

## 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

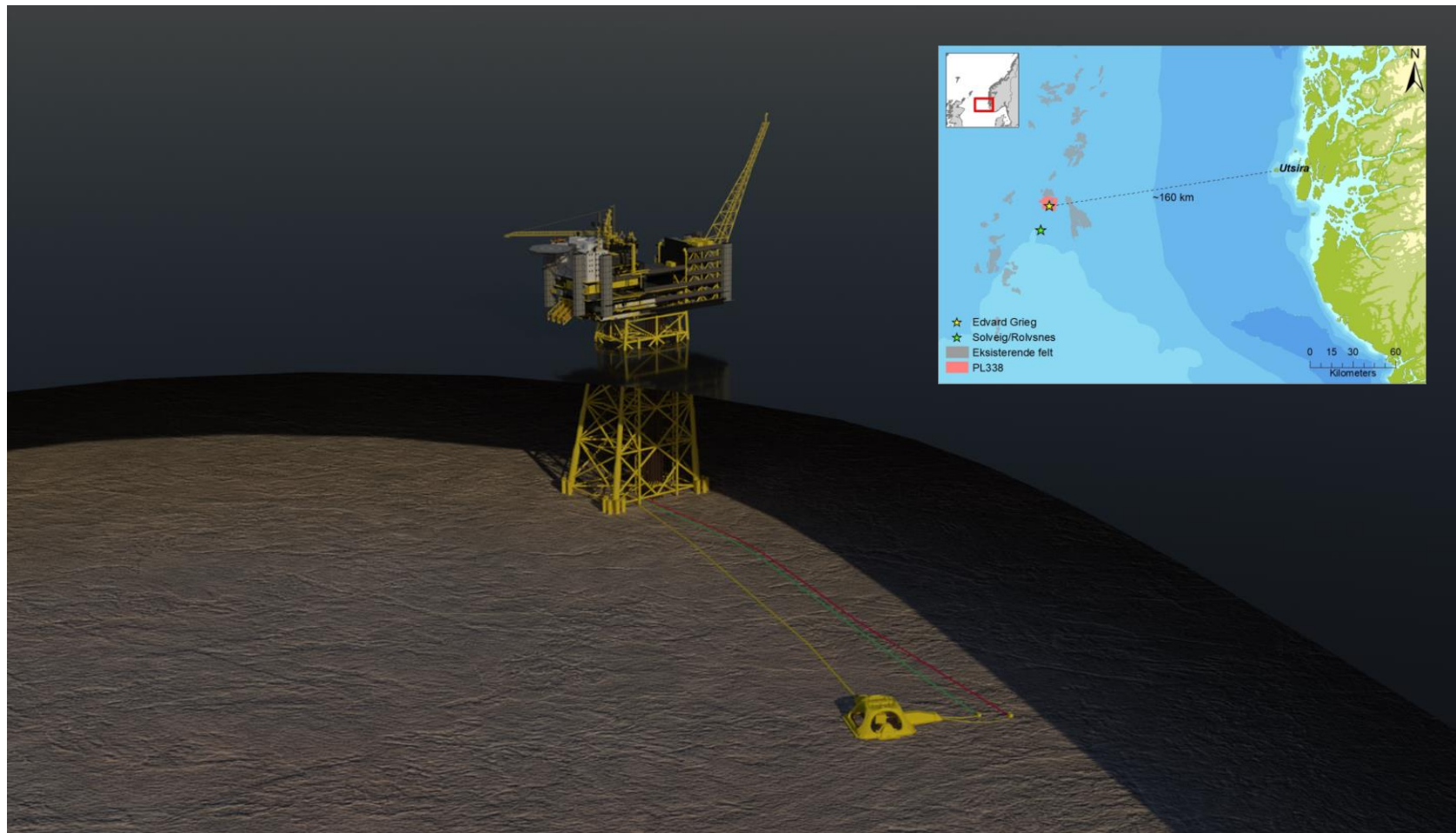
Insea Quality Services – Advisor

NUI AS – Advisor, diving support services, hyperbaric contingency

Technip FMC – The diving contractor, lessons learned

