20 YEARS
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an ACTEON company
Interpretation of Subsea Inspection Data

Subsea Integrity Management Summit
Dharmik Vadel
10 September 2013
Agenda

- Objectives of inspection
- Inspection planning
- Data interpretation examples
  - Marine growth observations
  - Cathodic protection data
  - UT wall thickness data
- Considerations for future inspections
- Conclusions
Objectives of Inspection

- Government Regulations
- Organizational Goals
- Industry Best Practices
- Design Requirements
Objectives of Inspection

- Determine Fitness for Service
- Confirm effectiveness of barrier(s)
- Increase knowledge of operational condition(s)
## Inspection Planning

| Why     | Compliance  
<table>
<thead>
<tr>
<th></th>
<th>Fitness for Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>What</td>
<td>Equipment (Object/Defect/Extent)</td>
</tr>
</tbody>
</table>
| Where   | Internal/External  
|         | Fatigue critical locations  
|         | Anomalous locations  |
| When    | Risk based  
|         | Prescriptive  
|         | Event based  |
| How     | GVI, CVI, UT, CP, Pigging  |
| Who     | Operators, Inspectors, Engineers  
|         | Certification/Training  |
Inspection Data Types

Pictures

Videos

Report

Tables

<table>
<thead>
<tr>
<th>Component</th>
<th>Reading</th>
<th>CP Potential</th>
<th>Visual/Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>1</td>
<td>-200mV</td>
<td>No corrosion observed</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-950mV</td>
<td>No corrosion observed</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-200mV</td>
<td>Minor corrosion damage</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>-980mV</td>
<td>No observations</td>
</tr>
<tr>
<td>Manifold</td>
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<td>-200mV</td>
<td>No corrosion observed</td>
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Data Quality and Relevance

**Scope**
- Subsea field
- Equipment(s)

**Quality**
- Inspection tool calibration
- Post processing

**Relevance**
- Failure mechanism
- Trends analysis
- Barriers/Mitigation effectiveness
Data Interpretation Process

- Observations
- Potential Risks
- Engineering Assessment
- Way Forward
Data Interpretation - Marine Growth

Observations
- Levels of marine growth
- Interference with visual condition assessment

Potential Risks
- Reduction in VIV suppression effectiveness
- Clashing risk from increased drag

Engineering Assessment
- Trend analysis – baseline/historic MG levels
- VIV fatigue analysis
- Clashing analysis

Way Forward
- Marine growth cleaning intervals
- Visual inspections
Data Interpretation
- Cathodic Protection Data
Data Interpretation
- Cathodic Protection Data

Observations
• Cathodic potential measurements
• Anode wastage levels

Potential Risks
• Inadequate cathodic protection
• Increased external corrosion risk

Engineering Assessment
• CP system design review
• Trend analysis – Baseline/Historic CP results
• Determination of remaining life of anodes

Way Forward
• CP inspection intervals
• Retrofit anode sled
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<th>Engineering Assessment</th>
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<td>• Wall thickness measurements</td>
<td>• Potential for leak</td>
<td>• Fitness for service assessments</td>
<td>• UT inspection intervals</td>
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<td>• Visual corrosion/coating damage</td>
<td>• Excessive wall loss – derate system</td>
<td>• Trend analysis – baseline/historic UT data</td>
<td>• Wall thickness loss rate</td>
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<td>• Determination of remaining life</td>
<td>• Permanent mitigation</td>
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Potential Risks:
- Potential for leak
- Excessive wall loss – derate system

Engineering Assessment:
- Fitness for service assessments
- Trend analysis – baseline/historic UT data
- Determination of remaining life

Way Forward:
- UT inspection intervals
- Wall thickness loss rate
- Permanent mitigation

Data Interpretation - UT Inspection Data

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Considerations for Future Inspections

- Risk Assessment is a tool to define inspection intervals
- Inspection work scopes
  - Define specific requirements
  - Provide historic information
  - Inspection data sheets versus data logs
- Video quality and display requirements
  - HD versus SD
  - ROV overlay
- Inspection tools
  - Repair kit, Cleaning, CP, UT
Effective Work Scope - Examples

- CP measurement locations
- Flange and bolt corrosion
Conclusion

- Interpretation of subsea inspection data depends upon
  - Relevant and quality inspection data
  - Baseline and historic inspection data
  - Knowledge of equipment design
  - Awareness of potential risks to your equipment

- A successful inspection campaign depends upon
  - Inspection planning
  - Detailed work scopes
  - Communication - pre and post inspection meetings

- Right people for the right job

- Review and update your inspection cycle periodically based on documented operational history
Thank you

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