Thums Long Beach Company
Process Risk Management Program

PRM

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

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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)

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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)

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Oxy Operating Philosophy

- 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

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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.

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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

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Preliminary Screening

- 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

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Hazards Risk Assessment Process

- 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

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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

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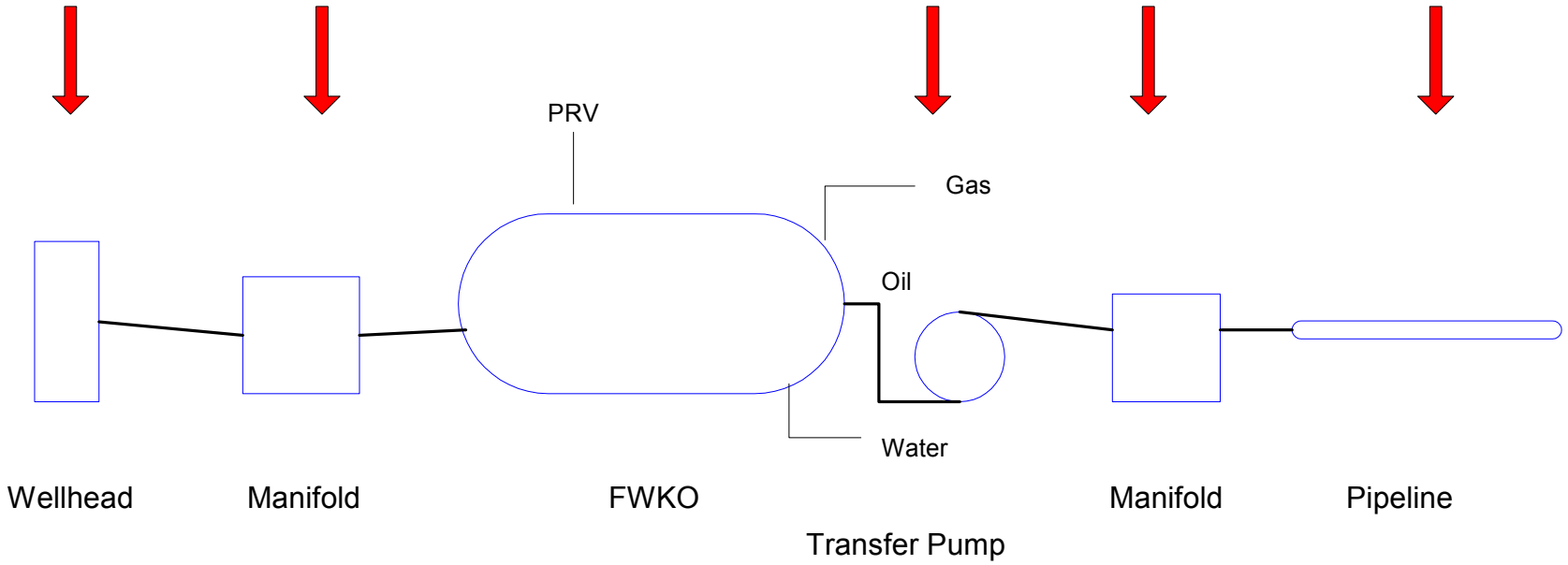
Sample Systems and Hazards

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



OIL GATHERING SYSTEM
ANALYSIS POINTS

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Hazards Analysis

- 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.	Date	Description	Issued	Approved	Form No. / Page
					60.400.102.F01
1	April 2001	Facility Overall Risk (Worst Case Scenario)			Page: 1 of 5

Asset:	Plant/Process Unit:	Hazardous Material and Inventory:
Thums Long Beach Company	Island Location	Prd. Wtr/Oil
HR No: 1A / System: Oil Gathering	Equipment: Wellhead downhole	Operating Conditions: Pressure (psig): 2000+ / Temperature (°F): 140

Plant / Process Unit Operating Mode	Process Hazard (1)	Initiating Event (2)	Facility Description
☐ Startup ☒ Normal Operation ☐ Shutdown ☐ Maintenance/Inspection	Pressure, communication to surface, loss of well control, flammability,	Containment failure, earthquake	Production and water injection wells, wellhead downhole. Scenario: Breakdown in well casing or communication outside casing to surface
	Escalating Event (3)	Incident Outcome (4)	
	Equipment failure, human error	Spill, environmental incident	

