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## Process Safety Management for Highly Dangerous Chemicals

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### Module 1: Introduction

#### Learning Objectives

By the end of this section, you will be able to:

- **Identify** the core criteria that trigger the applicability of the OSHA Process Safety Management (PSM) Rule (29 CFR 1910.119).
- **Evaluate** chemical inventories against threshold quantities (TQs) to determine if a specific process is covered under the rule.
- **Select** appropriate PSM elements to integrate when modifying or managing highly hazardous chemical (HHC) processes.

*Executive Summary:* The PSM Rule is a performance-based standard designed to prevent catastrophic releases of highly hazardous chemicals, flammable liquids, or explosives by integrating 14 management elements across a facility's technology, personnel, and equipment life cycle.

#### Design Fundamentals

Process safety management requires an ongoing, systematic effort to prevent catastrophic accidents involving hazardous materials and energies. It focuses on reducing risks during the onsite manufacture, use, handling, storage, and movement of chemicals.

The primary objective of the PSM Rule is to build safety into a process from the start and maintain safe operations through its entire life cycle.



Table 1.1 Overview of PSM Elements

<i>Employee Participation</i>	Ensure that workers and their representatives are consulted and have access to information regarding all PSM elements.
<i>Process Safety Information</i>	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.
<i>Process Hazard Analysis</i>	Identify and assess process hazards for each covered process, and take action to manage risk.
<i>Operating Procedures</i>	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.
<i>Training</i>	Provide initial and refresher training with a means of verifying employee understanding for all employees involved in operating a covered process.
<i>Subcontractor Safety</i>	Ensure that subcontractor operations do not compromise the level of safety on or in the vicinity of a process using HHCs.
<i>Pre-Startup Safety Review</i>	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.
<i>Mechanical Integrity</i>	Ensure the integrity and safe operation of process equipment through inspection, testing, preventive maintenance, and quality assurance.
<i>Nonroutine Work Authorizations</i>	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.
<i>Management of Change</i>	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)

<i>Incident Investigation</i>	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.
<i>Emergency Planning and Response</i>	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.
<i>Compliance Audit</i>	Ensure that the PSM program is operating in an integrated and effective manner in compliance with PSM requirements.
<i>Trade Secrets</i>	Ensure all information is available to support the PSM Rule. When necessary, confidentiality or nondisclosure agreements may be used.

