



# Process Safety Management

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# How Is PSM Applicable?

## 29 CFR 1910.119 – Process Safety Management

- Chemicals Above Specific Thresholds (Appendix A)
- Greater Than 10,000 Pounds Flammables
- Flammable Liquids in Atmospheric Tanks Without Refrigeration/Chilling
- Excludes Hydrocarbon Fuels Used For Comfort Heating and Vehicle Refueling
- Not Applicable to Retail Facilities, Oil or Gas Well Drilling/Service Activities, and Normally Unoccupied Remote Facilities

# What Does PSM Do?

## 29 CFR 1910.119 – Process Safety Management

- Documentation, Communication & Implementation
- Fewer Incidents Over the Life of the Process
- Prevent/Minimize Consequences of Catastrophic Releases
- Improved Emergency Response
- Improved Training & Understanding of the Process
- More Efficient & Productive Operations
- Improved Regulatory & Community Relations

# 14 Elements of PSM

1. Employee Participation\*
2. Process Safety Information\*
3. Process Hazard Analysis\*
4. Operating Procedures\*
5. Training Program\*
6. Contractor Compliance & Interface with PSM
7. Pre-Startup Safety Review
8. Mechanical Integrity\*
9. Hot Work Permits\*
10. Management of Change\*
11. Incident Investigation
12. Emergency Planning\*
13. Compliance Audits
14. Trade Secret Compliance with PSM\*

\*Addressed in the Process Hazard Analysis (PrHA) Element

# PSM Element #3

## Process Hazard Analysis - 1910.119(c)

- Identify & Evaluate Hazards
- Lessons Learned from Previous Incidents
- Engineering & Administrative Safeguards
- Facility Siting Information
- Human Factors Interfaces
- Qualitative Effects of Safeguard Failures
- Update / Revalidate Every 5 Years (Minimum)

# What Is Hazard Analysis?

## Hazard Identification + Hazard Evaluation

- HI + HE = Hazard Assessment (HA)
- Systematic Approach to Analyzing Hazards
- Identifies Controls/Safeguards
- Many Techniques to Choose From

# PrHA - Where Do I Start?

## #1: Define Analysis Scope & Boundaries

- Focus Resources
  - Resources Wasted Evaluating Out-of-Scope Processes
  - Neglect/Miss Important Parts of Process
- Identify Consequences of Interest
  - Receptors
  - Consequence Severity
  - Other Impacts ~ Environment, Business, Facility Damage
- Document Scope

# PrHA - Where Do I Start?

## #2: Choose a PrHA Technique

### Non-Scenario-Based

- Preliminary Hazards Analysis (PreHA)
- Safety Review
- Relative Ranking
- Checklist Analysis

### Scenario-Based

- What-If Analysis
- What-If/Checklist Analysis
- Hazard & Operability (HazOp) Studies
- Failure Modes & Effects Analysis (FMEA)
- Fault Tree Analysis
- Event Tree Analysis
- Other Techniques



# Limitations of PrHA

## Output Dependent on Input & Expertise

- Never 100% Certainty for Identification of All Hazards, Events, Causes, and Effects
- Results & Benefits Cannot Be Directly Verified
- Based on Existing Knowledge or Process/Operation
  - Quality Reflected in Drawing Accuracy, Procedure Accuracy, & Process Knowledge
- Dependent on Subjective Judgment, Assumptions, & Experience of Analysts
- Cannot Guarantee Incidents Will Not Occur
- Limitation Provides Justification
  - Periodic HE Throughout Lifecycle
  - Justification for Management of Change (MOC)

# Lessons Learned

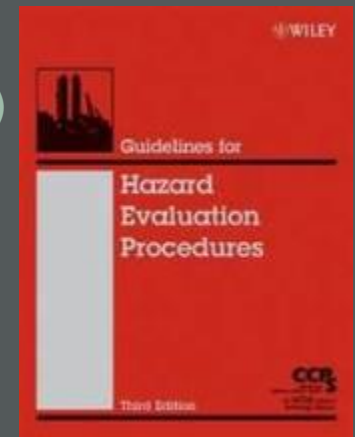
## Be Deliberate When Choosing A Technique

- Stakeholder Buy In
  - Scope, Schedule, & Budget
- Never Enough Time to Complete
  - Preparation, Analysis, & Documentation
- Use a Dedicated Workshop Facilitator
- Respect Team Leader Responsibilities
  - Required to Take On Process
    - Review, Documentation, Factual Accuracy, Comment Resolution, & Concurrence
  - Responsibilities in Addition to Workshop/Meetings
- Train Team on Technique

# Available Resources

## Guidelines for Hazard Evaluation Procedures (“The Red Book”)

- Published By Center for Chemical Process Safety (CCPS)
  - Established in 1985 by American Institute of Chemical Engineers
  - Develops & Disseminates Technical Information Supporting HE
  - Goal is Prevention of Major Chemical Accidents
  - Guidelines 1<sup>st</sup> Published in 1985
- Current (3<sup>rd</sup> Ed) Guidelines Encompass:
  - Lessons Learned from Industry Accidents
  - US Chemical Safety & Hazard Investigation Board (CSB)
    - Recommendations for Hazard Evaluations
    - <http://www.csb.gov/>
  - Process Safety Management Implementation
  - Laws & Regulations
  - International Standards
  - Experience Gained Since 1985 with Performing Hazard Evaluations



