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DOE HANDBOOK

PROCESS SAFETY MANAGEMENT FOR HIGHLY HAZARDOUS CHEMICALS

U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

ACKNOWLEDGEMENTS

The U.S. Department of Energy (DOE) wishes to thank several organizations for their support in developing this handbook. The Occupational Safety and Health Administration (OSHA) staff provided assistance. Mobil Chemical, General Electric, and Dow Chemical graciously shared their process safety management experience and program materials. JBF Associates shared sample programs and responses by an OSHA/industry panel to process safety management questions. Mr. John Piatt of Pacific Northwest National Laboratories (PNNL) managed the preparation of this standard by Battelle Memorial Institute staff at PNNL and the Battelle Columbus Division.

FOREWORD

The Office of Health (EH-5) under the Assistant Secretary for Environment, Safety and Health of the U.S. Department of Energy (DOE) has published two handbooks for use by DOE contractors managing facilities and processes covered by the Occupational Safety and Health Administration (OSHA) Rule for Process Safety Management of Highly Hazardous Chemicals (29 CFR 1910.119), herein referred to as the PSM Rule. The PSM Rule contains an integrated set of chemical process safety management elements designed to prevent chemical releases that can lead to catastrophic fires, explosions, or toxic exposures. The purpose of the two handbooks, "Process Safety Management for Highly Hazardous Chemicals" and "Chemical Process Hazards Analysis," is to facilitate implementation of the provisions of the PSM Rule within the DOE.

This handbook provides information necessary to determine if a chemical process is covered by the PSM Rule and provides an interpretation of the 14 elements of the PSM Rule. An overview of these elements is given in Table 1.1. This handbook also describes DOE programs that may, with or without modification, satisfy the requirements of this Rule. Questions and answers, based on OSHA's responses to questions from industry and labor, are provided at the end of most sections. Applicable question numbers are referenced in the text in brackets. Sample programs are included that may be used to satisfy provisions of the PSM Rule. These sample programs are adapted from industry and are not mandatory, even though some contain directive language (e.g., will, shall, should). Appendix D lists additional sources of detailed PSM information. For specific guidance on the Process Hazards Analysis element, the reader is referred to the handbook, "Chemical Process Hazards Analysis" (DOE-HDBK-1100-2004).

OSHA's performance-based Rule permits great latitude in how its requirements are implemented, so long as the objectives of each element are met. This handbook recognizes this latitude, but attempts to guide DOE contractors toward efficient and effective options, given existing DOE Orders and requirements. These handbooks describe PSM Rule implementation in terms of industry practices and do not supercede any DOE Orders or requirements.

Promulgation of the PSM Rule has heightened the awareness of chemical safety management issues within the DOE. Contractors whose chemical processes are not covered by the PSM Rule may use these handbooks as a basis for good safety management practices.

Implementation of PSM programs is expected to be a dynamic process. Further information and interpretations may be issued as necessary to clarify the Rule. DOE has an OSHA interpretation phone line at 1-800-292-8061 where DOE contractors can direct questions not covered in this handbook.

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ACRONYMS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CCPS	Center for Chemical Process Safety
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DCS	Distributed Control System
EMR	Experience Modification Rate
EPA	Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
ES&H	Environment, Safety, and Health
EVC	Equilibrium Vapor Concentration
FMEA	Failure Mode and Effects Analysis
FTA	Fault Tree Analysis
GOCO	Government Owned Contractor Operated
HAZCOM	Hazard Communication (Standard)
HAZOP	Hazard and Operability Analysis
HDBK	Handbook
Hg	Mercury (Atomic Symbol)
HHC	Highly Hazardous Chemical
IDLH	Immediately Dangerous to Life or Health
IEEE	Institute of Electrical and Electronic Engineers
ISA	Instrument Society of America
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
LPG	Liquid Petroleum Gas
M&O	Management and Operating
MOC	Management of Change
MSDS	Materials Safety Data Sheet
NDT	Nondestructive Testing
NFPA	National Fire Protection Association
ORC	Organization Resources Counselors
OSHA	Occupational Safety and Health Administration
P&ID	Piping and Instrumentation Diagram
PEL	Permissible Exposure Limit
PrHA	Process Hazard Analysis
PSI	Process Safety Information

PSM	Process Safety Management
PSR	Pre-Startup Safety Review
PSI	Process Safety Information
PSM	Process Safety Management
PSR	Prestartup Safety Review
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RMP	Risk Management Program
SAR	Safety Analysis Report
SASS	Safety Assurance System Summary
SCBA	Self-Contained Breathing Apparatus
SHI	Substance Hazard Index
SOP	Standard Operating Procedure
TLV	Threshold Limit Value
TQ	Threshold Quantity
TSD	Treatment, Storage, and Disposal

GLOSSARY

Accident, Accident Event Sequence

An unplanned event or sequence of events that has an undesirable consequence.

Aggregate Threshold Quantity

The total amount of a particular hazardous chemical contained in vessels that are interconnected, or contained in a process and nearby unconnected vessels that may be adversely affected by an incident at that process.

Atmospheric Tank

A storage tank that has been designed to operate at pressures from atmospheric pressure 1.01 x 10^6 dynes/cm2 (14.7 psia) through 1.05 x 10^6 dynes/cm2 (15.2 psia).

Audit (Process Safety Audit)

An inspection of a plant or process unit, drawings, procedures, emergency plan, and/or management systems by an independent team.

Battery Limits

That portion of a chemical plant in which the actual processes are carried out, as distinguished from storage buildings, offices, and other subordinate structures.

Boiling Point

The initial temperature at which a liquid begins to pass into the gaseous phase at a pressure of 1.01 x 10^6 dynes/cm2 (14.7 psia). If an accurate boiling point is not available, see ASTM D-86-62.

Catastrophic Release

A major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to employees in the workplace or to the public.

Consult

To exchange information and solicit input and participation from workers and their representatives in developing a written employee action plan and process hazard analyses; and to provide employees with access to information required under the Rule.

Contractor

For the purposes of this document, contractor in the PSM Rule refers to DOE subtier contractors, i.e., subcontractors of DOE contractors.

Employee

Under 29 CFR 1910.119, an hourly, salaried, or contract individual who works at a facility and comes in direct contact with a covered process [Q36].

Event

An occurrence involving process, equipment, or human performance either internal or external to a system that causes system upset. In terms of accidents, an event is either a cause or contributing cause of a near miss or accident, or a response to the accident-initiating event.

Facility

The buildings, containers, or equipment that contain a chemical process.

Flammable Gas

A gas that at ambient temperature and pressure forms a flammable mixture with air at a concentration of 13% by volume or less, or a gas that at ambient temperature and pressure forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.

Flammable Liquid

A liquid with a flash point below 37.8 ^{o}C (100 ^{o}F), except mixtures where such liquids account for 1% or less of the total volume.

Hazard

A chemical property, energy source, or physical condition that has the potential to cause illness, injury, or death to personnel, or damage to property or to the environment, without regard for the likelihood or credibility of potential accidents or the mitigation of consequences.

Highly Hazardous Chemical (HHC)

Toxic, reactive, flammable, or explosive substances, such as those identified in the PSM Rule.

Hot Work

Work involving electric or gas welding, cutting, brazing, grinding, or similar flame- or spark-producing operations capable of igniting flammable vapors or gases.

Management Systems

Arrangements for guiding and controlling the work of complex organizations.

Near Miss

An event that did not result in an accidental release of a highly hazardous chemical, but which could have, given another “failure.” Near misses, sometimes called “precursors,” include:

- the occurrence of an accident initiator where the protection functioned properly to preclude a release of a highly hazardous chemical, or
- the determination that a protection system was out of service such that if an initiating event had occurred, a release of the highly hazardous chemical would have taken place.

Normally Unoccupied Remote Facility

A facility that is operated, maintained, or serviced by workers who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No workers are regularly or permanently stationed at the facility. Such facilities are not contiguous with, and must be geographically remote from, all other buildings, processes, or persons [Q22].

Probability

An expression of the likelihood that an event or event sequence will occur during an interval of time, or the likelihood of the success or failure of an event on test or on demand. By definition, probability must be expressed as a number ranging from 0 to 1.

Process

Any onsite [Q25] activity that involves a highly hazardous chemical, including any use, storage, manufacturing, handling, and/or movement of a highly hazardous chemical. Any interconnected group of vessels is considered a single process. Vessels with no physical interconnections located such that an accident in one vessel could spread to adjacent vessels are considered a single process.

Process Change

Modification of a facility, process, procedure or operation that is significant enough to alter the process safety information (see Section 2.10, Management of Change).

Process Hazards Analysis (PrHA)

The application of one or more analytical methods to identify and evaluate process hazards for the purpose of determining the adequacy of or need for control measures.

Process Safety Management (PSM)

The application of management principles, methods, and practices to prevent and control accidental releases of process chemicals or energy.

PSM Rule

The Occupational Safety and Health Administration's "Rule for Process Safety Management of Highly Hazardous Chemicals," 29 CFR 1910.119.

Replacement in Kind

A replacement that satisfies the design specification.

Risk

The quantitative or qualitative expression of possible loss that considers both the probability that a hazard will result in an adverse event and the consequences of that event.

Subtier Contractor

An individual or organization contracted to a DOE contractor.

Threshold Quantity (TQ)

The minimum amount of a toxic, reactive, or flammable chemical judged by OSHA as capable of causing a catastrophic event. The threshold quantity triggers application of the PSM Rule's requirements.

Trade Secret

Any confidential formula, pattern, process, device, information, or compilation of information used in a business that provides a competitive advantage. In the DOE context, trade secrets include classified information.

REFERENCES

DOE Orders, Guides, and Manuals (Manuals are not listed unless the title is different from parent Order.)

DOE O 151.1B	COMPREHENSIVE EMERGENCY MANAGEMENT SYSTEM
DOE O 225.1A	ACCIDENT INVESTIGATION
DOE O 231.1A	ENVIRONMENTAL, SAFETY, AND HEALTH REPORTING
DOE G 231.1-1	OCCURRENCE REPORTING AND PERFORMANCE ANALYSIS GUIDE
DOE G 231.1-2	OCCURRENCE REPORTING CASUAL ANALYSIS GUIDE
DOE M 231.1-2	OCCURRENCE REPORTING AND PROCESSING OF OPERATIONS INFORMATION
DOE O 360.1B	FEDERAL EMPLOYEE TRAINING
DOE O 412.1	WORK AUTHORIZATION SYSTEM
DOE O 414.1A Chg 1	QUALITY ASSURANCE
DOE G 414.1-1A	MANAGEMENT ASSESSMENT AND INDEPENDENT ASSESSMENT GUIDE
DOE G 414.1-2	QUALITY ASSURANCE MANAGEMENT SYSTEM GUIDE FOR USE WITH 10 CFR 830.120 AND DOE O 414.1A Chg 1
DOE O 420.1A	FACILITY SAFETY
DOE G 424.1-1	IMPLEMENTATION GUIDE FOR USE IN ADDRESSING UNREVIEWED SAFETY QUESTION REQUIREMENTS
DOE O 425.1C	STARTUP AND RESTART OF NUCLEAR FACILITIES
DOE O 430.1B	REAL PROPERTY ASSET MANAGEMENT
DOE O 440.1A	WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES

DOE M 440.1-1	DOE EXPLOSIVES SAFETY MANUAL
DOE O 5480.19 Chg 2	CONDUCT OF OPERATIONS REQUIREMENTS FOR DOE FACILITIES
DOE O 5480.20A Chg 1	PERSONNEL SELECTION, QUALIFICATION, AND TRAINING REQUIREMENTS FOR DOE NUCLEAR FACILITIES

DOE Standards and Handbooks

DOE-STD-1027-92 (CH-1)	Hazard Categorization and Accident Analysis Techniques for Compliance with DOE order 5480.23, Nuclear Safety Analysis Reports
DOE-STD-1029-92 (CH-1)	Writers' Guide for Technical Procedures
DOE-STD-1073-2003	Configuration Management
DOE-HDBK-1100-2004	Chemical Process Hazards Analysis
DOE-HDBK-1205-97	Guide to Good Practices for the Design, Development and Implementation of Examinations

OSHA Standards

1910.38	Employee Emergency Plans and Fire Prevention Plans
1910.38 (a)	Emergency Action Plan
1910.106	Flammable and combustible Liquids
1910.109	Explosives and Blasting Agents
1910.119	Process Safety Management of Highly Hazardous Chemicals
1910.120	Hazardous Waste Operations and Emergency Response
1910.252	General Requirements (Welding, Cutting, and Brazing)
1910.252 (a)	Fire Prevention and Protection
1910.1200	Hazard Communication
1910.1200 (g)	Material Safety Data Sheets
1910.1200 (i)	Trade Secrets

Other References

DOE Report, "Example Process Hazard Analysis of a Department of Energy Water Chlorination Process", DOE/EH-0340, September 1993.

See Appendix D for other sources of information on PSM topics.

1.0 Introduction

1.1 Purpose

The purpose of this document is to assist U.S. Department of Energy (DOE) contractors who work with threshold quantities of highly hazardous chemicals (HHCs), flammable liquids or gases, or explosives in successfully implementing the requirements of the Occupational Safety and Health Administration (OSHA) *OSHA Rule for Process Safety Management of Highly Hazardous Chemicals* (29 CFR 1910.119), hereafter referred to as the PSM Rule. Successful implementation requires each contractor to study existing and required chemical process safety management (PSM) systems to determine that a comprehensive program is in place.

Process safety management requires an ongoing effort to prevent catastrophic accidents involving hazardous process materials and energies. It applies management principles and analytic techniques to reduce risks to processes during the onsite manufacture, use, handling, storage, and movement of chemicals. Its focus is on hazards related to the materials and energies present in chemical process facilities.

The purpose of the PSM Rule is to prevent releases of HHCs (listed in Appendix A) that have the potential to cause catastrophic fires, explosions, or toxic exposures. This objective is achieved by first building safety into a process, and then keeping the facility operating safely throughout its life cycle, by identifying process hazards and providing necessary controls over the life of the process [Q36, Q47]. PSM integrates 14 elements to manage facilities, technology, and personnel, as summarized in Table 1.1. The elements of the PSM system are employee participation, process safety information (PSI), process hazard analysis (PrHA), operating procedures, training, subcontractor safety, pre-startup safety review, mechanical integrity, nonroutine work authorizations, management of change (MOC), incident investigation, emergency management, compliance audits and trade secrets.

Other DOE Orders and OSHA rules address general industrial hazards, industrial hygiene, and radiation protection. Thus, PSM is just one program in a comprehensive safety management system. Figure 1.1 shows how PSM and other OSHA chemical safety programs apply to the accident consequence continuum.

The following example shows how the PSM elements are integrated in actual practice. Pilot studies indicate that higher yields can be obtained by maintaining higher temperatures in a reaction vessel. A change in operating temperature must be approved by all technical and support functions (MOC). The impact of this change is assessed though revision of the process hazard analysis (PrHA), which results in a recommendation to modify the pressure relief system. The modifications in temperature and pressure relief system mandate new steps for process operators (Operating Procedures), who require training and verification in the new procedures (Training). The modifications to the pressure relief system are made by the supplier (Contractor Safety) and require that a portion of the process be shut down for this work. The work includes a brazing operation requiring a Hot Work Permit (Nonroutine Work Authorization). Potential impacts on the process require a review of emergency response plans (Emergency Planning).

Table 1.1 Overview of PSM Elements

Employee Participation	Ensure that workers and their representatives are consulted and have access to information regarding all PSM elements.
Process Safety Information	Maintain complete and accurate information on the process technology, process equipment, and hazardous characteristics and physical properties of all chemicals and intermediates for all covered processes.
Process Hazard Analysis	Identify and assess process hazards for each covered process, and take action to manage risk.
Operating Procedures	Provide clear written instructions for safely conducting activities at each covered process that address operating limits, safety and health considerations, and safety systems and their functions.
Training	Provide initial and refresher training with a means of verifying employee understanding for all employees involved in operating a covered process.
Subcontractor Safety	Ensure that subcontractor operations do not compromise the level of safety on or in the vicinity of a process using HHCs.
Pre-Startup Safety Review	Perform safety reviews for new and modified facilities prior to operation when the modification is significant enough to require a change in the process safety information.
Mechanical Integrity	Ensure the integrity and safe operation of process equipment through inspection, testing, preventive maintenance, and quality assurance.
Nonroutine Work Authorizations	Ensure that appropriate measures are taken any time nonroutine operations are performed on or near covered process areas that might initiate or promote a release.
Management of Change	Establish and implement written procedures to manage changes(except for replacements in kind) to process chemicals, technology, equipment, and procedures, and to facilities that affect a covered process.

Table 1.1 Overview of PSM Elements (Continued)

Incident Investigation	Using a written procedure, provide a team investigation of any incident which results in, or could reasonably result in, a catastrophic release of a highly hazardous chemical. Each investigation must be documented in a written report and findings and recommendations resolved in a timely manner.
Emergency Planning and Response	Establish and implement an emergency action plan for the entire plant that complies with 29 CFR 1910.38(a) and that also addresses small releases.
Compliance Audit	Ensure that the PSM program is operating in an integrated and effective manner in compliance with PSM requirements.
Trade Secrets	Ensure all information is available to support the PSM Rule. When necessary, confidentiality or nondisclosure agreements may be used.

The new pressure relief system must be inspected and tested (Mechanical Integrity) and all factors for safe operation must be reviewed (Pre-startup Safety Review [PSR]) before that portion of the process is brought back on line. The piping and instrumentation diagrams (P&IDs) and other engineering drawings must be revised to show the as-modified configuration of the system (PSI). The rationale and information about the changes must be available for review by employees and their representatives (Employee Involvement). Using this information, the PrHA is updated to account for potential hazards associated with the new equipment. Also, inspection and maintenance procedures and training must be updated (Mechanical Integrity, Operating Procedures, Training).

The PSM Rule is a performance-based rule; it does not prescribe how each element is to be implemented. Therefore, this Handbook has been developed to suggest an approach to effectively implement the elements of this Rule within DOE. Relevant excerpts of the Rule are provided with the discussion of each element, and the complete text is provided in Appendix B. In addition, the discussion of each element concludes with questions and answers taken from OSHA's interpretation of the Rule in response to industry and labor inquiries. Appendix C compares the elements of the PSM Rule with the provisions of EPA's Risk Management Program.

Note that the function of PSM differs from that of DOE Safety Analysis Reports (SARs). Hazard analyses are conducted during the SAR process to identify potential accident scenarios whose risks are assessed to determine whether designs, controls, and limits are sufficient to ensure that a DOE facility can be operated safely in a manner that adequately protects workers, the public, and the environment. Unmitigated releases are compared against the evaluation guidelines to determine whether they challenge those guidelines. PrHAs are conducted to identify all process hazards and to evaluate the adequacy of control measures for each hazard. As discussed in

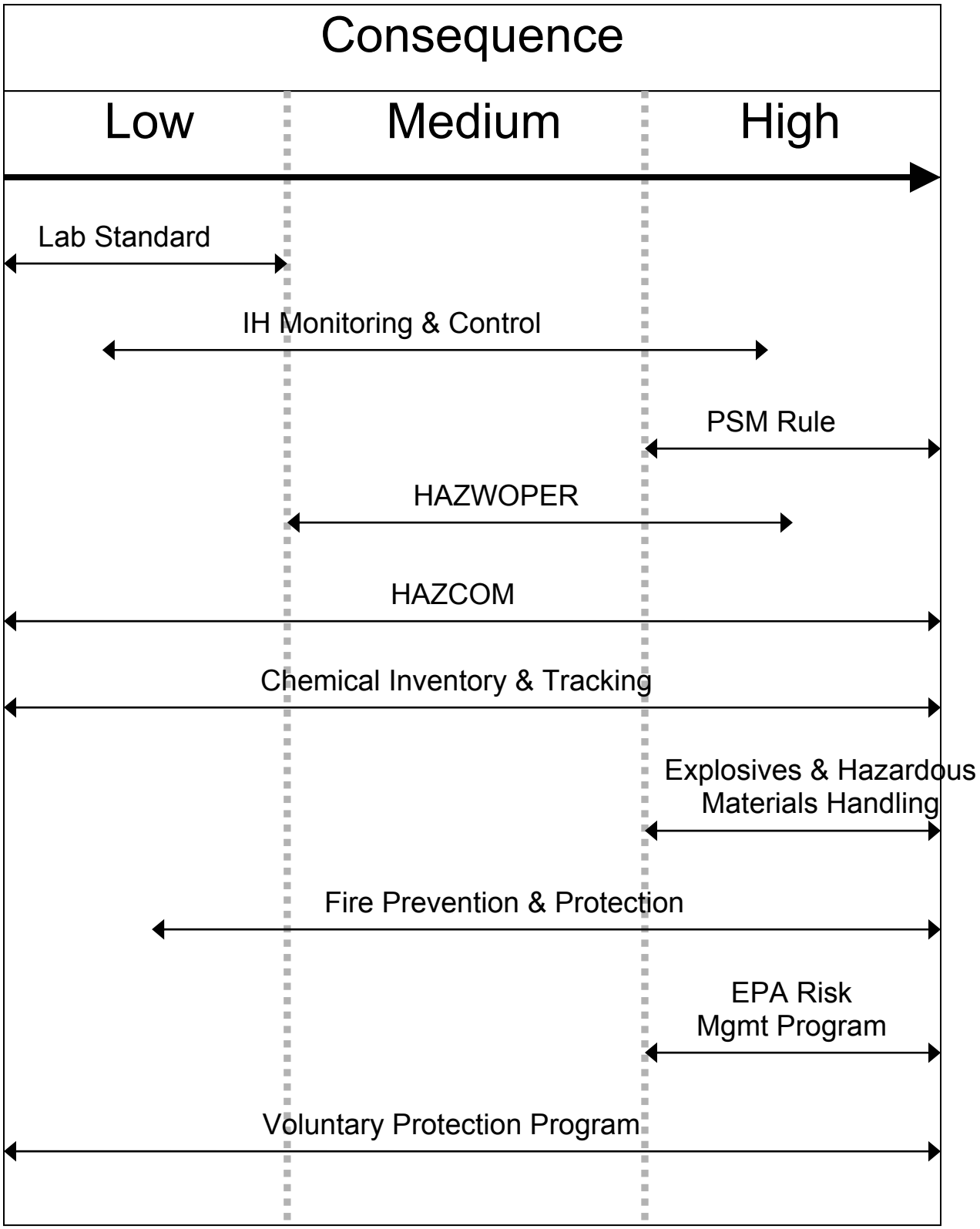

Figure 1.1 Chemical Safety Programs Related to Accident Consequence

Section 2.3, PrHAs may be used to support development of SARs. SARs may incorporate information on many or all PSM elements. However, the minimum requirements for the PSM Rule must be met if the SAR is to be the source of PSM documentation for a covered process.

1.2 Background

Historically, chemical process hazards within the DOE complex have been considered relatively minor compared to nuclear hazards. Prior to the promulgation of the PSM Rule, HHCs were generally viewed as standard industrial hazards unless they could potentially affect the nuclear inventory of a facility. Thus, consideration of chemical releases in safety analysis documents is a relatively recent practice within DOE. DOE policies and Orders have not provided an integrated approach to chemical process safety management. While some PSM elements were in place within DOE, they were designed for nuclear rather than chemical process safety.

The PSM Rule, which was issued February 24, 1992, addresses chemical process hazards by redefining the minimum management program requirements for quantities of certain HHCs that equal or exceed specified threshold quantities (TQs). DOE O 440.1A, WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES, requires that covered chemical processes within DOE comply with the PSM Rule. In June 2004 the DOE sent the Office of Management and Budget, DRAFT 10 CFR 851 “Worker Safety and Health” for subsequent publication in the Federal Register as the new DOE Worker Safety and Health Rule. This new Rule will require contractors to follow all applicable portions of 29 CFR 1910. Where DOE contractors have processes covered by the PSM Rule, all PSM elements must be in place prior to process startup. The PSI and PrHA elements must be updated and revalidated at least every five (5) years after the completion of the initial process hazard analysis to assure that the process hazard analysis is consistent with the current process. Refresher training and compliance audits must be completed at least every three years following the initial refresher training and audits.

1.3 Application

The PSM Rule applies to “processes” rather than to “plants” [Q1, Q2, Q3]. The definition of *process* given in the glossary indicates that chemical quantities in *distinct and separate* processes may be compared individually, rather than collectively, to the threshold quantity (TQ) [Q4, glossary definition of *process*]. The PSM Rule applies to any process that meets the following criteria.

- The process contains the specified TQ or more, by weight, of any of the 137 listed HHCs [Q5, Q6, Q7]. (OSHA’s toxic and reactive HHCs and their respective TQs are provided in Appendix A.)
- The process contains 10,000 pounds or more of a flammable HHC (liquid or gas, or mixture of flammable liquids or gases) [Q8, Q9], in one location, with the following exceptions.

1) When a hydrocarbon fuel is used exclusively onsite, the PSM Rule does not apply so long as the fuel is not a part of a process containing another highly hazardous material covered by the Rule [Q10].

2) The PSM Rule also does not apply to flammable liquids that are stored in atmospheric tanks [Q11, Q12, Q13, Q14, Q15] or transferred through associated piping when those liquids are kept below their normal boiling point without benefit of chilling or refrigeration. Atmospheric storage tanks containing flammable liquids are not exempt if they are located close enough to a covered process that they could be involved in a catastrophic release [Q16, Q17]. Similarly, flammable liquids stored in barrels and drums, would be exempt from coverage so long as they are not stored in such close proximity to a covered process that an incident in that process could involve the containers [Q18]. Where this exemption is invoked, the boiling point (or 10% point of distillation) of the flammable liquid, and its proximity to and absence of interconnections with other covered process equipment should be documented.

- The process involves any quantity of an explosive or pyrotechnic HHC in a manufacturing process. Storage and use of explosives outside the manufacturing process are covered by 29 CFR 1910.109 [Q15]. Compliance with the DOE Manual 440.1-1, DOE Explosive Safety Manual, should promote compliance with the PSM Rule, but does not preclude the need to comply with the PSM Rule as well [Q19, Q20].

In addition to the instances cited above, the PSM Rule does not apply to the following situations.

- Retail facilities (at which over half of the income is obtained from direct sales to end users).

- Oil or gas well drilling or servicing operations. The PSM Rule may apply to other operations associated with drilling, such as separation or treatment of flammable liquids and gases produced by these wells [Q21]. OSHA has determined that DOE petroleum reserves must comply with the PSM Rule.

- Remote facilities that are normally unoccupied [See glossary definition of *normally unoccupied remote facility*).

Figure 1.2 provides a general logic diagram for determining the applicability of the PSM Rule in DOE. No documentation for exclusion is required by the Rule. However, DOE contractors should maintain a list of covered processes and, where the Rule is subject to interpretation, document the basis for excluding a process [Q23].

Questions

Note: Where OSHA speaks of *employers*, this Handbook uses *DOE contractors*. Where OSHA speaks of *contractors*, this Handbook uses *subcontractors*.

1. Does the calculated process inventory for a specific HHC apply to an entire plant, or is each process unit viewed as a separate location?

Each process should be evaluated separately to determine whether it is covered by the Rule. If several distinct and separate processes use the same HHC, coverage is determined by comparing the maximum intended inventory of each process to the appropriate TQ for the HHC. DOE contractors should not add up the inventory of all processes to determine whether the facility is covered.

Compliance is Required if You . . .

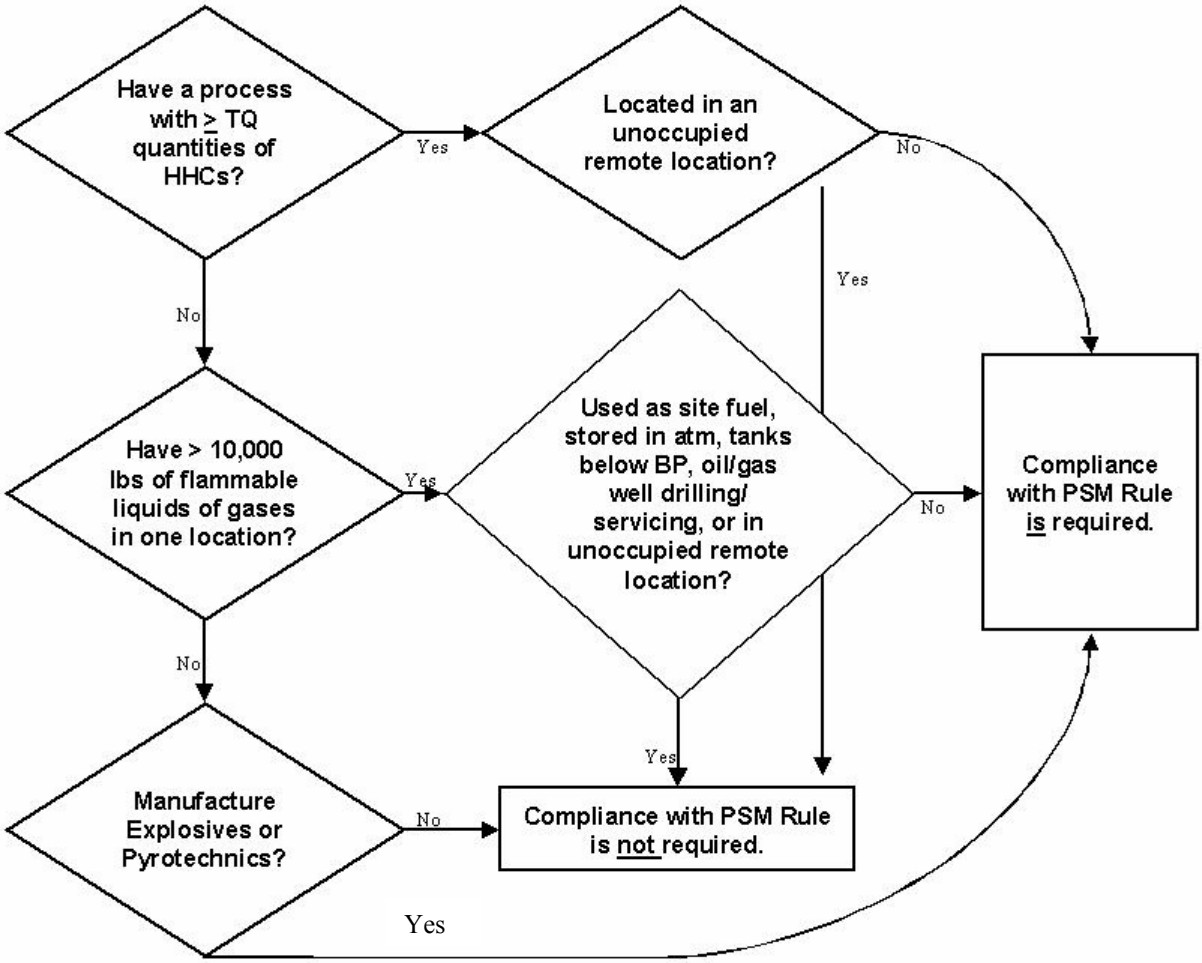

Figure 1.2 Applicability of the PSM Rule

2. If a plant has only one process covered by the Rule, must the PSM Rule be applied to all process areas in the plant?

No. A plant may have some process areas that are covered by the PSM Rule and others that are not. PSM provisions are invoked for covered processes only. However, DOE contractors may choose to implement certain PSM elements in areas not covered by the Rule if they believe activities in these areas pose a significant hazard. To avoid regulatory confusion, contractors should document those parts of their plants that are covered processes.

