Life Extension of Ageing Platform Well Conductors

T. King Lim, H. Howells, E. Tellier

AOG
February 2017
Life Extension of Ageing Platform Well Conductors

Tze King Lim, Elizabeth Tellier, Hugh Howells
AOG 2017, Perth
22nd February 2017

Learn more at www.2hoffshore.com
Ageing Conductor Integrity Challenges

- Multiple ageing wells, requiring life extension of 20-30 years
- Limited records of construction and maintenance
- Heavily corroded (~60% wall loss)

Learn more at www.2hoffshore.com
Agenda

- Introduction
- Analytical Integrity Assessment
- Measuring Axial Load
- Remedial Measures
- Conclusions

Learn more at www.2hoffshore.com
Platform Conductor Assessment

- Sources of conductor loading:
  - Well construction loads
  - Drilling equipment
  - Production thermal loads
  - Environmental loads – waves and currents

- Typical analysis:
  - Strength and stability
  - Fatigue

- Uncertainty in loads requires conservative assumptions

Learn more at www.2hoffshore.com
Case Study

- 13m water depth
- Wells have been in service for 30 years with life extension for a further 25 years
- 30in conductor, 13-3/8in surface casing
- Severe corrosion found in many conductors

Learn more at www.2hoffshore.com
Loading Uncertainties

- Typically assume all well tubulars supported at surface
- Casing bottom support often evident
- Robustness of conductor foundation uncertain
- Leads to variability in load sharing

Learn more at www.2hoffshore.com
Zakum Field Corroded Conductor Assessment

VON MISES / YIELD (UZ-108 WELL)

100 Year RP; 30in Conductor; No Corrosion

100 Year RP; 30in Conductor; Measured Corrosion

Preload Group 1
Preload Group 2
Preload Group 3
Preload Group 4
Preload Group 5

Measured Wall Thickness
0.875" (uncorroded)

Measured Wall Thickness
0.629"
0.650"
0.602"
0.472"
0.512"
0.335"
0.354"

Mean Sea Level

Upper Guide
Lower Deck
Lower Guide

Learn more at www.2hoffshore.com
How Much Corrosion is Allowed?

ALLOWABLE CONDUCTOR WALL THICKNESS
30in Conductor; Conductor Supported

- von Mises / Yield = 1.0
- von Mises / Yield = 0.8
- von Mises / Yield = 0.6

Preload Group 1: 61.8% corrosion, 0.335in wall thickness
Preload Group 2: 48.6% corrosion, 0.450in wall thickness
Preload Group 3
Preload Group 4
Preload Group 5
No corrosion, 0.875in wall thickness

Learn more at www.2hoffshore.com
Axial Load Measurement

- ASTM hole drilling method
- Apply strain gauges
- Drill hole to half wall thickness
- Measure change in strain during drilling
- Measurements interpreted into axial stress through wall thickness

Learn more at www.2hoffshore.com
Offshore Implementation of Load Measurement

Learn more at www.2hoffshore.com
Typical Axial Stress Results

Mid-wall stress represents average across thickness
Averaged between 2 diametrically opposite tests to remove bending effects

Learn more at www.2hoffshore.com
Example Results

- Expected axial compression loads up to 1300kips
- Measured axial loads on 5 conductors of 300 to 1300kips
- Indication of bottom support for casings
- Preloads lower than expected
- Increased corrosion acceptable, delaying need for remedial measures

Learn more at www.2hoffshore.com
Conductor Sleeve

- Two half shells secured around conductor
- Can be bolted or welded
- Restores structural integrity

Learn more at www.2hoffshore.com
Grouting

- Limits corrosion
- Provides load sharing between conductor and surface casing

Learn more at www.2hoffshore.com
Conclusions

- Significant need for conductor life extension worldwide
- Lack of information leads to conservative assumptions
- Conservative assumptions can result in unacceptable strength and fatigue performance
- Measurement of corrosion levels and axial loads are important inputs to integrity management plan
- Implement remediation where and when necessary

Learn more at www.2hoffshore.com
Questions?

Learn more at www.2hoffshore.com
Thank you

www.2hoffshore.com
Learn more at www.2hoffshore.com
<table>
<thead>
<tr>
<th>Rev</th>
<th>Description</th>
<th>Date</th>
<th>Author</th>
<th>Checked</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Write revision description here</td>
<td>DD Mmm YY</td>
<td>X Yyyyy</td>
<td>X Yyyyy</td>
<td>X Yyyyy</td>
</tr>
</tbody>
</table>

Document No: pppp-TTT-nnnn

Client Ref: pppp-ttt-nnnn-xxx-zzzzz

**HARD COPIES ARE UNCONTROLLED**

Controlled copies of this document are only issued in the PDF format that includes digital signatures of the author, checker, and approver. These signatures can be viewed in Adobe Acrobat. The document will be digitally marked if it has been altered since signing. In order for recipients of documents to verify digital signatures, digital signature certificates may be requested from 2H.