Process Safety Management

- 29 CFR 1910.119
Objectives

In this course, we will discuss the following:

- Importance of Process Safety Management (PSM)
- Elements of a PSM Program
Process Safety Management

- Prevent catastrophic releases of highly hazardous chemicals.
Events Leading to PSM Standard

- 1985: Institute, WV; 135 injured
- 1988: Norco, LA; 7 dead/42 injured
- 1988: Henderson, NV; 2 dead/350 injured
- 1989: Richmond, CA; 9 injured
- 1989: Pasadena, TX; 23 dead/232 injured
- 1990: Channelview, TX; 7 dead
Clean Air Act Amendments of 1990 - Section 304

- OSHA develops chemical safety standard
  - Standard to contain a list of chemicals
  - Standard to contain certain elements
Implementation of the PSM Standard

- Top management support
- Personnel and capital investments
- “Giving another hat”
- Outside consultants
- Company take ownership
- “Canned programs”
- Time intensive
Toxic or reactive process chemical(s) ≥ Threshold Quantity (TQ):

- Chemicals covered in appendix A
- Ammonia TQ = 10,000 Lbs.
- Chlorine TQ = 1,500 Lbs.
- Flammable liquids and gasses TQ = 10,000 Lbs.
  » (except [A] and [B])
The Meer Decision

- Court decision implemented by directive
- Language in standard for flammable liquids “unconstitutionally vague”
  - **RESULT:** Flammable liquids in atmospheric storage tanks not counted in determining TQ
## List of Hazardous Chemicals

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS*</th>
<th>TQ**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>75-07-0</td>
<td>2500</td>
</tr>
<tr>
<td>Acrolein (2-Propenal)</td>
<td>107-02-3</td>
<td>150</td>
</tr>
<tr>
<td>Acrlyl Chloride</td>
<td>814-88-8</td>
<td>250</td>
</tr>
<tr>
<td>Allyl Chloride</td>
<td>107-05-1</td>
<td>1000</td>
</tr>
<tr>
<td>Allylamine</td>
<td>107-11-9</td>
<td>1000</td>
</tr>
<tr>
<td>Alkylaluminums</td>
<td>Varies</td>
<td>5000</td>
</tr>
<tr>
<td>Ammonia, Anhydrous</td>
<td>7664-41-7</td>
<td>10000</td>
</tr>
<tr>
<td>Ammonia solutions (&gt; 44% ammonia by weight)</td>
<td>7664-41-7</td>
<td>15000</td>
</tr>
<tr>
<td>Ammonium Perchlorate</td>
<td>7790-98-9</td>
<td>7500</td>
</tr>
<tr>
<td>Ammonium Permanganate</td>
<td>7787-36-2</td>
<td>7500</td>
</tr>
<tr>
<td>Arsine (also called Arsenic Hydride)</td>
<td>7784-42-1</td>
<td>100</td>
</tr>
<tr>
<td>Bis (Chloromethyl) Ether</td>
<td>542-88-1</td>
<td>100</td>
</tr>
<tr>
<td>Boron Trichloride</td>
<td>10294-34-5</td>
<td>2500</td>
</tr>
<tr>
<td>Boron Trifluoride</td>
<td>7637-07-2</td>
<td>250</td>
</tr>
<tr>
<td>Bromine</td>
<td>7728-95-6</td>
<td>1500</td>
</tr>
<tr>
<td>Bromine Chloride</td>
<td>13883-41-7</td>
<td>1500</td>
</tr>
<tr>
<td>Bromine Pentafluoride</td>
<td>7789-30-2</td>
<td>2500</td>
</tr>
<tr>
<td>Bromine Trifluoride</td>
<td>7787-71-5</td>
<td>15000</td>
</tr>
<tr>
<td>3-Bromopropyne (also called Propargyl Bromide)</td>
<td>106-98-7</td>
<td>100</td>
</tr>
</tbody>
</table>
Definitions

- Catastrophic release
- Facilities
- Hot work
- Normally unoccupied remote facility

- Process
- Replacement in kind
- Trade secret
- Covered process
Employee Participation

Consult with employees throughout development

Develop written employee participation plan

Provide employee access to all elements of process safety program
Process Safety Information

Chemical Information

- Toxicity information
- Permissible exposure limits (PEL)
- Physical data
- Reactivity data
- Corrosivity data
- Thermal and chemical stability data
- Hazardous effects of inadvertent mixing
Technology information

