Process Safety Management
Process Safety Management
Is the proactive identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in processes, procedures, or equipment.
Purpose

• Prevent Catastrophic Releases of Highly Hazardous Chemicals

• Minimize Consequences of Such Releases to Employees and the Community
29 CFR 1910.119

OSHA’s Process Safety Management Standard
Anticipated Benefits

OSHA estimated that the integrated approach of the PSM standard would reduce the average annual number of deaths (265) by 200 and reduce the average annual number of serious injuries (900) by 700 in industries involved with highly hazardous chemicals.
Resources

• European Economic Community (EEC)
• World Bank
• International Labor Office (ILO)
• U.S. Environmental Protection Agency
• Superfund Amendments and Reauthorization Act (SARA)
• States, Industry, & Labor Organizations
Performance
NOT
Specification Standard
PSM Standard

- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Training
- Contractors
- Pre-startup Safety Review
- Mechanical Integrity
- Hot-work Permits
- Management of Change
- Incident Investigations
- Emergency Planning & Response
- Compliance Safety Audits
What’s Covered

• Listed Chemicals in Appendix A
  – > 10,000 pounds of Flammable Liquids or Gases

• Examples

  Acetaldehyde    Chlorine
  Nitromethane    Ethylamine
  Perchloric Acid Phosgene
  Tetramethyl Lead Ketone
  HF              NO
What’s Not Covered

• HC fuels used only for workplace consumption and if not a part of a covered hazardous process
• Flammable liquids stored or transferred below NBP w/o chilling or refrigeration
• Retail facilities
• Oil, gas well drilling, servicing
• Normally unmanned remote facilities
Process Safety Information: Chemicals

- Toxicity
- PEL
- Physical Data
- Reactivity and Corrosivity
- Thermal and Chemical Stability
- Effects of Mixing Chemicals
Process Safety Information: Process

• Block flow or process flow diagram
• Process chemistry
• Maximum intended inventory
• Safe upper/lower limits for such items as temperatures, pressures, flows or compositions
• Consequences of deviations, e.g. runaway reaction potential
Process Safety Information: Equipment

- Materials of construction
- P&IDs
- Electrical Classification
- Relief system design & design basis
- Ventilation system design
- Design codes and standards
- Material & energy balances
- Safety systems
Process Hazard Analysis

Organized and systematic effort to identify and analyze the significance of potential hazards associated with the processing or handling of highly hazardous chemicals

- Causes/consequences of fires & explosions
- Releases of toxic or flammable chemicals
- Major spills of hazardous chemicals
- Methodology depends on the process & its characteristics
- PHA METHODS: What If?, Checklist, What If?/Checklist, HAZOP, FMEA, FTA etc
PHA Focuses On

- Equipment
- Instrumentation
- Utilities
- Human Actions
- External Factors
PHA Must Address

- Hazards of the process
- Engineering & administrative controls
- Consequences of failure of controls
- Facility siting
- Human factors
- Evaluate potential effects to on-site personnel from failure of controls
- Identification of previous incidents
PHA Team

• Expertise in engineering & process operations
• One member to have knowledge of & experience with process being evaluated
• One member knowledgeable in specific PHA methodology used for evaluating the process
• Other members with specific knowledge: instrumentation, chemistry, etc.
Employer PHA Actions

- Establish system for prompt response
- Ensure timely resolution of findings & recommendations
- Document actions taken
- Develop written schedule for completions
- Complete actions ASAP
- Communicate actions to affected employees
Operating Procedures

• Provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information
• Address at least the listed elements
• Operating procedures readily accessible
• Reviewed as necessary to reflect current procedures and changes
• Certified annually as current & accurate
• Develop & implement safe work practices to provide for the control of hazards during operations, e.g. lockout/tag out/ confined space entry, opening equipment & pipes, facility entry
• Apply to employees & contractor employees
Operating Procedures

• Steps for Each Operating Phase
  – Initial startup, operation, shutdown
  – Temporary & emergency operations, emergency shutdown
  – Startup following shutdowns

• Operating limits
  – consequences of deviations
  – prevention of deviations

• Safety & Health Considerations
  – Chemical properties and hazards
  – Precautions to prevent exposure
  – Control measures if contact or airborne exposure occurs
  – Quality controls for raw materials
  – Control of hazardous chemical inventories
  – Special or unique hazards
  – Safety systems & their functions
Training

- Process overview
- Process hazards
- Operating procedures
- Emergency procedures
- Refresher training at least every 3 yrs
- Documentation
Employer Responsibilities

• Evaluate contractor’s safety performance & programs
• Inform contractor of potential hazards: fire, explosion, toxic release, applicable plant safety rules
• Develop/Implement safe work practices
• Evaluate contractor performance
Contractor Responsibilities

• Advise employer of any unique work hazards of contracted work
• Each employee follow all applicable work practices & safety rules of the facility
• Ensure each employee is trained in necessary work practices
• Ensure each employee is instructed in known fire, explosion, or toxic release problems related to his/her job
• Document that understanding of training has been evaluated, verified
Pre-startup Safety Review

• Done when:
  – New processes
  – Modified process

• Pre-startup Review Verifies
  – Construction: conforms to design
  – Procedures: adequate, in place
  – PHA recommendations resolved or implemented
  – Management of change requirements met
  – All affected workers trained
PSM Mechanical Integrity

- Pressure vessels, storage tanks
- Piping systems, components
- Relief & vent systems, devices
- Emergency shutdown systems
- Controls: monitoring devices, sensors, alarms, interlocks
- Pumps
Mechanical Integrity

• Written procedures
• Training: process hazards, job tasks
• Inspections
• Testing
• Corrective action
• Records
Hot Work Permits

- Welding, cutting, brazing
- Control of ignition sources
- Verify safe conditions
- Authorization
Management of Change

- Establish written procedures
- Develop management support
- Evaluate safety of any changes to:
  - process chemicals facility
  - technology equipment

**MOC Procedures Must Address**
- Everything except “replacement in kind”
- Temporary as well as permanent changes
- Technical basis for change
- Safety & health effects
- Modified operation procedures
- Time necessary for change
- Authorization for change
- Ways to inform & train workers before change
Incident Investigation Goals

• **Goals**
  – Identify incident causes and implement steps to prevent reoccurrence

• **Implementation**
  – Every incident
  – Prompt investigation
  – Knowledgeable team
  – Documentation & report
  – Recommendations & findings
  – Resolutions & corrective actions
Emergency Planning & Response

- Develop Emergency Action Plans
- Pre-plan for catastrophe
- Train & equip workers
- Drills
• Certify all elements of standard
• Knowledgeable audit team
• Report & recommendations
• Address all finding & recommendations
• Conduct every three years
Appendices

A: List of chemicals
B: Sample block & flow diagrams
C: Compliance guidelines
D: References
In a Few Words, What is PSM?

• The *proactive* and *systematic* identification, evaluation, and mitigation or prevention of chemical releases that could occur as a result of failures in process, procedures, or equipment.
What’s Covered by PSM?

- Process Safety Information
- Employee Involvement
- Process Hazard Analysis
- Operating Procedures
- Training
- Contractors
- Pre-Startup Safety Review
- Mechanical Integrity
- Hot Work
- Management of Change
- Incident Investigation
- Emergency Planning and Response
- Compliance Audits
- Trade Secrets