3. Can a facility contain more than one process?

A facility can contain several processes. If multiple processes are interconnected, they may be considered a single process under the PSM Rule.

4. To determine whether a process is covered, should DOE contractors compare the OSHA TQ for an HHC to the amount of the chemical annually consumed by the process, or to the maximum intended inventory?

DOE contractors should determine whether a process is covered based on the maximum intended inventory that the process can contain (tank or vessel capacity plus interconnected piping capacity), rather than on its cumulative, annual use. Contractors who wish to maintain the quantity of an HHC below its TQ limit, in a process capable of containing over the TQ, must be able to demonstrate that they have effective measures in place to ensure that the inventory in the process cannot exceed the TQ.

5. Several HHCs are listed in Appendix A along with a minimum threshold concentration. What is the technical basis for the list and these thresholds?

The Appendix A list was drawn from several sources, including lists prepared by States that have enacted similar regulations. In determining TQs and threshold concentrations for the Appendix A HHCs, OSHA used an approach similar to that used by the State of Delaware. For example, in evaluating toxic materials, OSHA assumed a ground-level, continuous, steady state release for 1 hour. They also used neutrally buoyant Gaussian dispersion modeling with a 4.3 m/s (14.1 ft/sec) wind speed, D-class stability, and urban dispersion coefficients. The preamble to the PSM Rule discusses all of the specific assumptions used by OSHA for its technical basis for toxic and reactive materials in Appendix A.

In developing its Recommendation for Process Hazards Management of Substances with Catastrophic Potential, the Organization Resources Counselors, Inc. (ORC) compiled a list of dangerous toxic substances from a number of hazardous substance lists. This compilation was then ranked by calculating the substance hazard index (SHI) for specific concentrations. The SHI is defined as the substance vapor pressure (in mm Hg) at 20 ^{o}C multiplied by 1,000,000, divided by 760, and divided by an acute toxicity concentration for the substance. The priority cutoff for the list of toxins in ORC's recommendations was 5,000. To be consistent with the technical basis for toxic materials submitted by ORC to OSHA, the threshold concentration listed in Appendix A should correspond to an SHI of 5,000. Where the concentrations specified for HHCs do not correspond, they reflect judgments made by OSHA during the rulemaking process.

6. How will the list of covered toxic and reactive chemicals found in Appendix A and their TQs be updated?

The list of HHCs can be revised through the normal OSHA rulemaking process. Other than corrections for typographical errors, OSHA has indicated no firm plans to change the Appendix A HHCs.

7. How do DOE contractors determine if a process is covered, when an Appendix A chemical is contained in a mixture? Do you calculate the mass of the Appendix A chemical in the mixture and then compare it to the TQ for the pure HHC listed in Appendix A?

The substances listed in Appendix A without specified concentration limits are intended to be covered by the PSM Rule at commercial grade percentages purity. The commercial grade of most of the HHCs is approximately 99% pure. Many of the HHCs, if not actually 99% pure, are only one to two percent less than 99% pure. For example, the commercial grades of acrolein and allyl chloride are 97% pure. However, some of the HHCs are considerably less than 99% pure. For example, the commercial grade of hydrogen fluoride is 70%. OSHA defines *commercial grade* as a typical maximum concentration of a chemical that is commercially available, and shipped. The term *commercial grade* includes reagent grades that, in some cases, differ in concentration from the typical commercial grades. In cases where different concentrations for commercial and reagent grades are typically shipped, the lowest (or lower) concentration (and any concentration greater) is covered by the PSM Rule. Where covered, the total mass of the mixture is used for comparison with the applicable TQ.

8. Are processes involving flammable liquids (e.g., ethyl alcohol) covered by the PSM Rule?

Processes involving flammable liquids (e.g., a distillation process) in quantities at or above 10,000 lb. are covered. Flammable liquids in atmospheric storage tanks are considered a part of a process if the storage tanks are interconnected with the process, or if they are sufficiently near the process that an explosion, fire, or release could reasonably involve the storage area.

Flammable liquids that are stored in atmospheric tanks in a tank farm where only transferring and storage are performed are not covered by the PSM Rule. They are, however, covered under 29 CFR 1910.106.

9. Two flammable chemicals in quantities below 10,000 lb are combined in a process to form a flammable liquid in excess of 10,000 lb. Is this process covered?

Based upon this consideration alone, yes.

10. Are processes covered if they contain fuel used for process heating or drying only?

The PSM rule exempts processes using flammable liquids or gases solely as fuels in the workplace. Thus, these processes are not covered unless they are covered for other reasons.

11. There is an exemption for atmospheric storage and transfer of flammable liquids. Are all atmospheric vessels excluded from coverage?

This exemption deals with storage and transfer of flammable liquids only. Atmospheric storage and transfer of HHCs listed in Appendix A are not exempt. Further, atmospheric storage tanks of flammable liquids may be covered if they are interconnected or in close proximity to a covered process. Contractors should evaluate each situation based on local site-specific considerations and document the technical basis for invoking this exemption.

12. Are activities such as atmospheric mixing, and blending of flammable liquids covered under the Rule?

The requirements of the PSM Rule apply to such operations. The exemption for atmospheric storage and transfer of flammable liquids does not apply to mixing and blending operations, because such operations may generate static charges capable of ignition.

13. Are flammable liquids covered by the Rule when stored at atmospheric pressure in tanks designed for pressure-service?

The Rule exempts storage of flammable liquids in atmospheric storage tanks in certain instances. If a DOE contractor can reasonably show that the tank cannot be operated above atmospheric pressure, then the exemption can still apply. The means to ensure adherence to this operating practice should be reliable and documented.

14. Are flammable liquid storage tanks that are gas-blanketed for vapor control, covered by the PSM Rule?

Under the PSM Rule, an atmospheric storage tank means a tank which is designed to operate at pressures from atmosphere through 0.5 p.s.i.g. Therefore, flammable liquid storage in tanks in which gas blanketing is maintained at or below 0.5 p.s.i.g. is exempt if it is not connected to a covered process. Tanks containing 10,000 pounds or more of a flammable liquid are covered by the PSM Rule if they are gas blanketed at a pressure greater than 0.5 p.s.i.g.

15. Are warehouses that store HHCs considered covered processes if the total inventory exceeds the TQ for Appendix A materials? For flammable materials? For explosives?

Warehouses are covered by the PSM Rule if the total quantity of an HHC stored in one location exceeds the TQ for the particular HHC. If a warehouse is used to store containers of Appendix A HHCs and, either individually or collectively, they exceed their TQs, then the warehouse is covered under the PSM Rule. However, atmospheric storage of flammable liquids is covered under other OSHA regulations (e.g., 29 CFR 1910.106) and is not covered under this Rule. Further, explosives manufacturing is covered under the PSM Rule. However, storage and use of explosives outside the manufacturing process are covered under 29 CFR 1910.109, Explosives and Blasting Agents; not under the PSM Rule.

16. Does the exemption for flammable liquids in atmospheric storage tanks apply if connected to a process or process vessel?

No, it only applies to atmospheric tanks, containers, and pipes used only for storage and transfer (to storage).

17. Are atmospheric storage tanks containing flammable liquids exempt even if they are located adjacent to a covered process?

Atmospheric storage tanks containing flammable liquids are not exempt if they are located close enough to a covered process that they could be involved in a catastrophic release.

18. For the purposes of the PSM Rule, does OSHA consider Department of Transportation (DOT) approved containers to be atmospheric tanks?

Containers such as 55 gallon drums are considered to be atmospheric tanks. Therefore, storage of flammable liquids in such containers, even if the quantity exceeds 10,000 pounds, would not be covered by the PSM Rule. However, such storage would have to meet the requirements contained in the 1910.106, Flammable and Combustible Liquids.

19. What explosive substances are covered by the PSM Rule?

In 1910.109(a)(3), an explosive is defined as any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion (i.e., with substantially instantaneous release of gas and heat).

20. What is meant by the manufacture of explosives?

OSHA considers the manufacture of explosives to mean mixing, blending, extruding, synthesizing, assembling, disassembling, and other activities involved in the making of a product or device which is intended to explode.

21. Are flammable liquid and gas separation vessels associated with oil and gas well drilling and servicing operations exempt?

Yes; however, these operations are often closely associated with a variety of vessels used to separate and treat the flammable liquids and gases produced by the wells. Some oil and gas production vessels may be excluded from coverage under the Rule by the atmospheric storage and transfer exemption. However, other vessels associated with oil and gas are covered if the flammable materials are stored above atmospheric pressure and meet the 10,000-lb TQ requirement.

22. Please clarify the definition for the exemption of a normally unoccupied remote facility? What does normally unoccupied mean? How remote is remote?

Normally unoccupied means that employees are not permanently stationed at the remote location. This includes those sites where employees make periodic, scheduled visits (e.g., for preventive maintenance, sample collection, equipment calibration, or inspections). Facilities meeting this definition are not contiguous with and must be geographically remote from all other buildings, processes, or persons. There is no minimum distance

specified to define *remote*. DOE contractors should review each situation and document their technical bases for determining whether a process is exempt. No accident at a remote location should have the potential to injure people at locations which are normally occupied.

23. What documentation is needed, if any, to support a DOE contractor's judgment that a particular site, facility, or process is not covered?

No specific documentation is required by the PSM Rule concerning the establishment of covered processes. However, DOE contractors should maintain a list of covered processes and document the technical basis for any decision to exclude a process from coverage where the PSM Rule is subject to interpretation.

24. Single containers used to store a specific HHC, each containing less than the TQ amount, are located at several distinct, widely-separated locations in a plant. Is the storage and handling of this HHC covered under the Rule if the combined amount of two or more containers exceeds the TQ for the HHC?

If the containers are not connected and are not in one location, then each container and its associated process should be evaluated separately. On the other hand, if widely separated containers are connected by process piping, and a loss of containment in one section could cause an HHC to be released from more than one container, then coverage should be evaluated on the basis of the total amount of HHC in all of the connected containers. A similar argument applies if these separate containers, although unconnected, are all stored in one location where a single, common event could release the HHC from two or more containers.

25. Does the PSM Rule apply to onsite movement of HHCs in containers, trucks, or railcars?

The PSM Rule applies to the onsite movement and storage of HHCs in containers or vehicles operated by employees. Onsite and offsite movement of HHCs by commercial carriers is regulated by other agencies such as the U.S. Department of Transportation (DOT), the Office of Pipeline Safety, and the U.S. Coast Guard.

For example, a railroad tank car is subject to PSM requirements if it contains more than the TQ of an HHC. However, the exception for flammable liquids stored in atmospheric tanks or transferred below their normal boiling point without the benefit of chilling or refrigeration may apply so long as the rail car is not pressurized.

26. A process contains a material not covered by the PSM Rule. However, release of this material to the atmosphere in sufficient amounts would generate (e.g., through oxidation, fire, reaction with moisture, etc.) an HHC in excess of its TQ. Is this process covered?

A process is not covered under the PSM Rule unless it contains an HHC that exceeds its TQ. However, when DOE contractors recognize situations with significant potential impacts to workers, the public, the environment, or facilities and operations; they should consider applying appropriate PSM safety management elements.

27. A process normally contains no HHCs, but under upset conditions, the process could generate an HHC in an amount in excess of the TQ. Is the process covered?

Processes are covered by the Rule only if, at any time under normal processing circumstances, they contain an HHC in excess of its TQ. The ability to generate an HHC during an upset condition does not invoke coverage by the PSM Rule. However, when DOE contractors recognize situations with significant potential for safety and health impacts, they should consider applying appropriate PSM practices to protect worker health and safety.

28. An Appendix A chemical is created within and then immediately consumed in a process. Does the brief existence of this short-term intermediate chemical cause this process to be covered by the Rule? If the inventory of this intermediate can only exceed the TQ under upset conditions, is it a covered process?

A process is covered if, at any time in one location, it contains an HHC in excess of its TQ. This process is covered as long as the intermediate existed under normal conditions in the process. If the intermediate chemical could exist above the TQ only under upset conditions, then the process is not covered. However, when DOE contractors recognize situations with significant potential for safety and health impacts, they should consider applying appropriate PSM practices to protect worker health and safety.

29. Please clarify the exemptions for the following types of operations covered under the workplace fuel criteria: hazardous waste incinerators, refinery fuel gas systems, liquefied petroleum gas (LPG) storage for vehicle fueling, natural gas systems for utility boilers, and natural gas systems used to sweep flare systems.

If the incinerator is used to destroy either a flammable material or another HHC that is listed in Appendix A, and the process contains a TQ of an HHC, the incinerator is covered. Generally, fuel gas or natural gas systems are exempt if they are operated only for fueling process furnaces or utility boilers that are also not covered. However, if fuel gas or natural gas is used to fuel a covered process, then the fuel gas or natural gas systems associated with the process are covered. LPG storage and handling systems used exclusively to fuel vehicles are not covered. A natural gas supply used to "sweep" a flare system is not covered unless the flare system is covered for other reasons.

30. Must the boundary of a covered process containing many interconnected vessels always extend in all directions to the process unit's battery limits?

No. In many cases, DOE contractors may wish to define the physical limits of coverage based on an evaluation of the threat of a catastrophic release of an HHC. Contractors are encouraged to document the technical basis of their coverage decision for those cases subject to interpretation.

31. A continuous process uses an HHC, but the HHC inventory exceeds the TQ in only one vessel. Upstream of this vessel, except for the HHC supply system, there are no HHCs. Because the HHC is consumed almost entirely in the vessel, normally only trace amounts of the HHC exist downstream of this vessel. Is this process covered, and if so, how far upstream and downstream do the covered process boundaries extend?

This process is covered. DOE contractors may wish to adopt the following approach. Extend the boundary upstream and downstream to the point at which there is no reasonable potential for a catastrophic release. At least the equipment immediately upstream and downstream from the vessel containing the TQ of the HHC should be included in the boundaries of the process.

32. A batch process uses an HHC, above its TQ, in one of its many processing steps. Is this step, and its associated equipment, a covered process?

Yes. In addition, the same strategy discussed in Questions 30 and 31 may apply to the equipment used in a batch process. A DOE contractor may apply a similar approach in setting the boundaries around the processing steps that are covered under the Rule.

33. Must the inventory of HHCs contained in offsite interconnecting pipelines be included in the inventory calculation? If so, can reliable isolation devices at the fence line be used to limit the inventory used in the coverage calculation?

DOE contractors should consider the amount of material that could reasonably be released if a loss of containment occurred onsite. If this amount represents a catastrophic release to the workplace (i.e., it exceeds the TQ for an HHC), then the process is covered. OSHA has not yet recognized the use of isolation devices as adequate mechanisms to limit inventories for purposes of determining coverage under the PSM Rule. However, if isolation devices are considered as preventative or mitigative control measures against catastrophic releases, then documentation should be provided as to their effectiveness and reliability.

34. Does the PSM Rule apply to laboratory and research operations?

A laboratory or research operation involving at least the TQ of one or more HHCs is subject to the PSM Rule.

35. Does the PSM Rule apply to EPA regulated and permitted Resource Conservation and Recovery Act (RCRA) hazardous waste treatment, storage, and disposal (TSD) facilities, when such facilities keep onsite in one location a hazardous waste chemical in a concentration and quantity that exceeds the applicable TQ of Appendix A.

Yes. Contractors having TSD facilities which contain covered processes must comply with the PSM Rule.

2.0 Process Safety Management Elements

The PSM Rule describes a comprehensive management system containing 14 elements for effective control of process hazards. The word *system* implies the integration of all management elements with a method for assessing the efficiency and effectiveness of implementation. The elements of the PSM Rule discussed in this section are an interrelated set of management systems associated with the process, people, production, and preparedness, as shown in Figure 2.1.

This section describes the intent of each element; corresponding DOE programs and requirements; documentation requirements; and minimum implementation criteria for development of new programs or evaluation of existing ones. Where DOE Orders are referenced, associated DOE Manuals and Contractor Requirement Documents should also be consulted. DOE contractors can use the implementation criteria to determine when the requirements of the element are satisfied. Each section concludes with questions and answers based on OSHA's interpretation of the PSM Rule. Appendix C compares the elements of the PSM Rule with the provisions of the EPA's Risk Management Program.

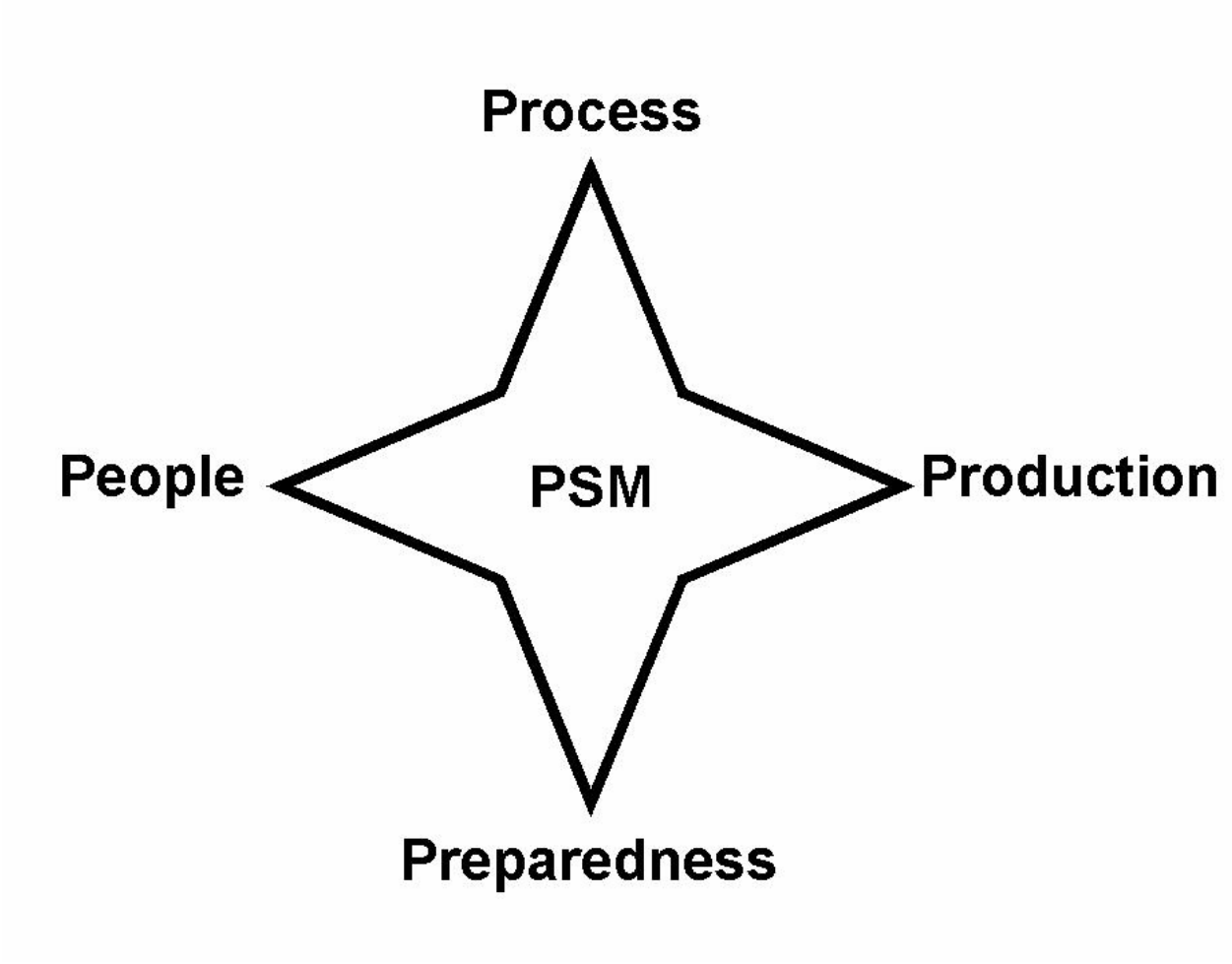

Figure 2.1 The Process Safety Management System

2.1 Employee Participation

29 CFR 1910.119 (c)

(1) Employers shall develop a written plan of action regarding the implementation of the employee participation required by this paragraph.
(2) Employers shall 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.
(3) Employers shall provide to employees and their representatives access to process hazard analyses and to all other information required to be developed under this standard

Intent

Recent enforcement actions indicate that OSHA expects employers to consult with employees and their representatives on each PSM element (including development of the employee participation plan) [Q36, Q37]. Employees with a working understanding of chemical processes should serve as informational resources in the development of chemical process accident prevention plans, the performance of PrHAs, and the conduct of incident investigations and audits. As a minimum, employees and their representatives must be consulted (i.e., information exchanged and input solicited) [Q38, Q39]. The effectiveness of PSM programs depends on the employees' sense of ownership and accountability.

DOE contractors should work with employees and their representatives to reach agreement on and to document the optimum level of employee involvement for each element. Contractors must also ensure that workers have access to PrHAs and PSI to promote the safety of day-to-day operations [Q40, Q41].

Corresponding DOE Programs and Requirements

General areas for employee participation in DOE safety and health programs are identified in DOE O 440.1A, WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES.

Documentation Requirements

Contractors are required to prepare written plan for worker involvement. The plan must address the minimum requirements for consultation on development of PrHAs and other PSM elements. It must also address worker access to PrHAs, PSI, and all documentation developed under the PSM Rule. A sample employee involvement program is included at the end of this section in Exhibit 2.1.

Minimum Implementation Criteria

DOE contractors must develop a plan that provides for an appropriate level of employee participation in the conduct of each PSM element (e.g., consultation with workers on PrHAs, employee access to PrHAs and PSI, and training).

Questions

36. Please clarify the definition of *employee*. Does the PSM Rule mean hourly, salaried, or both?

Under the PSM Rule, OSHA normally considers an employee to be an hourly worker who is directly involved with a covered process. However, DOE encourages full worker participation, including subcontractor, hourly, and exempt workers.

37. What are acceptable levels of employee participation? Must employees participate in all PSM elements? What documentation is required to demonstrate participation?

DOE contractors should decide the appropriate level of employee involvement in PSM activities based on site-specific conditions and consultation with employees. Although the PSM Rule requires no specific documentation of employee involvement beyond that specified in the written plan, the degree of employee participation should be evident in such PSM documentation as PrHA reports and minutes of safety meetings.

38. How do DOE contractors *consult with employees and their representatives* at a non-union facility?

DOE contractors may provide a broad spectrum of possibilities for employee participation in various PSM activities. They may also create management/employee committees to address site PSM and safety and health issues.

39. The PSM Rule requires contractors to consult with *employees and their representatives*. Is the term broad enough to include representatives of international unions or consultants designated by the union locals or international?

The term *employee representative* means a union representative where a union exists, or an employee-designated representative in the absence of a union. The term may include the local union representatives, international union representatives, or individuals designated by these parties, such as safety and health committee representatives at the sites or non-employee consultants. In the absence of a union, employees may designate a representative to participate in the consultation process.

40. What does *access* mean? Does *access* refer to availability at a central location? Do DOE contractors have to make copies for employees if requested?

Access under the PSM Rule means that information must be made available for employees and their representatives in a reasonable manner. Reasonable access may require loaning documents or placing copies in more convenient places than a central location. The trade secret provision of the Rule permits contractors to require confidentiality agreements when needed.

41. What does *access* to PrHAs mean?

Employees working in a covered process area should be able to review a PrHA report on the process.

SAMPLE EMPLOYEE PARTICIPATION PLAN

PURPOSE

The purpose of this plan is to document the program elements used by (Contractor/Site) to:

a) consult with employees and their representatives, where applicable, on the development of the various elements contained within the OSHA Process Safety Management Rule (29 CFR 1920.119) and

b) provide employees and their representatives access to information developed under this Rule.

GENERAL

The intent of this program is to foster broad and active participation involving hourly, exempt, nonexempt, and contract employees cooperating to make the workplace safer. Consistent with this intent, site management will do the following.

a) Inform employees about the promulgation of the OSHA PSM Rule and its contents, using currently established communication methods.

b) Assess compliance status and develop specific plans to ensure that the PSM Rule is effectively implemented, and communicate this information to employees as appropriate.

c) Identify operations (processes) covered under the requirements of the rule and communicate these findings to employees.

d) Inform employees of the relevancy and applicability of existing company safety elements to satisfying the requirements of the PSM Rule.

e) Involve employees in compliance with the various elements within the OSHA PSM using their knowledge, skills, and experience.

f) Encourage employees to submit safety suggestions via an existing safety/operations/quality improvement suggestions system.

EMPLOYEE INVOLVEMENT BY PSM PROGRAM ELEMENT

This section describes opportunities for employee involvement in specific PSM elements. (Detailed descriptions of program elements and their requirements are provided in the later sections of this handbook. This section provides samples of employee involvement in a few PSM elements. DOE contractors should examine each PSM element for potential opportunities for employee involvement. Employee participation is not required for all PSM elements; just where it makes good sense.)

Exhibit 2.1

Process Hazard Analyses (PrHA)

Employees participate on the PrHA team or in support of the analysis effort. The results of the PrHA are shared with employees affected by the findings or recommendations. Employees are advised of any necessary changes brought about by the PrHA and may be involved in the design and implementation of required changes.

Operating Procedures

Employee involvement in the development and implementation of operating, maintenance, and safe work practice procedures may take several forms.

- Consultation during development/implementation to determine if procedures accurately reflect what is done, what should be done, and the steps necessary to attain the desired result in a safe and environmentally responsible manner.
- Procedure development assignments based on employee knowledge and experience.
- Commissioning team assignments to critique and implement new processes or procedures.

Training

Employees may be involved through self-managed learning, coaching new employees, working with training guides, and one-on-one, on-the-job training in the field. The workplace environment encourages employees to identify training needs and take part in training development and implementation.

Pre-startup Safety Review

Whenever possible, cognizant employees will be involved in the performance of the PSR. Employees are encouraged to have a questioning attitude and report any concerns that are not addressed by the PSR.

Mechanical Integrity

Maintenance personnel receive training based on written procedures for the maintenance of process equipment. They must have an understanding of the process and its operation based on applicable operating procedures, an overview of the process, and process hazards, prior to being qualified.

Employees typically do much of the work in this area providing input for equipment history and reliability; recording observed data; maintaining the inspection and maintenance database. Employees doing the actual test and inspection work are typically asked to review and comment on manufacturer's recommendations for testing and inspection approaches and frequencies.

Exhibit 2.1

Employees take part in equipment failure reviews, participate in work process critiques, and are encouraged to make recommendations for change.

Hot Work Permit (Nonroutine Work Authorizations)

Employees are involved in planning and implementing the safe work procedures documented in hot work permits and other nonroutine work authorizations.

Management of Change

Procedures exist to manage changes to process chemicals, technology, equipment, procedures, and process facilities. These procedures provide assurance that the PrHA, PSI, and procedures are updated, if necessary, to reflect the changes. Essential to the success of MOC system is the active participation by both site and affected subcontractor employees in the review and evaluation process to determine the impacts of proposed changes.

Incident Investigation

An incident is an event whose occurrence resulted in, or could reasonably resulted in a catastrophic release of a highly hazardous chemical in the workplace. It is site policy that all incidents will be investigated as soon as possible, but be initiated no later than 48 hours after the incident. The team investigating the incident shall consist of at least one person knowledgeable in the process involved; a contract employee, if a subcontractor was involved; and other cognizant and informed individuals. Employees are typically involved in incident investigations since their knowledge and skills in operations or maintenance are necessary for the conduct of the investigation.

When the investigation is completed, a report containing the contributing factors to the incident and recommendations for prevention of future occurrences will be made. This report will be circulated by posting in work areas or by discussing it in scheduled safety meetings or ad hoc meetings with employees. Management then addresses, resolves, and implements the report findings and recommendations. All site and contractor personnel affected by the changes are informed of any changes and may be involved in their implementation.

