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Paper Title: Proactive Operator Monitoring (POM) as a Safety Barrier for a Global Service Company

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Introduction

• Recognition that our industry relies heavily on dynamic real-time human interaction as part of a robust assurance program.

• Failures during critical tasks where insufficient monitoring or responses led to incidents occurring, prompted a deeper review of the causes to understand ‘what lies beneath’.

• In order for Proactive Operator Monitoring to perform effectively as a barrier or safeguard, we need to ensure the conditions that support effective monitoring are in place.

Ref. IOGP Report No.566
In-depth Independent Review

• Commissioned a deeper independent review of our process/human barriers
  • Use 'what lies beneath' clear view thinking
  • Better understand how human factors influence the outcomes of tasks
  • Identify if operators are being set up to succeed or to fail

• Used existing process safety bowtie assessments where a significant number of barriers were related to monitoring tasks

• Review identified opportunity to take a ‘deep-dive’ into operator monitoring tasks to better understand what elements constitute these barrier and the threats against them

Tinted View
• Human actions are the cause of incidents
• Asks – who is responsible?
• Answers – why did it go wrong?
• Solutions “fix” the person
• Stops short of digging deeper

Clear View
• Human actions are influenced by systemic issues
• Asks – are we setting up people for success?
• Answers – how could this happen?
• Solutions include fixing organisational factors
• Digs deeper to find what lies beneath
Basis of the review

• Industry Good Practice
  • Centre for Chemical Process Safety ‘Bowties for Risk Management’ (2018)
  • Chartered Institute of Ergonomics and Human Factors (CIEHF) ‘Human Factors in Barrier Management’
    www.ergonomics.org.uk

• Barrier Properties. At least;
  • Independent
  • Effective
  • Auditable

• Active Barriers must have Detect, Decide, Act functionality

• Human error should NOT be modeled as a Threat (in a top level Bowtie)
  • It is a Degradation Factor that defeats Barriers. What is the Barrier it defeats?
  • Recommended by both CCPS and CIEHF.
Observations from existing BHGE BowTies

• Tubular Cutting and Milling
  • 6 Threats
  • 22 Barriers
    • 14 = Verify/ Confirm/ Review (Pre operations)
    • 4 = Monitor (During Operations)

• Primary Cementing (Operations)
  • 8 Threats
  • 20 Barriers
    • 3 = Verify/ Confirm/ Review (Pre operations)
    • 4 = Monitor (During Operations)
Suggested top-level Bowtie for service operations

Pressure in well exceeds planned controls

- Confirmed well conditions
  - Detect

- Confirmed state of existing barriers
  - Detect

- Validated plan
  - Decide

- Operation conducted according to validated plan
  - Act

Alarms and Operator Response

- Operation conducted in compliance with plan
  - Detect

Proactive Operator Monitoring and Response

- Proactive Operator Monitoring
  - Decide

- STOP
  - Decide

- MOC
  - Decide & Act

Hydrocarbons in Wellbore

- High pressure hydrocarbons in reservoir

Detect

Decide

Act

Detect

Decide & Act

Detect
Examples of Degradation Factors for Proactive Operator Monitoring

- Pressure in well exceeds controls
- Lack of risk awareness
- Unaware of personal role in POM
- Over-confidence in client well information

- Over-confidence in technology / alarms
  - Over-reliance on other people to POM
  - Over-confidence in other barriers
  - Not knowing what KRI to monitor
  - No independent sources of KRI

- Confirmation Bias
- POM not aligned with current state of operation
- Not aware that source of KRI is not functional

- Competing priorities or incentives
- Workload/ competing job demands

- KRI weak, uncertain or unambiguous
- KRI not accessible where and when needed for POM

Hydrocarbons in Wellbore

Operator proactive monitoring and response
“Extension” (CCPS) or “Level -1” (CIEHF) Bowties
An “Extension” (Level -1) Bowtie for Proactive Operator Monitoring

- Over-confidence in technology/alarms
  - Not taken seriously
  - Not completed
  - Not Effective

- POM training
  - KRI not shared
  - KRI not used
  - KRI not shared
  - KRI not available

- Awareness of KRI
  - Data not used
  - Data not shared
  - Data not available

- Awareness of system reliability performance
  - Known faults not shared
  - Complacency
  - Distraction

- Awareness of current faults in SCEs
  - Pre-job POM review
  - Chronic unease / Mindfulness

- POM inspection routines
  - Failure to monitor proactively

- Contractual arrangements
  - Not covered
  - Liability risk

- Protocols for handling KRI data
  - Don’t exist
  - Not followed

- Shift handover procedure
  - Not conducted
  - Incomplete
  - Ambiguous

- KRI not shared
  - Remote from hazards
### Prioritising Safeguards: Practicality x Impact Assessment

<table>
<thead>
<tr>
<th>Practicality</th>
<th>Impact</th>
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<tbody>
<tr>
<td>Simple actions can be implemented with little effort.</td>
<td>Coalition would also improve other barriers</td>
</tr>
<tr>
<td>Little capital or resource requirement</td>
<td>Degradation factor is widely recognised as a risk</td>
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<tr>
<td>Few stakeholders</td>
<td>Little change from existing practice</td>
</tr>
<tr>
<td>Ease of Implementation</td>
<td>Confidence the action would quickly be effective</td>
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- **Agree** (score 5)
- **Somewhat Agree** (score 4)
- **Not Sure** (score 3)
- **Somewhat Disagree** (score 2)
- **Disagree** (score 1).
Practicality x Impact Plot

Trying to improve this Safeguard is impractical and would have little impact.

Action to improve these Safeguards is very practical and would have high impact.
## Examples of challenge / Barrier verification questions for POM

<table>
<thead>
<tr>
<th>Degradation factor</th>
<th>Description</th>
<th>Challenges / Barrier verification questions</th>
</tr>
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<tbody>
<tr>
<td>Lack of risk awareness</td>
<td>Not aware of criticality or heightened risk in current operational state</td>
<td>• Does training ensure a competent person would understand the risks?</td>
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<td>• Do pre-job briefings ensure all crew are aware of heightened risk?</td>
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<tr>
<td>Over-confidence in client or 3rd party information</td>
<td>Uncritically accepts KRI information provided by the client or 3rd parties</td>
<td>• Do client’s explain uncertainties in operational information?</td>
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<tr>
<td></td>
<td></td>
<td>• Could 3rd parties have a different view of operational risks?</td>
</tr>
<tr>
<td>Over-confidence in technology</td>
<td>Over confidence alarms, or technical systems will intervene</td>
<td>• Do the team get feedback on the reliability of critical alarms or equipment?</td>
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<tr>
<td></td>
<td></td>
<td>• Is it normal to carry on with operations when critical equipment has reliability problems?</td>
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Closing Remarks & Learnings

- Verification (pre-operations) and Proactive Operator Monitoring (during operations) play a critical role in assuring the safety of service company operations

- Applying a ‘What Lies beneath’ approach identified many organisational and psychological factors that can degrade or defeat POM

- Identified need for barriers with POM to be strength tested to understand and be confident of it’s role – Proactive Operator Monitoring Assessment Tool (POMAT) developed (see paper SPE-190670-MS)

- Areas of potential weakness identified built back into barrier Threat Response Scenarios to test and reinforce employees responses
  - Mixed reality software at booth to demonstrate a way of achieving this

- Provided it is properly implemented and supported, POM is vital to a full barrier system

- Further highlighted the importance of a shared understanding and collaboration between barrier owners and those that depend on their ability to function effectively
Acknowledgements / Thank You / Questions