Process Safety Management of Highly Hazardous & Explosive Chemicals

Jan-22

29CFR1910.119

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What Is Process Safety Management?

- PSM:
  - Addresses the management of Highly Hazardous Chemicals (HHC)
  - Integrates
    - Technology
    - Operating Procedures
    - Standard management protocols

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Why Did OSHA Develop PSM?

- Bhopal, India (1984)
  - 2,000 deaths
    Isocyanate release
- Pasadena, TX (1989)
  - 23 deaths, 132 injuries
    Petroleum explosion
- Cincinnati, OH (1990)
  - 2 deaths
    Explosion
- Sterlington, LA (1991)
  - 8 deaths, 128 injuries
    Chemical release
- 1991 EPA developed the RMP

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PSM vs. RMP - What's the Difference?

- PSM - Like HAZCOM
  - Protects the Workforce
  - Protects Contractors
  - Protects Visitors to the Facility
  - Basically Protects the Workplace
- RMP-Like Sara Title III
  - Protects the Community
  - Protects the General Public Around the Facility
  - Protects Adjacent Facilities Such as Schools & Hospitals

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The Standard Was Promulgated in 1991 - Is it Working?

- BP Products Texas City - March 2005
  - 15 Workers Killed
  - 170 Injured
  - Major Property Damage
  - $50.6 Million in Fines

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DEPARTMENT OF
FIRE PROTECTION AND SAFETY ENGINEERING TECHNOLOGY

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Elements of the PSM Standard

- Application
- Exclusions
- Definitions
- Employee Participation
- Hazards of the Process
- Toxicity
- Technology of the Process
- Equipment in the Process
- Mechanical Integrity
- Inspection & Testing
- Quality Assurance
- Process Hazard Analysis
- Management of Change
- Operating Procedures
- Pre-Startup Safety Review
- Hot Work Procedures
- Safe Work Practices
- Training
- Contractor Management
- Emergency Planning & Response
- Incident Investigation
- Compliance Audits
- Trade Secrets

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What Facilities are Covered

- Those Who Use Chemicals in Appendix A: A List of highly hazardous chemicals, toxics and reactive (Mandatory). Contains a listing of toxic and reactive highly hazardous chemicals which present a potential for a catastrophic event at or above the threshold quantity
- Examples

Chemical	Threshold Quantity (TQ)
Anhydrous Ammonia	10,000 lbs
Chlorine	1,500 lbs

Jan-22 1910.119 Appendix A List of Highly Hazardous Chemicals 8

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What is a Threshold Quantity (TQ)?

- The amount of HHC in the process at any one point in time.
- Flammable liquids and gasses are considered in aggregate.
  - 10,000 lbs

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What Facilities are Covered

- A process which involves a Cat 1 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

1910.106

1910.1200 (c)

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Flammable Liquid: NFPA vs OSHA

NFPA 704	NFPA CLASS	NFPA FLASH POINT	NFPA BOILING POINT	OSHA CATEGORY	OSHA FLASH POINT	OSHA BOILING POINT
4 (Danger)	IA	< 73°F	< 100°F	1	< 73.4°F	< 95°F
3 (Warning)	IB	< 73°F	> 100°F	2	< 73.4°F	> 95°F
	IC	73-100°F		3	73.4-140°F	
2 (Caution)	II	100-140°F				
	IIIA	140-200°F		4	140-199.4°F	
1	IIIB	> 200°F				
0	Not Combustible					

Triggers PSM =>10,000 lbs

U.S. DOT regulations, a flammable liquid is any liquid with a flash point below 140°F (60°C),

U.S. DOT flammable liquids must be labeled and placarded for transport with red flammable liquid placards.

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The Standard does not apply to:

- Hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling),
- Flammable liquids with a flashpoint below 100°F (37.8°C)
  - stored in atmospheric tanks or transferred
  - kept below their normal boiling point without benefit of chilling or refrigeration.
- Retail facilities – What is a retail facility?
- Oil or gas well drilling or servicing operations; or,
- Normally unoccupied remote facilities.