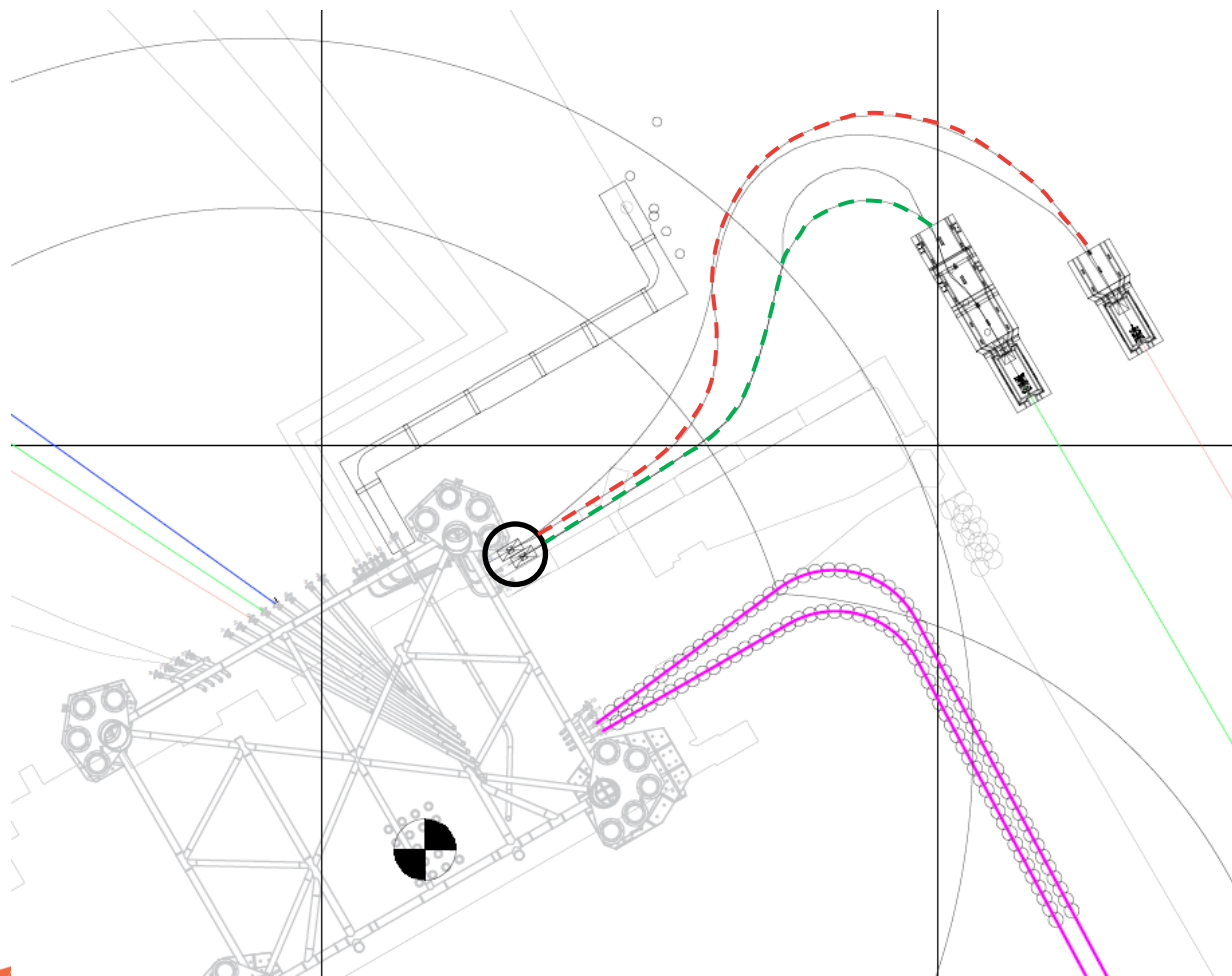


# Rolvsnes Extended Well Test (EWT)





# Rolvsnæs Tie-in to Edvard Grieg



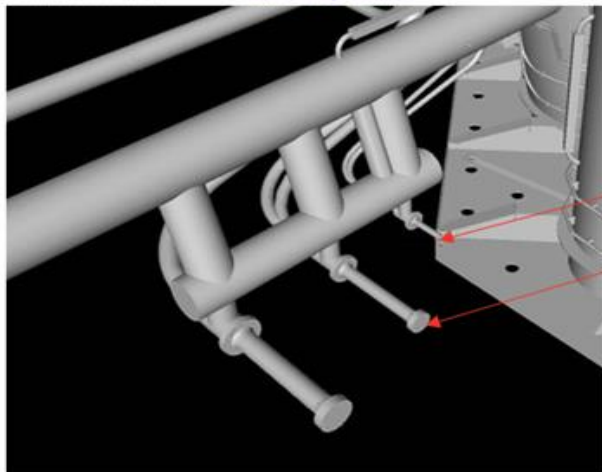
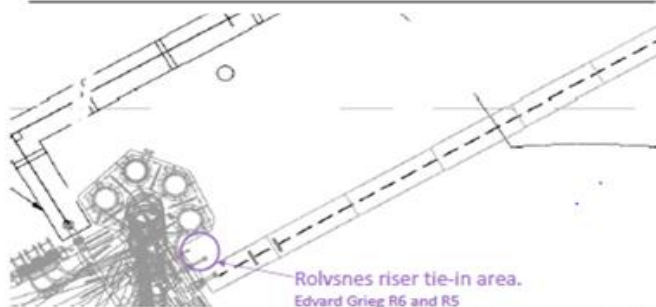
## Legend

- 4" Gas Lift Jumper, 155m
- 9.5" Production Jumper, 130m
