Thums Long Beach Company
Process Risk Management Program
Process Risk Management Overview

• Thums an Occidental Oil and Gas Company
• Operating Philosophy
• What is Process Risk Management (PRM)?
• Process Risk Management Objectives
• PRM Program Process
• Hazards Assessments
• The risk reduction process
• Written PRM program
• Reporting results Program follow up
**PRM**

*The Long Beach Unit*

- Southern portion of the East Wilmington field
- Owner - State of California
- Overseen by State Lands commission
- Operator - City of Long Beach, Department of Oil Properties
- Contract operating company - Thums (Oxy)
PRM

Thums Long Beach Company

- Texaco, Humble (Exxon), Union, Mobil, Shell
- Arco, BP, Occidental Oil and Gas Company (OOGC)
- 32,000 B/D Oil, 9MMcfd gas, 800K B/d Water Injection
- Five upstream operating locations, Gas dehydrating & sales, Power generation (under construction)
Corporate wide Health, Environment and Safety (HES) direction

- OOGC facilities shall be designed, built and operated in a safe manner so as to minimize the potential risks to personnel, assets and the environment
What is the Process Risk Program?

- A program that provides a means to identify and increase awareness of foreseeable process and operational risks that could potentially lead to an unplanned and unwanted event. The PRM process leads to recommendations that would eliminate or mitigate such risks.
Process Risk Management Objectives

• To understand HES and process risks to the same degree as other business risks.

• To provide a means to categorize risks in a standardized & uniform way corporate wide.

• To ensure management is aware of risks, their rankings and mitigation actions.

• To ensure that the knowledge of risks are considered in the quality of business decisions.

• To be used as a tool to evaluate the effectiveness of HES programs
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Process Risk Management Program Process

- Preliminary screening to identify general hazards and determine which regulatory programs apply (PSM, RMPP, etc.)
- Detailed Process Hazards Review w/validations
- Identify measures to mitigate identified risks
- Report remaining higher level risks (if any) to OOGC
- Follow up plan for new or modified facilities
• Initial screening verified PSM facility - B&M

• Choose to implement PRM program in addition to other regulatory required programs (Thums decision)

• Initial risk screening identified potential higher risk systems
Identified systems, processes and Operating procedures

Conduct Hazards Assessment using field expertise
  - Consequences of an event
  - Likelihood of Occurrence
  - Grade and rank

Validated hazards and assumptions

Summarize hazards
PRM

Hazards Review Process

• Identify all systems

• Identify system break points or nodes

• Analyze nodes considering significantly different hazards
  – example: wellhead manifold corrosion and loss of containment vs. human error

• Hazard Register - node, possible hazards, Scenario that could result from the hazard, outcome, initial preventative measures and mitigation measures
# Sample Systems and Hazards

<table>
<thead>
<tr>
<th>HR No.</th>
<th>System</th>
<th>sub-node</th>
<th>Hazards</th>
<th>Scenario</th>
<th>Incident Outcome</th>
<th>Preventative/protective Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>system break point</td>
<td>Pressure, flammability, corrosion, human error, natural catastrophe,</td>
<td>Possible condition that may result in hazard</td>
<td>Oil spill, fire, injury, etc.</td>
<td>Operating procedures, maintenance, basic alarms &amp; shut downs, manual isolation, monitoring,</td>
</tr>
<tr>
<td>1A</td>
<td>Oil gathering</td>
<td>Wellhead downhole</td>
<td>Pressure - communication to surface, loss of well control, Flammability, fire, communication to ocean</td>
<td>Breakdown in well casing or pressure communication outside casing to surface</td>
<td>blowout, fire, toxic release</td>
<td>Operating &amp; Maint. Procedures, monitoring,</td>
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<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td>1B1</td>
<td>Wellhead to manifold</td>
<td>Corrosion, pressure containment failure, spill on location</td>
<td>Line failure due to corroded pipe.</td>
<td>Contained spill</td>
<td>NDT of piping systems, replacement program, monitoring</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B2</td>
<td></td>
<td>Human error - close system</td>
<td>Inadequate closure of flow line valve at FWKO manifold.</td>
<td>Contained spill</td>
<td>Training, tag and flag program, operator supervision, well page drains</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manifold through FWKO</td>
<td>Pressure, flammability, human error</td>
<td>Closure of downstream water or oil valves, failure of control valves, downstream pressure increase</td>
<td>gas release through vent system</td>
<td>Basic alarms and shut downs, vent relief system, remote isolation/shut down monitoring</td>
<td></td>
</tr>
<tr>
<td>1D</td>
<td>FWKO through transfer pumps</td>
<td>Pressure - flammability</td>
<td>Closure of downstream valve, increase in downstream pressure</td>
<td>Local oil spill, fire</td>
<td>Basic alarms and shut downs, vent relief system, remote isolation/shut down monitoring</td>
<td></td>
</tr>
</tbody>
</table>
OIL GATHERING SYSTEM
ANALYSIS POINTS
• Review for worst case scenario