Emergency Planning and Response

A formal review process for site-wide procedures exists for soliciting and obtaining employee input on site emergency response plans. Employees may critique drills and actual incidents to identify opportunities for performance improvements, and improve both emergency response planning and responder performance. Communication to employees and subcontractors is essential to promote understanding of the actions to take during an emergency.

2.2 Process Safety Information

29 CFR 1910.119 (d)

In accordance with the schedule set forth in paragraph (e)(1), the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard. The compilation of written process safety information is to enable the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals. This process safety information shall include information pertaining to the hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process, and information pertaining to the equipment in the process.

(1) Information pertaining to the hazards of the highly hazardous chemicals in the process. This information shall consist of at least the following:

- *(i) Toxicity information;*
- *(ii) Permissible exposure limits;*
- *(iii) Physical data;*
- *(iv) Reactivity data:*
- *(v) Corrosivity data;*
- *(vi) Thermal and chemical stability data; and*
- *(vii) Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.*

Note: Material Safety Data Sheets meeting the requirements of 29 CFR 1910.1200(g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph.

(2) Information pertaining to the technology of the process.

(i) Information concerning the technology of the process shall include at least the following:

- *(A) A block flow diagram or simplified process flow diagram (see Appendix B to this section);*
- *(B) Process chemistry;*
- *(C) Maximum intended inventory;*
- *(D) Safe upper and lower limits for such items as temperatures, pressures, flows or compositions; and,*
- *(E) An evaluation of the consequences of deviations, including those affecting the safety and health of employees.*

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

(3) Information pertaining to the equipment in the process.

(i) Information pertaining to the equipment in the process shall include:

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

(ii)	*The employer shall document that equipment complies with recognized and generally accepted good engineering practices.*
(iii)	*For existing equipment designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer shall determine and document that the equipment is designed, maintained, inspected, tested, and operating in a safe manner.*

Intent

The objective of the PSI element is to collect complete and accurate process information sufficient to conduct PrHAs, to support hazard communication requirements, and to document the design configuration of each process [Q42].

PSI must be sufficient to allow assessment of fire, explosion, and toxic hazards; the corrosive or erosive effects of process chemicals on equipment and instrumentation; the potential for overpressures or runaway reactions; and the existence of incompatibilities between materials commonly found around covered processes [Q43].

Information on process technology must describe the process chemistry, maximum inventories of
process chemicals, and limits for process parameters. Information is also needed to support a qualitative estimate of the consequences of deviations or upsets outside established process limits. A description of process technology should include block or process flow diagrams. Process flow diagrams may include equipment sizes and ratings, process parameters for each mode of operation in each piping segment, limits on chemical levels in all process vessels, pressure and flow data for pumps, and process temperature and pressure limits for all equipment. Such diagrams may include set points for pressure relief valves and alarms, monitoring and surveillance equipment, and batch size information. Thus, detailed process flow diagrams may contain all required process technology information except process chemistry. However, a simple block flow diagram is adequate if the other necessary information is captured on the P&IDs or in a written process description. For existing processes for which the original process technology information no longer exists, it may be developed in conjunction with the PrHA.

Process equipment information should describe all hardware used in a process and provide the actual or reconstructed design, including all codes, standards, or other good engineering practices that were followed. It must describe materials of construction; electrical classification; and design of pressure relief, ventilation, monitoring and surveillance equipment, and other safety systems. PSI should contain a functional description of the safety systems in a covered process to convey the protective features that exist for emergencies [Q43]. P&IDs, which generally contain more detailed information than process flow diagrams, must be provided to show the relationship between equipment and instrumentation. Information on new processes must also include material and energy balances. For older processes where the design basis is unknown or the standards, codes, and practices are not in general use, documentation must be developed to show that the equipment is still safe to use.

Corresponding DOE Programs and Requirements

Most DOE contractors have hazard communication programs that use information from Materials Safety Data Sheets (MSDSs) to comply with 29 CFR 1910.1200. Information about the hazards posed by most process chemicals may also be obtained from MSDSs. Additional information may be required to describe process chemistry conditions that can lead to overpressures or runaway reactions. DOE information requirements regarding hazard identification are included in DOE O 151.1B, COMPREHENSIVE EMERGENCY MANAGEMENT SYSTEM, DOE O 420.1A FACILITY SAFETY, DOE O 430.1B, REAL PROPERTY ASSET MANAGEMENT, and DOE O 440.1A, WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES.

Some DOE facilities, especially nuclear facilities, have design information for systems, structures, and components to support Safety Analysis Reports (SARs) and ongoing engineering improvements to systems. Systems for maintaining as-built drawings of processes, together with their original design basis and history of modifications, may be available for these facilities. However, documentation of the design basis for older DOE facilities and nonnuclear facilities is often weak.

New DOE facilities are required under DOE O 430.1B to meet certain facility safety requirements. SARs for existing facilities require that the facility design be evaluated for conformance with these requirements. Statements in the design information and/or the SAR regarding compliance with these safety design requirements provide documentation that facilities and equipment are designed in accordance with recognized and generally accepted good engineering practices. DOE information requirements associated with the technology and equipment of a nuclear process are found in 10 CFR 830 Subpart B, NUCLEAR SAFETY MANAGEMENT, SAFETY BASIS REQUIREMENTS.

Documentation Requirements

The PSI element is a documentation requirement. It specifies the minimum written PSI package needed to support a PSM program. It should be updated as part of the MOC element of the PSM Rule because the safety of processes depends on workers having access to accurate process safety information. PSI used to support the development of facility safety documentation or PrHAs should be referenced. PSI need not be located in one document or in one place [Q42]. Electronic storage media may be used so long as a backup version is available at all times [Q44]. PSI should be part of the facility configuration information and should be maintained for the life of a process through a configuration management system [Q45].

Complete PSI packages are essential for conducting PrHAs. Initial PSI is required to establish risk-based priorities for completion of PrHAs.

Minimum Implementation Criteria

Adequate information must be available to support preparation of PrHAs, operating procedures, training materials, and emergency plans. The PrHA team can generate information on process technology when complete information does not exist. In addition, documentation must be available to confirm that process equipment complies with recognized and generally accepted

good engineering practices. Some of the more frequently used codes and standards include the following.

- American National Standards Institute (ANSI) establishes piping/valves/fittings/flanges and equipment design criteria, including selection of materials and standards for engineering drawings
- American Society for Testing and Materials (ASTM) establishes standard testing methods and acceptable test results, and definition of metallic and non-metallic material
- National Fire Protection Association (NFPA) establishes electrical area classifications and requirements, and fire protection design standards
- American Society of Mechanical Engineers (ASME) establishes Boiler and Pressure Vessel Code; welding materials and welder qualifications, NDT requirements, and standards; and ferrous and non-ferrous material specifications
- Institute of Electrical and Electronic Engineers (IEEE)/Instrument Society of America (ISA) establishes design and application specifications for electrical and electronic equipment, and failure rate data
- The American Petroleum Institute (API) recommended practices govern the design of hydrocarbon systems and facilities, including safety systems and process hazards management guidelines for petrochemical facilities.

For existing equipment designed and constructed according to codes, standards, or practices that are no longer in use, a determination must be made and documented that the equipment is designed, maintained, inspected, tested, and operated in a safe manner. The following methods can be used to demonstrate that the equipment is designed for safe operation.

- Conduct engineering analyses or empirical testing to show that the equipment design provides a level of protection equivalent to current codes or standards.
- Change process parameters to comply with new codes or standards.
- Use the PrHA to demonstrate that continued use of existing equipment does not significantly increase the likelihood of catastrophic consequences, compared to equipment designed to current standards [Q46].

Information about process chemical hazards must include the following.

- Toxicity information, such as LD_{50} /LC_{50} values, Threshold Limit Values (TLVs)), Immediately Dangerous to Life or Health (IDLH) values, and Emergency Response Planning Guideline (ERPG) concentrations.
- Permissible Exposure Limits (PELs).
- Physical data, such as boiling point, freezing point, density, vapor pressure, vapor density, solubility, evaporation rate, appearance, and odor.
- Reactivity data, such as stability and compatibility with other families of materials including acids, bases, and water.
- Corrosivity data for containment vessels, metallics, and plastics.

- Thermal and chemical stability data, such as flammability limits, flash point, and auto ignition temperature.
- Hazardous effects of inadvertent mixing of different materials.

Information about process technology must include the following.

- Block flow diagrams or simplified process flow diagrams.
- Process chemistry, such as flow rates, chemical equations, chemistry of intermediates, utility systems, and exothermic/endothermic reactions.
- Maximum intended inventory for all storage tanks, reactors, and other vessels.
- Safe upper and lower limits for process parameters, such as flow rates, pressures, temperatures, levels, phases, and composition, for all modes of operation in all major piping segments.
- Consequences of deviations outside safe operating limits.

Information about process equipment must include the following.

- Materials of construction and basis for selection, such as material compatibility or corrosion resistance.
- Electrical area classification, based on flammable materials located near the process.
- Relief system design and design basis.
- Ventilation system design, including airflow, and psychometric and equipment sizing calculations.
- Design codes and standards.
- Material and energy balances for processes. The balances must

  show that mass flows and heat transfers sum properly.
- Safety systems, such as control interlocks, depressurization, containment and disposal, and toxic/flammable material detection systems.
- Piping and instrumentation diagrams.

Questions

42. Must all PSI be kept in one place? Can it be spread out in a variety of documents and locations?

All PSI does not have to be in one document or in one place but should be accessible to all employees who need it to safely perform their jobs. DOE contractors may choose to store their PSI in a central location. However, they should ensure that this level of document control does not hamper worker access to up-to-date PSI. DOE contractors may consider developing a PSI road map to help workers find necessary information easily.

43. PSI is required for ventilation system design, safety systems, and mixing of materials that could foreseeably occur. What is meant by these terms?

PSI should contain a description of the function and design basis for all ventilation systems whose purpose is to maintain a healthy environment, particularly when these ventilation systems are used to maintain a safe haven in the event of a catastrophic release of a HHC.

PSI should contain a functional description of the safety systems in a covered process. Safety systems are systems designed to control and maintain a process within safe design parameters. Examples of safety systems are interlocks, scrubbers, flares, and detection systems for releases of toxic or flammable chemicals. Workers should know what protective features exist and how to use these safety systems in an emergency.

Chemical hazard information should contain information on the incompatibility of HHCs with materials that are known to exist in the workplace. Employees routinely working with materials commonly found around a covered process should be familiar with the potential safety and health impacts from inadvertently combining these materials with the HHC.

44. Do we have to keep hard copies of all of the PSI or can we use electronic media?

There is no specific storage requirement for PSI or any other documentation created under the PSM Rule. Any medium may be used as long as the accessibility requirements are met. However, DOE contractors who use electronic storage media should consider in advance what they will do when computers used to access this information are unavailable (e.g., during power failures).

45. How long must DOE contractors maintain process safety information?

To demonstrate compliance and to meet the intent of the PSM Rule, PSI must be kept for the lifetime of a process and updated whenever changes other than replacement in kind are made.

46. How can a PrHA be used to demonstrate that equipment is designed safely?

The PrHA can be used to perform a sensitivity analysis to evaluate the impacts of using equipment or facilities which have not been designed to current codes and standards.

2.3 Process Hazard Analysis

29 CFR 1910.119 (e)

(1) The employer shall perform an initial process hazard analysis (hazard evaluation) on processes covered by this standard. The process hazard analysis shall be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process. Employers shall determine and document the priority order for conducting process hazard analyses based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process. The process hazard analysis shall be completed prior to process startup.

(2) The employer shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed.

- (i) What-If;
- (ii) Checklist;
- (iii) What-If/Checklist;
- (iv) Hazard and Operability Study (HAZOP);
- (v) Failure Mode and Effects Analysis (FMEA);
- (vi) Fault Tree Analysis; or
- (vii) An appropriate equivalent methodology.

(3) The process hazard analysis shall address:

- (i) The hazards of the process;
- (ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;
- (iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies 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.);
- (iv) Consequences of failure of engineering and administrative controls;
- (v) Facility sitting;
- (vi) Human factors; and
- (vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

(4) The 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.

(5) The employer shall establish a system to promptly address the team's findings and recommendations; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.

(6)	At least every five (5) years after the completion of the initial process hazard analysis, the process hazard analysis shall be updated and revalidated by a team meeting the requirements in paragraph (e)(4) of this section, to assure that the process hazard analysis is consistent with the current process.
(7)	Employers shall retain process hazards analyses and updates or revalidations for each process covered by this section, as well as the documented resolution of recommendations described in paragraph (e)(5) of this section for the life of the process.

Intent

PrHA is a systematic method to identify and assess process hazards, and is the cornerstone of a PSM program. PrHAs can be used to identify causes and consequences of potential accidents associated with equipment, instrumentation, utilities, human performance, external factors, and natural phenomena such as earthquakes. The objective of PrHA is to determine areas of excessive risk where preventative and mitigative measures may be warranted to better control the hazards. PrHAs can help identify accident scenarios leading to worker injuries or fatalities, property damage, public exposure to chemicals, environmental impacts, or other adverse consequences.

Corresponding DOE Programs and Requirements

General Guidance DOE-HDBK-1100-96, *Chemical Process Hazards Analysis*, provides detailed information on PrHA methodologies and the PrHA process. DOE guidance available to support the process hazard analysis team includes DOE/EH-0340, *Example Process Hazard Analysis of a Department of Energy Water Chlorination Process*.

Safety Analyses DOE O 430.1B, REAL PROPERTY ASSET MANAGEMENT, requires a preliminary safety assessment as part of the project management system prior to execution of design plans. DOE requires that hazard analyses be performed to support SARs under 10 CFR 830 Subpart B NUCLEAR SAFETY MANAGEMENT, SAFETY BASIS REQUIREMENTS and DOE-STD-1027-92 (CH-1). PrHAs will not replace SARs, nor will SARs replace PrHAs; they are conducted to satisfy two independent sets of requirements. Therefore, conduct of a PrHA does not necessarily mean that a SAR must be performed or vice versa. However, because a PrHA is a systematic method to identify accident scenarios, it may be used as an integral part of the overall hazards analysis required in the development of a SAR, when a SAR is necessary. When the PrHA is used to support the SAR, all PSM documents used to develop the PrHA should be referenced in the appropriate SAR chapter. References and summaries should include not only the results of the PrHA, but also all documents concerning the resolution of the PrHA team's findings.

OSHA requires that PrHAs address facility sitting issues (e.g., the physical spacing between processes, or between a process and administrative facilities). Consideration of natural phenomenon hazards is also an appropriate sitting issue, especially for new proposed facilities.

DOE O 420.1A, FACILITY SAFETY, identifies safety analysis requirements for various types of facilities and requires consideration of natural phenomena hazards relative to facility sitting.

DOE O 440.1A, WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES, describes general hazard identification and analysis requirements for occupational safety and health.

Emergency Planning DOE O 151.1B, COMPREHENSIVE EMERGENCY MANAGEMENT SYSTEM, requires hazard identification as the basis for emergency planning. PrHAs have direct application for identifying chemical process hazards in support of emergency planning as required by DOE O 151.1B. They should be used to support the emergency planning element in the PSM Rule in conjunction with consequence modeling. PrHAs, SARs, and emergency planning hazard analyses should be combined to satisfy all program requirements whenever possible.

MOC If the PrHA identifies an issue that leads to a change in procedures, drawings, or design, the change must be submitted through the facility's MOC systems. If the PrHA identifies an issue that falls outside the safety envelope for a facility, that issue should be treated as a potential unreviewed safety question as described in 10 CFR 830 Subpart B NUCLEAR SAFETY MANAGEMENT, SAFETY BASIS REQUIREMENTS and DOE G 424.1-1, IMPLEMENTATION GUIDE FOR USE IN ADDRESSING UNREVIEWED SAFETY QUESTION REQUIREMENTS.

Documentation Requirements

Written PrHAs, updates and revalidations, and documentation of resolutions to recommendations must be kept for the life of a process and reviewed every five years. The PrHA may be a stand-alone document or an attachment used in conjunction with facility safety documentation. A PrHA report should identify the PrHA team members, the processes analyzed, the PrHA method used, and the manner in which required PrHA issues were addressed. Other documentation to support the review depends on the method selected, the covered process, and the particular needs of the facility [Q53].

Minimum Implementation Criteria

This section provides a summary of the minimum implementation criteria for the PrHA element. DOE-HDBK-1100-96, Chemical Process Hazards Analysis, addresses the PrHA element of the PSM Rule in detail.

Schedule PrHAs must be completed by risk-priority, based on a relative ranking of the risks of the covered processes [Q54]. This ranking must consider the extent of the process hazards, the number of potentially affected employees, the age of the process, and the operating history of the process. The basis for this ranking must be documented [Q55]. DOE contractors must complete the required PrHAs prior to process startup [Q56]. PrHAs must be reviewed and updated at least every 5 years and retained for the life of the process [Q57,Q58,Q59].
Team PrHAs must be performed by a team having the following mandatory qualifications.

- At least one individual with expertise in engineering and process operations.
- At least one individual with specific process experience.
- A team leader knowledgeable in the methodology.

A PrHA team is usually composed of two to five members and may include a safety engineer or analyst, a process engineer, a maintenance supervisor, a operations supervisor, a facilities engineer, or other members with needed expertise. At a minimum, the team leader should be able to properly and impartially use the selected PrHA methodology. There are no specific requirements for PrHA leader qualifications or for documenting the qualifications of team members. However, brief resumes of team members should be included in PrHA documentation. Detailed classroom training on PrHA methods is an appropriate way for team members to gain knowledge about specific PrHA methods. Contractors may elect to compile a list of PrHA-qualified individuals at a facility along with their PrHA experience [Q48].

Method Selection of an appropriate PrHA method depends on several factors including the complexity of a process, historical and industry information about the process, and process stability. Selection of the methodology must be consistent with the process being analyzed. One or more of the following methodologies, or an appropriate equivalent methodology, must be used. The PSM Rule allows other equivalent analysis methodologies to be used if they are systematic and appropriate for the level of complexity of the process [Q47].

- What if
- Checklist
- What if/checklist
- HAZOP
- FMEA
- Fault Tree Analysis.

DOE contractors should refer to appropriate industry references such as CCPS's Guidelines for Hazard Evaluation Procedures, Second Edition with Worked Examples for more information about appropriate, equivalent PrHA methodologies. Descriptions of PrHA methods are also provided in DOE-HDBK-1100-96, Chemical Process Hazards Analysis. The PrHA process is generally divided into three phases: information gathering; conduct of the PrHA and development of recommendations; and resolution. PSI should be developed prior to initiating a PrHA or as part of the PrHA process.

During the PrHA, the team must identify process hazards; review the accident history of the process to identify process hazards, accident precursors, lessons learned, and trends; consider the impacts of human factors; identify engineering and administrative control measures and their interrelationships; determine the consequences if those control measures fail, taking facility sitting into consideration; and determine the qualitative range of safety and health effects on employees at the worksite [Q49]. In developing the PrHA, the team must consult with any subcontractor employees involved in the operation or maintenance of the process.

The PSM Rule requires DOE contractors to address in the PrHA previous incidents at their facilities that had a potential for catastrophic effects in the workplace. Under the incident

investigation provision of this Rule, contractors are required to retain incident reports for 5 years, the time between PrHA updates. Although there are no requirements to consider incidents that occurred outside a facility, DOE contractors should review and consider relevant incidents that have occurred elsewhere in their company, in the DOE complex, or in industry [Q50].

Determining the impacts of human factors requires considering the degree to which process safety depends on human performance; whether workers can reasonably be expected to perform the tasks they are assigned; and whether procedures and training adequately guide and prepare workers to perform tasks correctly. The human factors assessment in a PrHA could include listing potential human-error causes of accidents; examining the location of and access to critical safety instruments, alarms, and equipment; or reviewing critical procedures used by operators and maintenance personnel. For critical operations, it may be necessary to perform task hazard analyses to analyze the operator/machine interface in process control rooms or other work locations to adequately evaluate human factor impacts [Q52].

Addressing facility sitting in a PrHA means considering the physical location of covered processes within the plant property. A PrHA team should consider the proximity of the covered process to workers and egress routes when evaluating the potential safety and health impacts of possible HHC releases. The team must also consider the impact of vehicle traffic and adjacent operations on the safety of the process. Possible facility sitting issues include the location of vessels containing HHCs and their proximity to other equipment, control rooms, maintenance shops, and administration buildings [Q51].

Resolution of Recommendations Process hazard analysis is not an end in itself. It is a method to identify areas of excessive risk. Therefore, a tracking system must be in place to ensure that the findings and recommendations of the PrHA team are resolved in a timely manner, that actions taken are documented, and that all affected operating and maintenance workers are made aware of these actions. This system must ensure that:

- findings and recommendations are addressed promptly
- recommendations are resolved and documented
- actions are completed as soon as possible
- a schedule for all resolutions is established and followed
- actions are communicated to employees affected by any changes.

Resolution of recommendations should be accomplished through a MOC system. In any case, contractors should develop a schedule for completion of corrective actions and document the basis for the amount of time needed [Q52].

The PrHA team's findings and recommendations must be addressed and resolved. However, DOE contractors may reject a recommendation where it can be documented that one of the following conditions is true.

- The recommendation is based on factual errors.
- The recommendation is not necessary to protect health and safety.
- An alternative measure can provide a sufficient level of protection.
- The recommendation is infeasible.

Questions

47. What characteristics does an "appropriate equivalent methodology" need to be considered acceptable for performing a PrHA?

Any technique or combination of techniques used to perform a PrHA must address the issues specified in this provision (e.g., the extent of hazards, the qualitative description of range of consequences). Moreover, the methods should generate the types of results and documentation required by the Rule (e.g., a list of recommendations). Beyond these criteria, a PrHA method should help ensure a thorough evaluation of potential safety and health impacts from process equipment failures and human errors.

48. What training/experience is necessary for a member of the PrHA team to be considered knowledgeable in the selected PrHA methodology? What documentation is required?

Knowledge of the PrHA method selected for use for a particular process is required for only one member of the PrHA team. There are no specific requirements for PrHA qualifications or for documenting the qualifications of PrHA team members. Detailed hands-on classroom training on PrHA methods is an appropriate way for team members to gain necessary knowledge of a specific PrHA method. Previously demonstrated experience in the use of the technique may also be accepted as sufficient "qualification" for PrHA team leaders. Contractors may elect to compile a list of PrHA-qualified individuals at a facility along with their PrHA experience.

49. If batch processes involve hundreds of recipes and chemicals, must a separate PrHA be performed on each recipe, or can these PrHAs be done generically?

PrHAs for batch processes that use a variety of chemicals and recipes can be performed on a generic basis as long as the chemicals and recipes represent the full range of possible processing circumstances, including worst case situations. The technical basis for this worstcase selection of circumstances should be documented.

50. Is identification of previous incidents restricted to the specific facility or must DOE contractors conduct an industry-wide search for incident information?

The PSM Rule requires DOE contractors to address in the PrHA previous incidents at their facilities that had a reasonable potential for catastrophic effects in the workplace. Although there are no requirements to consider incidents that occurred outside a facility, DOE contractors should review relevant incidents that have occurred elsewhere in their company, in the DOE complex, or in industry.

51. How should facility sitting and human factors be addressed in a PrHA?

Facility siting means the location of covered processes within the plant property. A PrHA

team should consider how close a covered process is to workers or high traffic areas when evaluating the potential safety and health impacts of possible releases of HHCs. Possible facility siting issues include the location of vessels containing HHCs and their proximity to other equipment, control rooms, maintenance shops, and administration buildings.

Human factors is a broad classification of issues and techniques dealing with the functional relationship between human operators and engineered systems. In a PrHA, human factors could include listing potential human-error causes of accidents; examining the location of and access to critical safety instruments, alarms, and equipment; or reviewing critical procedures used by operators and maintenance personnel.

DOE Contractors should examine the specific needs of each covered process to determine an appropriate way to address facility siting, human factors, and other issues in a PrHA. These issues need not be addressed at the same level of detail for all covered processes.

52. The PSM Rule requires that employers promptly address the problems identified in the PrHA in a timely manner, and complete actions as soon as possible. What time frame is intended here?

As soon as possible means that DOE contractors must proceed with all due speed, considering the complexity of the recommendation and the difficulty of implementation. OSHA expects employers to resolve PrHA team recommendations promptly; normally within weeks to a few months. DOE contractors should develop a schedule for completion of any corrective actions expected to require more than three months to implement and to document the basis for the extended time needed.

53. What minimum documentation is required in a PrHA report?

Because the PSM Rule is primarily a performance-based regulation, no prescriptive documentation requirements have been established for PrHAs. Contractors should include sufficient information to show that the required issues in paragraph (e)(3) of the Rule have been addressed. For example, the report should identify the PrHA team members, the process analyzed, the selected PrHA method used, the manner in which the required PrHA issues were addressed, and the recommendations from the study. Other documentation to support the review depends on the method selected, the process analyzed, and the particular needs of the facility.

54. Can a company prioritize the PrHAs to be performed on a company-wide basis instead of a site-specific basis? Can a large processing complex be divided into several logical systems for the purpose of applying the phase-in provisions for initial PrHAs?

PrHAs must be prioritized on a site-by-site basis. When PrHAs are performed on similar processes, DOE contractors may order these analyses to make the best use of their experience. A large, processing complex consisting of several discrete systems (e.g., feed, reaction, purification, storage) or containing several different HHCs may be divided into logical separate processes as long as this division is performed in a technically

consistent way. DOE contractors must document their prioritization of processes for PrHA.

55. What rationale must DOE contractors use to determine the priority for conducting PrHAs? Should the rationale include age, history, and extent of employee exposure?

The appropriate priority for conducting PrHAs must be determined using all of the criteria identified in this paragraph, i.e., the extent of the process hazards (catastrophic potential), the age of the process, the number of potentially exposed employees, and the operating history. Other appropriate factors may also be considered, such as normal delays to allow for capital improvements to be made. Documentation should demonstrate the underlying rationale for the prioritization.

56. What is the time requirement for completion of PrHAs for newly covered processes?

All initial process hazard analyses must be completed prior to process startup.

57. What does it mean to revalidate a PrHA ?

Because the PSM Rule is primarily a performance-based regulation, it includes no prescriptive PrHA revalidation criteria. DOE contractors should determine appropriate methods for updating/revalidating PrHAs based on the specific conditions associated with the covered processes. Updates/revalidations must be completed by teams that meet the requirements of the PrHA provision. Further, contractors should evaluate whether changes or incidents that occurred since the last PrHA caused new hazards or revealed previously unrecognized ones. If the design, operating practices, and other important circumstances associated with a covered process have not changed since the last PrHA, a PrHA team may be able to invest minimal effort in updating/revalidating the PrHA.

58. How often are PrHAs performed to satisfy PrHA obligations for the processes analyzed?

The PrHA elements must be updated and revalidated at least every five (5) years.

2.4 Operating Procedures

29 CFR 1910.119 (f)

(1) The employer shall 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 and shall address at least the following elements.

- *(i) Steps for each operating phase:*
  - *(A) Initial startup;*
  - *(B) Normal operations;*
  - *(C) Temporary operations;*
  - *(D) Emergency shutdown including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators to ensure that emergency shutdown is executed in a safe and timely manner.*
  - *(E) Emergency Operations;*
  - *(F) Normal shutdown; and,*
  - *(G) Startup following a turnaround, or after an emergency shutdown.*
- *(ii) Operating limits:*
  - *(A) Consequences of deviation; and*
  - *(B) Steps required to correct or avoid deviation*
- *(iii) Safety and health considerations:*
  - *(A) Properties of, and hazards presented by, the chemicals used in the process;*
  - *(B) Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment;*
  - *(C) Control measures to be taken if physical contact or airborne exposure occurs;*
  - *(D) Quality control for raw materials and control of hazardous chemical inventory levels; and,*
  - *(E) Any special or unique hazards.*
- *(iv) Safety systems and their functions.*

(2) Operating procedures shall be readily accessible to employees who work in or maintain a process.

(3) The operating procedures shall be reviewed as often as necessary to assure that they reflect current operating practice, including changes that result from changes in process chemicals, technology, and equipment, and changes to facilities. The employer shall certify annually that these operating procedures are current and accurate.

(4) The employer shall develop and implement safe work practices to provide for the control of hazards during operations 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. These safe work practices shall apply to employees and contractor employees.

Intent

Operating procedures are an important tool for achieving safe, consistent, and efficient process operation. Process procedures differ from many procedures because they cover all phases of operations. They must discuss operating limits, the consequences of deviating from these limits, and recovery from deviations. Procedures must address normal, abnormal, and emergency conditions to prepare workers for any event that may reasonably occur. Administrative and special engineering control measures, as well as required monitoring and surveillance equipment must be described.

Procedures must be clearly written, with easy-to-follow steps for each operating phase. They should be written at an education level that all process workers can understand. If workers have difficulty understanding instructions in English, contractors should consider providing procedures in a second language understood by the workers, or the workers should be teamed with others who can explain the procedures and provide necessary guidance. Critical or complex procedures may be enhanced with job performance aids, such as flow diagrams, photos, or expanded assembly drawings.

A close relationship exists between training and operating procedures. High-quality procedures alone achieve nothing unless the operators are trained in their use. When operating procedures are used for training, the trainer has an opportunity to satisfy procedure review and update requirements by ensuring that the procedure still represents current practice.

Procedures should include a graded approach to highlighting dangers, such as the military system of notes, cautions, and warnings. (Notes indicate that care is required. Cautions indicate that incorrect operation may lead to injury or equipment damage. Warnings indicated that incorrect operation may lead to serious injury or major equipment damage.)