- Diver tie-ins



# Edvard Grieg tie-in locations R5 og R6

Rolvsnes tie-in area



R5 and R6 – Survey 09/03/2019



# 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

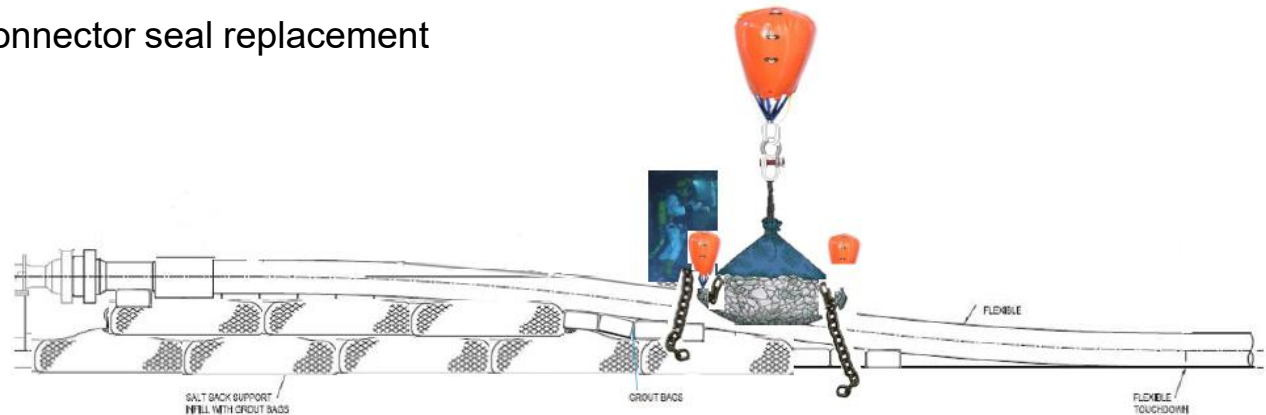
# Scope overview for the diver assisted operation