- Process chemistry
- Maximum inventory
- Safe upper and lower limits
- Consequences of deviation
Flow Diagrams

- Block or simplified process flow diagram

![Block flow diagram and simplified process flow diagram (non-mandatory)]
Example of a Process Flow Diagram
Equipment Information

- Materials of construction
- Piping and instrument diagrams (P & ID’s)
- Electrical classification
- Relief system design and design basis
Equipment Information

- Ventilation systems design
- Design codes and standards employed
- Material and energy balances for processes
- Safety systems
Equipment Information

- The equipment information must be compiled prior to process hazard analysis initiation.
Process Hazard Analysis

- Process hazard analysis (PHA) - cornerstone of PSM
  - Formal, systematic means of identifying, evaluating, and controlling process hazards
  - Must perform an initial process hazard analysis (hazard evaluation) on processes
Process Hazard Analysis

Methodologies must be appropriate to complexity of process

- What-if analysis
- Checklist analysis
- What-if/checklist
- Fault tree analysis
- Hazard and operability study (HAZOP)
- Failure modes and effects analysis
- Other
Process Hazard Analysis

- Process hazards
- Identification of previous incidents
- Engineering and administrative controls
- Consequences of failures
- Facility siting
- Human factors
- Qualitative evaluation of effects of failure of controls on employees
Assemble team with:

- Expertise in engineering and process operations
- Experience and knowledge specific to the process being evaluated
- Knowledgeable in the specific process hazard analysis methodology being used
Process Hazard Analysis

- System to promptly address team’s findings and recommendations
- PHA updated and revalidated every 5 years
- Retain records for life of process
Operating Procedures

- Operating phases
- Operating limits
- Safety systems and their functions
- Safety and health considerations
Operating Procedures

- Quality control for raw materials and hazardous chemical inventory levels
- Special or unique hazards
- Safety systems and functions
- Accessible operating procedures
  - Annual certification
- Safe work practices
Training

- Process overview
- Process hazards
- Operating procedures
- Emergency procedures
- Means to verify/document training
- Refresher training at least every three years
Employer Responsibilities 1910.119(h)(1)-(2)

- Evaluate contractor’s safety performance before hire
- Inform of process hazards
- Explain emergency action plan
- Develop/implement safe work practices
- Ensure contractors fulfilling obligations
- Maintain contract employee injury and illness log
Contract Employer Responsibilities

- Assure employees are trained
- Assure employees understand emergency action plan
- Document employee receipt and understanding
- Assure employees follow safe work practices
- Advise facility of unique hazards present or discovered
Pre-Startup Safety Review

- Construction and equipment meet design specifications
- Operating procedures in place and adequate
- New facilities; perform process hazard analysis
- Modified facilities; meets management of change
- Training before startup
Mechanical Integrity

- Establish list of equipment covered
- Establish and implement written procedures to maintain on-going integrity of equipment
- Training for maintenance activities
Inspection and Testing

- Inspect and test equipment
- Document inspection results
  - Frequency consistent with manufacturer’s recommendations and good engineering practices
- Correct equipment deficiencies
- Establish quality assurance of equipment
  - Appropriate checks and inspections
Hot Work Permits

- Requires written permit

- Authorization for welding, cutting, brazing, flame or spark producing operations
  - On or near covered process

- Fire prevention and protection requirements
  - Requirements are in 29 CFR 1910.252(a)
Management of Change (MOC) 1910.119(l)

- Written procedures to manage changes to process chemicals, technology, equipment, procedures
  - Except “replacements in kind”

- Must address: technical basis, impact of change, modifications to operating procedures, and time period for change
Management of Change

- Authorization requirements for change
- Training for employees *prior* to start up
- Update process safety information after a change
Incident Investigation

- Incidents which did or could result in catastrophic release of hazardous chemicals
  - Investigation initiated within 48 hours
- Report and recommendations
- System to address recommendations
- Review with affected personnel
- Retained 5 years
Emergency Planning and Response

- Implementing emergency action plan
  - Handling of small releases
Compliance Audits

- Certify program in compliance
  - Every 3 years

- Ensure at least one person knowledgeable in process

- Develop report and recommendations
  - Document response and correction of deficiencies

- Retain 2 most current audits
Trade Secrets

- Protection of process trade secrets
- Confidentiality agreements (if needed)
- Information available to affected employees
In this course, we discussed:

- Importance of Process Safety Management (PSM)
- Elements of a PSM Program
Thank You For Attending!

Final Questions?