Safe work practices are also discussed in Section 2.9 because they address nonroutine operations and often require special authorizations. Safe work practices are more generic than procedures and describe a program and an approach for conducting an activity (e.g., confined space entry or lockout/ tagout). Both operating procedures and safe work practices are required for safe process operation.

Seven steps are suggested for developing procedures:

Step 1 Determine the tasks involved in operating a process unit, the relationship between the tasks, and the order in which they are to be carried out. Use Job Safety Analyses to identify and discuss hazards associated with each task.

Step 2 Analyze each task and reach consensus on how it should be carried out. The analysis should be done by senior operators and supervisors, with input from management and technical staff. Task analysis is often beneficial because it illuminates inconsistencies in the way tasks are performed by different workers on different shifts.

Step 3 Write the procedures based in interviews or personal experience, and follow the logic developed in the task analysis.

Step 4 Distribute written procedures to operators for comment and discussion.

Step 5 Perform a PrHA for the procedures. The PrHA team thoroughly reviews the procedures and generates the safety and health information to be incorporated.

Step 6 Ensure that users receive the proper training.

Step 7 Ensure that procedures are written and structured so that they can be updated regularly to reflect changes. Note that MOC procedures identify activities that lead to changes in operating procedures.

To instill a sense of ownership, each operator may be assigned a portion of procedures to develop, review, and maintenance, even if the first draft of the procedures is written by someone else. This approach is not intended to preclude other workers from writing or amending procedures. Rather, it ensures that someone takes responsibility for their accuracy, timely completion, and current applicability.

Corresponding DOE Programs and Requirements

DOE O 5480.19 Chg 2, CONDUCT OF OPERATIONS REQUIREMENTS FOR DOE FACILITIES, and DOE O 440.1A, WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES, contain provisions for written operating procedures. Operating procedures for processes covered by the PSM Rule should be reviewed to ensure that they comply with these requirements. Safe work practices should be reviewed to ensure that they are current. Additional safe work practices may need to be developed if PrHAs identify frequently encountered hazards that are not unique to a given process. Additional DOE guidance is provided in DOE-STD-1029-92 (CH-1), *Writer's Guide for Technical Procedures.*

Documentation Requirements

If operators are to work safely and efficiently, they must understand the reasons for the actions described. Therefore, operating procedures for chemical processes covered by the PSM Rule should describe operator interactions with process units, explaining why actions are to be carried out in the manner described. Generally, procedures should be written at a level of detail such that 1) an experienced operator who is not familiar with a particular process unit could run the unit with minimal supervision or help from other operators, or 2) the least experienced operator released for unsupervised work could run the unit. Operating procedures should be readily available for rapid reference[59].

DOE contractors should develop their own "systems" for confirming that the operating procedures are current and accurate. Contractors must certify annually that procedures for operation of covered processes are current and accurate [Q60].

Minimum Implementation Criteria

Operating procedures must be developed to cover all phases of process operations, including the following [Q61].

- Initial startup [Q62].
- Normal operation and/or partial operation.
- Temporary operation.
- Emergency operations/shutdown.
- Normal shutdown.
- Start-up following a turnaround or after an emergency shutdown.

Procedures must include operating limits and the steps required to correct or avoid deviation from these limits. Operators must be able to recognize a deviation that affects safety, and know what to do to maintain control. They must know the consequences of deviations, what actions to take, and how to use the appropriate safety equipment.

Operating procedures must address safety and health considerations [Q63]. They must be reviewed and updated regularly to ensure changes in procedures have been incorporated. In addition, the procedures must be reviewed and updated whenever a change is made to the process, the equipment, or the chemicals that are used.

DOE contractors must develop and implement safe work practices for controlling hazards during operations such as lockout/tagout; confined space entry; opening process equipment or piping; and entrance into a facility by maintenance personnel, subcontractors, laboratory workers, or other support personnel. Safe work practices apply equally to DOE contractors and their subcontractors.

Procedures must be communicated properly to the personnel who need to use them. The users of the procedures must be represented during the development of procedures to ensure the procedures reflect actual practice and are easily understood. After procedures are finalized, they form the foundation of plant-specific training programs.

At least one control room copy of all operating procedures should be available at all times. In addition, DOE contractors must provide the ability to generate new copies if the originals are damaged or lost.

Questions

59. Must all of the information required under this element be kept in written form? Must it be kept in a single document? Can it be stored electronically?

There is no specific requirement regarding a storage location for operating procedures or for the storage medium used. Procedures can be placed in separate documents, kept at different locations, and stored on any medium as long as accessibility requirements are met. Keeping hard copies of written operating procedures in the control room is a good way of providing accessibility to procedures. Contractors who use computers to store this information should consider in advance what they would do if the computers are unavailable (e.g., during power or network failure).

60. What documentation is required for annual certification of operating procedures? Must individual procedures be signed-off, or can a facility manager certify an entire operating manual?

The PSM Rule does not require DOE contractors to use any specific wording to document the annual certification of operating procedures. Contractors should develop their own certification language, which should confirm that the operating procedures are current and accurate. Contractors may choose to certify individual procedures or sets of procedures.

61. Do DOE contractors have to create a written procedure for every job function or task that an operator performs, or only the most important ones?

The PSM Rule specifies the phases of operation for which written procedures are required. However, it does not specify the job tasks necessary within each operating phase. Contractors may determine if job functions and tasks need detailed, step-by-step, written procedures. For example, in some cases detailed procedures for drawing laboratory samples from processes may be needed to train employees to safely conduct sampling tasks. In other cases, sampling tasks may not present any hazard to a worker, and a detailed written procedure would not be necessary.

62. If an existing process has already undergone initial startup (e.g., after an emergency shutdown, or turnaround), must a written procedure for initial startup be developed in addition to procedures for other types of startups?

DOE contractors should have operating procedures for every type of startup expected during the life of a process. Many contractors will use the initial startup procedure for startups following major turnarounds or long outages. If a particular phase of operation specified in the PSM Rule is not relevant to a process, contractors should document this fact.

63. Does *control measures to be taken if physical contact or airborne exposure occurs* refer to first aid, or industrial hygiene services?

The term *control measures* refers to first aid procedures or emergency medical attention, which should be consistent with the information on material safety data sheets.

2.5 Training

29 CFR 1910.119 (g)

(1) Initial training.

(i) Each employee presently involved in operating a process, and each employee before being involved in operating a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in paragraph (f) of this section. The training shall include emphasis on the specific safety and health hazards, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks.

(ii) In lieu of initial training for those employees already involved in operating a process on (Insert the effective date of the standard), an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.

(2) Refresher training. Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure 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, shall determine the appropriate frequency of refresher training.

(3) Training documentation. The employer shall ascertain that each employee involved in operating a process has received and understood 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.

Intent

DOE contractors must train all employees involved in operating and maintaining chemical processes covered by the PSM Rule, including supervisors and managers, and temporary or intermittent workers [Q66]. Contractors must decide what level of training is needed and how that training is to be provided (e.g., classroom, hands on, on the job, equipment familiarization). Training must ensure competency, and contractors must document the means used to employee understanding (e.g., tests, demonstration of skills, etc.). Training must result in employees understanding:

- chemical hazards and the controls;
- proper procedures;
- safe operating limits and how to avoid unsafe conditions;
- how to respond to upset and emergency conditions; and
- opportunities available for employees to contribute to process safety improvements.

Training programs should have the following elements:

- Written training plans and schedules.
- Qualified trainers.
- Training materials on the process tasks.
- Methods to ensure that competencies are developed (e.g., testing appropriate to the complexity of the operations and the hazards involved).

- Periodic review of operations/activities to ensure that operators follow procedures and competencies are maintained.

Initial training is required before assigning an employee to work at a covered process. Refresher training is required at least every 3 years, or more frequently based on complexity of the operations and consultation with employees [64]. DOE contractors are encouraged to obtain worker input to identify needs, assist in development, and review content of initial and refresher training.

Corresponding DOE Programs and Requirements

All DOE sites have safety training programs, including Hazard Communication training as required by OSHA (29 CFR 1910.1200), and other generic and job-specific safety training. Each site has a system for documenting training. Thus, the training infrastructure is in place to support required PSM training. Existing training must be examined to ensure that all information required by the PSM Rule is included.

DOE O 360.1B, FEDERAL EMPLOYEE TRAINING, and DOE O 440.1A, WORKER PROTECTION MANAGEMENT FOR DOE FEDERAL AND CONTRACTOR EMPLOYEES, provide general training requirements. DOE 5480.20A Chg 1, PERSONNEL SELECTION, QUALIFICATION, AND TRAINING REQUIRMENTS FOR DOE NUCLEAR FACILITIES, establishes selection, qualification, training, and staffing requirements for personnel involved in the operation, maintenance, and technical support of DOE reactor and non-reactor nuclear facilities.

Additional DOE guidance is available in DOE- HDBK-1205-97, Guide to Good Practices for the Design, Development and Implementation of Examinations.

Documentation Requirements

Training records must be maintained which identify the process operator, the date of training, and the method used to verify successful completion and understanding of the training. Although not required, checklists covering the required training and testing are often useful tools to ensure that training requirements are completed prior to job assignment.

Minimum Implementation Criteria

Initial and refresher training (every three years or more frequently as needed are required. Initial training for new process operators or operators new to a process must emphasize:

- safe work practices, including startup, normal operations, and temporary operations procedures;
- hazardous chemicals and specific safety and health hazards and precautions for preventing exposure;
- emergency procedures, including shutdown and startup procedures;
- Standard Operating Procedures (SOPs) and Job Hazard Analyses (JHAs);

- accidents and near misses;

- operating limits, the consequences of deviations, and the steps required to avoid deviations;
- equipment and process parameters, such as pressure, flow, and temperature.

Review of initial training elements is needed because process practices change over time and may not reflect desired procedures or behaviors. Thus, management must emphasize the importance of procedures and behaviors during training reviews [65]. The following elements should be emphasized in refresher training.

- Current operating procedures of the process.
- Impacts of recent or planned process and equipment changes.
- Changes in equipment and process parameters such as pressure, flow, and temperature.
- Process accidents, incidents, or near misses.

Written tests provide assurance that training is effective, although the PSM Rule does not require that formal written tests be used. DOE contractors may choose to have operating managers or supervisors from covered processes review the training and experience level of employees already involved in operating the processes [Q66, Q67, Q68].

Questions

64. Which employees must receive training (e.g., operators, engineers, shift foremen, janitors, plant managers)?

DOE contractors should develop an appropriate level of initial and refresher training for every worker involved in operating a covered process, including operators and other employees expected to carry out duties specified in the operating procedures. In addition, because the preamble to the PSM Rule specifically states that "this paragraph [operating procedures] is not intended to be limited to equipment operators," supervisors and managers who provide interpretation and guidance concerning operating procedures should receive appropriate training. Persons not involved in the actual operation of a covered process (e.g., janitors, plant managers) are not required to have process-specific training as defined by the PSM Rule.

65. What topics must be covered in refresher training? Is there a minimum amount of time DOE contractors must spend on refresher training? How often should refresher training be conducted? Must contractors document that employees understand refresher training?

Contractors should develop topics based on the operating procedures appropriate for each job. Because of the performance-based nature of the PSM Rule, no minimum number of hours or frequency for refresher training is specified. The frequency of refresher training should be determined by consulting with employees involved in operating a process, but it must be provided at least every 3 years. Although not specifically stated in the PSM

Rule, DOE contractors should apply the same documentation and verification requirements for refresher training as for initial training.

66. What criteria must DOE contractors follow and what documentation must DOE contractors have to *grandfather* the initial training of existing employees?

DOE contractors should decide what criteria to use to certify that existing employees have "the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures." Contractors may choose to have operating managers or supervisors for covered processes review the training and experience level of employees already involved in operating the processes.

67. What criteria must DOE contractors use to determine whether employees understand their training? What documentation is needed to provide evidence of this understanding?

DOE contractors should develop their own criteria appropriate for job functions and types of training delivered (e.g., classroom, on-the-job). Documentation should be appropriate to the training provided. For example, test scores may be adequate to demonstrate understanding of classroom training. In-the-field skill demonstrations or on-the-job quizzes may also be appropriate. In every case, the means used to verify that the employee understands the training must be documented.

68. The PSM Rule requires that DOE contractors make sure that operators understand the training provided to them under this section. Is some method of testing required?

Some positive means must be taken by DOE contractors to ensure that employees understand their training and are capable of adhering to current operating procedures. Assurance could be gained through the administration of written tests, although the PSM Rule does not require that formal written tests be used. Other means of ascertaining comprehension, such as on-the-job demonstrations, are acceptable so long as they are adequately documented.

2.6 Subcontractor Safety

Where OSHA speaks of *employers*, this handbook uses DOE *contractors*. The term DOE *contractor* refers to Management and Operation (M&O), Environmental Remediation Management Contractors (ERMC), and other DOE prime contractors. Where OSHA speaks of *contractors*, this handbook uses *subcontractors*. This section applies to such DOE subtier contractors, performing maintenance, repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. It does not apply to incidental subcontractors such as vendors, janitorial workers, or delivery services.

29 CFR 1910.119 (h)

(1) Application. This paragraph applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. It does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services.

(2) Employer responsibilities.

- *(i) The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs.*
- *(ii) The employer shall inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the process.*
- *(iii) The employer shall explain to contract employers the applicable provisions of the emergency action plan required by paragraph (n) of this section.*
- *(iv) The employer shall develop and implement safe work practices consistent with paragraph (f)(4) of this section, to control the entrance, presence and exit of contract employers and contract employees in covered process areas.*
- *(v) The employer shall periodically evaluate the performance of contract employers in fulfilling their obligations as specified in paragraph (h)(3).*
- *(vi) The employer shall maintain a contract employee injury and illness log related to the contractor's work in process areas.*

(3) Contract employer responsibilities.

- *(i) The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job.*
- *(ii) The contract employer shall assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.*
- *(iii) The contract employer shall document that each contract employee has received and understood the training required by this paragraph. The contract employer shall prepare a record which contains the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.*
- *(iv) The contract employer shall assure that each contract employee follows the safety Rules of the facility including the safe work practices required by paragraph (f)(4) of this section.*
- *(v) The contract employer shall advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.*

Intent

The objective of the subcontractor safety element is to ensure that levels of safety are not compromised by subcontractor operations and that subcontractor employees are an integral part of the PSM program. (A sample subcontractor safety program is provided at the end of this section.) Prior to hiring such subcontractors, DOE contractors must screen their safety programs and performance to ensure that they have the knowledge, skills, and certifications to safely complete the work [Q69]. The subcontractor safety element includes requirements for both DOE contractors and their subcontractors, as described below.

Corresponding DOE Programs and Requirements

Most DOE contractors are required to describe applicable workplace hazards and to monitor the safety of subcontractor operations as part of traditional safety programs. These programs are reexamined periodically to ensure continued control under conduct of operations and maintenance management requirements. Similarly, such programs must be examined for consistency with the requirements of the PSM subcontractor safety element.

DOE has program oversight responsibility for DOE contractors. However, the principle focus of this PSM element is on DOE contractors who have operational control of covered processes and their subcontractors whose work might affect these process units.

Documentation Requirements

DOE contractors may use a variety of methods to ensure that subcontractors comply with obligations under the PSM Rule, including pre-contract evaluation of safety programs, periodic inspections of a work site, reviews of subcontractor training programs and records, and inspection of subcontractor incident reports. These methods can be used to obtain a sampling of contractor activity. The results of physical and record-keeping audits can be summarized and retained in a subcontractor performance file [Q70].

DOE contractors are required to maintain a log of subcontractor injuries and illnesses (OSHA 200 Form) for operations in the vicinity of processes covered by the PSM Rule. Subcontractors are required to document worker training.

Minimum Implementation Criteria

DOE contractors must:

- obtain and evaluate information about subcontractors safety and performance including safety manuals, current injury and illness incidence rates, and the past years OSHA 200 Log;
- before work begins, inform subcontractors of the potential fire, explosion, and toxic release hazards related to the subcontractors work and describe the process;
- provide for subcontractor employee access to PrHAs and PSI for the processes where they are working [Q71];
- explain the applicable provisions of the emergency action plan to subcontractors;

- develop and implement safe work practices to control the entrance, presence, and exit of subcontractors;
- conduct periodic evaluations of subcontractor worker performance and training and ensure compliance with applicable PSM and other safety requirements;
- verify that each subcontractor worker is trained in the work necessary to perform the job safely [72];
- maintain an employee injury and illness log related to the subcontractors work in process areas covered by the PSM Rule [Q73];
- establish a work authorization or permit system to control access to process areas and ensure that workers are aware of subcontractor operations that may have an impact on covered processes;
- provide relevant information from the process and site emergency action plans to subcontractors so that their employees know what to do in an emergency [Q71].

Subcontractors must:

- train each worker in the potential fire, explosion, or toxic release hazards related to the job and the process, and the applicable provisions of the emergency action plan [Q71];
- document worker training required by the PSM Rule with records that identify the employee and date of training, and include a means to verify successful completion
- ensure that each of its workers follows the safety rules of the facility, including the safe work practices;
- advise DOE contractors of any unique hazards presented by their work, or of any hazards found in the course of their work.

Questions

69. Must contractors apply all of the PSM Rule contractor requirements to a subcontractor already working on or near a covered process?

Yes. DOE contractors should consider evaluating their programs and performance as a way of ensuring that the subcontractor is able to comply with the facility's safe work practices. However, the PSM Rule does not require that DOE contractors subject existing subcontractors to the pre-contract screening designed for selection of new subcontractors.

70. What is acceptable documentation for ensuring that a subcontractor complies with its obligations under the PSM Rule?

DOE contractors may use a variety of methods to ensure that subcontractors comply with obligations under the PSM Rule, including periodic inspections of a work sites, reviews of subcontractor training programs and records, and inspection of subcontractor incident reports. Each method can be used to obtain a sampling of subcontractor activity. The results of these physical or record-keeping audits can be summarized and retained in a subcontractor performance file.

71. Who is responsible for training subcontractor employees to do their job safely? Who is responsible for providing site-specific safety orientation?

Subcontractors are responsible for training their own employees. DOE contractors are responsible for providing their subcontractors with sufficient hazard and process information to enable them to conduct appropriate training. DOE contractors are also responsible for ensuring that this training has been performed. Further, DOE contractors are responsible for providing sufficient emergency action plan information to subcontractors so that their employees know what to do in an emergency. In some cases, it may be more efficient for DOE contractors to perform safety orientations and to familiarize subcontractor employees with emergency action plans. In these cases, the training responsibilities of the two parties should be clearly defined and understood.

72. When a subcontractor is hired to perform a job for which a DOE contractor has no expertise, how can the DOE contractor be expected to ensure that the subcontract employees are trained to do their job safely?

A DOE contractor must establish safe work practices for the facility and is expected to require subcontractors to follow these practices. Although a DOE contractor is not expected to know all requirements for a specific work practice associated with a special skill or craft for which the subcontractor was hired (e.g., proper handling of hazardous waste generated as a result of a unique maintenance activity), the DOE contractor is required to evaluate and audit the subcontractor's own safety programs and practices.

73. Is a subcontractor injury/illness log required during the construction of a covered process?

If a new process is being built in an area totally removed from any other covered process, and if no HHC has been introduced, the subcontractor injury/illness log provision does not apply. However, if an existing process has been made chemical-free for construction purposes, the subcontractor element of the PSM Rule still applies, due to the potential presence of residual chemicals.

Exhibit 2.6.1

Sample Subcontractor Safety Program

(This sample Subcontractor Safety Program uses mandatory language that a DOE contractor might use in such a document. It is not intended to imply that this sample program is mandatory for DOE use. Italicized references to *the DOE contractor* are used in place of a specific contractor.)

INTRODUCTION

I. General

A. Introduction

Subcontractors play a vital role in the day-to-day operation of DOE-owned facilities. They perform a variety of tasks that range from general maintenance to specialty work. In providing these services, subcontractor employees may work in and around processes that involve highly hazardous chemicals. Therefore, it is important that these subcontractors are knowledgeable in the dangers posed by these chemicals.

B. Scope and Objectives

This program applies to those subcontractors that are involved in safety-sensitive work, such as maintenance, repair, turnaround, or major renovation. This guide includes the principles, practices, and requirements of OSHA's PSM Rule.

This program also addresses the screening process used to select subcontractors. It defines the responsibilities of both *the DOE contractor's* management and the subcontractor in ensuring that all employees accomplish their work safely.

II. Subcontractor Responsibility

A. Pre-Selection

1. Subcontractor Qualifications

   The DOE contractor shall do a preliminary check on subcontractors for the type of work that they will perform at *the Government Owned Contractor Operated (GOCO*) facility. This check shall involve asking the potential subcontractor to submit the information contained in the Subcontractor’s Safety Questionnaire enclosed as Exhibit 2.6.2. DOE contractors are encouraged to share qualified sources.

2. Approved Subcontractor List

   The DOE contractor shall develop a list of approved subcontractors from the data collected in (1) above.

3. Audit of List

   The Approved List should be audited yearly to ensure that subcontractors continue to meet this guide’s requirements.

4. Validation

   Data submitted should be revalidated to ensure that it applies to the local subcontractor and not to its parent company or an affiliate.

B. Pre-Bid

The DOE contractor shall inform subcontractors of the facility's safety requirements by clearly outlining safety performance requirements in its bid package, which will be used as part of the selection process. *The DOE contractor* shall request specific safety information from the subcontractor to compare with qualification criteria to establish contractor responsibility. The subcontractor should be advised of the qualification criteria and that the lowest bid might not be selected.

1. Subcontractor Suitability to Bid

   Once the scope of work has been defined, *the DOE contractor* will request that subcontractors selected to bid submit all safety management program information necessary to establish contractor suitability.

2. GOCO Facility Safety and Health Qualification Criteria

   The DOE contractor shall clearly outline safety and health requirements in the bid package. The items contained in the Subcontractor's Safety Questionnaire (Exhibit 2.6.2) should be included, along with any site specific safety and health rules that might apply. These requirements shall be consistent with the requirements *the DOE contractor* has for its own employees.

3. Contract Safety Language

   Standard safety language ("the subcontractor must comply with all federal, state, and local safety laws and regulations") shall be included in contracts. Also, safety and health requirements specific to *the GOCO* facility and the work being performed shall be included in the contract as a separate addendum.

4. Pre-bid Meeting

   The DOE contractor shall hold a pre-bid meeting to discuss facility safety and health requirements. Subcontractors shall be provided copies of any applicable facility safety and health policies and procedures. This meeting shall also establish who provides the required safety and health equipment and training, and shall define subcontractor documentation requirements.

C. Selecting Subcontractors

1. Considerations

   The DOE contractor shall review each subcontractor's Safety Questionnaire, along with the requested material, for thoroughness and ability to meet or exceed the facility's minimum safety and health qualification criteria. The subcontractor's ability to safely perform the specified work should be a

significant factor, along with cost, quality and time. The reasoning used to select the subcontractor must be documented.

2. Safety and Health Rating System

A subcontractor safety and health rating system should be developed to help in evaluating the subcontractor's ability to safely perform the specified work.

D. Pre-Job Safety and Health Meeting

1. Discussion of Specific Safety and Health Requirements

GOCO facility management shall specifically discuss safety, unusual hazards, training, documentation, and permit requirements with the subcontractor's site management personnel, who will be directly responsible for supervising the contracted work.

2. Verifying Training Requirements

The DOE contractor management shall review subcontractor certifications for required training based on criteria set forth in the Pre-bid section. Safety and health training for subcontractor employees can be divided into three components.

- Basic job skills training: the skills required to perform a specific task.
- Basic job safety and health training: the skills necessary to safely perform the task no matter where it may be performed.
- Plant-specific safety and health training: the skills necessary to safely perform a task at a specific plant site.

The first two components are the responsibility of the subcontractor and the third is the responsibility of the *DOE contractor*. To fulfill the obligations of the first two training components, the subcontractor shall be requested to define the training needed to satisfy these components, provide the training, and certify that the training has occurred, enabling their respective workers to safely perform their assigned duties. The subcontractor will not be able to start on the project until these training requirements are met. Also, arrangements will be made with the subcontractor to schedule the safety orientation that covers plant-specific safety and health training.

E. Subcontractor Safety Orientation

Before work begins, all subcontractor personnel, including supervisors and managers, shall receive *the GOCO facility's* safety and health orientation. Where this training is not provided by *the DOE contractor*, management will ensure that it is conducted and covers the same site-specific safety and health material that GOCO facility employees receive at their new hire orientation. Training content and attendance must be documented.

F. On the Job Control

1. Review Subcontractor Safety Performance

   The DOE contractor shall designate a representative (site contact) for each contract issued to subcontractors performing work onsite. This site contact will have the authority to enforce the provisions set forth in the contract. The site contact shall be required to monitor and make regular inspections of the subcontractor's activities as follows.

   - Audit work to verify that all safety and health related clauses in the contract are being followed.
   - Conduct regular safety and health review meetings with the subcontractor's site manager that include review of incidents, status of documented inspection items needing correction, status of concerns raised during the safety meeting, and any other concerns the contact administrator has about the subcontractor's safety and health performance.
   - Counsel and stop work, if necessary, if the subcontractor is working in an unsafe manner. If work is stopped, the subcontractor will not be allowed to return to work until the unsafe practice is corrected. The site contact will notify the subcontractor, in writing, of the unsafe practice and will require the subcontractor to submit a report as to why this unsafe practice was allowed to occur and what steps have been taken to prevent recurrence. Delays resulting from these work stoppages may be considered a breach of the subcontractor's contractual obligations.

2. Maintain Safety Statistics for Subcontractor Injuries

   Each subcontractor shall submit monthly safety reports with monthly and cumulative accident statistics.

3. Accident Report

   Each subcontractor shall be required to submit written reports of all events resulting in or having the potential for injury, damage or loss to *the GOCO facility's* safety department with immediate notification to the site contact responsible for the subcontractor's contract.

   If the incident involved an injury requiring medical treatment or has the potential to cause a serious incident, the site contact and *the GOCO facility's* management will meet with the subcontractor to discuss the incident and means to prevent recurrence.

4. Monitor Training

   The GOCO facility shall establish a control point to monitor subcontractor personnel entering the facility to ensure that no new employees are brought onto the site without the required training.

5. Specific Job Instruction

For hazardous operations, the site contact and the subcontractor shall develop a work plan (i.e., job safety analysis, safe job procedure, etc.) and go over it with all personnel doing the hazardous work. Work shall not start until everyone understands how to accomplish the work safely.

G. Performance Evaluation

1. Performance Reports

Upon completion of the project, the site contact shall submit a performance report on the subcontractor's completed project, discussing safety, work quality, schedule adherence and budget adherence. A draft of this report should be circulated to appropriate *GOCO facility* personnel for comment before the final review with the subcontractor.

2. Post Job Performance Review

The final review with the subcontractor should include the site contact, the safety supervisor, *the GOCO facility* contract committee, and other appropriate *GOCO facility* management. At this review meeting, the subcontractor shall be given an overall assessment of work performance and will be told whether the subcontractor will be permitted to bid on any future projects at the facility.

III. Subcontractor Responsibilities

A. Written Safety Program

Subcontractors shall have a written safety program, which shall be reviewed by *the GOCO facility*.

B. Compliance with GOCO Facility Safety Requirements

The subcontractor shall ensure that all its employees understand and follow *the GOCO facility's* safety and health requirements.

C. Safety Inspections

The subcontractor shall conduct monthly safety and health inspections that will be documented with a system to track recommendations to a final resolution. Copies of the documented inspections and the resolution of the recommendations will be forwarded to the subcontractor's site contact and *the GOCO facility's* safety department.

D. Accident Investigation Reporting & Record Keeping

While working at *the GOCO facility*, the subcontractor will report all accidents that result in an injury or illness to the subcontractor's site contact and *the GOCO facility's* safety department. An investigation shall be initiated within 48 hours after occurrence. The subcontractor shall have a system in place to track identified corrective recommendations to final resolution. A copy of the investigative report with documentation showing final resolution of the accident's corrective recommendations will be forwarded to *the DOE contractor's* site contact and safety department. The subcontractor shall keep site injury statistics that include the total number of man-hours that the subcontractor has worked at

the GOCO facility, the number of recordable injuries, the recordable incident rate, the lost work day case incident rate, the severity rate and the number of first aid cases. These statistics shall be kept on a monthly and a cumulative basis. The subcontractor should be able to obtain much of this information from the OSHA 200 Log.

E. Job Planning

To ensure safety and health during hazardous operations, the site contact and the subcontractor shall develop a work plan (i.e. job safety analysis, safe job procedure, etc.) and review it with all personnel involved. Work will not commence until everyone understands what is required to accomplish this work safely.

F. Safety and Health Training

1. Basic Job Skills and Safety Training

   The subcontractor shall providing training to ensure its employees are competent and skilled in the trade or craft that they will be practicing at facilities. They shall also provide training in the basic safety skills necessary.

   Subcontractors shall be required to submit written documentation that defines their training systems, certifies training has occurred, and that their workers are competent to safely perform their assigned duties.

2. Plant Specific Safety Training

   The subcontractor shall ensure that all its employees have attended *the GOCO facility's* safety and health orientation. They will also agree not to bring any employee into *the DOE contractor's* site until that employee has received this orientation.

3. Safety Meetings

   The subcontractor shall hold routine safety meetings, monthly at a minimum. These meetings should conform to the following basic guidelines.

   - Subject material should be preplanned.
   - Subject should be job related and timely.
   - Meetings should be conducted by a competent person
   - Provisions should be made for employee feedback.
   - Meeting content and attendance should be documented.
   - Copies of these meetings should be forwarded to the GOCO facility's site contact and safety department.

