Emergency Disconnect Procedures: Industry Approaches to DP Drift-Off Analysis

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Preview

- Background on DP Drillship Operations
- DP Watch Circles – Emergency Disconnect
- Drift-off Analysis Techniques
- Operations
- Conclusions
Drillship Operations

- Derrick
- Heave Compensator
- Rig Floor
- Riser Tensioners
- Drilling Riser
- DP Thrusters
- Blow Out Preventer
- Casing
Drilling Riser Management

● Objective:
  ■ Protect the vessel, riser and well
  ■ Establish limits on operations

● Scope:
  ■ Riser deployment
  ■ Riser tensioning
  ■ Emergency disconnect
  ■ Riser recoil
  ■ Storm hang-off
Emergency Disconnect

- What is emergency disconnect?
- How often does it happen?
- Allowable limits:
  - Conductor pipe – bending stress
  - Wellhead – bending moment
  - Riser bottom flex joint – limiting angle
  - Riser top flex joint – limiting angle, moonpool contact
  - Riser slip joint – stroke limits
  - Riser tensioners – stroke limits
- How are these managed? Watch Circles and Drift-Off Analysis.
Watch Circles: Concept

- Drift off analysis results
- POD
- EDS Time
- Red Alert Offset
- Yellow Alert Offset

- $T_{pod} = t_{(sec)}$
- $T_{RED} = t - EDS \text{ Time (sec)}$
- $T_{YELLOW} = t - EDS \text{ Time (sec)} - 90 \text{ sec}$
Watch Circles

- Thresholds that are color-coded yellow and red
- Established using drift-off analysis
- Based on scenarios of drift-off under total loss of power, drive-off, degraded thrusters, or other events

Offset definitions:
- Point of disconnect (POD) – offset at which any allowable limit is first exceeded
- Red – offset at which the emergency disconnect sequence (EDS) must be activated. Drillpipe would be sheared during EDS.
- Yellow – offset at which preparations begin prior to EDS
Watch Circles: Compass View
Drift-Off Analysis Results

Drift Off Analysis - Vessel Excursion From Well Centre

- Vessel Excursion - 10 ppg Mud Weight & 1455 k/p Top Tension

POINT OF DISCONNECT

RED ALERT OFFSET

70 sec
Drift-Off Analysis Techniques

- **Fully coupled analysis (state-of-the-art)**
  - Riser analysis fully coupled with vessel analysis
  - Includes riser restoring force, riser dynamics

- **Uncoupled techniques**
  - Vessel drift-off analysis without riser, static riser analysis
  - Vessel drift-off analysis without riser, dynamic riser analysis

- **Fixed offset**
  - Constant watch circle sizes, typically based on % water depth
Operations

- Dynamic Watch Circles (updates on the rig every 6 hours)
  - Prevailing or forecast weather
  - Changes in riser top tension or drilling mud weight
  - Can use coupled or uncoupled drift-off analysis
Fixed vs. Dynamic (Fully Coupled)
Conclusions

- Use of fully-coupled drift-off analysis makes a difference; providing a more realistic solution
- Regular updates of watch circles also make a difference, accounting for:
  - Prevailing weather
  - “What-if” forecast weather
  - Changes in top tension and mud weight
- Fully-coupled drift-off analysis is referenced as part of marine drilling riser assessments in ISO 13624-1 and ISO 13624-2.