close when needed? (This can occur due to extremely cold weather, reliability due to inspection/ testing/maintenance or design problems) ❶ ❸	Release of highly flammable materials in the operating area. Potential for fire/explosion with employee injuries/fatalities ❶ ❸	1. Specific Inspection/testing/ maintenance program for ESDs 2. Valve actuator sizing 3. ESD-23 is fail closed design ❷	4 ❹	2 ❹	B ❹	1. Due to cold weather modify MI procedures to increase ESD valve testing to 1/2wks. 2. Inspection records for ESD 23 not in file, follow-up to assure ESD-23 inspected as required by MI procedures 3. No equipment data sheet was found for actuator for ESD-23, follow-up with engineering to assure design is correct. 4. Consider over sizing valve actuator

Figure 2 - Example Excerpt from HAZOP PHA Methodology
C= Consequence Class, L= Likelihood Class, R = Risk Class

Deviation	Causes	Consequences	Safeguards	Recommendations/ Actions	C	L	R
Loss of Agitation ❶	Agitator motor fails Electrical utility lost Agitator mechanical linkage fails Operator fails to activate agitator ❶❷	Un-reacted HHC in the reactor carried over to Storage Tank 3 (ST-3) and is released to the enclosed work area. Probable injuries or fatalities to workers due to highly acute toxic material hazard ❸	HHC detector and alarm ❷	1. Consider adding alarm/shutdown of the system for loss of agitation to the reactor 2. Ensure adequate ventilation exists for enclosed work area and/or use an enclosed ST-3 3. Update PSI file and Op. Procedure HHC-39 to include consequence of deviation, engineering controls including safety system information, e.g. SIS and emergency ventilation	4 ❹	2 ❹	B ❹

Figure 3 - Consequence Table

Consequence Class	Qualitative Employee Safety Consequence Criteria
1	No employee injuries
2	One Loss Time Injury or Illness
3	Multiple Lost Time Injuries or Illnesses
4	Multiple Lost Time Injuries or Illnesses w/one or more fatalities

Figure 4 - Likelihood Table

Likelihood Class	Qualitative Likelihood Criteria
1	Not expected to occur during the lifetime of the process. Examples – Simultaneous failures of two or more independent instrument or mechanical systems
2	Expected to occur only a few times during the life of the process. Examples – Rupture of product piping, trained employees w/procedures injured during LOTO operation
3	Expected to occur several times during the life of the process. Examples – hose rupture, pipe leaks, pump seal failure
4	Expected to occur yearly. Examples - instrument component failures, valve failure, human error, hose leaks

Figure 5 - Example Risk Priority Matrix

Consequences ↑					
	4	C	B	A	A
	3	C	B	B	A
	2	D	C	B	B
	1	D	D	C	C
		1	2	3	4
Likelihood →					

Figure 6 - Example Risk Priority Legend

Priority →	Risk Class	Explanation of Risk
	A	Risk intolerable - needs to be mitigated within 2 weeks to at least a Class C, if that cannot be accomplished, process needs to be shutdown
	B	Risk undesirable - needs to be mitigated within 6 months to at least a Class C
	C	Risk tolerable with controls (engineering and administrative)
	D	Risk acceptable – no further action required

Workers' Rights

Under federal law, workers are entitled to working conditions that do not pose a risk of serious harm.

For more information on how to assure a safe and healthful workplace, see OSHA's Workers page.

OSHA Assistance, Services and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their safety and health program.

Establishing a Safety and Health Program

Safety and health programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers.

Visit www.osha.gov/shpguidelines for more information.

Compliance Assistance Specialists

OSHA Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources.

Visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations.

For more information or to find the local On-site Consultation office in your state, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP)**. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/cooperativeprograms.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provide the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. Through the Alliance Program, OSHA works with groups to develop compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in private industry and federal agencies who have implemented effective safety and health management programs and maintain injury and illness rates below the national average for their respective industries.

Occupational Safety and Health Training Courses

The OSHA Training Institute partners with 27 OSHA Training Institute Education Centers at 42 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials to assist employers and workers in finding and preventing workplace hazards.

All OSHA publications are free at www.osha.gov/publications and www.osha.gov/ebooks. You can also call 1-800-321-OSHA (6742) to order publications.

Employers and safety and health professionals can sign-up for *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist in finding and preventing workplace hazards. To sign up visit www.osha.gov/quicktakes.

OSHA Regional Offices

Region I
Boston Regional Office
(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
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(312) 353-2220 (312) 353-7774 Fax

Region VI
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(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
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Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa,
Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

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For more information:

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www.osha.gov (800) 321-OSHA (6742)