Exhibit 2.6.2

Sample Subcontractor Safety Questionnaire

Company: _____ Date: _____

I. Your Firm's Safety Performance and Program

A. Workers Compensation Insurance - Experience Modification Rate (EMR)

1. Please obtain from your insurance agent (or state fund, if applicable) your interstate EMR for the last three rating periods and complete the following.

	Policy Year	Modification Rate
Most Recent Policy Year	_____	_____
1 year previously	_____	_____
2 years previously	_____	_____

Are the above rates interstate or intrastate? _____

If intrastate, which state? _____

If your EMR is exactly 1.0 for any policy year, is it because your firm is (was) too new or too small to have an EMR calculated?

[ ] Yes [ ] No

Is your firm self-insured for Workers Compensation claims?

[ ] Yes [ ] No

2. We require back-up for the above information. Which of the following methods would be acceptable:

- Furnish a letter from your insurance agent, insurance carrier, or state fund (on their letterhead) verifying the EMR data listed above, or
- Furnish a photostat of the last 3 years, Experience Rating Calculation Sheets, which your insurance carrier should forward to you annually; or
- Furnish a photostat of the page of your last 3 year's insurance policies that shows the modification rate and the coverage period; or
- If you're in a state fund state, such as Ohio or West Virginia, furnish a photostat of the state's last 3 years' annual statement page that shows the modification rate and the coverage period:

B. OSHA Recordable Incidents

1. Furnish a copy of your firm's OSHA 200 Log and total man-hours for each year from the last 3 years. Indicate which injuries occurred at the GOCO facility.

Exhibit 2.6.2

2. Some firms are not required to complete OSHA 200 Log, because they have too few employees.

   (a) If you haven't completed the OSHA Log, is it because your firm has too few employees?

   [ ] Yes [ ] No If you answer "NO," please explain.

   _____

   (b) If your company does not have to keep an OSHA 200 Log, provide a yearly list for the past 3 years of injuries resulting in lost time and a list of injuries not resulting lost time along with total man-hours worked for each year.

3. Total employee hours worked last year at *the GOCO facility*? _____

4. Your OSHA Recordable Incidence Rate[1] for last 3 years?

   Last Year _____

   1 Year Previous _____

   2 Years Previous _____

5. Your Lost Workday Incidence Rate[2] for last 3 years?

   Last Year _____

   1 Year Previous _____

   2 Years Previous _____

C. Industry Comparison Information

1. What North American Industry Classification System (NAICS) Code does your company work under?

   _____

2. What is the OSHA Recordable Incidence Rate (most recent year) for your NAICS?

   _____

3. What is the Lost Workday Incidence Rate (most recent year) for your NAICS?

   _____

4. If your OSHA Recordable Incidence Rate and/or Lost Workday Incidence Rate is greater than your NAICS code rate, attach a brief explanation and describe the action plan that your company is using to improve your rates.

D. Safety Policy and Organization

1. Do you have a written statement of your safety policy? (Please provide a copy.)
2. How is the safety policy communicated to employees?

[1] OSHA Recordable Incidence Rate = #Recordable Injuries X 200,000 / Manhours
[2] Lost Workday Incidence Rate = #Lost Workday Injuries X 2,000,000 / Manhours

Exhibit 2.6.2

3. Do you have a safety organization? (Please provide an organization chart and description of responsibilities.)
4. Who is the most senior person for coordinating safety matters, and what is his/her experience?
5. Is management accountable for safety performance? If so, state how this is practiced.

E. Procedures

1. Do you have a safety manual? (Provide current copy).
2. Do you have written safe working practices and safety policies, such as those covering hazard communications, use of scaffolding, etc. (Provide a copy).

F. Safety Training

1. What safety training is given to your employees and up to what level of management is it given? (Provide details and examples)
2. Have the personnel who will undertake specific work received formal training in safe working practices and in the use of protective equipment relating to the potential hazards of the work? (Provide details.)
3. What formal safety qualifications does your staff have? (Describe)

G. Accident Investigation

1. Do you have a procedure for the investigation, reporting, and follow-up of accidents, near misses, and occupational injuries?
2. How are the results of accident investigations communicated to your employees? (Please give examples.)

H. Safety Awareness

1. Do you organize in-house safety meetings? (Describe the frequency, attendance and topics).
2. Do you have an established system for communicating safety matters to workers?
3. Do you conduct safety inspections on your own operations? If so, how are unsafe acts and/or conditions resolved?

I. Subcontractors

1. What safety requirements do you specify for your subcontractors?

2. Do you have procedures for the control of the safety performance of a subcontractor? (If so, please give details).

Exhibit 2.6.3

Sample Subcontractor Safety Program Evaluation and Criteria

Subcontractor:

_____

Address:

_____

_____

_____

Point of Contact_____ Phone Number _____

I. Safety Program Evaluation Rating

Circle the number which best represents this evaluations based on the criteria for rating purposes attached.

		A	B	C	D	Comment
Safety Program						
1.	Policy Statement	0	3	7	10	
2.	Safety Manual	0	3	7	10	
3.	Emergency Response Procedures	0	3	7	10	
4.	Basic Safety Rules	0	3	7	10	
5.	Accident Reporting Procedure	0	3	7	10	
6.	Employee Orientation Program	0	3	7	10	
7.	Safety Meeting Program	0	3	7	10	
8.	Safety Training Program	0	3	7	10	
9.	Safety Inspection Program	0	3	7	10	
10.	Professional Safety Support	0	3	7	10	
11.	Alcohol/Drug Control Policy	0	3	7	10	

Total Rating __ + __ + __ + __x.60 = Rating

Exhibit 2.6.3

		A	B	C	D	Comment
Safety Performance						
1.	Latest year injury frequency rate compared to average of previous 3 years.	0	7	14	20	
2.	Latest year injury severity rate compared to average of previous 3 years.	0	7	14	20	
3.	The 3-year cumulative injury frequency rate compared to industry 3-year average.	0	10	20	30	
4.	The 3-year cumulative injury severity rate compared to industry 3-year average.	0	10	20	30	
	Total Rating	__ +	__ +	__ +	___	x.60=Rating

Summary

The numerical values below are the weighted ratings calculated above. The total represents the overall score for the subcontractor.

A. SAFETY PROGRAM _____

B. EXPERIENCE FACTORS _____

TOTAL RATING _____%

Evaluated by: _____ _____ _____
Title Date

Exhibit 2.6.3

II Safety Program Evaluation Criteria

Safety Program Documentation

	A	B	C	D
1.	Policy Statement			
	No written Safety Policy	A policy statement exists in a widely distributed document	Safety Policy establishes responsibility for safety, but not widely distributed to supervisors.	Policy clearly establishes responsibility and accountability and is distributed to all supervisors.
2.	Safety Manual			
	None written	A few basic safety procedures exist.	Subcontractor has written procedures to cover all applicable *DOE contractor* safety precautions.	Subcontractor has written procedures to cover all applicable *DOE contractor* program requirements.
3.	Emergency Response Procedures			
	None written	Basic procedures only.	Emergency procedures written for major scenarios, e.g. fire/ explosion; release of toxic or flammable materials; and medical emergencies. No requirements established for drill frequencies.	Emergency procedures for all major scenarios, e.g. fire/explosion; release of toxic or flammable materials; and medical emergencies. Emergency Procedures distributed to all staff. Drill frequency is established and followed.
4.	Basic Safety Rules			
	No written rules	Safety rules are in memo/document form.	Safety rules are incorporated in Safety Manual, but not in a	Safety rules exist in handbook form distributed to all

	A	B	C	D
			format which is distributed to all employees.	employees. Disciplinary actions are established for infractions of safety rules.
5.	Accident reporting procedure			
	No Procedure exists	Written procedures requiring basic reporting of personal injuries only	Written procedure requiring reports on all accidents /incidents.	Procedure indicates that accident reports must be provided to supervisor and that investigation of accidents and incidents is required to determine and correct root cause.
6.	New Employee Orientation Program			
	No formal program	Verbal instructions on company procedures only.	Orientation booklet provided for new employee, but no on the job orientation by the supervisor.	Employee handbook provided and supervisor describes and demonstrates new employee's job. Safe work practices and emergency duties are also discussed. Follow up observation of new employee at work is included.
7.	Safety Meeting Program			
	None	Periodic safety meetings for special operations only.	Safety meetings performed on a regularly scheduled basis by the supervisor or safety representative.	In addition to C, employees are assigned topics to discus on a regular basis.
8.	Safety Training Program			

	A	B	C	D
	None	Safety materials distributing for reading	Has generic safety and health classes and pre-job briefings.	Job-specific training with **C** and training is documented.
9.	Safety Inspection Program			
	None	Occasional safety inspections by untrained workers	Periodic inspections by trained individual documented.	Formal safety inspection/resolution program with monthly inspections plus **C.**
10.	Professional Safety Support			
	No professional	Offsite support from corporate office.	Onsite support lacks professional status or is limited.	Experienced onsite professional safety support
11	Alcohol/Drug Control Policy	A policy exists	The policy is enforced and **B.**	Policy provides treatment/counseling for those seeking it and **C.**

Experience Factors

	A	B	C	D
1.	Latest year injury frequency rate compared to average of subcontractor's three preceding years.			
	Subcontractor supplied insufficient information to establish rate, or rate is more than 75% higher than the average of the subcontractor's three proceeding years	Rate is 26% to 75% above the average of the subcontractor's three proceeding years.	Rate is within +/- 25% of the average of the subcontractor's three preceding years.	Rate is more than 25% below the average of the subcontractor's three proceeding years.
2.	Latest year injury severity rate compared to average of subcontractor's three proceeding years.			
	Subcontractor supplied	Rate is 26% to 75% above the average of the	Rate is within +/-25% of the average of the	Rate is more than 25% below the average of the

insufficient information to establish rate, or rate is more than 75 % higher than the average of the subcontractors three proceeding years.	subcontractor's three proceeding years.	subcontractor's three preceding years.	subcontractor's three preceding years.

3. Three year cumulative injury frequency rate comparison to comparable industry three year cumulative rate.

Subcontractor supplied insufficient information to establish rate, or rate is more than two standard deviations higher then industry norm.	Rate is more than one but less than two standard deviations above the industry norm.	Rate is within +/- one standard deviation of the industry norm.	Rate is more than one standard deviation below the norm

4 Three year cumulative severity rate comparison to comparable industry three year cumulative rate.

Subcontractor supplied insufficient information to establish a cumulative injury severity rate, or rate is more than two standard deviations higher than industry norm.	Rate is more than one but less than two standard deviations above the industry norm.	Rate is within +/- one standard deviation of the industry norm.	Rate is more than one standard deviation below the norm.

2.7 Pre-Startup Safety Review

29 CFR 1910.119 (i)

(1) The employer shall 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.

(2) The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process

(i) Construction and equipment are in accordance with design specifications;
(ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate;
(iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (l).
(iv) Training of each employee involved in operating a process has been completed.

Intent

The purpose of PSRs is to ensure the following.

- New or modified facilities and equipment are built and installed in accordance with design requirements.
- All process procedures and related process operator training are adequate and completed prior to the introduction of hazardous materials into the process.
- Adequate safety reviews are conducted
- All PrHA safety recommendations are complete prior to startup.

PSRs are important in MOC procedures after a process has been modified [Q74] or shut down for process safety-related reasons.

Corresponding DOE Programs and Requirements

DOE readiness reviews serve many of the same functions as PSRs. PSRs completed for processes covered by the PSM Rule support DOE readiness review requirements.

Operational readiness reviews are currently required for start and restart of nuclear facilities under DOE O 425.1C, STARTUP AND RESTART OF NUCLEAR FACILITIES. There is a general requirement for readiness reviews for new facilities under DOE O 430.1B, REAL PROPERTY ASSET MANAGEMENT.

Documentation Requirements

PSR documentation includes a checklist of items reviewed and the resulting action plan. (A sample PSR checklist is provided at the end of this section.) DOE contractors should use a graded approach to conducting PSRs. For simple processes, it may be adequate to complete a form with appropriate authorization blocks indicating that the covered process is ready for

startup. Information should be documented by checklists and formal readiness review plans for initial startups or following a safety related shut-down. This documentation, with the appropriate approvals, must be maintained on file to indicate the equipment was constructed according to the design specifications and was properly installed and tested. Other documents, such as training records and procedure sign-offs, must also be available.

Minimum Implementation Criteria

A qualified team should be assembled to conduct each PSR. This team, at a minimum, should include individuals with design and process safety expertise. The team must conduct a physical examination of the plant, process, or equipment that is new or modified, or that has been shutdown for safety reasons. The physical examination is to verify that the plant or process was built according to design, and that all necessary safety features are included and functioning. This examination must include interviews with key personnel and reviews of documentation, such as specifications and drawings, to verify that the design criteria are met.

A system should be in place to track, address, and close out issues identified by incident investigations, audits, PrHAs, or the PSR. A PSR tracking system can be encompassed within existing internal self-assessment and corrective action tracking programs within DOE. The tracking system should be used to ensure that the process is not operated with unresolved issues that significantly degrade the safety of operations.

The level or depth of a PSR should be consistent with the level of hazard of the process or the reason for shutdown. A written action plan must be developed for each PSR. As a minimum, all plans must include the scope of the PSR, names of the PSR team members and their qualifications, the PSR objectives, the action items, and the individuals responsible for the action items. For new facilities, a PrHA is performed and recommendations are resolved or implemented prior to startup. For existing processes, MOC items, such as training and procedures, are addressed.

Questions

74. How should DOE contractors interpret the phrase when the modification is significant enough to require a change in PSI? Must the same PSR procedure be used for all significant changes?

Contractors should define the types of startups they expect to experience following maintenance or construction on covered processes. They should then design appropriate PSR approaches for each situation using a graded approach. Not all PSRs must be completed using the same number or types of people, or using the same review method. PSRs for major or complex new processes are expected to be greater in scope, take longer, and involve more resources than the startup of simple processes or a restart after relatively minor process modifications.

Exhibit 2.7 Sample Prestart Safety Review

Date: _____ PSR Team Leader: _____

Facility / Process / Equipment: _____
_____

Type of Startup: New Construction _____ Process Modification _____

List of Associated PSR Checklist Materials (and location if not attached to this form):

_____

_____

_____

PSR Completion Summary: The following issues have been resolved and the undersigned believe the process/facility is ready for startup.

1. The construction and equipment meet design specifications.

2. Safety, operating, maintenance, and emergency procedures are in place and adequate.

3. For new facilities, the initial PrHA has been performed and recommendations have been resolved.

4. Changes made to modify the process/facility have been reviewed and authorized under the Management of Change Program.

Authorization For Startup:

Title	Name	Signature	Date
DOE Contract Manager			
Facility/Process Manager			
Engineering Manager			
Maintenance Manager			
Training Manager			
PrHA Team Leader			
Others as Required			

Exhibit 2.7

Item	*Responsible Person*	*Date Forecast*	*Date Completed*
Controlled Documents			
Approved SOP's in Control Room			
Practice for Maintenance Planning			
Training			
Fire Department training			
▪ **Operator Training/Documentation**			
Evacuation Shutdown Plans			
Emergency Procedures			
SOPs			
Escape Pack Procedures			
SCBA Procedures			
Deluge System Training			
EPA Hazardous Waste Training			
Distributed Control Sys. (DCS) Training			
Site & Local Emergency Procedures			
HAZCOM Training			
Employee Training & Certification			
Safety Shower Training			
Analytical Procedures (Process Lab)			
▪ **Supervisor Training/Documentation**			
Evacuation Shutdown Plan			
Emergency Shutdown Procedures			
SOP's			
Critical Plant Detectors & Alarms			
Escape Pack Procedures			
SCBA Procedures			
Deluge System Training			
EPA Hazardous Waste Training			

Exhibit 2.7

Item	*Responsible Party*	*Date Forecast*	*Date Completed*
DCS Training / Certification			
Site & Local Emergency Procedures			
HAZCOM Training			
Employee Training & Certification			
Safety Shower Training			
Analytical Procedures w/ Control Charts			
Utilities			
Mechanical Integrity & Blinds Removed			
Operator Facilities			
Operator Shelter			
SCBA Available			
Escape Packs Available			
▪ **Safety Showers**			
Low pressure Alarm- Safety Showers			
All Showers checked & working			
Clearly Marked & Unobstructed			
▪ **Fire protection**			
Fire extinguishers in place			
Hydrants & Monitors			
Required Fire Hoses in Place			
Electric Fire Water Pumps			
Diesel Fire Water Pumps			
System Integrity Assurance & Alarms			
Control Room Alarms			
Hydrocarbon Monitors & Alarms			
▪ **Electrical**			
Required Electrical Systems in Place			
Lighting Adequate			

Exhibit 2.7

Item	*Responsible Party*	*Date Forecast*	*Date Completed*
Covers on Panels per OSHA Standards			
Seals Poured			
Temporary Power Out of Operating Areas			
▪ **Instrument Air**			
Instrument Air is Dry			
Dry Air Alarm Working			
Backup System Tested			
▪ **Chilled Water**			
Chilled Water Circulating			
Orifice Plates Properly Installed			
▪ **250-psg Steam**			
Orifice Plates Properly Installed			
Control Loops Checked			
System Commissioned			
▪ **40 psig Steam**			
Orifice Plates Properly Installed			
Control Loops Checked			
40 lb Letdown			
40 lb Vent			
Steam Tracer Circuits Active			
Desuperheaters			
System Commissioned			
Distributed Control System (DCS)			
System Problems Cleared			
Alarms & Trips at Proper Settings			
Field Switch Alarm & Trip Settings			
Daily Check of Analyzer Zero & Span			
Graphics Correct			

Exhibit 2.7

Item	*Responsible Party*	*Date Forecast*	*Date Completed*
Required Loops Checked and Working			
Propane			
Adequate Inventory Level			
Supplier Delivery Schedule			
Unloading Personnel Training			
Unloading Compressor Trips in Service			
Product Tanks			
Ready to Receive Product-Blinds Out			
Operator Training to Prevent Overfill			
Quality Assurance Management System			
Control Room			
Operator Facilities			
SCBA Available			
Escape Packs Available			
Acid Suit Available			
Acid Suit Procedures & Training for Use			
Monitoring Equip. Test Calibration			
Process Control System Tested			
TV Monitor Working			
Wet Lab in Service			
Lab Procedures & Data Sheets Present			
Standard Solutions & Equip. Checked			
Quality Standards Run on Schedule			
Fire Protection (Control Room)			
All Alarm Panels in Service			
Ventilation			
Ventilation Shutdown Tested			
Detectors/Alarms Tested			

Item	*Responsible Party*	*Date Forecast*	*Date Completed*
Fire Extinguishers in Place			
System Specific Checkouts			
(Tailor to process)			

2.8 Mechanical Integrity

29 CFR 1910.119 (j)

(1) Application. Paragraphs (j)(2) through (j)(6) of this section apply to the following process equipment:

(i) Pressure vessels and storage tanks;
(ii) Piping systems (including piping components such as valves);
(iii) Relief and vent systems and devices;
(iv) Emergency shutdown systems;
(v) Controls (including monitoring devices and sensors, alarms, and interlocks) and,
(vi) Pumps.

(2) Written procedures. The employer shall establish and implement written procedures to maintain the ongoing integrity of process equipment.

(3) Training for process maintenance activities. The employer shall 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 the employee can perform the job tasks in a safe manner.

(4) Inspection and testing.

(i) Inspections and tests shall be performed on process equipment.

(ii) Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.

(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturer's recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

(iv) The employer shall document each inspection and test that has been performed on process equipment. The documentation shall identify the date of the inspection or test, the name of the person who performed the inspection or test, the serial number or other identifier of the equipment on which the inspection or test was performed, a description of the inspection or test performed, and the results of the inspection or test.

(5) Equipment deficiencies. The employer shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in paragraph (d)) before further use or in a safe and timely manner when necessary means are taken to assure safe operation.

(6) Quality assurance.

(i) In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which they will be used.

(ii) Appropriate checks and inspections shall be performed to assure that equipment is installed properly and consistent with design specifications and the manufacturer's instructions.

(iii) The employer shall assure that maintenance materials, spare parts and equipment are suitable for the process application for which they will be used.

Intent

The purpose of the mechanical integrity element is to ensure the integrity and safe operation of process equipment through inspection, testing, preventative maintenance, and quality assurance. The preventative maintenance program must be proactive rather than reactive, encompassing all equipment used to process, store, or handle HHCs from installation through retirement.

Equipment in contact with HHCs forms the first line of defense in preventing uncontrolled catastrophic HHC releases. The second line of defense is typically a combination of containment and safety systems. For example, controlled releases of chemicals may be made to surge or overflow tanks, to diked areas or controlled drainage systems, or through pressure relief valves or vents to scrubbers, filtration systems, or flares. Second line systems also include chemical detection systems and fire detection and suppression systems. The mechanical integrity program must ensure that components in both primary and secondary lines of defense are designed, installed, and operated properly.

Corresponding DOE Programs and Requirements

Most contractors already have preventative maintenance programs for their facilities. These programs must comply with maintenance management requirements contained in DOE O 420.1A, FACILITY SAFETY, and DOE O 430.1B, REAL PROPERTY ASSET MANAGEMENT which address most requirements of the Mechanical Integrity element with little modification. DOE's quality assurance program described in DOE O 414.1A Chg 1, QUALITY ASSURANCE and DOE G 414.1-2, QUALITY ASSURANCE MANAGEMENT SYSTEM GUIDE FOR USE WITH 10 CFR 830.120 AND DOE O 414.1A Chg 1 helps to ensure that process equipment meets specifications and is properly installed. Configuration control and management requirements found in DOE O 430.1B also help ensure the mechanical integrity of process equipment. The DOE safety analysis process can help to focus mechanical integrity programs on safety critical systems, components, and structures.

Documentation Requirements

Written procedures are required for maintenance operations including the inspection, testing, maintenance, and repair of process equipment. Inspections and tests must be documented and must include the date, the name of the person performing the inspection or test, identification of the equipment examined or tested, the nature of the test or inspection, and results. Deficiencies must be corrected before the equipment is returned to service, or it must be tracked to ensure that corrective action is taken in a safe and timely manner. A system must be in place to track, address, and close out deficiencies identified during inspection and testing. Routine maintenance activities should also be documented.

Documentation of the training of maintenance workers on the process, related hazards, and applicable procedures should be consistent with documentation requirements noted in Section 2.5.

Minimum Implementation Criteria

Maintenance and quality assurance programs are crucial for fabrication, installation, and repair of process equipment. When inspection and testing identify conditions outside of safety limits, deficiencies must be repaired before operations are resumed. If it is not possible to stop operations, actions must be taken to ensure safe operations so that corrective actions can be made in a safe and timely manner. The program to ensure the mechanical integrity of process equipment should contain:

- written maintenance procedures [Q75,Q76];
- trained process maintenance personnel;
- inspection and test procedures;
- scheduled inspection, testing, and maintenance of process equipment;
- a quality assurance (QA) program to verify that
  - for new construction, equipment is suitable for its intended use and is properly installed according to design specifications and manufacturer's recommendations;
  - replacement parts and maintenance materials are suitable for the process application in which they will be used;
- a preventive maintenance program that includes
  - pressure vessels and storage tanks;
  - piping systems, including valves;
  - relief and vent systems and devices;
  - emergency shutdown systems;
  - controls, such as monitoring devices, sensors, alarms, and interlocks [Q77]; and
  - pumps [Q79].

Although the PSM Rule does not specifically require inspectors to be certified, it does require that qualified personnel be used. In addition, industry standards and guidelines, as well as state regulations, may require certification as evidence of qualification. All workers performing quality assurance, maintenance, inspection and testing tasks must be trained in an overview of the process, the process hazards, and the relevant written maintenance procedures for the covered process [Q77]. DOE contractors may apply training provisions (Section 2.5) for initial and refresher maintenance training, documentation, and grandfathering [Q80].

The frequency of inspections, testing, and replacement should be consistent with accepted standards and codes and manufacturer recommendations. In addition, prior testing, inspection, and operating records can better determine whether more frequent tests, inspections, or replacements are needed. These records should also be used to establish testing, inspection, or replacement frequencies for equipment not covered by codes and standards.

Contractors are responsible for ensuring that installations performed by subcontractors are consistent with design specifications and manufacturer's instructions. Thus, contractors may need to be involved in the reviews, inspections, certifications, and quality assurance work performed by their subcontractors [Q79].

Questions

75. Must equipment-specific maintenance procedures be written for every type of maintenance activity performed on the equipment? Can generic procedures for preventive maintenance be used?

DOE contractors may use generic written maintenance procedures for some classes of components and activities (e.g., lubrication of bearings on a class of rotating machinery). On the other hand, for some combinations of equipment and activities, unique written procedures should be developed.

76. Must written maintenance procedures be specific to each vessel, type of vessel, or group of equipment types listed?

Maintenance procedures need to be specific to the type of vessel or equipment. Identical or very similar vessels, and items of equipment in similar service, need not have individualized maintenance procedures. Each procedure must clearly identify the equipment to which it applies.

77. What are process equipment-type controls? Are all controls and interlocks included in this type, or only the most critical ones?

Process equipment controls are controls, alarms, and interlocks that play a role in preventing or mitigating the effects of potential catastrophic releases of HHCs to the workplace. Contractors should consider the importance of each control, alarm, and interlock in a covered process, as well as the results of PrHAs, in selecting the appropriate maintenance and inspection procedures and schedules. All process control equipment is covered. Decisions affect the frequency and nature of the inspection, test, and preventive maintenance procedures.

78. Why are some types of process equipment (e.g., compressors, turbines, heat exchangers, furnaces, scrubbers) left out of the list of items covered under the PSM Rule?

The PSM Rule does not exclude any equipment within a covered process that is critical to preventing or mitigating catastrophic releases of HHCs. The equipment listed above could be included in a generic class called “piping systems and components, pressure vessels and storage tanks.” Contractors should develop lists of such equipment in their facilities and assess the safety criticality of each item. The assessment should be used to ensure that maintenance and inspection practices are appropriate in frequency and comprehensiveness.

79. Must DOE contractors train subcontract maintenance workers on their maintenance procedures?

No. Procedures pertinent to subcontractor work must be provided to the maintenance subcontractor, who is then responsible for training its own workers. However, DOE contractors are obligated to verify that training has been performed and that subcontractor workers follow established safe work practices, some of which may be specified in the written maintenance procedures for covered processes. Some contractors may determine that it is more efficient for them to train their maintenance subcontractors on unique process equipment maintenance procedures. In these cases, the training responsibilities of the two parties should be clearly defined and understood.

80. Can we grandfather training requirements for existing maintenance employees? Is refresher training required for maintenance workers?

Initial and refresher training; documentation requirements; and grandfather provisions for training of employees operating a process have been extended to workers responsible for maintaining the process, except that the content of the training differs.

81. If subcontractors are performing an installation, are DOE contractors required to implement a quality assurance program to monitor the activities of these subcontractors?

DOE contractors are responsible for ensuring that equipment is installed consistent with design specifications and manufacturer instructions. Providing such assurance may require contractors to be involved in the review, inspection, certification, and quality assurance of work performed by their subcontractors.

2.9 Nonroutine Work Authorizations (Hot Work Permits)

29 CFR 1910.119 (k)

(1) The employer shall issue a hot work permit for hot work operations conducted on or near a covered process.

(2) The permit shall document that the fire prevention and protection requirements in 29 CFR 1910.252(d) have been implemented prior to beginning the hot work operations; it shall indicate the date(s) authorized for hot work; and identify the object on which hot work is to be performed. The permit shall be kept on file until completion of the hot work operations.

(See also 29 CFR 1910.119 (f) 4, Safe Work Practices)

Intent

Work authorizations are required to ensure that appropriate safety measures are taken any time nonroutine operations are performed on or near covered processes. The intent of this authorization system is to require DOE contractors to control, in a consistent manner, nonroutine work conducted in covered process areas that might initiate or promote a release. Routine work is covered by approved operating procedures and training.

One of the most important nonroutine work authorizations is the hot work permit. Hot work permits address welding, cutting, and other spark-producing operations. Under the requirements of the PSM Rule, contractors are required to issue hot work permits for hot work operations conducted on or near a covered process [Q82]. Hot work permits must document compliance with the fire prevention and protection requirements contained in 29 CFR 1910.252(d).

If a DOE contractor has a covered process, a hot work permit must be issued whenever a welding or cutting operation is performed in a location away from a safe area designated by management for routine welding and cutting operations.

Corresponding DOE Programs and Requirements

DOE O 412.1, WORK AUTHORIZATION SYSTEM, DOE O 430.1B, REAL PROPERTY ASSET MANAGEMENT, and DOE O 420.1A, FACILITY SAFETY, require a work control system for maintenance and operations in DOE facilities. DOE contractors must review their work request systems to verify that adequate safety review is provided for nonroutine operations in covered process units.

Nonroutine work authorizations important to safety include hot work permits, radiation work permits, and confined space entry permits. Typical authorizations address procedures, special administrative and engineering controls, and monitoring and surveillance requirements. Safe work practices provide a generic approach for conducting many nonroutine activities and are typically found in safety-related manuals.

Hot work permits are normally included in fire prevention and protection programs at DOE facilities. They are required by 29 CFR 1910.252(d), which is an OSHA standard prescribed for DOE compliance under DOE Order 440.1A. This element of the Rule is not expected to require any change to hot work permit authorizations at DOE sites.

Documentation Requirements

Written permits are required for all hot work activities at covered processes. Permits must be kept on file until the work is completed. A sample hot work permit is provided at the end of this section in Exhibit 2.9.

Minimum Implementation Criteria

Management must:

- establish areas and procedures for safe welding and cutting based on fire potential;
- designate the individual responsible for authorizing cutting and welding in process areas;
- ensure that welders, cutters, and their supervisor(s) are trained in the safe operation of their equipment; and
- advise subcontractors about the hot work permitting program.