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On Site Location

- when a threshold quantity of a highly hazardous chemical (HHC) exists within an area under the control of an employer or group of affiliated employers.
- It also applies to any group of vessels that are interconnected, or in separate vessels that are close enough in proximity that the HHC could be involved in a potential catastrophic release.

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What Facilities are Covered?

- Affect of the “Meer” Decision:
- MEER ruling and the MEER Memorandum addressed OSHA's enforcement policy
  - would not cite employers for violations of 1910.119 where stored flammable liquids in atmospheric tanks were connected to a process,
  - unless the process outside of the amount in storage contained more than 10,000 pounds of the substance.

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Chemical Systems that are exempt from PSM

- Chemicals listed in Appendix A below listed RQ
- Hydrocarbon fuels used for workplace consumption
  - Gasoline, diesel, etc.
- Flammable liquids stored in atmospheric tanks
  - Below flash point
  - No added temperature control
  - No connection other than transfer
- Retail facilities
  - NAICS code 44, 45, selected AGR 42
- Oil and Gas Well Drilling operations
- Normally unoccupied remote facilities

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What Types of Industries?

- Industries that Process Chemicals Such As:
  - Industrial Organics & Inorganics
  - Paints
  - Pharmaceuticals
  - Adhesives
  - Sealants and Fibers
  - Petrochemical facilities
  - Paper Mills
  - Food Processing with Anhydrous Ammonia over the TQ

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Elements of the PSM Standard

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- Hazards of the Process
- Toxicity
- Technology of the Process
- Equipment in the Process
- Mechanical Integrity
- Inspection & Testing
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- Process Hazard Analysis
- Management of Change
- Operating Procedures
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- Incident Investigation
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- Trade Secrets

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Employee Participation

- Form a Team in Your Company, i.e..
  - Process Engineers
  - Operators
  - Safety
  - Maintenance
  - Management
  - Consultants

1910.119(c)

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Now that we are required to comply, then what?

- Form a Plan, Determine:
  - Responsibilities
  - Duties
  - Reporting
  - Document Control
  - Progress Reports
  - Tracking Changes

Then…Begin the Process of Developing & Implementing the PSM Program

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The Requirements of the Standard - Hazard Determination

- Determine:
  - Chemicals in Your Process
  - Process Chemistry
  - Quantity of Chemicals <u>in lbs</u>
- Compare to Appendix A List with Threshold Quantities (TQ's)

Jan-22 1910.119(d)(1)

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Toxicity Information

- Obtain Toxicity Information on the Chemical(s) in the Process
- SDS are Typical Resource

- Other References,
  - NIOSH Pocket Guide,
  - ACGIH TLV's

1910.119(d)(1)(i)

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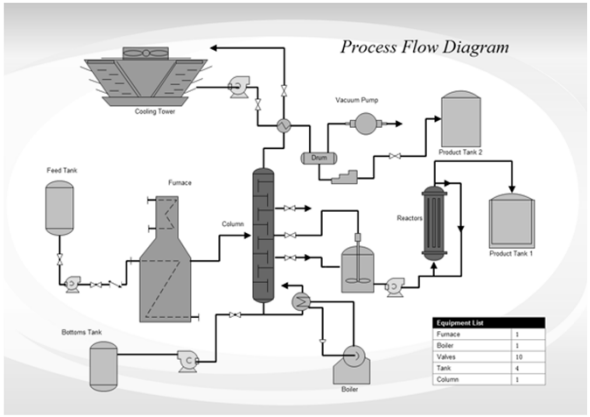
Technology of the Process

- Block flow diagram or process flow diagram
- Process chemistry
- Maximum intended inventory
- Operating Envelope
  - Upper and lower limits
- Consequences of deviations



1910.119(d)(2)