• Determine consequences - worst case
  – Personnel
  – Plant/Process Unit Operations
  – Environmental
  – Public

• Determine likelihood for each consequence

• Calculate risk for each consequence
## HAZARD REGISTER

**Rev. No.:** 1  
**Date:** April 2001  
**Facility Overall Risk:** (Absecon Case Scenario)

### Plant/Process Unit Operating Mode
- [x] Normal Operation
- [ ] Shutdown
- [ ] Maintenance/Inspection

### Process Hazard (1)
- Process hazard: Communication to surface, loss of well control, item 1.

### Initiation Event (2)
- Pressurization failure, earthmoving equipment failure

### Escalating Event (3)
- Equipment failure, item 1

### Facility Description
- Production and water injection well, wellhead downhole
- Scenario: Breakdown in well casing or communication outside casing to surface

### Preventive Measures
- [ ] Process Hazard Reviews
- [x] Mechanical Integrity Program
- [ ] Management of Change Program
- [ ] Operating & Maintenance Procedures
- [ ] Safe Work Practices

### Protective Measures
- [ ] Basic & Critical Process Controls
- [x] Gas & Fire Detection Systems
- [ ] Pressure Relief and Vent Systems
- [ ] Remote HFC/ESD Systems
- [ ] Automatic SIS or ESD Systems

### Mitigation Measures
- [ ] Adequate Spacing and Layout
- [x] Drainage and Containment Systems
- [ ] Fire Protection Systems
- [ ] Blast Resistant Structures/Buildings
- [x] Personal Protection Equipment

### Consequence Rating
- Personnel: 1
- Plant/Process Unit Operations: 8
- Environment: 8
- Public: 16

### Likelihood Rating
- Personnel: 1
- Plant/Process Unit Operations: 1
- Environment: 1
- Public: 2

### Consequence x Likelihood = Risk Ranking
- Personnel: 1
- Plant/Process Unit Operations: 8
- Environment: 8
- Public: 32

Note: From the consequence table select a consequence ranking value for each of the parameters and record those values in the respective box.

Note: From the likelihood table select a likelihood ranking value for each of the parameters and record those values in the respective box.

Note: Based on the Consequence and Likelihood values, multiply and record the product of both these ranking values. The largest value shall be used to determine the Risk Ranking for this hazard.
# Example Consequence Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Critical</th>
<th>Catastrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranking</td>
<td>1</td>
<td>8</td>
<td>16</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

**Personnel**

Property damage and/or loss of revenue less than 500 M$.  
Property damage and/or loss of revenue ranging from 500 M$ to 10 MM$.  
Property damage and/or loss of revenue ranging from 10 MM$ to 25 MM$.  
Property damage and/or loss of revenue ranging from 25 MM$ to 100 MM$.  
Property damage and/or loss of revenue in excess of 100 MM$.

