Introduction to Process Safety Principles

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Young Professional (YP) Session

Contents

- What is Process Safety?
- Standards and Rules
- Resources for a Young Professional (YP)
What is Process Safety?

**Industry Success:**
- Illness and injury statistics now dominant metric.
- Industry has driven down rate

**Personal Safety is:**
- Classic worker health and safety
- ‘Slips, Trips, and Falls’
- Protective Equipment
- Hot work permits
- Industrial Hygiene

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What is Process Safety?

**Process Safety is:**
- Major Accident Prevention
- Fires, Explosions, Toxics
- Accidental chemical releases
- Unintended reactions

**Industry success:**
- New or modified standards and practices covering process safety, instrumentation and controls, mechanical integrity, operator procedures, and management systems.
What is Process Safety?

**Process Safety is:**
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Process Safety - On-shore

**Federal Agency**
- Occupational Safety and Health Administration (OSHA)

**Promulgated – 1990**
- Clean Air Act Amendments

**Standard**
- OSHA 1910.119 “Process Safety Management (PSM) of Highly Hazardous Chemicals”

**Applies - now**
- Locations with specific chemicals and quantities
Process Safety – Offshore
– Outer Continental Shelf

Federal Agency
– US Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)

Ruling - Sept. 2010
– Workplace Safety Rule on Safety and Environmental Management Systems (SEMS)

Standards
– API RP 75
– 30 CFR Part 250, Subpart S

Applies - Comply by Nov. 15, 2011

Practical Limitation:
This presentation cannot cover all elements of PSM or SEMS.
Everyday Impact of PSM

- Process Safety Information – OSHA PSM
  - Safety and Environmental Information - API RP 75
- Operating Procedures
- Hazard Analysis
- Management of Change
- Pre-Startup Safety Review
- Mechanical Integrity
  - Quality Assurance/Mechanical Integrity - API RP 75

Process Safety Information (PSI)

- Timing - Written prior to hazard analysis and thereafter part of MOC
- Resource - Process Technology, Equipment, and Chemical Hazard Information

<table>
<thead>
<tr>
<th>Process Flow Diagram</th>
<th>P&amp;IDs</th>
<th>Materials of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe Operating Limits</td>
<td>Relief System</td>
<td>Thermal and Chemical Stability</td>
</tr>
<tr>
<td>Consequence of Deviations</td>
<td>Interlocks, ESD</td>
<td>Inadvertent Mixing</td>
</tr>
</tbody>
</table>

- Similar to Safety and Environmental Information within API RP 75
Operating Procedures

- Timing - Initially written prior to PSSR and thereafter reviewed and certified annually (and with each MOC)
- Resource - PSI and operating steps for each phase

<table>
<thead>
<tr>
<th>Resource, temporary, emergency operations</th>
<th>Start up (Initial, post turnaround, post unplanned shutdown)</th>
<th>Shutdown (Normal and Emergency)</th>
</tr>
</thead>
</table>

- Tip - Consider all modes of operations during your work.
  - For petrochemical facilities, less than 10% of the time is spent in transient operations; however, 75% of major accidents occur during non-routine operations

Hazard Analysis

- Timing - Every 5 years
  - 10 years for low priority facilities per API RP 75
- Simple Description - Qualitative evaluation of hazards by experienced team

<table>
<thead>
<tr>
<th>Process Hazards</th>
<th>Previous Incidents</th>
<th>Human factors</th>
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<tbody>
<tr>
<td>Facility siting (potential releases and their potential impact)</td>
<td>Consequence of failure of Monitoring, Controls, Alarms, Interlocks, ESD</td>
<td>Various methods (HAZOP, FMEA, What-If, LOPA, Fault Tree, etc)</td>
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- Tip - In practical terms, establishes hazard baseline. After such, managing change is key.
Management of Change (MOC)

- **Timing - Prior to non ‘replacement in kind’ change**

- **Simple description -** Written procedures to manage change to process, technology, equipment, facilities, procedures, and personnel (RP 75).

<table>
<thead>
<tr>
<th>Technical basis</th>
<th>Potential impact on Safety and Health</th>
<th>Update PSI and procedures</th>
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</thead>
<tbody>
<tr>
<td>Prior to PSSR and start up</td>
<td>Inform and train employees and contractors</td>
<td>Timing and Authorization requirements</td>
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- **Tip -** Managing change is key to safe design and maintaining safe operations.

Pre-start up Safety Review (PSSR)

- **Timing - Prior to Implementation of ‘Significant’ Change**

- **Simple description -** A safety review prior to start up by those responsible for operations and maintenance

<table>
<thead>
<tr>
<th>Change in accordance with specifications</th>
<th>Safety, operating, maintenance, and emergency procedures in place and adequate</th>
<th>Hazard Analysis recommendations resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training completed</td>
<td>PSI current</td>
<td>Safe work practices in place</td>
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Mechanical Integrity

- Timing - Continuous
- Simple description - Written procedures to design, fabricate, install, test and inspect, monitor, and maintain ‘mechanical intent’ of critical process equipment

<table>
<thead>
<tr>
<th>Pressure vessels, piping systems, pumps</th>
<th>Relief and vent systems</th>
<th>Emergency shutdown systems</th>
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</thead>
<tbody>
<tr>
<td>Controls, alarms, and interlocks</td>
<td>Deficiencies outside limits are corrected</td>
<td>Suitability with process application</td>
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</tbody>
</table>

- Tip - Mechanical integrity extends beyond preventive maintenance and testing. It is a means of ensuring the on-going performance of critical equipment.

Summary

- Process safety isn’t one department – it’s everyone’s responsibility
- Process safety isn’t a one-time job or a project – it’s everyday, all day
- Process safety isn’t paperwork – it’s a way of thinking and acting
- Process safety is a culture; it’s a way of doing business.
References

- Bridges et. al., "How to Efficiently Perform the Hazard Evaluation Required for Non-Routine Modes of Operation (Startup, Shutdown, Online Maintenance)," AIChE, GCPS, March 2011
- OSHA 1910.119 "Process Safety Management (PSM) of Highly Hazardous Chemicals"