Efficient Safety Critical Element Identification for Onshore Facilities

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Catastrophic Onshore Incident
Failure or Ineffective Layers of Protection

Level Gauge

Detection System

High Level Switch

Dike Area
Safety Critical Element Definition

SCEs are any part of installation, plant or computer program whose failure, Absence and Inactivity will either cause or contribute to a major accident.
Safety Case – PSM Relationship

Safety Case

- Hazard Assessment
- Bow-Tie
- Safety Critical Element

Operations

- Performance Standard
- Verification Scheme
- Safety Critical Task
## Major Hazard Identification

<table>
<thead>
<tr>
<th>Likelihood/Impact</th>
<th>Nearly No</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Disaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will Happen</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
<td>Extreme</td>
</tr>
<tr>
<td>Most likely</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
</tr>
<tr>
<td>Possible</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>Extreme</td>
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<tr>
<td>Unlikely</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Rare</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
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</table>
Safety Critical Element Characteristics

- Be able to prevent a threat
- Be effective to mitigate a consequence
- Be independent from other critical element in same threat line

<table>
<thead>
<tr>
<th></th>
<th>Jet Fire</th>
<th>Pool Fire</th>
<th>Leakage Spillage</th>
<th>Toxic Release</th>
<th>Explosion</th>
<th>Overpressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Detection</td>
<td>P</td>
<td></td>
<td>C/M</td>
<td></td>
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<tr>
<td>Fire Detection</td>
<td>M</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Fireproofing</td>
<td>M</td>
<td>M</td>
<td></td>
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<tr>
<td>Fire Protection</td>
<td>M/E</td>
<td>M/E</td>
<td>M/C</td>
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<tr>
<td>Secondary Containment</td>
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<td></td>
<td>C</td>
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<td>PSV</td>
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<td></td>
<td></td>
<td></td>
<td>P/C</td>
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<tr>
<td>Level Switch High</td>
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<td></td>
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<tr>
<td>Blowdown Valve</td>
<td>M</td>
<td></td>
<td></td>
<td>M</td>
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<td>Flare Line</td>
<td>M</td>
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<td>M</td>
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<tr>
<td>Safe Haven Building</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td></td>
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</tr>
</tbody>
</table>
Pre-requisite Studies

Number of Barriers:

✓ Depends on Effectiveness of SCE.
✓ Decide on the number and type of barriers by the means of supporting studies
Performance Standards

• Performance standards provide strategy for operations to ensure the following objectives of SCE are achieved:
  – Functionality
  – Availability
  – Reliability
  – Survivability
  – Dependability
SIL Study and SCE Identification

• SIL is a method to justify the reliability and availability of a preventive SCE (barrier) in a hazardous event.

• If the identified SIL doesn’t reduce the risk to a tolerable level then another independent safety barrier (different type) is needed.
Do we Need it in Canada?
ABS A

ABS A AB-525:
The ORA shall include a list of Safety Critical Elements utilized in the determination of the Maximum Upset Pressure.

The Owner shall have a system for documenting, monitoring and maintaining the safety critical elements which impact each OPPSD case.
Effective SCE Process

Identification

- HAZOP and SIL are not adequate for the projects
- Ensure sufficient attention to abnormal operations
Effective SCE Process

**Analysis:**
- Comprehensive SCE identification process supporting by quantitative studies

**Management:**
- Including all essentials supplier requirement in performance standard
- Management of Change
- Asset integrity management and periodic verification Code and Standard compliance
Thank you

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