**Environmental**

**Public**
<table>
<thead>
<tr>
<th>Category</th>
<th>Insignificant</th>
<th>Remote</th>
<th>Infrequent</th>
<th>Occasional</th>
<th>Frequent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranking</td>
<td>0.5</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Quantitative</td>
<td>Less than $1 \times 10^{-6}$</td>
<td>Between $1 \times 10^{-6}$ and $1 \times 10^{-4}$ (e.g., multiple instrument or valve failures; or human errors; or spontaneous tank or vessel failures).</td>
<td>Between $1 \times 10^{-4}$ and $1 \times 10^{-3}$ (e.g., combination of instrument failures and human errors; or full bore failures of process lines or fittings).</td>
<td>Between $1 \times 10^{-3}$ and $1 \times 10^{-2}$ (e.g., dual instrument or valve failures; hose ruptures; piping leaks).</td>
<td>Greater than $1 \times 10^{-2}$ (e.g., single instrument valve failures; hose leaks; or human error in every day activity).</td>
</tr>
<tr>
<td>Layers of Protection</td>
<td>Four or more independent, highly reliable safeguards in place; failure of three safeguards would not initiate an unwanted event.</td>
<td>Three independent, highly reliable safeguards in place; failure of two safeguards would not initiate an unwanted event.</td>
<td>Two independent, highly reliable safeguards in place; failure of one would not initiate an unwanted event.</td>
<td>Single level, highly reliable safeguard in place to prevent an unwanted event.</td>
<td>Procedures and/or operator interface relied upon to prevent unwanted events.</td>
</tr>
<tr>
<td>(See Layers of Protection Analysis — Form No. 60.400.210.F02)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazard Scenario</td>
<td>Should not occur during the life of the process, and there is no industry experience to suggest it will occur.</td>
<td>Similar events are unlikely to occur, but have occurred in this type of process somewhere within this industry.</td>
<td>Likely to occur somewhere within this industry during the life of this general type of process.</td>
<td>Will almost certainly occur somewhere within this industry during the life of this specific type of process (but not necessarily at this location).</td>
<td>Has occurred somewhere within the industry in this specific type of process and/or is likely to occur at this location during the life of this facility.</td>
</tr>
<tr>
<td>LIKELIHOOD</td>
<td>Minor</td>
<td>Moderate</td>
<td>Major</td>
<td>Critical</td>
<td>Catastrophic</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>----------</td>
<td>-------</td>
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<td>--------------</td>
</tr>
<tr>
<td>Remote</td>
<td>A (1)</td>
<td>B (8)</td>
<td>B (16)</td>
<td>C (50)</td>
<td>D (100)</td>
</tr>
<tr>
<td>Infrequent</td>
<td>A (2)</td>
<td>B (16)</td>
<td>C (32)</td>
<td>D (100)</td>
<td>E (200)</td>
</tr>
<tr>
<td>Occasional</td>
<td>A (5)</td>
<td>C (40)</td>
<td>C/D (80/100)</td>
<td>D (250)</td>
<td>E (500)</td>
</tr>
<tr>
<td>Frequent</td>
<td>B (10)</td>
<td>C (80)</td>
<td>D (160)</td>
<td>E (500)</td>
<td>E (1000)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONSEQUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
• Level E (Highest Risk)

• Level D (High Risk)

• Level C (Intermediate Risk)

• Level B (Moderate risk)

• Level A (Low risk)
A company-wide mandated response is required for each risk level.

Risk must be discussed with a management level that is commensurate with the risk.

Higher risks require annual review to determine if additional mitigation opportunities are available.
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Risk Validation

• Team with facility and operational experience, systems knowledge

• Includes OOGC Corporate HES representation

• Confirm assumptions

• Validate findings
• Review findings with Maintenance and Operations
  – Verify initial assumptions and that all layers of protection have been considered
  – Determine risk reduction alternatives
  – Establish program for implementing risk reduction measures as warranted
  – Prepare new Hazard Register with risk reduction measures

• Document and report final risk assessment
## Sample Process Hazards Summary

<table>
<thead>
<tr>
<th>Location:</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>System/sub-node</td>
<td>Hazards</td>
</tr>
<tr>
<td>Risk Cat. &amp; Rank</td>
<td>Risk Reduction Alternatives</td>
</tr>
<tr>
<td>Modified Risk</td>
<td>Implement Time</td>
</tr>
</tbody>
</table>

| HR No. |  |  |  |  |  |  |
|--------|--------|-------------------|-----------------|-----------------|-----------------|
| 1A     | C100   | Public            | Flammable storage system | Flammable, fire explosion | Fire suppression system | C40 | 6 months | $50,000 |
| 2B     | C80    | Plant             | Oil Shipping pumps      | Loss of containment, fire | Shut down system, berm with pump | C32, B10 | 1 months, 3 months | $5000, $1000 |
| 3      | C40    | Environ.          | Berms, sumps & equipment | Loss of containment, environmental | Sump level alarm, Extend burn | B16, B8 | 3 months, 6 months | $1000, $10,000 |
Thums Written PRM Program

- Develop elements following OOGC guidelines
- Ensure program meets regulatory requirements and adheres to industry standards
- Customized to reflect processes currently in place
Program Elements

• Facilities Technical Information
• Process Hazards Review and Risk Assessment
• Management of Change
• Operating and Maintenance Procedures
• Quality Assurance and Mechanical Integrity
• Pre-Startup Safety Reviews
• Documents Thums business structure
  – Element scope
  – Program requirements
  – Procedures
  – Responsibilities
  – Documentation requirements
• Addresses elements required in a recognized safety management system
PRM

Summary

• RM program required for all OOGC assets
• Structured, phased implementation process
• Customized to suit each asset
• Reality check for perceived hazards
• Mitigation process
• Reporting requirements
• Follow up process for new or changed facilities