If combustibles are present, supervisors must ensure they are protected from ignition prior to welding or cutting by moving them, shielding them, or scheduling welding around their production. They must also secure authorization, prior to welding, from the designated responsible individual.

Hot work permits must:

- include the date authorized for hot work;
- include the object on which the hot work is to be performed;
- identify openings, cracks, and holes where sparks may drop to combustible materials below;
- describe fire extinguishers required to handle fires that are of incipient type;
- assign fire watchers for locations where more than a minor fire could potentially develop;
- describe precautions associated with combustible materials on floors, walls, partitions, ceilings, or roofs of combustible construction;
- prohibit welding or cutting in unauthorized areas, in buildings with sprinkler systems while such protection is impaired, in explosive atmospheres, and in storage areas for large quantities of readily ignitable materials;
- require relocation of combustibles where practicable and cover with flameproofed covers where not practicable;
- identify for shutdown any ducts or conveyors systems that may convey sparks to distant combustibles.

Questions

82. What is the definition of *near a covered process*?

The area around each covered process should be examined to determine whether a fire in adjacent areas could reasonably propagate to the covered process and should therefore be subject to this PSM requirement.

Exhibit 2.9 Sample Hot Work Permit

	CONTROLLED WELDING, CUTTING, GRINDING AND OPEN FLAME PERMIT	Building No.	Location (Room, Basement, Roof, etc.)

Description of Job and Object on which Hot Work is to be performed

Period of Permit Authorization (Date and Time) From: To:	12-Hour extension review (Date, Time, Initials) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

Yes	No	
__	__	Radiation Work Permit required
__	__	Fire Sprinkler System in service(where applicable)
__	__	Curtain or fire blanket to catch sparks
__	__	Combustibles removed or covered within 35 feet
__	__	Painted surfaces protected
__	__	Service piping and electrical systems protected
__	__	Nearest Fire alarm located
__	__	Test for combustible gases required
__	__	Wall and Floor openings protected or covered
__	__	Fire Extinguisher required Type _____
__	__	Supplemental ventilation required Type _____
__	__	Respiratory protection required Type _____

Special Instructions and Names of Persons Involved

Job Preparation complies with 29 CFR 1910.252(d) Signature_____ _____ Project Manager/Field Engineer Date	The job location has been reviewed and complies with requirements above. Signature_____ _____ Supervisor of personnel doing work Date

Subject to strict adherence during the permit authorization period, protective requirements, other specified restrictions; permission is granted for welding, cutting, grinding, and/or open flames within the location above. The right to rescind this permit is reserved by the undersigned in case of unforeseen circumstances.
Signature_____ Date_____
Building Manager

This job has been completed as indicated below:			Upon completion of the job, sign below and return permit to Building Manager.
Yes	No		Signature _____ _____
__	__	Work area has been cleaned up	Supervisor of personnel doing work Date
__	__	Subsequent ½ hour fire watch completed	

2.10 Management of Change

29 CFR 1910.119(l)

(1) The employer shall 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.

(2) The procedures shall assure that the following considerations are addressed prior to any change:
- *(i) The technical basis for the proposed change;*
- *(ii) Impact of change on safety and health;*
- *(iii) Modifications to operating procedures;*
- *(iv) Necessary time period for the change; and,*
- *(v) Authorization requirements for the proposed change.*

(3) Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.

(4) If a change covered by this paragraph results in a change in the process safety information required by paragraph (d), such information shall be updated accordingly.

(5) If a change covered by this paragraph results in a change in the operating procedures or practices required by paragraph (f), such procedures or practices shall be updated accordingly.

Intent

The intent of the MOC element is to require management of all modifications to equipment, procedures, materials, and processing conditions other than replacement in kind. All changes should be identified and reviewed prior to their implementation, and the impact of design, operational, and procedural changes on process safety should be addressed and managed. A process change is defined as any alteration, whether temporary or permanent, that could affect the control or integrity of a system covered by the PSM Rule. This element is a critical part of the PSM Rule because it helps to integrate many of the other elements of the Rule. Process changes include:

- changes in process technology such as raw materials, process chemistry, process control systems, equipment design, and piping and equipment specifications;
- addition or removal of process equipment or piping;
- changes in process parameters;
- changes in utilities;
- changes in procedures;
- changes in facilities; and
- personnel changes (OSHA has held that personnel changes are inferred in term *facilities*).

Corresponding DOE Programs and Requirements

Management of change is addressed under DOE O 5480.19 Chg 2, CONDUCT OF OPERATIONS REQUIREMENTS, and DOE G 424.1-1, IMPLEMENTATION GUIDE FOR USE IN ADDRESSING UNREVIEWED SAFETY QUESTION REQUIREMENTS. Programs that address configuration control also support this element. For new construction, configuration control is addressed in DOE O 430.1B, REAL PROPERTY ASSET MANAGEMENT. DOE-STD-1073-2003, *Configuration Management*, applies to existing facilities. DOE O 420.1A, FACILITY SAFETY, requires that modifications conform to requirements for new facilities. For years, DOE accident investigation classes have taught the use of a technique called Change Analysis to identify changes that contribute to accidents. This emphasizes the importance of a good MOC system in accident prevention, because virtually all accidents involve some degree of change.

The MOC process should facilitate identification of potential unreviewed safety questions introduced by process changes. DOE G 424.1-1 describes how such issues should be resolved.

Documentation Requirements

There is no specific documentation requirement for MOC beyond developing a written MOC procedure and updating the existing process safety information and operating and maintenance procedures [Q83]. As a practical matter, MOC procedures should include the development of a request for change form. A sample form is provided in Exhibit 2.10 at the end of this section.

Minimum Implementation Criteria

For a management of change program to be effective, DOE contractor personnel at all levels must be trained to recognize and understand the ramifications of proposed changes on the safe operation of a chemical process, including the interdependencies and interrelationships among facility functions, processes, and activities. For example, a simple change in a valve design may potentially require changes and modifications to the normal and emergency operating procedures, maintenance routines, and staff training. Such issues must be resolved before the change is implemented.

An effective MOC program should contain a means to initiate (request), track, review, and approve changes. Written MOC procedures must address responsibilities, the basis for a change, and the impacts of the change, including the following issues.

- Assignment of responsibility for requesting changes to existing systems, processes, and procedures.
- Assignment of responsibility for approving changes.
- The criteria for approving changes.
- Assignment of responsibility for implementing changes.

The basis for the change should be documented on the request for change form, including a discussion of the technical, safety, and operational needs for the change, and an analysis of the proposed change, including:

- acceptable safety/risk assessment methods and approaches;
- impact on potential for release;
- format and content of the analysis.

Impacts of the proposed change include:

- procedures, functions, processes, and activities, such as maintenance and operation
- additional training needs
- additional resource requirements.

The level of review should be commensurate with the potential risk associated with the change [Q84]. A MOC program for contractors with simple chemical processes may consist of appropriate review of a change request form. For more complex processes, it may be necessary to modify the work order/work request system and the process required for approval of capital projects.

Change includes both capital changes and daily changes associated with maintenance and operations. Daily changes are more subtle and therefore more likely to be overlooked. Examples include substitution of parts that may affect a process or deviations from operating or maintenance procedures. Replacement-in-kind changes must be defined based on process safety issues in a facility. An overly restrictive definition may be excessively burdensome and costly [Q85].

An effective MOC program should also include an assessment procedure to determine the importance of the change to process safety and a procedure to manage each proposed change. This procedure should enable management to:

- determine the level and effort required for review and implementation of a change;
- update PSI and PrHAs and address any resulting recommendations;
- modify operating procedures;
- inform affected employees and subcontractors;
- retrain affected employees;
- update emergency plans;
- develop a schedule [Q86] and a list of required authorizations;
- update pre-startup procedural changes;
- modify pre-startup inspection and testing procedures; and
- verify mechanical and system integrity prior to startup.

The MOC tracking and approval system may be integrated into existing systems. Because change of even an inexpensive component may result in a catastrophic release, changes covered in the MOC tracking system must be based on risk rather than cost. Finally, an effective MOC program should include a method to audit the MOC program to ensure it is working.

Questions

83. What documentation is needed to demonstrate compliance with MOC requirements?

Other than having a written MOC procedure, no specific documentation is required for MOC beyond updating existing PSI and operating and maintenance procedures. However, many process safety experts agree that having a request for change form is necessary to document changes. These forms should contain enough information to ascertain that all considerations required under the PSM Rule for each change have been resolved.

84. What type of review method must be used to evaluate the impacts of changes on safety and health? How many people must review each change situation?

DOE contractors may use a graded approach to develop the review method and authorization procedure appropriate for each class of change in a covered process. The level of review should be commensurate with the potential risk associated with the change. DOE contractors should consider the degree to which the change introduces new potential hazards or affects safety-critical systems or components.

85. Are any types of changes on or around a covered process (e.g., changes to safety showers, catwalks, structural steel) intended to be excluded from MOC requirements?

DOE contractors should decide what types of facility changes, excluding replacement-in-kind, to cover under the MOC system. Contractors should use caution in simply dismissing any broadly defined class of change because no apparent safety and health impacts can be seen on a generic basis.

86. What does *necessary time period for change* mean?

Used in conjunction with temporary changes, it means the time that the change is allowed to exist without undergoing further review.

Exhibit 2.10

Sample of Management of Change Form

General Information	**Urgency of Change**
Date_____ Originator(s)_____ Department_____	□ Emergency □ Priority □ Routine
Basis for the Change (Check One)	Review of Change (Check One)
□ Improved Safety/Reduced Risk □ Improved Performance/ Efficiency □ Pollution Prevention/ Waste minimization □ Essential to the Operation □ Other	□ Approved □ Not Approved Reason: _____ _____ _____

	Name	Organization/Position
Reviewed By	_____	_____
	_____	_____
	_____	_____

Exhibit 2.10

Change Management Plan

Task	Required Y/N	Responsibility		Completed Date/Initials
		Name	Organization	
Process Hazard Review (PrHA)				
Safety Design Review				
New/Revised Operating Procedures				
New/Revised Maint. Procedures				
HAZCOM Review				
Operator Training				
Maint./Contractor Training				
Operating Manual Update				
Maintenance Record Update				
Process Flow Diagram Update				
P&ID Update				
Equip. Test/Insp. Record Update				
Spare Parts Review				
Environmental Reqmts. Review				
Basic Design Review				
Other:				

Note: If change is made on an emergency basis during an off shift, request for change should be routed to the Change Management Committee as soon as possible. The Management Committee will be responsible for ensuring that the risk of change is evaluated and documented through the normal change process.

All Required Reviews Completed

Engineering Manager _____ Date _____

2.11 Incident Investigation

29 CFR 1910.119 (m)

(1) The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.

(2) An incident investigation shall be initiated as promptly as possible, but not later than 48 hours following the incident.

(3) An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.

(4) A report shall be prepared at the conclusion of the investigation which includes at a minimum:
- *(i) Date of incident;*
- *(ii) Date investigation began;*
- *(iii) A description of the incident;*
- *(iv) The factors that contributed to the incident; and,*
- *(v) Any recommendations resulting from the investigation.*

(5) The employer shall establish a system to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions shall be documented.

(6) The report shall be reviewed with all affected personnel whose job task are relevant to the incident findings including contract employees where applicable.

(7) Incident investigation reports shall be retained for five years.

Intent

The purpose of incident investigation is to prevent recurrence of incidents having the same nature or the root cause. Every incident that results in or could reasonably result in a catastrophic chemical release must be investigated. The PSM Rule defines catastrophic as “a major, uncontrolled emission, fire, or explosion, involving one or more HHCs, that present a serious danger to employees in the workplace” [Q87].

The incident investigation team's recommendations are to be implemented unless it can be documented that an alternative will address the concerns at least as effectively and efficiently. Management may reject recommendations that are erroneous, infeasible, or more costly or complex than a equally protective measure.

Corresponding DOE Programs and Requirements

DOE incident investigations are addressed in DOE O 225.1A, ACCIDENT INVESTIGATION and DOE M 231.1-2, OCCURRENCE REPORTING AND PROCESSING OF OPERATIONS INFORMATION. The Accident/Incident Reporting System and the Occurrence Reporting and Processing System within DOE meet the intent of the incident investigation element of the PSM Rule. Additional DOE guidance is provided in DOE G 231.1-1, OCCURRENCE REPORTING AND PERFORMANCE ANALYSIS GUIDE and DOE G 231.1-2, OCCURRENCE REPORTING CAUSAL ANALYSIS GUIDE.

Documentation Requirements

Incident investigation findings must be documented in a written report that contains the date of the incident, the date the investigation began, a description of the incident, the factors that contributed to the incident, and recommendations. The PSM Rule requires that a team be appointed and an investigation initiated within 48 hours of discovery of the incident. However, current DOE Orders are more restrictive and should be consulted for additional requirements.

Minimum Implementation Criteria

Investigations must be conducted for all incidents that result in, or could reasonably result in, catastrophic releases of highly hazardous chemicals. DOE contractors must assemble a team and initiate an investigation within 48 hours of an incident or sooner, per DOE requirements [Q88]. Therefore, an effective written incident investigation procedure must be in place for establishing an incident investigation team, including a leader, and preserving relevant information and evidence. Activities for preserving information include securing/barricading the scene, initiating the collection of transient information, and interviewing personnel.

The incident investigation team should vary according to the type of incident. A typical team may include management personnel from the facility where the incident occurred; engineering and/or maintenance personnel; facility and/or operations personnel; ES&H personnel; and technical and/or research personnel. Incident investigation teams must include at least one person knowledgeable in the process involved in the incident. If the incident involved the work of a subcontractor, at least one subcontractor employee must be included on the investigation team. Other members should have the appropriate knowledge and experience to support the investigation.

The team chairperson must effectively control the scope of team activities by identifying the lines of investigation to be pursued; assigning tasks and establishing timetables; and keeping facility management advised of the progress of the investigation.

Investigations should include a visit to the incident scene; preparation of visual aids, such as photos and field sketches; eyewitness interviews, conducted privately and individually; observation of any mechanical equipment involved; review of as-built drawings, operating logs, recorder charts, previous reports, procedures, equipment manuals, design data, laboratory tests, and other potentially useful information; and documentation of the sources of information for the incident report.

Incident investigations should analyze for root causes that will lead to recommendations for corrective actions. Recommendations should include the actions to prevent a recurrence of the incident, the identification of the person responsible for completing the actions, and the schedule for completion. Corrective actions should be aimed primarily at preventing or controlling the underlying causes of an incident rather than the surface manifestations.

Incident investigation report findings and recommendations must be implemented and documented promptly. A system should be in place to ensure follow-up, closure, and documentation of open recommendations from an incident investigation.

Incident investigation reports must be reviewed with all affected personnel, whose jobs relate to the incident findings, including subcontractor employees, where applicable. Consideration should be given to sharing lessons learned with similar DOE facilities through the Accident/Incident Reporting System or the Occurrence Reporting and Processing System. Incident investigation reports must be retained for at least 5 years. The purpose of maintaining the reports is to detect incident patterns.

Questions

87. How severe must an incident be before it is investigated? What does *or could reasonably have resulted in* mean? Does the same investigation technique have to be applied to all incidents covered under this element?

DOE contractors must investigate each incident that resulted in or could reasonably have resulted in a catastrophic release which the PSM Rule defines as "a major, uncontrolled emission, fire, or explosion, involving one or more HHCs, that presents a serious danger to employees in the workplace." The PSM Rule provides no further guidance on what *or could reasonably have resulted in* means. Existing criteria which mandate the investigation of occurrences and accidents and incidents provide the basic guidance within DOE. However, contractors should include relevant process incidents historically referred to as near-misses.

88. If we cannot gain access to the area where an accident occurred within 48 hours due to the hazards the area may pose to members of the investigation team, are we in violation of the requirement to begin the investigation within this time period?

Assembling an accident investigation team and preparing to conduct an onsite inspection is considered the beginning of the investigation. Contractors are not relieved of time requirements for occurrence reporting.

2.12 Emergency Planning and Response

29 CFR 1910.119 (n)

The employer shall establish and implement an emergency action plan for the entire plant in accordance with the provisions of 29 CFR 1910.38(a). In addition, the emergency action plan shall include procedures for handling small releases. Employers covered under this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120(a), (p) and (q).

Intent

Emergency planning and response are required under the PSM Rule to mitigate the consequences of catastrophic chemical releases. Emergency plans form the last line of defense in protecting workers from such events. Plans must specify evacuation routes, safe zones, and alarms; incident reporting; actions an employee should take to stop releases; and preplanning for incidental releases. The PSM Rule requires DOE contractors to develop an emergency action plan in compliance with 29 CFR 1910.38(a). Plans must include procedures for dealing with small chemical releases. In addition, DOE contractors are subject to the emergency response provisions in 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

Corresponding DOE Programs and Requirements

DOE O 151.1B, COMPREHENSIVE EMERGENCY MANAGEMENT SYSTEM, deals with emergency preparedness for DOE contractors. Little modification of DOE requirements or site emergency plans is expected to address the emergency planning and response requirements of the PSM Rule. Existing emergency plans for DOE facilities must already comply with the requirements of 29 CFR 1910.38 and 29 CFR 1910.120, both of which are required by DOE order. Nevertheless, emergency plans should be reviewed to ensure that they adequately address the requirements of this element.

Documentation Requirements

Detailed written emergency plans are required for subcontractor facilities with processes covered by the PSM Rule.

Minimum Implementation Criteria

Emergency plans must be developed and current for all processes covered by the PSM Rule. DOE contractor employees must be trained to respond in accordance with the plans, which must contain:

- emergency procedures and responsibilities;
- escape routes;
- the location of safe zones;
- types of accidents considered;
- a description of alarms;
- procedures for safe shutdown before evacuation;

- procedures to account for all employees following evacuation;
- rescue and medical responsibilities;
- reporting procedures;
- emergency contact personnel; and
- strategies and procedures for handling small releases [Q89].

Questions

89. What does the PSM Rule mean by procedures for handling small releases?

DOE contractors should develop appropriate strategies and procedures for workers to use in dealing with localized, small releases of HHCs that are not of sufficient magnitude to cause wide-scale evacuation of a facility. These procedures typically include the steps that operating and maintenance personnel may take to isolate such releases while using personal protective equipment. Contractors should develop their own appropriate classification of these incidents for each covered process.

2.13 Compliance Audits

29 CFR 1910.119 (o)

(1)	*Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.*
(2)	*The compliance audit shall be conducted by at least one person knowledgeable in the process.*
(3)	*A report of the findings of the audit shall be developed.*
(4)	*The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.*
(5)	*Employers shall retain the two (2) most recent compliance audit reports*

Intent

The purpose of the audit element is to ensure that the PSM program is operating in an integrated and effective manner. DOE contractors must conduct internal audits or self assessments for compliance with the PSM Rule at least every 3 years to determine the degree to which plans and programs have been implemented.

Audits are a tool to help contractors identify PSM weaknesses and develop recommendations. The audit team should provide an independent assessment of the degree of compliance with the PSM Rule, even though one member may by necessity be involved in the operation of the process.

Audits have two major objectives. The first is to assess whether the management system in place adequately addresses all elements of the PSM Rule. This part of the audit attempts to discover fundamental design deficiencies that could compromise the effectiveness of a PSM program. The second objective is to assess whether the management system has been adequately implemented for every facility or process. Deficiencies discovered during this part of the audit may indicate a need for better communications or training, or may signal fundamental management problems.

Corresponding DOE Programs and Requirements

DOE G 414.1-1A, Management Assessment and Independent Assessment Guide, provides nonmandatory guidance for satisfying requirements contained in DOE O 414.1A Chg 1, QUALITY ASSURANCE, and 10 CFR Part 830 Subpart A. DOE O 231.1A contains safety and health reporting requirements which provide indicators of program performance that can be used to highlight safety management weaknesses which should be examined.

PSM audits can be encompassed within existing internal self-assessment and corrective action tracking programs within DOE. DOE contractor self-assessments are implemented in various ways and by different organizational groups under DOE safety appraisal programs.

Documentation Requirements

Reports of internal audit findings must be written, and DOE contractors must document responses to the findings and certify that the deficiencies have been corrected.

Initially, the responses should be action plans indicating what corrective actions or additional investigations will be done and when they will be completed. The document should be updated periodically to indicate the completion of corrective actions.

Minimum Implementation Criteria

All elements of the PSM program must be evaluated for compliance with the PSM Rule every 3 years. DOE contractors must certify in writing that there has been a complete internal PSM audit at least every 3 years. However, a complete audit need not be done all at one time. Rather, various portions of a facility, such as process units or departments, may be audited at different times, so long as a complete audit covering all elements is performed at least once every 3 years.

An effective internal audit should include a review of relevant documentation, an inspection of the physical facilities, and interviews with all levels of plant personnel. (A sample audit format is provided at the end of this section in Exhibit 2.13.) The internal audit must be conducted by a team that includes at least one, and preferably several, persons knowledgeable in the processes being audited. Such persons should understand the fundamental process hazards for the operations being reviewed and should be familiar with the specific types of process units used.

The audit team should include a leader and members familiar with the process, experienced in PSM, and trained in audit techniques. Team size should be a function of the number, size, and complexity of the processes being audited. The internal audit team for any facility or process may be either a “standing” audit team, an “ad hoc” team, or a combination, with some permanent auditors augmented by different individuals for each audit.

Internal audits must detail the requirements of each element of the program being audited. A properly designed checklist may assist the auditor in expediting the audit and to ensuring that no requirements of the Rule are omitted. DOE contractors may adopt a sampling approach that examines representative evidence of the PSM practices, such as drawings; training and maintenance records; and results of personnel interviews. Contractors should develop their own criteria for assessing the effectiveness of their PSM programs [Q90].

An audit report must be developed for each audit and the responsible facility manager must promptly develop a response action plan for each finding. Such a response action plan may take the form of an internal memorandum setting forth action items, responsibilities, and completion targets. Action items and status may be tracked by computer to facilitate record keeping.

DOE contractors must further document that action items have been addressed and deficiencies have been corrected. If a computerized database is used to track action items, a paper copy of the documents that report completion of corrective actions should be maintained.

Contractor internal audit programs should provide a process to resolve worker or management disagreements with audit findings. This process may refer issues to higher levels of management. If a finding is reported for which management determines no action is necessary, the basis for the management decision should be documented as part of the audit process. That is, the conclusion that an audit finding is inappropriate or irrelevant may be an adequate response to a finding, provided that the conclusion is well-founded and documented.

The two most recent audit reports must be readily available for review by internal auditors, DOE, and interested workers or their representatives. If the same findings recur in successive audits, contractors must explain why problems were not corrected after their first appearance in an audit report.

Questions

90. What criteria can be used to certify compliance? Must DOE contractors evaluate every operating procedure, inspect every training record, etc.? Or can contractors use an auditing approach that looks at representative examples of PSM practices?

DOE contractors may adopt an auditing approach that looks at representative samples as evidence of PSM practices. The samples may include drawings, training and maintenance records, and results of interviews with personnel. Contractors should develop their own criteria for assessing the effectiveness of their PSM programs.

Exhibit 2.13

SAMPLE PSM AUDIT REPORT FORM

Explanation of Levels of Process Safety Management (PSM) Compliance Status (as shown on the following form)

None: Little or no information is available to determine compliance to the OSHA PSM rule; a lack of information or inability to easily provide information would constitute little proof of compliance.

Partial: Significant information is available, but not enough to determine compliance with the OSHA PSM rule; incompliance documentation (process descriptions, P&IDs, written procedures, etc.) would constitute partial compliance. Lack of formal methods (verbal only) of handling changes to process information would also constitute partial compliance.

Complete: The available information is sufficient to verify compliance to the OSHA PSM rule. Personnel responsibilities are clearly established and the documentation is complete and easily accessible.

Exhibit 2.13

PSM Element: PROCESS SAFETY INFORMATION

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
CHEMICAL INFORMATION Documentation The following chemical information is available. ▪ Toxicity Data ▪ Permissible exposure limits ▪ Physical Data ▪ Reactivity Data ▪ Corrosivity data ▪ Thermal and chemical stability data ▪ Chemical Incompatibility data					
CHEMICAL INFORMATION Communication Employees are aware of where chemical information is located.					
Employees are informed when changes are made to the chemical information.					
CHEMICAL INFORMATION Implementation Written program exists for maintaining, revisiting and updating chemical information.					
Responsibility for maintaining, revisiting, and updating chemical information is clearly established.					

PSM Element: PROCESS SAFETY INFORMATION, continued — Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
TECHNOLOGY **Documentation** Written, up-to-date process descriptions exist.					
Block flow diagrams or simplified process flow diagrams exist.					
Maximum intended inventories of chemicals are documented.					
Information concerning the process chemistry is documented.					
Safe operating ranges (upper and lower limits) are provided for such process parameters as temperature, pressure, flow rate, and composition.					
Consequences associated with process parameter deviations are provided, including those that would affect the safety and health of employees.					
TECHNOLOGY **Communication** Employees are aware of where information is located.					
Employees are informed when changes are made to the process technology information.					
TECHNOLOGY **Implementation** Written program exists for maintaining, revising, and updating process technology information.					
Responsibility for maintaining, revising, and updating technology information is clearly established.					

PSM Element: PROCESS SAFETY INFORMATION, continued Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
PROCESS EQUIPMENT Documentation Documentation is provided for materials of construction (including protective coatings) and their selection bases.					
Up to date piping and instrumentation diagrams (P&IDs) are available.					
Documentation is provided for electrical classifications of equipment (i.e. applicable service environments).					
Documentation is provided for the design basis of relief systems.					
Documentation is provided for the design of ventilation systems.					
Documentation is provided that indicates equipment complies with design codes, standards, or recognized and generally accepted engineering practices used in designing the process.					
Documentation is provided for material and energy balances.					
Documentation is provided for the design of safety systems equipment such as interlocks, detection and suppression systems, etc.					
PROCESS EQUIPMENT Communication Employees are aware of where process equipment information is located.					
Employees are informed when changes are made to the process equipment information.					

PSM Element: PROCESS SAFETY INFORMATION, continued Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
PROCESS EQUIPMENT **Implementation** Written program exists for maintaining, revising, and updating process equipment information.					
Responsibility for maintaining, revising, and updating process equipment information is clearly established					

PSM Element: Process Hazards Analysis — Exhibit 2.13

Major Issues/Questions	**PSM Compliance Status**			**Information Source**	**Notes/Comments**
	None	**Partial**	**Complete**		
Documentation The PrHA documentation includes the following. ▪ System analyzed (i.e. a list of P&IDs with revision numbers and dates) ▪ Personnel involved in the PrHA. ▪ PrHA method used. ▪ Recommended actions. ▪ Management response to the recommended actions.					
The documentation associated with the two most recent process hazard analyses (PrHAs) is on file.					
Communication The findings of the PrHA and actions taken in response to the findings are communicated to all affected personnel (i.e. operations, maintenance, etc.)					
Implementation Written protocol exists for performing PrHAs and established responsibilities.					
Written program exists describing 1) the PrHA techniques that may be used, 2) when to use them, and 3) how to use them.					
The PrHA method selected addresses the following. ▪ Hazards of the process. ▪ Engineering and administrative controls applicable to the hazards. ▪ Consequences of failure of these controls. ▪ Consequences to workplace employees of the engineering administrative control failures.					
ThePrHA is performed by a team with expertise in engineering and process operations, with at least one individual who has experience and knowledge specific to the process being evaluated.					

PSM Element: Process Hazards Analysis, continued Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Implementation (continued) Written program exists for 1) documenting the recommendations and management response to the recommendations, 2) communicating the results to affected individuals, and 3) implementing the recommendations in a timely manner.					
Written program exists for updating and revalidating PrHAs every 5 years.					

PSM Element: Operating Procedures — Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Written up-to-date operating procedures address at least the following operation modes. ▪ Initial startup ▪ Normal operation ▪ Temporary operation (as the need arises). ▪ Emergency operations (including emergency shutdowns, conditions under which to declare a shutdown, and assignment of shutdown responsibility.) ▪ Startup following a turnaround or after an emergency shutdown.					
Written up-to-date operating procedures address operating limits by considering the following. ▪ Consequences of deviations from operating limits. ▪ Steps necessary to correct and/or avoid deviations from operating limits. ▪ Safety systems and their functions.					
Written up-to-date operating procedures address the following safety and health considerations. ▪ Procedures and hazards of chemicals used in the process. ▪ Precautions necessary to prevent exposure (i.e. administrative and engineering controls and protective equipment.) ▪ Measure to be take if contact or exposures occurs. ▪ Safety procedures for opening process equipment (e.g. line breaks). ▪ Quality control for raw materials and chemical inventory levels. ▪ Any special or unique hazards.					
Communication Operating procedures are readily accessible to employees who work in or maintain a process.					

PSM Element: Operating Procedures, continued Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Communication (continued) Employees are informed when changes are made to the operating procedures.					
Implementation Written program exists for updating operating procedures to include changes in process chemicals, technology, equipment, and facilities.					
Responsibility for maintaining, revising, and updating operating procedures is clearly established.					
Written program exists for annually certifying that operating procedures are current and accurate.					

PSM Element: Training

Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation For initial and refresher training, an employee record exists that contains the name of the employee, the date of training, and the signature of the person doing the training.					
Communication Employees are made aware of initial and refresher training that is required.					
Training program ensures that employees understand and adhere to the operating procedures					
Implementation Written program exists for providing refresher and supplemental training and for establishing acceptable training methods, responsibilities for training instructors, and methods for maintaining , revising, and updating certification records.					
Written training program ensures that employees are trained in the following areas. • An overview of the process • Operating Procedures • Safety and health hazards and procedures • Safe work procedures applicable to the employee's job tasks.					