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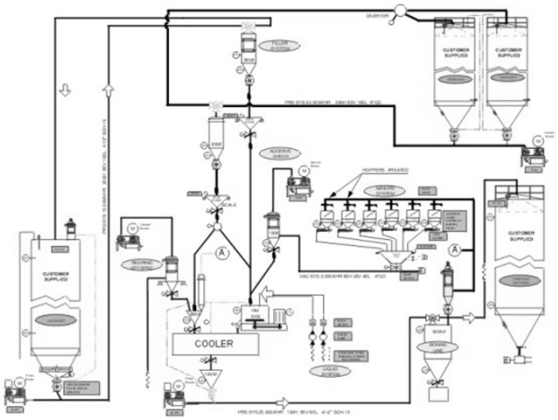
Process Equipment

- Materials of construction
- Process and instrument drawings (P&ID's)
- Electrical classification
- Relief system design
- Ventilation system design
- Design codes
- Material and energy balances
- Safety systems



1910.119(d)(3)

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Process Equipment

- Identify Each Piece of Equipment in the Covered Process by P&ID, Block Diagram and Number Them
- Must be Able to Track Each Number Through the Entire Program

1910.119(d)(3

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Process Equipment

- Mechanical Integrity Certificates
  - Must be Obtained for Each Element of the Process
  - Must be Marked with Numbering System that Follows Process Information System

CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

The American Society of Mechanical Engineers

COMPANY:
MCGRAW/KOKOSING, INC.
4701 E. OXFORD STATE ROAD
MIDDLETOWN, OHIO 45044

SCOPE:
FABRICATION AND ASSEMBLY OF PRESSURE PIPING AT THE ABOVE LOCATION AND FIELD SITES CONTROLLED BY THE ABOVE LOCATION

AUTHORIZED: MAY 24, 2005
EXPIRES: JUNE 10, 2008
CERTIFICATE NUMBER: 27,135

Chairman of The Boiler And Pressure Vessel Committee

Director, Accreditation and Certification

1910.119(j)

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Process Hazard Analysis (PHA's)

- Every 5 years
- What-if
- HazOp
- FMEA
- Fault Tree Analysis
- Other recognized methodology

1910.119(e)

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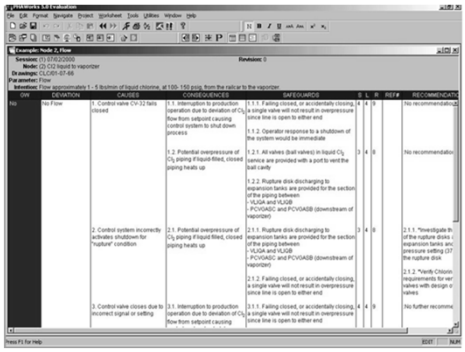
Process Hazard Analysis

- Hazards of the Process
- Review of Previous Incidents
- Hazard Controls
- Consequences of Failure
- Facility Siting
- Human Factors



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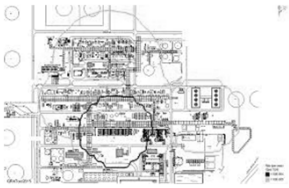
Facility Siting

- assessment of impacts of fire and explosion
- life safety
- structures,
- equipment
- effects of releases of toxic substances and their ingress into buildings.



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There is Much More to PSM

- Inspection & Testing
- Quality Assurance
- Management of Change
- Operating Procedures
- Safe Work Practices
- Training
- Contractor Management
- Emergency Planning & Response
- Incident Investigation
- Compliance Audits
- Trade Secrets

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Management of Change

- Procedures to manage changes to the covered process.
  - Exception: “replacement in kind”
- Management of Change includes:
  - Process chemicals
  - Technology
  - Equipment
  - Operating Procedures
  - Facilities

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Management of Change Addresses

- Technical basis of the change
- Impact to employee safety and health
- Modification to operating procedures
- Time period for change
- Authorization of change

Operating Procedures

- Develop and implement written operating procedures that are clear instructions for all expected phases of operations.
- AKA – Standard Operating Procedures (SOPs)
- Must cover:
  - Operation phase
  - Operational limits
  - Safety & health considerations