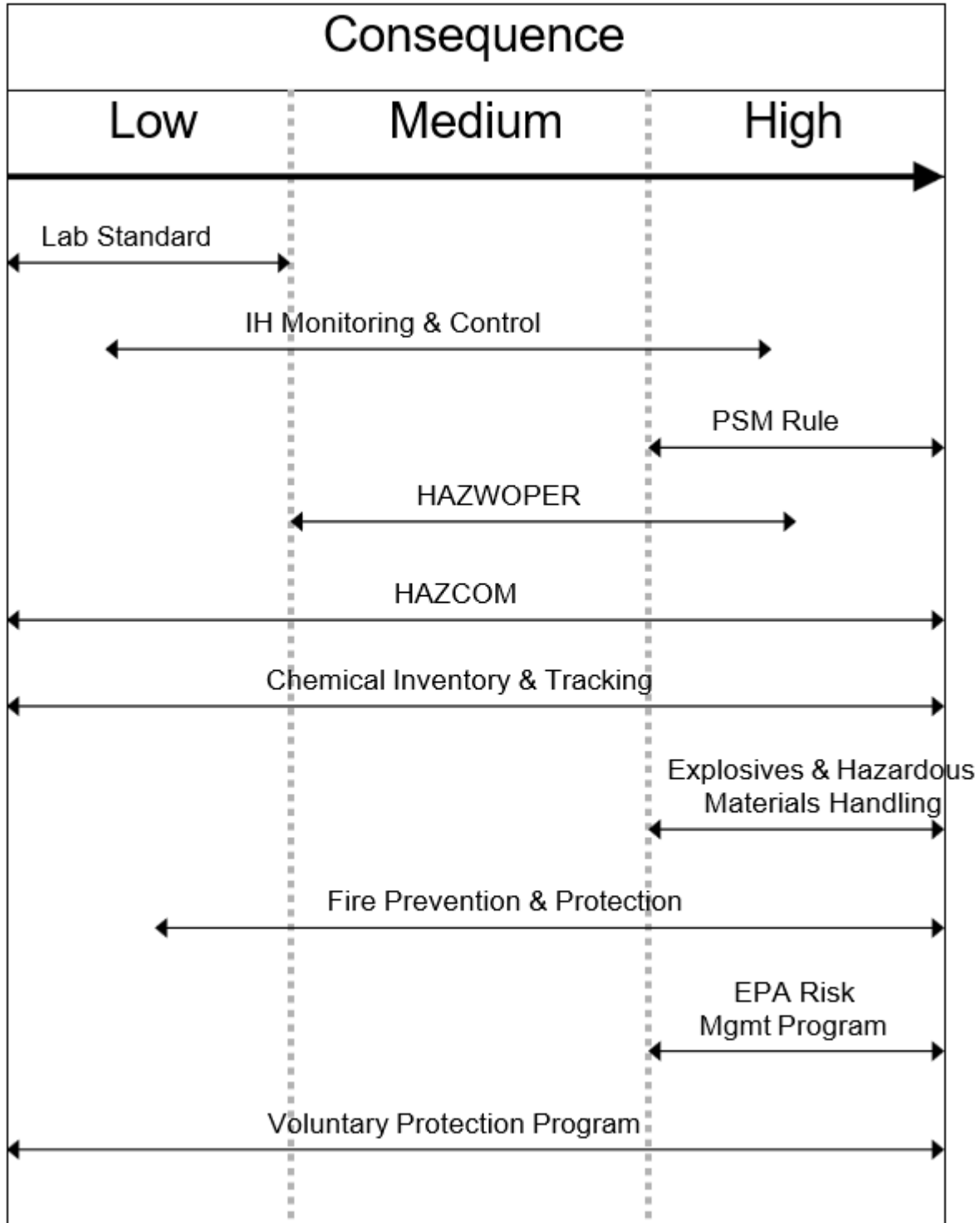


Figure 1.1: Chemical Safety Programs Related to Accident Consequence

### Overview of the 14 PSM Elements

The rule integrates 14 specific elements to manage risks:



## Process Safety Management for Highly Dangerous Chemicals

- **Employee Participation:** Consultation with workers regarding all PSM elements.
- **Process Safety Information (PSI):** Documentation of chemical hazards, technology, and equipment.
- **Process Hazard Analysis (PrHA):** Identification and assessment of process hazards.
- **Operating Procedures:** Written instructions for safe operation.
- **Training:** Verification of employee understanding for process operations.
- **Subcontractor Safety:** Managing the safety of specialty or maintenance workers.
- **Pre-Startup Safety Review (PSR):** Safety verification for new or modified facilities.
- **Mechanical Integrity:** Maintenance and inspection of process equipment.
- **Nonroutine Work Authorizations:** Permits for activities like hot work.
- **Management of Change (MOC):** Procedures for managing modifications to technology or equipment.
- **Incident Investigation:** Team-based analysis of releases or near-misses.
- **Emergency Planning and Response:** Action plans for plant-wide emergencies.
- **Compliance Audit:** Program evaluation every three years.
- **Trade Secrets:** Ensuring information access while maintaining confidentiality.

### Background

Historically, chemical hazards within the DOE were viewed as minor compared to nuclear hazards. The PSM Rule redefined management requirements for quantities of HHCs that meet or exceed specified **Threshold Quantities (TQs)**.

**⚠ Safety Constraint:** Where DOE contractors have processes covered by the PSM Rule, all PSM elements must be in place prior to process startup.

### Maintenance of Safety Documentation

- **PrHA and PSI:** Update and revalidate at least every **five years**.
- **Training and Audits:** Complete refresher training and compliance audits at least every **three years**.




### Application

The PSM Rule applies to specific **processes** rather than entire plants. Interconnected vessels or separate vessels located where a single release could involve all of them are considered a single process.

### Coverage Criteria

A process is covered if it meets any of the following:

- Contains a listed HHC at or above its TQ.
- Contains **10,000 pounds** or more of a flammable liquid or gas in one location.
- Involves the manufacture of explosives or pyrotechnics in any quantity.

 **Design Tip:** While documentation for exclusion is not required, contractors should maintain a list of covered processes and document the technical basis for any exclusions.

### Exemptions to Coverage

The rule does not apply to:

- **Hydrocarbon fuels** used solely for workplace consumption (e.g., propane for heating).
- **Flammable liquids** in atmospheric tanks (designed for 0 to 0.5 p.s.i.g.) kept below their boiling point without refrigeration.
- **Retail facilities** or oil/gas well drilling operations.
- **Normally unoccupied remote facilities.**



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