# Available Resources, cont.

## Commonly Referenced Guides & Standards

- *System Safety Analysis Handbook “Green Book”*, Published by System Safety Society
- *System Safety for the 21<sup>st</sup> Century*, by Richard A. Stephans
- OSHA 1910.119, *Process Safety Management of Highly Hazardous Chemicals*
- ANSI Z590, *Prevention Through Design Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes*
- MIL-STD-882E, *Department of Defense Standard Practice System Safety*

# Thank You!

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# PSM Element #1

## Employee Participation – 1910.199(d)

- Written Plan of Action for Employee Participation in Process Hazard Analysis (PrHA) and PSM
- Include Employees in PrHA Development
- PrHA Document and Supplemental Materials Accessible for Employee Review
- Required Reading for Employees

# PSM Element #2

## Process Safety Information – 1910.119(d)

- Chemical Information and Hazards  
SDS, Toxicity, Exposure, Incompatibilities, Changes
- Process Technology  
Diagrams, Inventory, Process Chemistry, Hazards
- Process Equipment  
Safety Systems, P&IDs, Engineering Practices,  
Design Codes & Standards, Etc.



# PSM Element #3

## Process Hazard Analysis - 1910.119(c)

- Identify & Evaluate Hazards
- Lessons Learned from Previous Incidents
- Engineering & Administrative Safeguards
- Facility Siting Information
- Human Factors Interfaces
- Qualitative Effects of Safeguard Failures
- Update / Revalidate Every 5 Years (Minimum)

# PSM Element #4

## Operating Procedures - 1910.119(f)

- Operating Steps
- Emergency Shutdown & Recovery
- Operating Limits
- Technical Work Documents
- Safety and Health Concerns
- Safety Systems and Functions
- Maintenance

# PSM Element #5

## Training Program - 1910.119(g)

- Initial Training
- On-the-Job Training
- Refresher Training
- Documentation of Training

# PSM Element #6

## Contractor Compliance & Safety – 1910.119(h)

- Applies to Contractors Performing Maintenance/Repair, Major Renovations, Specialty Process Work
- Recommend Requiring Health and Safety Plan from All Contractors
- Recommend Requiring Job Site Hazard Analysis for Maintenance

# PSM Element #7

## Pre-Startup Safety Review - 1910.119(i)

- Confirms Construction of Facility Against Design
- Confirms Equipment Installation Against Design
- Confirms Safe Operation and Maintenance of Equipment
- Confirms Documentation of Employee Training and Qualifications

# PSM Element #8

## Mechanical Integrity - 1910.119(j)

- Develop & Implement Procedures for Maintaining Equipment, Processes, and Systems
- Identify Training for Maintenance Activities
- Inspection and Testing Plans
- Preventive Maintenance Plans
- Quality Assurance Checks of Stability, Inspections, Testing, and Completed Maintenance

# PSM Element #9

## Hot Work Permits - 1910.119(k)

- Permits Required for Non-Routine Work On or Near Hazardous Process or Equipment
- Incorporate Elements of 29 CFR 1910.252(a) – Welding, Cutting, and Brazing; Fire Prevention and Protection
- Identify Dates for Authorized Work
- Specify Equipment Associated With Hot Work Activities
- Keep Permit On File Until Hot Work is Completed

# PSM Element #10

## Management of Change - 1910.119(1)

- Formalized and Documented Process
- Evaluates Potential Impacts from Changes
  - Technical Basis for Change
  - Impact of Change on Safety & Health
  - Modifications to Operating Procedures
  - Required Time Period for the Change
  - Review and Authorization Requirements
- Applicable to Chemicals, Technology, Equipment, Procedures, Facility Safeguards, Etc.



# PSM Element #11

## Incident Investigation - 1910.119(m)

- Investigate Occurrences Catastrophic Releases and Potential Catastrophic Releases
- Initiate Investigation Within 48 Hours of Incident
- Investigation Report Developed by Team
  - Incident Date and Investigation Dates
  - Description of Incident
  - Contributing Factors
  - Recommendations
- Report Must Be Kept on File for 5 Years

# PSM Element #12

## Emergency Planning- 1910.119(n)

- Document, Communicate, Implement, and Drill Emergency Action Plan for Facility
- Address Both Small and Catastrophic Release Scenarios
- Incorporate Elements of 29 CFR 1910.38 – Emergency Action Plans
- Incorporate Elements of 29 CFR 1910.120 – Hazardous Waste Operations and Emergency Response

# PSM Element #13

## Compliance Audits - 1910.119(o)

- Evaluate and Review Compliance at Least Triennially
- Verification of Validity and Implementation of Procedures and Practices
- Perform Self Assessments and Internal Audits
- Document Findings, Deficiencies, Observations, and Noteworthy Practices
- Document and Track Corrective Action Process
- 2 Most Recent Compliance Audit Reports Must Be Kept On File

# PSM Element #14

## Trade Secret Compliance - 1910.119(p)

- Trade Secrets are Not Exempt from Requirements of 29 CFR 1910.1200 – Hazard Communication
- Information Must be Available to Persons Involved In:
  - ✓ Compiling Process
  - ✓ Safety Information
  - ✓ PrHA Development
  - ✓ Operating Procedures
  - ✓ Incident Investigations
  - ✓ Emergency Planning
  - ✓ Compliance Audits