Operating Procedures Must Address

- Initial start-up
- Normal operations
- Temporary operations
- Emergency shutdown
- Emergency operations
- Normal shutdown
- Start-up following turnaround
- Consequences of deviation
- Steps required to correct or avoid deviation

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Operating Procedures…

- Must be readily available to employees
- Must be reviewed as needed to ensure they reflect current operating practice.
- Must cover:
  - Process chemicals
  - Technology and equipment
  - Facilities
- OPs must be certified annually that they are correct and accurate.

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Safe Work Practices (SWPs)

- Must be developed and implemented to provide for the control of hazards during work activities such as:
  - Lock-out/Tag-out
  - Confined space entry
  - Opening processes, piping or equipment

SWPs are for:
- Operators
- Maintenance personnel
- Contractors
- Lab personnel
- Or other support personnel

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Training

- PSM specific training is required
- Must cover:
  - Safety and health hazards associated with the covered process
  - Safe work practices
- Refresher training is required every 3 years or as needed to ensure employees are complying with all PSM requirements

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Contractors

- Contractors involved in or around a covered process must be informed of required PSM elements.
- Contract work includes:
  - Maintenance and repair
  - Turn around
  - Major renovations
  - Specialty knowledge or services
  - Does not include support services not involved with the covered process, like laundry or vending machine supply

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Emergency Action Plans (EAP)

- Must have EAP for entire facility
- EAP must have provisions for small releases of HHCs
- Develop a Early Warning Method for Releases
- Train on the Meaning of the Alarms
- Develop Emergency Evacuation Written Plans, Evacuation Maps & Assembly Points

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Incident Investigations

- Must be initiated ASAP, but within 48 hours
- Team must include:
  - Person knowledgeable in the process involved
  - Includes contractor if work of the contractor involved
  - Other persons with appropriate knowledge of the covered process

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Incident Investigation Report

- Report must be produced with the following:
  - Date of incident
  - Date of start of investigation
  - Description of incident
  - Factors contributing to incident
  - Recommendations
- System must be established to promptly address recommendations and findings of report
- Resolutions and corrective action must be documented

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Compliance Audits

- To ensure that PSM is effective, employers must certify every 3 years that they have evaluated compliance with the standard
- Must be completed by at least on person knowledgeable in the process
- Report must be developed and documented
- Deficiency corrections must be documented
- Last two compliance audits must be kept on file

Trade Secrets

- Employers must make all necessary information required to comply with PSM, regardless of trade secrets, available to persons involved in developing or creating:
  - Compiling process safety information
  - PHAs
  - SOPs
  - Incident investigations
  - Emergency planning and response
  - Compliance audits
- Confidentiality agreements are allowed

OSHA National Emphasis Program (NEP) for Refineries & Chemical Facilities

- Petroleum Refineries NEP
  - Issued August 2009
- Chemical Facilities NEP
  - Issued July 2010

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Typical Standards Cited in PSM facilities

- 1910.119 PSM
- 1910.147 Lock and Tag
- 1910.120 HAZWOPER
- 1910.1200 HazCom
- 1910.146 Confined Space
- 5A.001 General Duty Clause
- 1910.307 Electrical for Hazardous Locations

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Severe Violator Enforcement Program (SVEP)

- SVEP concentrates resources on inspecting employers who have demonstrated indifference to their OSH Act obligations
- by willful, repeated, or failure-to-abate violations.