PSM Element: CONTRACTORS Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Documentation exists for contractor orientation to known potential hazards and the applicable provisions of the emergency action plan.					
Communication Employer assumes the following responsibilities. ▪ Inform contractors of known potential hazards related to the contractor's work and the process. ▪ Explain to contractor the applicable provisions of the emergency action plan.					
Implementation Written program establishes responsibilities for orientating contractors to potential hazards and the applicable provisions of the emergency action plan and for documenting the orientation.					
Written programs exists for developing and implementing safe work practices to control the entrance, the exit, and the movement of contractor personnel at the affected processes.					
Written program exists for ensuring that the contractor assumes the following responsibilities. ▪ Ensuring their workers are trained in safe work practices. ▪ Ensuring their workers follow all applicable safety rules and work practices.					

PSM Element: PRE-STARTUP SAFETY REVIEW Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Prior to introduction of hazardous materials into the affected process, documentation exists indicating that a pre-startup safety review was conducted and confirming the following. ▪ Construction is in accordance with design specifications. ▪ Safety, operating, maintenance, and emergency procedures are in place and are adequate. ▪ PrHA recommendations have been addressed and actions necessary for startup have been completed. ▪ Operating procedures are in place and each operating employee has been trained.					
Communication Operating employees are properly trained in the hazards and safe operating practices of the new or modified facility.					
Implementation Written program exists for determining when a pre-startup safety review is necessary and establishing responsibilities for conducting such a review.					
Written procedure exists for conducting and documenting pre-startup reviews.					

PSM Element: MECHANICAL INTEGRITY Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Written procedures exist for maintaining the on-going integrity of process equipment. Procedures include maintenance and inspection/testing frequency for process equipment. The frequency of inspections/tests shall be consistent with applicable codes and standards, or more frequently if operating experience so dictates.					
Certification records exist documenting inspections and tests of equipment. The records contain as a minimum, the following information. ▪ Date of the inspection and/or test. ▪ Name of the individual who performed the inspection and/or test. ▪ Serial number, or other identifier, of the equipment tested.					
Written quality assurance program exists for ensuring the following: ▪ Equipment as fabricated meets design specifications ▪ Appropriate checks and inspections are performed, as necessary, to ensure that equipment is installed properly, consistent with design specifications and manufacture's instructions. ▪ Maintenance materials and spare parts and equipment meet design specifications.					
Communication Employees involved in maintaining the on-going integrity of process equipment are trained in the procedures applicable to the job tasks.					
Implementation Formal system exists for determining maintenance and test frequencies for equipment					

PSM Element: MECHANICAL INTEGRITY, continued Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Implementation (continued) A record keeping system exists for documenting the mechanical integrity of all affected equipment.					
A quality assurance program exists for ensuring that all affected equipment is properly designed, installed, and maintained.					
Written program requires that equipment deficiencies outside acceptable limits be corrected to meet acceptable limits as specified in the process safety information package before further use.					
Inspection and testing procedures follow generally accepted good engineering practices that are consistent with manufacture's recommendations.					

PSM Element: MECHANICAL INTEGRITY Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation A permit exists on file (until completion of the hot work operations) containing the following information. • Certification that the fire prevention and protection requirements contained in 29 CFR 1910.252(a) have been implemented prior to beginning the hot work operations. • Date(s) authorized for hot work • Equipment or facility on which the hot work is to be done.					
Communication Completion of hot work operations is properly communicated to the individuals responsible for maintaining hot work permits on file.					
Implementation A system exists for issuing permits and responsibility for issuing permits is clearly established.					

PSM Element: MANAGEMENT OF CHANGE — Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Written procedures exist to manage changes (except for "replacements in kind") to process chemical technology, equipment, and changes to facilities. Procedures ensure that the following are addressed prior to any change. ▪ Technical basis for the change. ▪ Impact of the change on safety and health. ▪ Modifications to operating procedures. ▪ Necessary time period for the change. ▪ Authorization requirements for the change.					
Communication Employees involved in the process are informed of and trained in the change in process as early as practicable prior to its implementation.					
Implementation Written protocol exists for determining what changes in the process (equipment, operating limits, etc.) require implementation of management of change requirements.					
Written protocol exists for implementing management of change in training employees, revising operating procedures, and process safety information.					

PSM Element: INCIDENT INVESTIGATION Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Incident investigation reports shall be retained for 5 years and shall contain, as a minimum, the follow information. ▪ Date of the incident ▪ Date the investigation began ▪ Description of the incident. ▪ Factors that contributed to the incident. ▪ Any recommendations resulting from the investigation.					
Communication The report has been reviewed with all operating, maintenance, and other personnel whose work assignments are within the facility where the incident took place.					
Implementation Written program exists for reporting and investigating (within 48 hours) any incident that results in, or could reasonably have resulted in, a major accident. Written program includes establishment of an incident investigation team consisting of persons knowledgeable in the process and other appropriate specialties, as necessary. Written program includes system for promptly addressing the incident investigation report findings and recommendations and for implementing report recommendations in a timely manner.					

PSM Element: EMERGENCY PLANNING AND RESPONSE Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation Written up-to-date, emergency response plan exists containing the following elements. ▪ Emergency escape procedures and escape route assignments. ▪ Procedures to be followed by employees who remain to operate critical plant operations before they evacuate. ▪ Procedures to account for all employees after emergency evacuation have been completed. ▪ Rescue and medical duties for those employees who are to perform them ▪ The preferred means for reporting fires and emergencies. ▪ Names or regular job titles or persons or departments who can be contacted for further information or explanation of duties under the plan.					
Documentation exists of employee training with respect to the emergency response plan, including refresher training.					
Communication An alarm system exists with distinctive signals for each purpose.					
Employees are aware of the location of emergency response plan documentation , have access to it, and are notified when changes are made to the plan.					

PSM Element: EMERGENCY PLANNING AND RESPONSE, continued — Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Implementation Personnel have been designated and trained to assist in the safe and orderly evacuation of employees.					
Written program exists for ensuring that employees are trained and familiar with the emergency response plan and for maintaining proper documentation records.					

PSM Element: COMPLIANCE SAFETY AUDITS Exhibit 2.13

Major Issues/Questions	PSM Compliance Status			Information Source	Notes/Comments
	None	Partial	Complete		
Documentation The employer documents compliance at least every 3 years. The employer documents the findings of the audit, the management response to the findings of the audit, and certifies that deficiencies have been corrected. The two most recent reports are retained.					
Communication Deficiencies found during the compliance safety audit are communicated to responsible individuals for subsequent improvement of the PSM program.					
Implementation Written procedure exists for performing and documenting compliance safety audits and for establishing a team of individuals (at least one of which is knowledgeable in the process).					

2.14 Trade Secrets

29 CFR 1910.119 (p)

(1)	*Employers shall make all information necessary to comply with the section available to those persons responsible for compiling the process safety information (required by paragraph (d)), those assisting in the development of the process hazard analysis (required by paragraph (e)), those responsible for developing the operating procedures (required by paragraph (f)), and those involved in incident investigations (required by paragraph (m)), emergency planning and response (paragraph (n)) and compliance audits (paragraph (o)) without regard to possible trade secret status of such information.*
(2)	*Nothing in this paragraph shall preclude the employer from requiring the persons to whom the information is made available under paragraph (p)(1) of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200.*
(3)	*Subject to the Rules and procedures set forth in 29 CFR 1910.1200(i)(1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.*

Intent

Trade secrets are addressed to ensure that necessary information is available to identify hazards and protect workers. Few trade secrets are expected in information required for DOE contractors to support the PSM Rule. When necessary, confidentiality or nondisclosure agreements are recommended to ensure that personnel having access to trade secrets do not disclose that information.

Corresponding DOE Programs and Requirements

For DOE contractors, classified information is the equivalent to trade secrets. All affected workers in classified areas should have access to PSI and PrHAs for processes covered by the PSM Rule [91]. Security conflicts should be rare, because workers who support such processes have the appropriate security clearances and access to the information necessary to support process safety.

Documentation Requirements

None.

Minimum Implementation Criteria

Information covered by trade secrets must be available to support development of PSI, PrHA, operating procedures, and incident investigations.

Process workers must have appropriate clearances and access to classified PSI. For situations involving National Security interests, DOE contractors must develop methods to provide an equivalent level of protection.

Questions

91. What does access to trade secret information contained within PrHA and other documents mean? Must PrHA team members have access to all confidential information concerning a covered process?

PrHA team members must be able to review all process safety information relevant to a covered process to allow a thorough evaluation of the potential problems that could affect the safety and health of employees. Likewise, process workers and their representatives must be able to review any process information (e.g., PSI, PrHA, incident investigations) necessary for the safe operation of that process.

3.0 PSM Program Development

This section describes a logical process for developing and implementing a PSM program at sites with processes covered by the PSM Rule.

3.1 Defining Process Safety Management Policy, Goals, and Objectives

Many of the elements of the PSM Rule can be applied to chemical safety programs in general. For years DOE safety programs have been concerned with releases of radioactive materials, without a commensurate emphasis on chemical safety. Therefore, affected DOE contractors should develop a policy giving adequate attention to process safety management. This policy must integrate existing programs that may be operating independently.

The primary goal of process safety management is to minimize catastrophic releases of HHCs. The minimum program goal is compliance with the PSM Rule. Although the immediate goal is compliance, contractors should focus on the ultimate goal of preventing all hazardous chemical releases.

Although the PSM Rule does not emphasize the same elements contained in the Chemical Manufacturers Association's Responsible Care Process Safety Code, the Center for Chemical Process Safety (CCPS) PSM program or the American Petroleum Institute Hazard Management program, these programs address nearly identical issues. Contractors may wish to supplement their PSM programs with concepts from industry programs or applicable in-house programs. In addition, contractors should be familiar with the proposed EPA Risk Management Program elements and incorporate these into their policies, goals and objectives. A comparison of the OSHA PSM and EPA's proposed Risk Management Program is provided in Appendix C.

3.2 Process Safety Management Planning

Identifying Chemical Processes Covered by the Rule

DOE contractors can determine the applicability of the PSM Rule by comparing the list of HHCs in Appendix A of the OSHA Rule with their chemical inventory information. Because the list of regulated substances which invoke coverage under EPA's Risk Management Program differs somewhat from those in the OSHA Rule, it is recommended that contractors use the integrated OSHA and EPA listing of HHCs in Appendix A to avoid doing this task twice. This assumes that contractors have systems in place for tracking chemical inventory and use. The TQs of the HHCs listed in Appendix A apply not to aggregate quantities at a site, but to individual processes which must be sufficiently separated from each other so that a release, fire, or explosion in one process will be unlikely to affect others. When processes are not adequately separated, aggregate quantities of individual HHCs used in adjacent processes are used for comparing TQs. Contractors should also check inventories of flammable gases and liquids and any manufacturing of explosives or pyrotechnics.

Where quantities of HHCs approach but do not exceed TQs, or chemicals are used which, though not on the OSHA list of HHCs, are known to be highly hazardous, DOE contractors may want to

ensure that their management of such chemicals conforms to the PSM Rule even though not required by law.

Baseline Audit

DOE contractors should conduct baseline audits to assess their current degree of compliance with the PSM Rule. An audit checklist is provided at the end of Section 2.13. Baseline audits provide a systematic evaluation of internal programs that address individual elements of the PSM Rule. Because they identify compliance gaps, baseline audits also help in preparing a strategy for compliance with the PSM Rule.

Implementation Plan

DOE contractors should develop a description of each activity needed to come into compliance with the PSM Rule. Descriptions must be in sufficient detail to explain exactly what is required. A written plan should then be developed with specific milestones for completing each activity. The plan must identify the individuals responsible for developing the overall PSM program and the lead personnel responsible for each activity.

Employee Involvement

A written plan for employee involvement in the PSM program must be developed. A team composed of safety personnel, process employees, and process managers should formulate the plan. If employee involvement programs exist, they should be reviewed to determine if additional activities are required or desirable, based on requirements in the PSM Rule.

Risk-Based Priorities

For DOE sites with several processes covered under the PSM Rule, completion of PSI and PrHAs must be prioritized based on risk factors associated with the processes. Risk factors suggested by the PSM Rule include the extent of the process hazards, the number of potentially affected employees, the age of the process, and past performance of the process. Other factors might include the complexity of the process or ratios of quantities of HHCs to their respective TQs. The prioritized list of processes and the criteria used to rank the processes must be documented as part of the PSM program records.

Resources and Schedule

The implementation of the PSM Rule at sites with extensive chemical processes may require additional resources to develop an integrated PSM program. OSHA requires a pre-startup safety review in addition to a process hazard analysis for new covered facilities and for modified facilities when the modification is significant enough to require a change in the process safety information. Additional sources of information regarding PSM program implementation are provided in Appendix D.

3.3 Program Leadership and Implementation

Management Commitment

Studies of the most effective safety programs show a high degree of management commitment. Thus, consistent emphasis on PSM and management attention to PSM programs are necessary for these programs to effectively prevent releases of HHCs.

Responsibilities and PSM Integration

Because responsibilities for PSM elements are scattered throughout DOE contractor organizations, clear assignment of responsibilities within PSM programs is essential. However, because a PSM program requires a single point of leadership, each affected site should identify a PSM Coordinator to be responsible for integrating all PSM elements. The PSM Coordinator might chair a site PSM committee composed of representatives from all supporting organizations. The PSM Coordinator might be the manager of a covered process, or the PSM subject-matter expert in the safety organization.

One of the most critical challenges in implementing an effective PSM program is integrating or forging 14 diverse management elements into a single management system focused on process safety. Many aspects of the PSM program exist within DOE. However, these elements often operate independently because they are performed by different departments within contractor organizations. A PSM program cannot succeed without good communication and coordination among elements. Careful implementation of the MOC element can provide critical linkages necessary for integration.

Tracking Systems

A system is essential for tracking incident and audit findings. This system should be implemented early in the PSM program to track progress against milestones in the implementation plan, because most of these milestones address findings of the baseline audit.

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Appendix A

OSHA and EPA Lists of Highly Hazardous Substances and Threshold Quantities (TQ) for Accidental Release Prevention

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OSHA and EPA Lists of Highly Hazardous Substances and Threshold Quantities (TQ) for Accident Release Prevention

The following table provides a side by side comparison of TQ's of regulated substances in the OSHA Process Safety Management Program (29 CFR 1910.119) and the EPA Risk Management Program (RMP) (40 CFR 68). The purpose of this appendix is to provide an integrated alphabetic listing of covered chemicals to assist DOE contractors in the determination of the applicability of the PSM and RMP requirements.

The EPA list incorporates both toxic and flammable substance lists. The OSHA listing is primarily from the "List of Highly Hazardous Chemicals, Toxics and Reactivities In Appendix A of the PSM rule. Because this includes EPA-listed flammable chemicals, OSHA's generic inclusion of flammable liquids and gases is applicable and is noted. No attempt has been made to try to provide a comprehensive listing of all flammable gases and liquids meeting the OSHA criteria found in 29 CFR 1910.1200(c). For explosives, this table compares the TQs and sources for explosive listing criteria. Certain chemicals were required to be on the EPA list by the 1990 Clear Air Act Amendments. Such chemicals are identified on this listing where applicable.

All concentrations given in the table are by weight percent.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
75-07-0	Acetaldehyde∞	2500	10,000
74-86-2	Acetylene∞	10,000†	10,000
107-02-8	Acrolein [2-Propenal]	150	5000
107-13-1	Acrylonitrile [2-Propenenitrile]		20,000
814-68-6	Acrylyl chloride [2-Propenoyl chloride]	250	5000
Varies	Alkylaluminums	5000	
107-18-61	Allyl alcohol [2-Propen-1-o1]		15,000
107-05-1	Allyl chloride	1000	
107-11-9	Allylamine [2-Propen-1-amine]	1000	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

Cas No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
7664-41-7	Ammonia (anhydrous) *	10,000	10,000
7664-41-7	Ammonia (aqueous solution)*	15,000 (>44% concentration	20,000 (>20% concentration)
7790-98-9	Ammonium Perchlorate	7500	
7787-36-2	Ammonium permanganate	7500	
7784-34-1	Arsenous trichloride		15,000
7784-42-1	Arsine [arsenic hydride]	100	1000
542-88-1	Bis (chloromethyl) ether [Chloromethyl ether]	100	1000
10294-34-5	Boron trichloride [Borane, trichloro-]	2500	5000
7637-07-2	Boron trifluoride [Borane, trifluoro-]	250	5000
353-42-4	Boron trifluoride compound with methyl ether (1:1)[Boron trifluoro (oxybis [methane]),T4 -		15,000
7726-95-6	Bromine*	1500	10,000
13863-41-7	Bromine chloride	1500	
7789-30-2	Bromine pentafluoride	2500	
7787-71-5	Bromine trifluoride	15,000	
106-96-7	3-Bromopropyne [Propargyl Bromide]	100	
598-73-2	Bromotrifluorethylene [Ethene, bromotrifluoro-]∞	10,000†	10,000
106-99-0	1,3-Butadiene∞	10,000†	10,000
106-97-8	Butane∞	10,000†	10,000
25167-67-3	Butene∞	10,000†	10,000
106-98-9	1-Butene∞	10,000†	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
107-01-7	2-Butene∞	10,000†	10,000
590-18-1	2-Butene-cis∞	10,000†	10,000
624-64-6	2-Butene-trans [2-Butene, (E)] ∞	10,000†	10,000
75-91-2	Butyl hydroperoxide (tertiary)	5000	
614-45-9	Butyl perbenzoate (tertiary)	7500	
463-58-1	Carbon oxysulfide [Carbon oxide sulfide (COS)] ∞	10,000†	10,000
75-15-0	Carbon disulfide		20,000
353-50-4	Carbonyl fluoride	2500	
9004-70-0	Cellulose nitrate	2500 (conc.>12.6% nitrogen)	
7782-50-5	Chlorine*	1500	2500
10049-04-4	Chlorine dioxide	1000	1000
7791-21-1	Chlorine monoxide [chlorine oxide]∞	10,000†	10,000
13637-63-3	Chlorine pentafluoride	1000	
7790-91-2	Chlorine trifluoride	1000	
97-00-07	1-Chloro-2,4-dinitrobenzene	5000	
96-10-6	Chlorodiethylaluminum [Diethylaluminum chloride]	5000	
67-66-3	Chloroform [Methane, trichloro-]		20,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxics & Flammables Tables (40 CFR 68.130)
107-30-2	Chloromethyl methyl ether [Methane, chloromethoxy-]	500	5000
76-06-2	Chloropicrin	500	
None	Chloropicrin and methyl bromide mixture	1500	
None	Chloropicrin and methyl chloride mixture	1500	
590-21-6	1-Chloropropylene [1-Propene, 1-chloro-]∞	10,000†	10,000
557-98-2	2-Chloropropylene [1-Propene, 2 chloro-]∞	10,000†	10,000
4170-30-3	Crotonaldehyde [2-Butenal]		20,000
123-73-9	Crotonaldehyde, (E)- [2-Butenal, (E)-]		20,000
80-15-9	Cumene hydroperoxide	5000	
460-19-5	Cyanogen [Ethanedinitrile]∞	2500	10,000
506-77-4	Cyanogen chloride	500	10,000
675-14-9	Cyanuric fluoride	100	
108-91-8	Cyclohexylamine [Cyclohexanamine]		15,000
75-19-4	Cyclopropane∞	10,000†	10,000
110-22-5	Diacetyl peroxide	5000 (concentration > 70%)	
334-88-3	Diazomethane	500	
94-36-0	Dibenzoyl peroxide	7500	
19287-45-7	Diborane	100	2500
110-05-4	Dibutyl peroxide (tertiary)	5000	
7572-29-4	Dichloroacetylene	250	

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxics & Flammables Tables (40 CFR 68.130)
4109-96-0	Dichlorosilane∞	2500	10,000
557-20-0	Diethylzinc	10,000	
75-37-6	Difluoroethane [Ethane, 1,1-difluoro-] ∞	10,000†	10,000
105-64-6	Diisopropyl peroxydicarbonate	7500	
105-74-8	Dilaluroyl peroxide	7500	
124-40-3	Dimethylamine (anhydrous) [methanamine, N-methyl-]	2500	10,000
75-78-5	Dimethyldichlorosilane	1000	5000
57-14-7	1,1-Dimethylhydrazine	1000	15,000
463-82-1	2,2 Dimethylpropane [Propane, 2,2-dimethyl-]∞		10,000
97-02-9	2,4 Dinitroaniline	5,000	
106-89-8	Epichlorohydrin [Oxirane, (chloromethyl)-]		20,000
74-84-0	Ethane∞	10,000†	10,000
107-00-6	Ethyl acetylene[1-Butyne] ∞	10,000†	10,000
75-00-3	Ethyl chloride [Ethane, chloro-]∞	10,000†	10,000
60-29-7	Ethyl ether [Ethane, 1, 1-oxybis-]∞	10,000†	10,000
75-08-1	Ethyl mercaptan [Ethanethiol] ∞	10,000†	10,000
1338-23-4	Ethyl methyl ketone peroxide [methyl ethyl ketone peroxide]	5000 (concentration >60%)	
109-95-5	Ethyl nitrite[Nitrous acid, ethyl ester] ∞	5000	10,000
75-04-7	Ethylamine [Ethanamine] ∞	7500	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
74-85-1	Ethylene [Ethene] ∞	10,000†	10,000
371-62-0	Ethylene fluorohydrin	100	
75-21-8	Ethylene oxide [Oxirane]*	5000	10,000
107-15-3	Ethylenediamine [1,2 Ethanediamine]		20,000
151-56-4	Ethyleneimine [Aziridine]	1000	10,000
None	Explosives or pyrotechnics manufacturer	Any amount of explosives or pyrotechnics manufacture [Explosives as defined in 29-CFR 1910.109(a)(3)]	5000 (explosives classified as Division 1.1 by DOT in 49 CFR 172.101, except that intended for onsite use)
7782-41-4	Fluorine	1000	1000
50-00-0	Formaldehyde (Formalin)	1000	15,000 (solution)
110-00-9	Furan	500	5000
684-16-2	Hexafluoroacetone	5000	
302-01-2	Hydrazine		15,000
7647-01-0	Hydrochloric acid (solution)		15,000 (Concentration ≥ 37%)
7647-01-0	Hydrogen chloride [hydrochloric acid, anhydrous]*	5000	5000
74-90-8	Hydrocyanic acid [hydrogen cyanide, anhydrous] *	1000	2500
7664-39-3	Hydrofluoric Acid (solution)*		1000 (Concentration >50%)
7664-39-3	Hydrogen fluoride [hydrofluoric acid, anhydrous]*	1000	1000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
1333-74-0	Hydrogen∞	10,000†	10,000
10035-10-6	Hydrogen bromide	5000	
7722-84-1	Hydrogen peroxide	7500 (Concentration ≥ 52%)	
7783-07-5	Hydrogen selenide	150	500
7783-06-4	Hydrogen sulfide*	1500	10,000
7803-49-8	Hydroxylamine	2500	
13463-40-6	Iron, pentacarbonyl	250	2500
75-28-5	Isobutane [Propane, 2-methyl-]∞	10,000†	10,000
78-82-0	Isobutyronitrile [Propanenitrile, 2-methyl-]∞		20,000
78-78-4	Isopentane [Butane, 2-methyl-]∞	10,000†	10,000
78-79-5	Isoprene[1,3 Butadinene, 2-methyl-]∞	10,000†	10,000
75-29-6	Isopropyl chloride [Propane, 2 chloro-]∞	10,000†	10,000
108-23-6	Isopropyl chloroformate [Carbonochloridic acid, 1-methyl ethyl ester]		15,000
75-31-0	Isopropylamine [2-Propanamine]∞	5000	10,000
463-51-4	Ketene	100	
78-85-3	Methacrylaldehyde	1000	
126-98-7	Methacrylonitrile [Methyl acrylonitrile] [2-Propenenitrile, 2-methyl-]	250	10,000
920-46-7	Methacryloyl chloride	150	
30674-80-7	Methacryloyloxyethyl isocyanate	100	

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
74-82-8	Methane∞	10,000†	10,000
74-83-9	Methyl bromide	2500	
563-46-2	2-Methyl-1-butene	10,000†	10,000
563-45-1	3-Methyl-1-butene	10,000†	10,000
74-87-3	Methyl chloride [Methane, chloro-]*	15,000	10,000
79-22-1	Methyl chloroformate [Carbonochloridic acid, methyl ester]	500	5000
115-10-6	Methyl ether [Methane, oxybis-]∞	10,000†	10,000
1338-23-4	Methyl ethyl ketone peroxide	5000 Concentration >60 %	
453-18-9	Methyl fluoroacetate	100	
421-20-5	Methyl fluorosulfate	100	
107-31-3	Methyl formate [Formic acid, methyl ester]∞	10,000†	10,000
60-34-4	Methyl hydrazine	100	15,000
74-88-4	Methyl iodide	7500	
624-83-9	Methyl isocyanate [Methane, isocyanate-]*	250	10,000
74-93-1	Methyl mercaptan [Methanethiol]	5000	10,000
556-64-9	Methyl thiocyanate [Thiocyanic acid, methyl ester]		20,000
79-84-4	Methyl vinyl ketone	100	
74-89-5	Methylamine (anhydrous) [Methanamine]∞	1000	10,000
115-11-7	2-Methylpropene [1-Propene, 2 methyl-]∞	10,000†	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
75-79-6	Methyltrichlorosilane	500	5000
13463-39-3	Nickel carbonyl [Nickel tetracarbonyl]	150	1000
7697-37-2	Nitirc Acid	500 (Concentration ≥ 94.5%)	15,000 (Concentration ≥ 80%)
10102-43-9	Nitric oxide [Nitrogen oxide(NO)]	250	10,000
100-01-6	Nitroaniline [para-Nitroaniline]	5000	
10102-44-0	Nitrogen dioxide	250	
10102-44-0	Nitrogen Oxides (NO; NO2; N204; N203)	250	
10544-72-6	Nitrogen tetroxide [Nitrogen peroxide]	250	
7783-54-2	Nitrogen trifluoride	5000	
10544-73-7	Nitrogen trioxide	250	
72-52-5	Nitromethane	2500	
8014-95-7	Oleum [Fuming sulfuric acid]	1000 (Concentration of S03 65-80%)	10,000 (Concentration of S03 not specified)
20816-12-0	Osmium tetroxide	100	
7783-41-7	Oxygen difluoride [Fluorine monoxide]	100	
10028-15-6	Ozone	100	
19624-22-7	Pentaborane	100	
13463-40-6	Pentacarbonyl-iron	250	2500
504-60-9	1,3-Pentadinene∞	10,000†	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
109-66-0	Pentane∞	10,000†	10,000
109-67-1	1-Pentene∞	10,000†	10,000
646-04-8	2-Pentene (E)-∞	10,000†	10,000
627-20-3	2-Pentene (Z)-∞	10,000†	10,000
79-21-0	Peracetic Acid [Peroxyacetic acid] [Ethane peroxoic acid]	1000 (Conc.>60% Acetic acid	10,000 (No concentration given)
7601-90-3	Perchloric acid	5000 (Concentration>60%)	
594-42-3	Perchloromethyl mercaptan [Methane sulfenyl chloride, trichloro-]	150	10,000
7616-94-6	Perchloryl fluoride	5000	
75-44-5	Phosgene [Carbonyl chloride][Carbonic dichloride]*	100	500
7803-51-2	Phosphine [Hydrogen phosphide]	100	5000
10025-87-3	Phosphorus oxychloride [Phosphoryl chloride]	1000	5000
7719-12-2	Phosphorus trichloride	1000	15,000
110-89-4	Piperidine		15,000
463-49-0	Propadiene [1,2-Propadiene]∞	10,000†	10,000
74-98-6	Propane∞	10,000†	10,000
107-12-0	Propionitrile [Propanenitrile]		10,000
109-61-5	Propyl chloroformate [Carbonochloridic acid, propylester		15,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
627-3-4	Propyl nitrate	2500	
115-07-1	Propylene [1-Propene]∞	10,000†	10,000
75-56-9	Propylene oxide [Oxirane, methyl-]		10,000
75-55-8	Propyleneimine [Aziridine, 2-methyl-]		10,000
74-99-7	Propyne [1-Propyne]∞	10,000†	10,000
107-44-8	Sarin	100	
7783-79-1	Selenium hexafluoride	1000	
7803-62-5	Silane ∞	10,000†	10,000
7803-52-3	Stibine (Antimony hydride)	500	
7446-09-5	Sulfur dioxide (anhydrous/liquid)*	1000	5000
5714-22-7	Sulfur pentafluoride	250	
7783-60-0	Sulfur tetrafluoride	250	2500
7446-11-9	Sulfur trioxide [Sulfuric anhydride]*	1000	10,000
7783-80-4	Tellurium hexafluoride	250	
116-14-3	Tetrafluoroethylene [Ethene, tetrafluoro-]∞	5000	10,000
10036-47-2	Tetrafluorohydrazine	5000	
75-74-1	Tetramethyl lead [Plumbane, tetramethyl-]	1000	10,000
75-76-3	Tetramethyl silane∞	10,000†	10,000
509-14-8	Tetranitromethane		10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
7719-09-7	Thionyl chloride	250	
7750-45-0	Titanium tetrachloride		2500
584-84-9	Toluene 2,4 diisocyanate*		10,000
91-08-7	Toluene 2,6-diisocyanate*		10,000
26471-62-5	Toluene diisocyanate (mixed isomers)*		10,000
1558-25-4	Trichloro (chloromethyl) silane	100	
27137-85-5	Trichloro (dichlorophenyl) silane	2500	
10025-78-2	Trichlorosilane ∞	5000	10,000
79-38-9	Trifluorochloroethylene [Ethene, chlorotrifluoro-]∞	10,000	10,000
75-50-3	Trimethylamine [Methanamine N,N-dimethyl-]∞	10,000†	10,000
75-77-4	Trimethylchlorosilane		10,000
2487-90-3	Trimethyloxysilane	1500	
108-05-4	Vinyl acetate monomer [Acetic acid ethenyl ester]		15,000
689-97-4	Vinyl acetylene [1-Buten-3-yne]∞	10,000†	10,000
75-01-4	Vinyl chloride [Ethene, chloro-]*∞	10,000†	10,000
109-92-2	Vinyl ethyl ether [Ethene, ethoxy-]∞	10,000†	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

CAS No.	Chemical Name	OSHA PSM TQ (lbs) Appendix A (29 CFR 1910.119)	EPA RMP TQ (lbs) Toxic & Flammables Tables (40 CFR 68.130)
75-02-5	Vinyl fluoride [Ethene, fluoro-]∞	10,000†	10,000
107-25-5	Vinyl methyl ether [Ethene, methoxy-]∞	10,000†	10,000
75-35-4	Vinylidene chloride [Ethene, 1,1-dichloro-]∞	10,000†	10,000
75-38-7	Vinylidene fluoride [Ethene, 1,1,-difluoro-]∞	10,000†	10,000

* Required to be on EPA's list by the 1990 Clean Air Act Amendments.
∞ On the EPA list of regulated flammable substances.
† The applicable OSHA TQ though not specifically listed in the PSM Rule.