Preventive Measures	Protective Measures	Mitigation Measures
☐ Process Hazard Reviews	☒ Basic & Critical Process Control	☐ Adequate Spacing and Layout
☐ Mechanical Integrity Program	☐ Gas & Fire Detection Systems	☒ Drainage and Containment Systems
☐ Management of Change Program	☐ Pressure Relief and Vent Systems	☐ Fire Protection Systems
☒ Operating & Maintenance Procedures	☐ Remote Process Isolation Systems	☐ Blast Resistant Structures/Buildings
☒ Safe Work Practices	☒ Automatic SIS or ESD Systems	☒ Personal Protection Equipment

Consequence Rating		Likelihood Rating		Consequence x Likelihood = Risk Ranking	
Personnel	1	Personnel	1	Personnel	1
Plant/Process Unit Operations	8	Plant/Process Unit Operations	1	Plant/Process Unit Operations	8
Environment	8	Environment	1	Environment	8
Public	16	Public	2	Public	32
Note: From the consequence table select a consequence ranking value for each of the parameters and record those values in their respective box..		Note: From the likelihood table select a likelihood ranking value for each of the parameters and record those values in their respective box..		Note: Based on the Consequence and Likelihood values, proceed and record the product of both in their respective boxes. The largest value shall be used to determine the Risk Ranking for the hazard.	

EXAMPLE CONSEQUENCE CATEGORY

	Consequence				
Category	**Minor**	**Moderate**	**Major**	**Critical**	**Catastrophic**
Ranking	**1**	**8**	**16**	**50**	**100**
Personnel					
Propert Damage and/or Loss of Revenue	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					

	Likelihood				
Category	**Insignificant**	**Remote**	**Infrequent**	**Occasional**	**Frequent**
Ranking	**0.5**	**1**	**2**	**5**	**10**
Quantitative	Less than 1×10^{-6}	Between 1×10^{-6} and 1×10^{-4} (e.g., multiple instrument or valve failures; or human errors; or spontaneous tank or vessel failures).	Between 1×10^{-4} and 1×10^{-3} (e.g., combination of instrument failures and human errors; or full bore failures of process lines or fittings).	Between 1×10^{-3} and 1×10^{-2} (e.g., dual instrument or valve failures; hose ruptures; piping leaks).	Greater than 1×10^{-2} (e.g., single instrument valve failures; hose leaks; or human error in every day activity).
Layers of Protection (See Layers of Protection Analysis – Form No. 60.400.210.F02)	Four or more independent, highly reliable safeguards in place; failure of three safeguards would not initiate an unwanted event.	Three independent, highly reliable safeguards in place; failure of two safeguards would not initiate an unwanted event.	Two independent, highly reliable safeguards in place; failure of one would not initiate an unwanted event.	Single level, highly reliable safeguard in place to prevent an unwanted event.	Procedures and/or operator interface relied upon to prevent unwanted events.
Hazard Scenario	Should not occur during the life of the process, and there is no industry experience to suggest it will occur.	Similar events are unlikely to occur, but have occurred in this type of process somewhere within this industry.	Likely to occur somewhere within this industry during the life of this general type of process.	Will almost certainly occur somewhere within this industry during the life of this specific type of process (but not necessarily at this location).	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.

			CONSEQUENCE				
			Minor	Moderate	Major	Critical	Catastrophic
			1	8	16	50	100
LIKELIHOOD	Frequent	10	B (10)	C (80)	D (160)	E (500)	E (1000)
	Occasional	5	A (5)	C (40)	C/D (80/ 100)	D (250)	E (500)
	Infrequent	2	A (2)	B (16)	C (32)	D (100)	D (200)
	Remote	1	A (1)	B (8)	B (16)	C (50)	D (100)
	Insignificant	0.5	A (0.5)	A (4)	B (8)	B (25)	C (50)

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Risk Levels

- Level E (Highest Risk)
- Level D (High Risk)
- Level C (Intermediate Risk)
- Level B (Moderate risk)
- Level A (Low risk)

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Risk Level Response

- 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

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Risk Mitigation

- 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

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Sample Process Hazards Summary

	Location:		Sample			Date: 9/11/02		
HR No.	Risk Cat. & Rank	Highest Risk to:	System/ sub-node	Hazards	Risk Reduction Alternatives	Modified Risk	Implement Time	Est. Cost
1A	C100	Public	Flammable storage system	Flammable, fire, explosion	Fire supression 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 burm	B16, B8	3 months, 6 months	$1000, $10,000

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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

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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

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Thums Written PRM Program - continued

- Documents Thums business structure
  - Element scope
  - Program requirements
  - Procedures
  - Responsibilities
  - Documentation requirements
- Addresses elements required in a recognized safety management system

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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