1st International Process Safety Symposium and Exhibition
Process Hazards Analysis and Risk reduction Planning

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Overview – PHA – PSM – CCPS

Commit to Process Safety
- Process Safety Culture
- Compliance with Standards
- Process Safety Competency
- Workforce Involvement
- Stakeholder Outreach

Understand Hazards and Risk
- Process Knowledge Management
  - Hazard Identification and Risk Analysis
    - Operating Procedures
    - Safe Work Practices
    - Asset Integrity & Reliability
    - Contractor Management
    - Training & Performance Assurance
      - Management of Change
      - Operational Readiness
      - Conduct of Operations
      - Emergency Management
      - Incident Investigation
      - Measurement & Metrics
      - Auditing
      - Management Review & Continuous Improvement

Manage Risk
- Operational Procedures
- Safe Work Practices
- Asset Integrity & Reliability
- Contractor Management
- Training & Performance Assurance
- Management of Change
- Operational Readiness
- Conduct of Operations
- Emergency Management
- Incident Investigation
- Measurement & Metrics
- Auditing
- Management Review & Continuous Improvement

Learning from Experience
- Management Review & Continuous Improvement
Overview – PHA

**Process Hazard Analysis** is an umbrella term for Process Safety related studies and methods, typically:

- Bowtie,
- HAZOP,
- LOPA,
- SWIFT,
- FMEA,
- QRA,

We do PHA to learn about the PS risks on the sites and the means for managing them.
Choice of technique depends upon:

- What questions you need to answer.
- The nature of the facility.
- If explosive materials onsite then a blast analysis may be needed.
- If the process is complex then HAZOP may be a good option.
- If the site is close of residential areas or large onsite populations (e.g. contractor camps, admin buildings) then a more detailed assessment may be needed to get better resolution.
- May be specified by regulation.
- Same facility in the different locations – a different location means the consequences of an incident are different, or the external impacts on the facility may be different. It is not possible to copy across.
Selection of PHA Technique

HAZARD

Event

Causes and Contributory Factors

Consequences

LOPA

FMEA

Residual Risk

SWIFT

HAZOP

QRA

Bowtie
Selection of PHA Technique

- SWIFT
- HAZOP
- LOPA
- QRA
- QRA with Blast Analysis
- LOPA
- FMEA
Flow of typical PHA sessions

- Day 1: Preparation, Briefing, Site Visit
- Day 2: Incident & Modification Review, Apply Technique
- 3 to n: Improvement Options & Recommendations
- Day n: Reporting & Follow-up

Remember PHA doesn’t reduce risk. Acting on its recommendations does!

Risk Reduction Planning!
Risk Reduction Planning (RRP), Why?

Essential additional considerations are required relating to:

- Corporate objectives/governance
- Residual risk appetite, both in country and corporate
- Gap closure initiatives which are already in place/planned
- Associated project initiatives eg. production enhancement, decommissioning etc.
- Availability of budget and resources
- Field/Facilities life considerations

Consideration of these points is critical, particularly with reference to the risk ranking and implementation exercises as it may significantly alter the logic and prioritization.
Risk Reduction Planning

<table>
<thead>
<tr>
<th>Hierarchy of Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
</tr>
<tr>
<td>Systems to control the primary initiating events</td>
</tr>
<tr>
<td>Detection</td>
</tr>
<tr>
<td>Systems to detect the primary safeguards have failed</td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Systems to prevent the event from escalating and bring plant to a safe state</td>
</tr>
<tr>
<td>Mitigation</td>
</tr>
<tr>
<td>Systems to minimize the effects of an event</td>
</tr>
<tr>
<td>Emergency Response &amp; Lifesaving</td>
</tr>
<tr>
<td>Systems to allow you to safely muster and evacuate</td>
</tr>
</tbody>
</table>
Contribution to the risk reduction

The gaps can be assigned to one of the following categories:

- Prevent Controls
- Detection Controls
- Control and Mitigation
- Emergency Response / Lifesaving, and,
- Others

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<td></td>
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Cost/Time analysis of recommendations
For the costing information, the following four broad categories (1-4) can be used or developed for specific use:

1) >$10M
2) $1M-$10M
3) >$100k-$1M
4) <$100k

For the implementation timing estimations, the following three broad categories (1-3) can be used or developed for specific use:

1) >12 months
2) 3-12 months
3) <3 months
### Cost/Time Analysis (CTA) Matrix

- **1-4** - implementation has the highest cost and longest time profile
- **6,8,9** – implementation has a medium cost and time profile
- **12** – implementation has the lowest cost and quickest time

#### Cost/Time Matrix

<table>
<thead>
<tr>
<th>Time</th>
<th>&gt;$10M (1)</th>
<th>$1-10M (2)</th>
<th>$100k-1M (3)</th>
<th>&lt;$100k (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;12months</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3-12months</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>&lt;3months</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>
Risk Reduction Planning

Contribution to risk reduction against cost/time benefit

Low Contribution  To  High Contribution

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**cost/time Analysis (CTA)**

- 1-4 - implementation has the highest cost and longest time profile
- 6,8,9 – implementation has a medium cost and time profile
- 12 – implementation has the lowest cost and quickest time
Risk Reduction Planning

Risk Reduction Matrix (contribution to risk reduction against cost/time benefit)

<table>
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<th>Cost / Time Analysis (CTA)</th>
<th>Others</th>
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<th>Control / Mitigate</th>
<th>Detect</th>
<th>Prevent</th>
</tr>
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<tbody>
<tr>
<td>(1-4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6,8,9)</td>
<td></td>
<td></td>
<td>X Number of Actions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(12)</td>
<td></td>
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The recommendations/gaps plotted against this matrix, as:
- Red – the highest overall benefit
- Amber – a mid range benefit
- Green – the lowest overall benefit
Risk Reduction Planning

- It is not unreasonable to assume that some of those actions currently showing as medium priority, but which are in close proximity to the high priority zone could be promoted to high.

- Equally some of those actions currently showing as medium priority but which are in close proximity to the low priority zone could be demoted to low.

- It may be reasonably argued that detection, control and mitigation are equally as important as prevention. If one accepts that loss of containment events will occur then such an argument is particularly strong, however, the initial control of hydrocarbon releases has been taken to be dominant.
Risk Reduction Planning

- The priority actions are clearly those which make a positive contribution to safe operation, aim to prevent a Major Accident Events and can be executed and implemented within the shortest time span.

- This does not negate those actions which may take longer to implement, and may cost more. Judgments at this stage require a greater depth of knowledge on issues such as risk appetite, field life, budgeting, project initiatives etc.
THANK YOU

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