An Operator's experience with Diving intervention

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Lundin Energy Norway
In 2020, Lundin Energy Norway conducted our first Manned Underwater Operation. This is a presentation of the process we went through in planning and preparation of the diving operation.
Offshore Diver Filip Muzinic
Overview of the presentation

1. Introduction to Lundin Energy Norway
2. Key contributing parties
3. Rolvsnes and Edvard Grieg tie-in locations
4. Concept risk evaluation: diving vs. diverless
5. Scope overview
6. Preparatory work
7. Work processes, roles and responsibilities
8. Verification and follow-up activities
9. Application for consent
10. Timeline
11. Pictures
12. Diving statistics
Lundin Energy Norway

- Contender on the Norwegian Continental Shelf since 2004, exploration since 2007

- Complete Operatorship since 2015
  - We explore better ways of producing and better ways of developing.

- Today: Among the five biggest operators on the Norwegian Continental Shelf.

- Compact, but very experienced organisation
  - Head Office at Lysaker
  - ~300 employees onshore (7 in Harstad)
  - ~100 employees offshore at Edvard Grieg
Key contributing parties

AkerBP – experience exchange
Equinor – experience exchange, emergency response support
Insea Quality Services – Advisor
NUI AS – Advisor, diving support services, hyperbaric contingency
Technip FMC – The diving contractor, lessons learned
Rolvsetnes Extended Well Test (EWT)
Rolvnes Tie-in to Edvard Grieg

Legend

- 4” Gas Lift Jumper, 155m
- 9.5” Production Jumper, 130m
- Diver tie-ins
Edvard Grieg tie-in locations R5 og R6
Concept risk evaluation: diver vs. diverless installation

Diverless solution presented by 4C Solutions

Both concepts:
- Technical feasible
- Operational risk acceptable
- Vessel in close proximity to platform

- Company doctor supported diving as safe operation and with low risk of injury
- Diving used by multiple operators on the NCS
- Contractor has extensive references from similar operations

**Conclusion for our case:**
- Diverless solution: Higher costs, higher complexity and longer operational period
- Lundin proceeded with use of diver assisted operations
Scope overview for the diver assisted operation

Diver scope
- Removal of Blind flanges
- Rigging for tie-in – ALBs, inverter lines, hold back rigging
- Tie-in – 9.5” Oil Production flexible jumper
- Free span support for 9.5” Oil Production flexible jumper
- Tie-in – 4” Gas Lift flexible jumper.
- Diver assistance during GRP cover and filter units installation
- Additional work: 4” GL connector seal replacement

Diverless scope
- Leak test
- GRP cover installation
- Filter unit installation
Preparatory work

✓ Lessons learned meetings with Contractor and experience gathering meetings with other Operators
✓ Contracted Diving Advisor
✓ Nominated company process owner
✓ Drafted work processes for planning and executing manned underwater operations
✓ Defined roles and responsibilities

Entered into membership/agreements with:

**NUI:** Diving support services

**Equinor:** Hyperbaric Lifeboat Rescue Support

**Kongsberg Maritime:** Weather monitoring decision support

**The Association Of Operators For Hyperbaric Lifeboat Reception Facilities (OFHB)**
Work processes for Manned underwater operations

Company manned underwater Operations manual

Contractor Diving scope method statement
Roles and Responsibilities

- **The Marine Operations lead** coordinates the MUO and together with an appointed Diving Advisor ensures appropriate planning and execution of the work.

- **The Diving Advisor (DA)** has a leading role during the planning, mobilization and execution of all MUO activities and ensures that all MUO is prepared and executed in accordance with the relevant rules, regulations, internal requirements and industry guidelines.

- **The Responsible Diving Doctor (RDD)** ensures that the Diving Contractor has adequate systems in place to verify, monitor and follow-up the occupational health aspects of divers in accordance with the relevant regulations and standards. He participates in the preparation of the application for consent to dive and is also engaged during the MUO.

- **The HSE Advisor** is involved in all phases of an MUO to ensure that all relevant HSE requirements are met and works closely with the SURF Lead during planning and execution of diving activities.

- **The Company Diving Representative (CDR)** ensures that all MUO is executed in line with the relevant rules, regulations and applicable guidelines. The CDR reports directly to the Offshore Client Representative lead during the work.

- **The Offshore Client Representative (OCR)** is the main representative on board the Diving Support Vessel (DSV) and is responsible for follow up all offshore operations on the vessel. The OCR works closely with the SURF Lead to rectify issues, and report progress and status regularly. The OCR also works closely with the CDR during the execution of MUO.
Verification and follow-up activities

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<td>0148</td>
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<td>Diving Operations Review (HAZID)</td>
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<td>Diving HAZID towards Operations</td>
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<td>Deep Arctic Diving OVID</td>
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<td>PSA Review of Manned Underater Operations (Diving)</td>
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<td>HIRA for Diving Operations</td>
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<td>Diving SIMOPS risk assessment</td>
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<td>0311</td>
<td>Deep Arctic Diving Vessel Mobilisation Brief</td>
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<tr>
<td>0306</td>
<td>Diving Operations Readiness Review</td>
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Application for consent (AfC)

Receiver: The Petroleum Safety Authority (PSA)
Case handling: 9 weeks

Application submitted: January 31st 2020
Meeting with Petroleum Safety Authority: March 26th 2020
Consent received: March 30th March 2020
Timeline

- **2019**
  - Concept Risk evaluation
  - Diving Advisor Planning commencement
  - Contractor Diving Method Statement
  - Diving Operations Review
  - Hyperbaric contingency agreement
  - Responsible Diving Doctor

- **2020**
  - Application for consent (AfC) submitted to PSA
  - Meeting with PSA
  - AfC Approved
  - Hyperbaric Lifeboat Rescue support Agreement with Equinor
  - Emergency Response Table Top
  - Hazard Identification Risk Assessment (HIRA)
  - July 22nd Operation commenced
  - July 18th Mobilization
  - Offshore Readiness Review
  - August 9th Divers out of compression
  - August 2nd Work completed
  - July 22nd Operation commenced
  - July 18th Mobilization
  - Offshore Readiness Review
  - Emergency Response Table Top
  - Hazard Identification Risk Assessment (HIRA)
Execution

Divers working with bolt tensioning on 9.5inch flange

Divers at diving bell ready for action
DSV Deep Arctic working next to Edvard Grieg
Job well done! Company representatives on deck
Diving Operation statistics

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<tr>
<th>Category</th>
<th>Value</th>
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<tbody>
<tr>
<td>Number of divers:</td>
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<tr>
<td>Working depth:</td>
<td>109m</td>
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<tr>
<td>Number of bell runs:</td>
<td>32</td>
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<tr>
<td>Total bell run time:</td>
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<tr>
<td>Total diver in water time:</td>
<td>233:42</td>
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<tr>
<td>Total manhours in Bell:</td>
<td>242:08</td>
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<tr>
<td>Total manhours in saturation:</td>
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Campaign duration: 19.8 days  
Diving operations duration: 11.8 days  
WOW: < 24 hours  
Divers decompression: 6 days

Scope successfully completed  
No injuries and no serious incidents!
Thank you for your attention!