## Diver scope

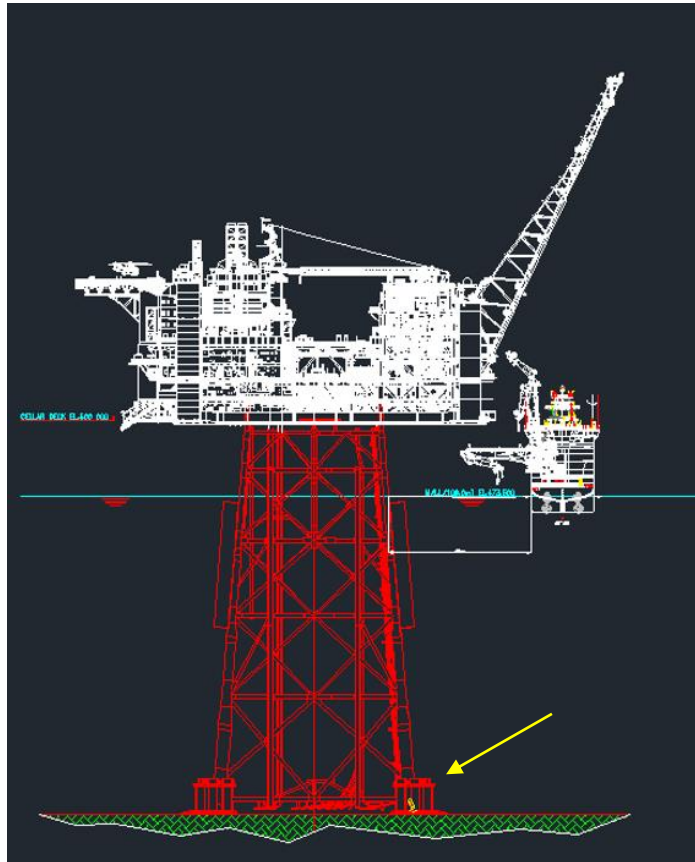
- Removal of Blind flanges
- Rigging for tie-in – ALBs, inverter lines, hold back rigging
- Tie-in – 9.5" Oil Production flexible jumper
- Free span support for 9.5" Oil Production flexible jumper
- Tie-in – 4" Gas Lift flexible jumper.
- Diver assistance during GRP cover and filter units installation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

## Diverless scope

- Leak test
- GRP cover installation
- Filter unit installation



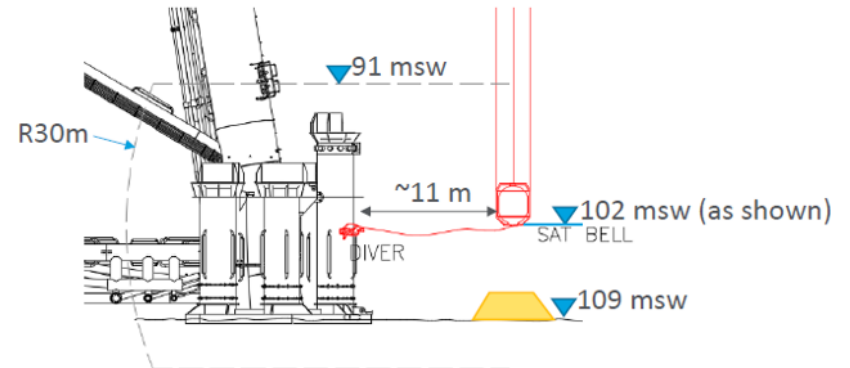
# Deep Arctic at Edvard Grieg



From South

Max diver umbilical length  
45 m (NORSOK)

Excursion depths (NORSOK)  
at 102 m → 11 m up/down



# 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

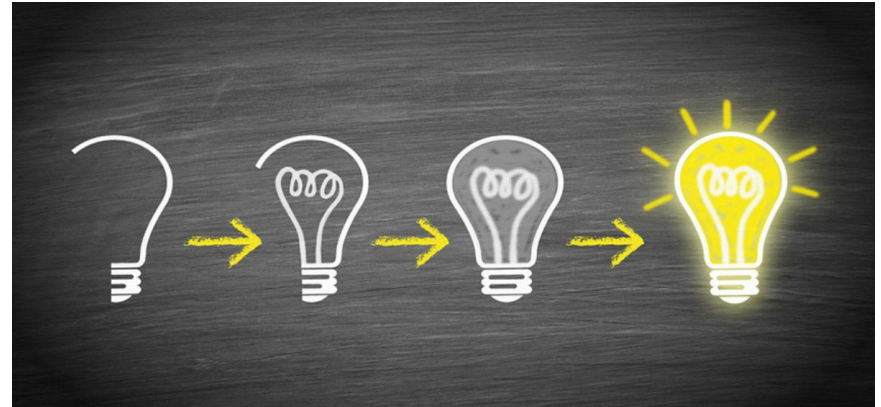
## Entered into membership/ agreements with:

**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)**



## Lundin Energy Norway

Contractor Diving scope  
method statement

**ONSHORE**



**The Project  
Manager**



**The HSE  
Advisor**



**The  
Company  
Doctor**



**The Diving  
Process  
owner**



**The SURF  
lead**



**The Marine  
Operations  
lead**



**The Diving  
Advisor**



**The Auditor**



**The Diving  
Contractor**



**The Offshore  
Client  
Representati  
ve (OCR)**



**The Company  
Diving  
Representative  
(CDR)**



**The  
Responsible  
Diving Doctor  
(RDD)**

**OFFSHORE**



# 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

<a href="#">0148</a>	Diving KOM
<a href="#">0189</a>	Diving Operations Review (HAZID)
<a href="#">0182</a>	Diving HAZID towards Operations
<a href="#">0341</a>	Deep Arctic Diving OVID
<a href="#">0271</a>	Audit of TFMC Diving led by CoP
<a href="#">0249</a>	PSA Review of Manned Underwater Operations (Diving)
<a href="#">0201</a>	Audit of Manned Underwater Operations (Diving)
<a href="#">0270</a>	Audit of NUI Diving led by AkerBP
<a href="#">0225</a>	HIRA for Diving Operations
<a href="#">0305</a>	Diving Emergency Table Top Exercise
<a href="#">0289</a>	Diving Vessel Suitability survey (OVID) (DSV Deep Arctic)
<a href="#">0314</a>	Diving SIMOPS risk assessment
<a href="#">0311</a>	Deep Arctic Diving Vessel Mobilisation Brief
<a href="#">0306</a>	Diving Operations Readiness Review



# Application for consent (AfC)

Receiver: The Petroleum Safety Authority (PSA)

Case handling: 9 weeks

Application submitted: January 31<sup>st</sup> 2020

Meeting with Petroleum Safety Authority: March 26<sup>th</sup> 2020

Consent received: March 30<sup>th</sup> March 2020



PETROLEUMSTILSYNET

Lundin Norway AS  
Postboks 247  
1326 LYSAKER

Vår saksbehandler  
John Arne Ask

Deres ref. Vår ref. (bes oppgitt ved svar) Dato  
Ptil 2020/344/JAA 30.03.2020

**Samtykke til gjennomføring av bemannede undervannsoperasjoner på Rolvsnes prosjektet**

Vi viser til deres søknad 29.1.2020 om samtykke til å gjennomføre bemannede undervannsoperasjoner på Rolvsnes prosjektet.

I medhold av forskrift om styring og opplysningsplikt i petroleumsvirksomheten og på enkelte landanlegg (styringsforskriften) § 25, fjerde ledd bokstav c, gis dere samtykke til gjennomføring av de planlagte bemannede undervannsoperasjonene på Rolvsnes prosjektet.