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Severe Violator Enforcement Program (SVEP)

- Enhanced Follow-up Inspections
- Nationwide Inspections of Related Workplaces/Worksites
- Increased Company Awareness of OSHA Enforcement
- Enhanced Settlement Provisions
- Federal Court Enforcement under Section 11(b) of the OSH Act
- Bottom Line: OSHA is Serious About Compliance and Enforcement of PSM

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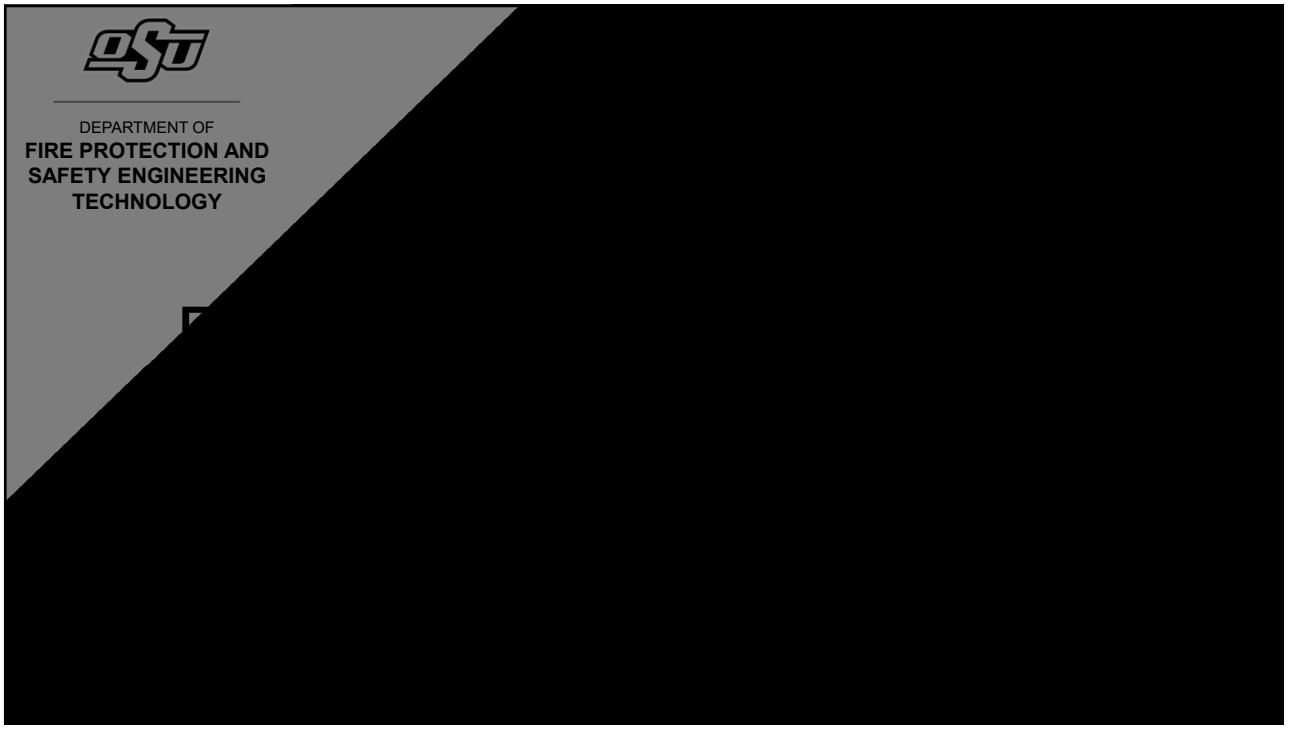

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EPA Risk Management Plans (RMP)

- The RMP Standard was to be a mirror of the PSM Standard
  - Didn't happen!
- Remember…PSM Protects the Workforce, RMP Protects the Community