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Appendix B
The Process Safety Management Rule

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The Process Safety Management Rule

SUBPART NUMBER: H (Hazardous Materials)

Process Safety Management of Highly Hazardous Chemicals

Purpose. This section contains requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. These releases may result in toxic, fire or explosion hazards.

(a) Application.

(1) This section applies to the following:

(i) A process which involves a chemical at or above the specified threshold quantities listed in Appendix A to this section;

(ii) A process which involves a flammable liquid or gas (as defined in 1910.1200(c) of this part) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more except for:

(A) 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;

(B) Flammable liquids stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration.

(2) This section does not apply to:

(i) Retail facilities;
(ii) Oil or gas well drilling or servicing operations; or,
(iii) Normally unoccupied remote facilities.

(b) Definitions.

Atmospheric tank means a storage tank which has been designed to operate at pressures from atmospheric through 0.5 p.s.i.g. (pounds per square inch gauge, 3.45 Kpa).

Boiling point means the boiling point of a liquid at a pressure of 14.7 pounds per square inch absolute (p.s.i.a.) (760 mm.). For the purposes of this section, where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, the 10 percent point of a distillation performed in accordance with the Standard Method of Test for Distillation of Petroleum Products, ASTM D-86-62, may be used as the boiling point of the liquid.

Catastrophic release means a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to employees in the workplace.

Facility means the buildings, containers or equipment which contain a process.

"Highly hazardous chemical" means a substance possessing toxic, reactive, flammable, or explosive properties and specified by paragraph (a)(1) of this section.

"Hot work" means work involving electric or gas welding, cutting, brazing, or similar flame or spark-producing operations.

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

"Process" means any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such chemicals, or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process.

"Replacement in kind" means a replacement which satisfies the design specification.

"Trade secret" means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D contained in 1910.1200 sets out the criteria to be used in evaluating trade secrets.

(c) Employee Participation.

(1) Employers shall develop a written plan of action regarding the implementation of the employee participation required by this paragraph.

(2) Employers shall 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.

(3) Employers shall provide to employees and their representatives access to process hazard analyses and to all other information required to be developed under this standard.

(d) Process Safety Information.

In accordance with the schedule set forth in paragraph (e)(1) of this section, the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard. The compilation of written process safety information is to enable the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals. This process safety information shall include information pertaining to the hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process, and information pertaining to the equipment in the process.

(1) Information pertaining to the hazards of the highly hazardous chemicals in the process. This information shall consist of at least the following:

(i) Toxicity information;

(ii) Permissible exposure limits;

(iii) Physical data;

(iv) Reactivity data:

(v) Corrosivity data;

(vi) Thermal and chemical stability data; and

(vii) Hazardous effects of inadvertent mixing of different materials that could foreseeably occur

Note: Material Safety Data Sheets meeting the requirements of 29 CFR1910.1200 (g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph.

(2) Information pertaining to the technology of the process.

(i) Information concerning the technology of the process shall include at least the following:

(A) A block flow diagram or simplified process flow diagram (see Appendix B to this section);

(B) Process chemistry;

(C) Maximum intended inventory;

(D) Safe upper and lower limits for such items as temperatures, pressures, flows or compositions; and,

(E) An evaluation of the consequences of deviations, including those affecting the safety and health of employees.

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

(3) Information pertaining to the equipment in the process.

(i) Information pertaining to the equipment in the process shall include:

(A) Materials of construction;

(B) Piping and instrument diagrams (P&ID's);

(C) Electrical classification;

(D) Relief system design and design basis;

(E) Ventilation system design;

(F) Design codes and standards employed;

(G) Material and energy balances for processes; and

(H) Safety systems (e.g. interlocks, detection or suppression systems).

(ii) The employer shall document that equipment complies with recognized and generally accepted good engineering practices.

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

(e) Process Hazard Analysis.

(1) The employer shall perform an initial process hazard analysis (hazard evaluation) on processes covered by this standard. The process hazard analysis shall be appropriate to the complexity of the process and shall

identify, evaluate, and control the hazards involved in the process. Employers shall determine and document the priority order for conducting process hazard analyses based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process. The process hazard analysis shall be completed prior to process startup.

(2) The employer shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed.

(i) What-If;

(ii) Checklist;

(iii) What-If/Checklist;

(iv) Hazard and Operability Study (HAZOP);

(v) Failure Mode and Effects Analysis (FMEA);

(vi) Fault Tree Analysis; or

(vii) An appropriate equivalent methodology.

(3) The process hazard analysis shall address:

(i) The hazards of the process;

(ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;

(iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies 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.);

(iv) Consequences of failure of engineering and administrative controls;

(v) Facility sitting;

(vi) Human factors; and

(vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

(4) The 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.

(5) The employer shall establish a system to promptly address the team's findings and recommendations; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.

(6) At least every five (5) years after the completion of the initial process hazard analysis, the process hazard analysis shall be updated and revalidated by a team meeting the requirements in paragraph (e)(4) of this section, to assure that the process hazard analysis is consistent with the current process.

(7) Employers shall retain process hazards analyses and updates or revalidations for each process covered by this section, as well as the documented resolution of recommendations described in paragraph (e)(5) of this section for the life of the process.

(f) Operating Procedures.

(1) The employer shall 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 and shall address at least the following elements.

(i) Steps for each operating phase:

(A) Initial startup;

(B) Normal operations;

(C) Temporary operations;

(D) Emergency shutdown including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators to ensure that emergency shutdown is executed in a safe and timely manner.

(E) Emergency Operations;

(F) Normal shutdown; and,

(G) Startup following a turnaround, or after an emergency shutdown.

(ii) Operating limits:

(A) Consequences of deviation; and

(B) Steps required to correct or avoid deviation.

(iii) Safety and health considerations:

(A) Properties of, and hazards presented by, the chemicals used in the process;

(B) Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment;

(C) Control measures to be taken if physical contact or airborne exposure occurs;

(D) Quality control for raw materials and control of hazardous chemical inventory levels; and,

(E) Any special or unique hazards.

(iv) Safety systems and their functions.

(2) Operating procedures shall be readily accessible to employees who work in or maintain a process.

(3) The operating procedures shall be reviewed as often as necessary to assure that they reflect current operating practice, including changes that result from changes in process chemicals, technology, and equipment, and changes to facilities. The employer shall certify annually that these operating procedures are current and accurate.

(4) The employer shall develop and implement safe work practices to provide for the control of hazards during operations 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. These safe work practices shall apply to employees and contractor employees.

(g) Training.

(1) Initial training.

(i) Each employee presently involved in operating a process, and each employee before being involved in operating a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in paragraph (f) of this section. The training shall include emphasis on the specific safety and health hazards, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks.

(ii) In lieu of initial training for those employees already involved in operating a process , an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.

(2) Refresher training. Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure 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, shall determine the appropriate frequency of refresher training.

(3) Training documentation. The employer shall ascertain that each employee involved in operating a process has received and understood 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.

(h) Contractors.

(1) Application. This paragraph applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. It does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services.

(2) Employer responsibilities.

(i) The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs.

(ii) The employer shall inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the process.

(iii) The employer shall explain to contract employers the applicable provisions of the emergency action plan required by paragraph (n) of this section.

(iv) The employer shall develop and implement safe work practices consistent with paragraph (f)(4) of this section, to control the entrance, presence and exit of contract employers and contract employees in covered process areas.

(v) The employer shall periodically evaluate the performance of contract employers in fulfilling their obligations as specified in paragraph (h)(3) of this section.

(vi) The employer shall maintain a contract employee injury and illness log related to the contractor's work in process areas.

(3) Contract employer responsibilities.

(i) The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job.

(ii) The contract employer shall assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.

(iii) The contract employer shall document that each contract employee has received and understood the training required by this paragraph. The contract employer shall prepare a record which contains the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.

(iv) The contract employer shall assure that each contract employee follows the safety rules of the facility including the safe work practices required by paragraph (f)(4) of this section.

(v) The contract employer shall advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.

(i) Pre-startup Safety Review.

(1) The employer shall 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.

(2) The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process:

(i) Construction and equipment is in accordance with design specifications;

(ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate;

(iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (l).

(iv) Training of each employee involved in operating a process has been completed.

(j) Mechanical Integrity.

(1) Application. Paragraphs (j)(2) through (j)(6) of this section apply to the following process equipment:

(i) Pressure vessels and storage tanks;

(ii) Piping systems (including piping components such as valves);

(iii) Relief and vent systems and devices;

(iv) Emergency shutdown systems;

(v) Controls (including monitoring devices and sensors, alarms, and interlocks) and,

(vi) Pumps.

(2) Written procedures. The employer shall establish and implement written procedures to maintain the on-going integrity of process equipment.

(3) Training for process maintenance activities. The employer shall 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 the employee can perform the job tasks in a safe manner.

(4) Inspection and testing.

(i) Inspections and tests shall be performed on process equipment.

(ii) Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.

(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

(iv) The employer shall document each inspection and test that has been performed on process equipment. The documentation shall identify the date of the inspection or test, the name of the person who performed the inspection or test, the serial number or other identifier of the equipment on which the inspection or test was performed, a description of the inspection or test performed, and the results of the inspection or test.

(5) Equipment deficiencies. The employer shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in paragraph (d) of this section) before further use or in a safe and timely manner when necessary means are taken to assure safe operation.

(6) Quality assurance.

(i) In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which they will be used.

(ii) Appropriate checks and inspections shall be performed to assure that equipment is installed properly and consistent with design specifications and the manufacturer's instructions.

(iii) The employer shall assure that maintenance materials, spare parts and equipment are suitable for the process application for which they will be used.

(k) Hot Work Permit.

(1) The employer shall issue a hot work permit for hot work operations conducted on or near a covered process.

(2) The permit shall document that the fire prevention and protection requirements in 29 CFR 1910.252(a) have been implemented prior to beginning the hot work operations; it shall indicate the date(s) authorized for hot work; and identify the object on which hot work is to be performed. The permit shall be kept on file until completion of the hot work operations.

(l) Management of Change.

(1) The employer shall 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.

(2) The procedures shall assure that the following considerations are addressed prior to any change:

(i) The technical basis for the proposed change;

(ii) Impact of change on safety and health;

(iii) Modifications to operating procedures;

(iv) Necessary time period for the change; and,

(v) Authorization requirements for the proposed change.

(3) Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.

(4) If a change covered by this paragraph results in a change in the process safety information required by paragraph (d) of this section, such information shall be updated accordingly.

(5) If a change covered by this paragraph results in a change in the operating procedures or practices required by paragraph (f) of this section, such procedures or practices shall be updated accordingly.

(m) Incident Investigation.

(1) The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.

(2) An incident investigation shall be initiated as promptly as possible, but not later than 48 hours following the incident.

(3) An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.

(4) A report shall be prepared at the conclusion of the investigation which includes at a minimum:

(i) Date of incident;

(ii) Date investigation began;

(iii) A description of the incident;

(iv) The factors that contributed to the incident; and,

(v) Any recommendations resulting from the investigation.

(5) The employer shall establish a system to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions shall be documented.

(6) The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees where applicable.

(7) Incident investigation reports shall be retained for five years.

(n) Emergency planning and response.

The employer shall establish and implement an emergency action plan for the entire plant in accordance with the provisions of 29 CFR 1910.38. In addition, the emergency action plan shall include procedures for handling small releases. Employers covered under this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120(a), (p) and (q).

(o) Compliance Audits.

(1) Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.

(2) The compliance audit shall be conducted by at least one person knowledgeable in the process.

(3) A report of the findings of the audit shall be developed.

(4) The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.

(5) Employers shall retain the two (2) most recent compliance audit reports.

(p) Trade secrets.

(1) Employers shall make all information necessary to comply with the section available to those persons responsible for compiling the process safety

information (required by paragraph (d) of this section), those assisting in the development of the process hazard analysis (required by paragraph (e) of this section), those responsible for developing the operating procedures (required by paragraph (f) of this section), and those involved in incident investigations (required by paragraph (m) of this section), emergency planning and response (paragraph (n) of this section) and compliance audits (paragraph (o) of this section) without regard to possible trade secret status of such information.

(2) Nothing in this paragraph shall preclude the employer from requiring the persons to whom the information is made available under paragraph (p)(1) of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200.

(3) Subject to the rules and procedures set forth in 29 CFR 1910.1200(i) (1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.

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Appendix C

Comparison of the EPA Risk Management Program with OSHA's Process Safety Management Program

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Comparison of the EPA Risk Management Program with OSHA's Process Safety Management Program

The Environmental Protection Agency's (EPA) "Risk Management Programs for Chemical Accidental Release Prevention" (40 CFR Part 68) adds significant new requirements beyond those in the Occupational Safety and Health Administration (OSHA), "Process Safety Management of Highly Hazardous Chemicals" (29 CFR 1910.119). In addition, the chemical list and threshold quantities for the EPA rule differ somewhat from those in the OSHA rule and may well result in a facility needing to expand their risk management program to other portions of the facility as shown in Appendix A.

The three principal areas in which the requirements of the EPA exceed those of the OSHA Rule are:

1) Performance of hazard assessments which includes analyses of the "worst case" accident consequences.
2) Preparation of written risk management plans to document the risk management program. EPA makes the plans available to the public, State and local emergency planning officials and the Chemical Safety and Hazard Investigation Board. Response actions have to be coordinated with local emergency planning and response agencies.
3) Registration of the risk management plans with the EPA.

The key differences between the OSHA rule on process safety management (PSM) and the EPA Risk Management Program (RMP) are discussed in the following sections.

Risk Management Program

A risk management plan must be developed and implemented by all facilities that manufacture, process, use, store, or handle regulated substances to provide an integrated approach to identifying and managing the hazards posed by the regulated substances. The RMP consists of three major parts (a) a hazard assessment, (b) a prevention program, and (c) an emergency response program.

EPA considers critical its requirement for the owner or operator of a facility to define its management system and name the person or position responsible for the program. The facility owner or operator also would be required to document the results of the risk management program(s) in the risk management plan. Facilities will be required to maintain onsite documentation of the implementation of the risk management plan.

EPA requires a risk management plan that summarizes the program elements because the information of most use to the public and local agencies will be related to the hazard assessment and consequence analysis.

Hazard Assessment

The EPA rule is designed to assist facilities and communities in efforts to lessen the number and severity of serious chemical accidents. Under EPA's RMP, facilities must complete a hazard assessment to evaluate potential effects of an accidental release of any regulated substance present at or above the threshold quantity. The hazard assessment also must evaluate the impact of significant accidental releases on the public health and environment. OSHA's PSM Rule requires only a qualitative evaluation of a range of possible safety and health effects on employees in the work place resulting from a release.

The hazard assessment of a regulated substance requires evaluation of a range of accidental release scenarios, including:

- “Worst-case” accidental releases
- Other more probable releases
- Potential offsite consequences
- Five-year accident history for the facility

The EPA rule defines “worst-case” release as the instantaneous loss of all of the regulated substance in a process, with failure of all passive and active mitigation systems. Once the worst-case and other significant accidental scenarios are identified, facilities would be required to analyze the potential offsite consequences associated with these scenarios using source release and air dispersion modeling. This analysis would include fires, explosions, and hazard material releases.

Air dispersion modeling would be used to evaluate the fate and transport of the regulated substance for the offsite consequence analyses. At a minimum, the offsite analyses would estimate the possible rate of release, the quantity released, the duration of the release, and the distances in any direction that the substance could travel before it dispersed enough to no longer pose a hazard to the public health or the environment.

Along with calculating the severity of the consequences, source term modeling would be used to calculate release rate as a function of time and other release characteristics.

Under the EPA rule, facilities would be required to update the offsite consequence analyses of their risk management plans no longer than every five years. Updates would be required sooner, if changes at the facility or its surroundings might change the results of the risk management plan to any significant degree.

A final element of the hazard assessment is compiling and documenting a five-year history of releases of the regulated substances. EPA's RMP would require the facility to document the releases that caused, or had the potential to cause, offsite consequences. The accident history must include:

- The substance and quantity released

- The concentration of the substance when released
- Duration of the release
- Date and time of the release
- Offsite consequence(s) (e.g., evacuations, injuries).

Note that most of the releases that meet the criteria of the proposed EPA RMP are already reported under CERCLA and SARA Title III. Most of the information needed to define accidental release scenarios will be derived from the process hazard analysis.

Prevention Program

Along with the hazard assessment and the emergency response program, the risk management plan includes a prevention program. In addition to the process hazard analysis, the prevention program covers safety precautions and maintenance, monitoring, and employee training measures. However, the OSHA PSM rule does include elements which are specific to worker protection issues that EPA has not included in its rule.

Requirements of the EPA prevention program are similar to the requirements of the OSHA PSM rule with parallel elements being nearly identical. This similarity exists because EPA separates the offsite consequence analysis and the five-year accident history from the formal process hazard analysis requirements.

The integrated approach of the EPA prevention program consists of the following twelve elements:

- Process hazard analysis
- Process safety information
- Standard operating procedures
- Training
- Maintenance (mechanical integrity)
- Pre-startup review
- Management of change
- Safety audits
- Accident investigation
- Employee participation
- Hot work permit
- Contractors.

EPA's RMP requires that the order in which PrHAs are conducted be prioritized based on offsite consequences. The qualitative evaluation of safety and health impacts focuses on impacts on public health and environment rather than impacts on employees. The identification of previous incidents as a part of the prevention program PrHA emphasizes offsite consequences rather than

those with catastrophic consequences in the workplace as required by the PSM Rule. Facilities are expected to have fewer incidents to consider under the EPA RMP Rule, because some potential incidents will not have offsite impacts.

Another EPA requirement, which is not included in the OSHA PSM rule, is that a facility define its management system. Facilities are required to identify the person (by name) or the position responsible for implementing the prevention program.

Emergency Response Program

An emergency response program also must be developed. The applicable emergency response program requirements are much more stringent under the proposed EPA RMP than those under OSHA's PSM rule. OSHA's emergency action plan regulation basically requires an evacuation plan. Whereas, under the EPA rule, facilities will need to develop a more extensive emergency response plan. This emergency response plan must detail how the facility would respond to a release to limit offsite consequences. Coordination of plans with the Local Emergency Planning Committee (LEPC) is also required. Coordination with the LEPC is not required by OSHA although many facilities do so currently.

RMP and Documentation

The RMP Rule requires facilities to submit the RMP to the LEPC and have it available for the public, the State, and the Chemical Safety and Hazard Investigation Board. The RMP would include the results of the risk management program elements, a copy of the registration, description of the management system, and certification of the accuracy and completeness of the information. Facilities would be required to maintain the documentation supporting the implementation of the risk management plan for inspection by EPA and other agencies.

Registration

The RMP Rule requires facilities to register with the EPA if they have a regulated substance in a quantity greater than the threshold quantity. The content of the registration would include the name and address of the facility, the facility's Dun and Bradstreet number, the regulated substances on site and the quantities, and the facility's North American Industry Classification System Code (NAICS) that apply to the use of each regulated substance. Most of these registration requirements are already reported under the SARA Title III.

If the information on registration changes (e.g., a change that requires a revised offsite consequence analysis or a revised process hazard analysis or hazard review) after the submittal of the registration or most recent update, facilities would be required to file an amended registration form within six (6) months.

Appendix D
Sources of Information

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Sources of Information

Federal

U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), 200 Constitution Ave. N.W., Washington, D.C. 20210. For general publication information, call the OSHA Publications Office at (202) 693-1888.

The following documents are available from the Docket Office by writing U.S. Department of Labor/OSHA, Technical Data Center, Docket Office, 200 Constitution Ave. N.W., Room N2625,
Washington, D.C. 20210 or calling (202) 693-2350 or by faxing a request to: (202) 693-1648

The Phillips 66 Company Houston Chemical Complex Explosion and Fire. A Report to the President. OSHA, Washington, DC. 1990.

Collection of Data and Information on the Procedures for Minimizing Employee Exposure to Toxic Chemical Releases. Plummer, Ralph W., Terrence J. Stobbe, and James E. Morgensen. OSHA, Washington, DC. Undated.

A Study of Safety and Health Practices as they Pertain to the Reliance Upon Petrochemical Industries, Preliminary Findings of the John Gray Institute of Lamar University. OSHA, Washington, DC.

Report on Chemical Special Emphasis Program. Washington, DC. OSHA, Undated

The following booklets are available from OSHA, Publications Office, Room N3101, 200 Constitution Ave. N.W., Washington, D.C. 20210. Enclose a self-addressed mailing label with request. Single copies are free.

Chemical Hazard Communication. OSHA 3084. Washington, DC.

Systems Safety Evaluation of Operations with Catastrophic Potential, OSHA Instruction CPL:2-2.45, Washington, DC. 1988.

Safety and Health Guide for the Chemical Industry, OSHA 3091. Washington, DC. 1986.

Health and Safety Committees: A Good Way to Protect Workers. OSHA 3035. Washington, DC.

Training Requirements in OSHA Standards and Training Guidelines. OSHA 2254. Washington, DC.

How to Prepare for Workplace Emergencies, OSHA 3088 (Rev.). Washington, DC. 1988.

Process Safety Management of Highly Hazardous Chemicals--Compliance Guidelines and Enforcement Procedures, OSHA Instruction CPL 2-2.45A CH-1. Washington, DC. 1994.

U.S. Environmental Protection Agency (EPA), 401 M St. S.W., Washington, DC. 20460.

To locate published material, call the main EPA library in Washington, D.C. at (202) 566-0556, the nearest EPA regional office or see ordering information listed under entries below. In addition, the office that issued the publication often maintains copies. Offices may be contacted directly by calling the EPA Locator at (202) 272-0167 and asking for the appropriate telephone number.

EPA's Environmental Services Division. *Chemical Safety Audit Report,* W.R. Grace Organic Chemicals Division, Nashua, N.H. Lexington, Mass,: Region 1, EPA, Nov. 17, 1989. Available from Region 1 office: (617) 918-1111.

EPA's Office of Toxic Substances (Prepared by Industrial Economics, Inc., Management Technology and Data Systems, Inc., and PEI Associates, Inc.) *Acute Hazardous Events DataBase.* EPA, 1985. Pb-86158946/LL. Available on CD-ROM from NTIS (703) 487-4650.

The following items, although issued by EPA, are available from the OSHA Docket Office; for ordering information, see OSHA resources section, above.

EPA, Federal Emergency Management Agency, and U.S. Department of Transportation. *Technical Guidance for Hazards Analysis*. EPA, Washington, DC. 1987.

Review of Emergency Systems, Report to Congress, Interim and Final Reports. EPA, Washington, DC. 1986.

Guidance Manual for Chemical Safety Audit Team Members. EPA, Washington, DC. 1990.

Professional Societies and Associations

American Petroleum Institute, 1220 L St. N.W., Washington, DC. 20005, (202) 682-8000.

Reports may be obtained from the publications office at (202) 682-8417.

Management of Process Hazards, API Recommended Practice 750, First Edition. API, Washington, DC. 1990.

Chlorine Institute, 1300 Wilson Boulevard, Arlington, VA. 22209, (703) 741-5760..

Safety Guidelines for the Manufacture of Chlorine, Edition 1, Revision 2, 1981. Publication No. 67

Guidelines on Risk Analysis, Edition 1, 1989. Publication No. 83

American Chemistry Council, 1300 Wilson Boulevard, Arlington, VA. 22209, (703) 741-5000.

A Manager's Guide to Reducing Human Errors, Improving Human Performance in the Chemical Industry. CMA, Washington, DC. 1990.

Evaluating Process Safety in the Chemical Industry, A Manager's Guide to Quantitative Risk Assessment. CMA, Washington, DC. 1989.

Process Safety Management (Control of Acute Hazards). CMA, Washington, DC. 1985.

Safe Warehousing of Chemicals, Resource Manual. CMA, Washington, DC. 1989.

Process Safety Manual. CMA, Washington, DC. 1985.

Managing Process Changes: Implementing and Improving Management of Change Programs. CMA, Washington, DC. Washington, DC. 1993.

Center for Chemical Process Safety, American Institute of Chemical Engineers (AIChE), 3 Park Avenue., New York, NY 10016-5991, (212) 591-7319.

Publications may be purchased at (800) 242-4363.

Guidelines for Technical Management of Chemical Process Safety. AIChE, New York, NY, 1989.

Plant Guidelines for Technical Management of Chemical Process Safety. AIChE, New York, NY, 1992.

Guidelines for Technical Management of Chemical Process Safety. AIChE, New York, 1989.

Guidelines for Implementing Process Safety Management Systems. AIChE, New York, NY, 1994.

Guidelines for Chemical Process Quantitative Risk Analysis. AIChE, New York, NY, 1989.

Guidelines for Process Equipment Reliability Data, with Data Tables. AIChE, New York, NY, 1989.

Prepared by Battelle Columbus Division. Guidelines for Hazard Evaluation Procedures. AIChE, New York, NY, 1992

Guidelines for Hazard Evaluation Procedures. Second Edition with Worked Examples, AIChE, New York, NY, 1992.

Guidelines for Chemical Reactivity Evaluation and Application to Process Design. AIChE, New York, NY, 1995.

Guidelines for Use of Vapor Cloud Dispersion Models. AIChE, New York, NY, 1987.

Workbook of Test Cases for Vapor Cloud Source Dispersion Models. AIChE, New York, NY, 1989.

Guidelines for Vapor Release Mitigation. AIChE, New York, NY, 1988.

Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs. AIChE, New York, NY, 1994.

Tools for Making Acute Risk Decisions: with Chemical Process Applications. AIChE, New York, NY, 1995.

Guideline for Safe Automation of Chemical Processes. AIChE, New York, NY, 1993.

Guidelines for Safe Storage and Handling of High Toxic Hazard Materials. AIChE, New York, NY, 1988.

Guideline for Engineering Design for Process Safety. AIChE, New York, NY, 1993.

Guidelines for Preventing Human Error in Process Safety. AIChE, New York, NY, 1994.

Guidelines for Investigating Chemical Process Incidents. AIChE, New York, NY, 1992.

Guidelines for Auditing Process Safety Management Systems. AIChE, New York, NY, 1993.

Guidelines for Process Safety Management Documentation. AIChE, New York, NY, 1995.

Guidelines for Safe Process Operations and Maintenance. AIChE, New York, NY, 1992.

Guidelines for Process Safety Fundamentals for General Plant Operations. AIChE, New York, NY, 1995.

Guidelines for Chemical Transport Risk Analysis. AIChE, New York, 1995.

Guidelines Technical Planning for On-Site Emergencies. AIChE, New York, NY, 1995.

Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires. AIChE, New York, NY, 1995.

Organization Resources Counselors Inc. (ORC), 1910 Sunderland N.W., Washington, DC. 20036, (202) 293-2980

Recommendations for Process Hazards Management of Substances with Catastrophic Potential. ORC, Process Hazard Management Task Force, Washington, DC. 1988.

Synthetic Organic Chemical Manufacturers Association (SOCMA), 1850 M Street, N.W., Suite 700, Washington, DC. 20036-5810, (202) 721-4100.

Level One Chemical Process Operator, Worker Certification Training Program. SOCMA, Washington, DC. 1990.

General Listings

The Dow Chemical Co., Corporate Safety & Loss Prevention. Fire & Explosion Index Hazard Classification Guide, 6th Edition. The Dow Chemical Co., Midland, MI. 1987.

The Dow Chemical Co., Corporate Safety & Loss Prevention. Guidelines for a Reactive Chemicals Program, 2nd Edition. The Dow Chemical Co., Midland, MI. 1987.

The Dow Chemical Co., Corporate Safety & Loss Prevention. Chemical Exposure Index. The Dow Chemical Co., Midland, MI. 1988.

The Workplace Health Fund, Center for Emergency Response Planning, Blueprint for Prevention, A Guide to Preventing Chemical Releases. The Workplace Health Fund, Washington, DC. November 1989.

CONCLUDING MATERIAL

Review Activity:

DOE HQ	FIELD OFFICES	**Preparing Activity:**
DP	AL	DOE EH-52
EH	ID	
EM	NV	**Project Number:**
ER	Oakland	
NE	NV	SAFT-0097
RW	RF	
SS	SR	

PROJECT OFFICES

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