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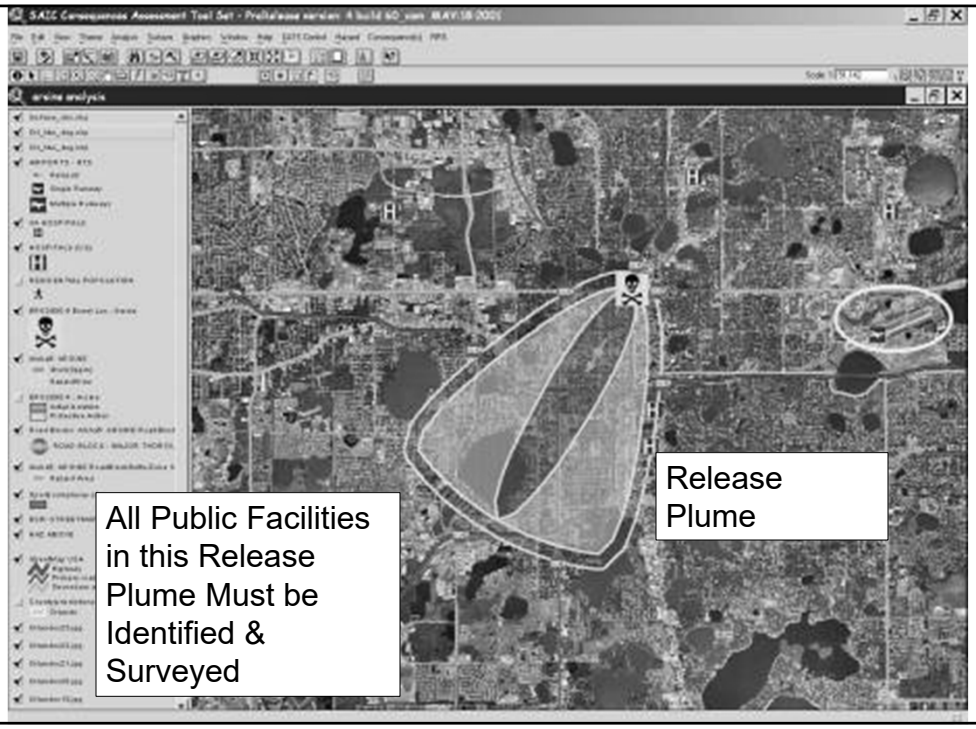

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Risk Management Program 112(r)(7)
40 CFR Part 68 Facilities Above Threshold Quantity (TQ)

PROGRAM 1	PROGRAM 2	PROGRAM 3
• **Worst case analysis** • **5-year accident history** • **Document management system**	• Worst case analysis • 5-year accident history • Document management system	• Worst case analysis • 5-year accident history • Document management system
Prevention Program		
Certify no additional prevention steps needed	• Safety information • Hazard review • Operating procedures • Training • Maintenance • Incident investigation • Compliance audit	• Process safety information • Process hazard analysis (PHA) • Operating procedures • Training • Maintenance • Incident investigation • Compliance audit • Management of change • Pre-startup review • Contractors • Employee participation • Hot work permits
Emergency Response Program		
Coordinate with local responders	Develop plan/program and coordinate with local responders	Develop plan/program and coordinate with local responders

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https://www.osha.gov/chemicalexecutiveorder/psm_terminology.html

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Program 1, 2 or 3?

Program 1	Program 2	Program 3
Less than TQ of listed substances (PSM/RMP) No releases in last 5 years resulting in • Death • Injury • Response or restoration services Emergency Response Plan	Does not meet requirements of program 1	Does not meet requirements of program 1 Or Required to follow OSHA PSM standard Or Wood Preservation Petrochemical Mfg Chemical Mfg

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Information Sharing-LEPC

- Summaries of chemical hazard information to be provided to LEPC:
  - Information on RMP regulated substances−names and quantities of regulated substances held in a process
  - Five-year accident history information (reported under §68.42)
  - Compliance audits
  - Incident investigation reports (with root cause findings)
  - IST implemented or planned to be implemented, if applicable
  - Exercises, including schedules and reports

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OSHA PSM Summary

- PSM is a Comprehensive, Difficult Standard
- Although it was Promulgated in 1991, Catastrophes Continue to Occur
- Recognizing these Facts, OSHA has Developed a National Emphasis Program for Refineries and Chemical Manufacturers
- More Emphasis Planned for all PSM Sites
- There is Much More Work to be Done…
- RMP Must Also be Considered for Many Facilities

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