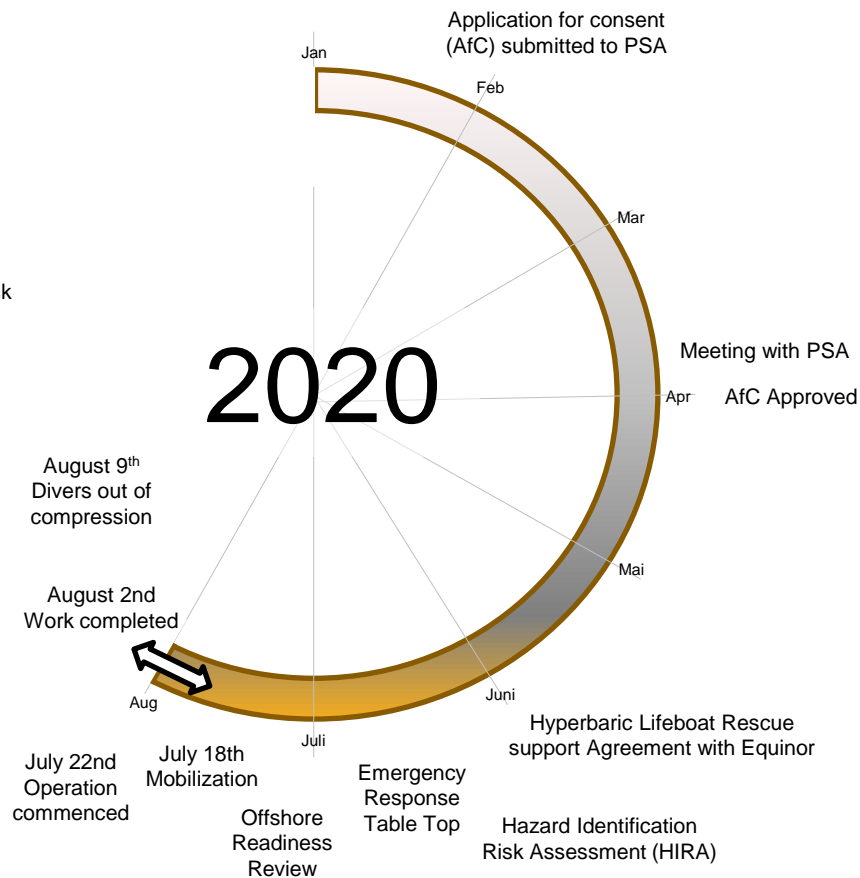
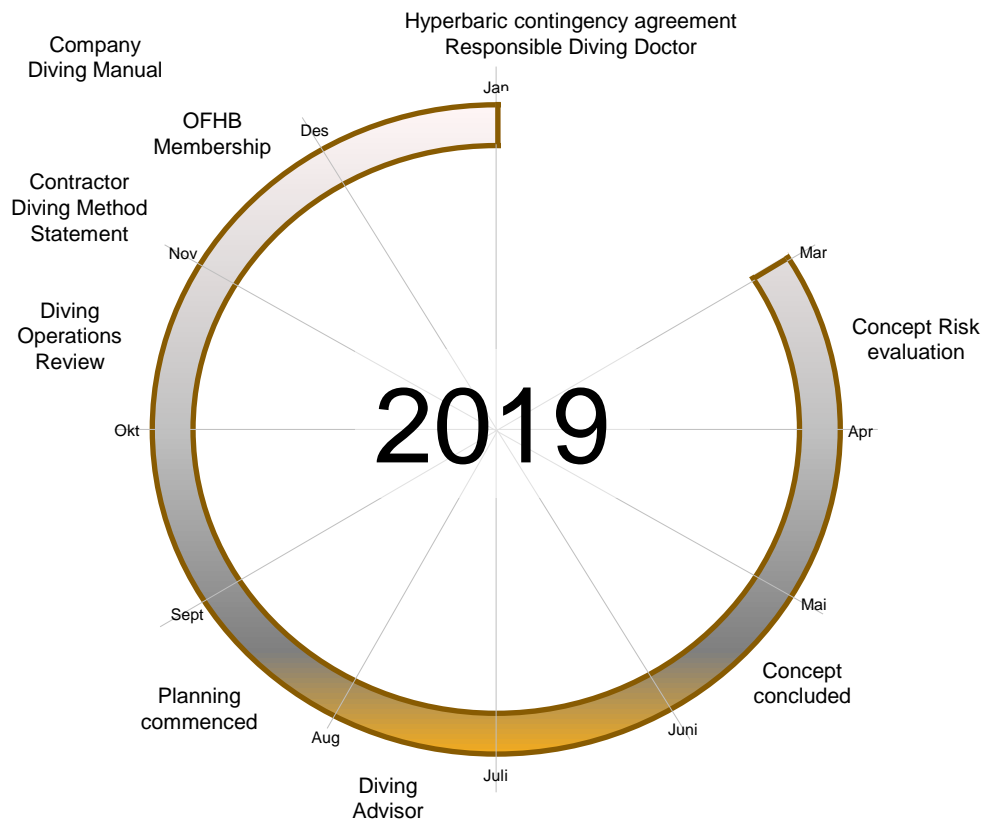
Behandlingen av søknaden om samtykke koordineres av oss, se veiledningen til styringsforskriften § 26. I tråd med dette er søknaden forelagt Fylkesmannen i Rogaland. Fylkesmannen i Rogaland har ingen kommentarer til at samtykke blir gitt.

Vedtaket kan påklages etter forvaltningsloven § 28. Fristen er tre uker fra mottak av dette brevet. En eventuell klage skal sendes til oss. Nærmere opplysninger om klageadgangen kan fås hos oss.



PETROLEUM SAFETY AUTHORITY NORWAY

# Timeline



# Execution

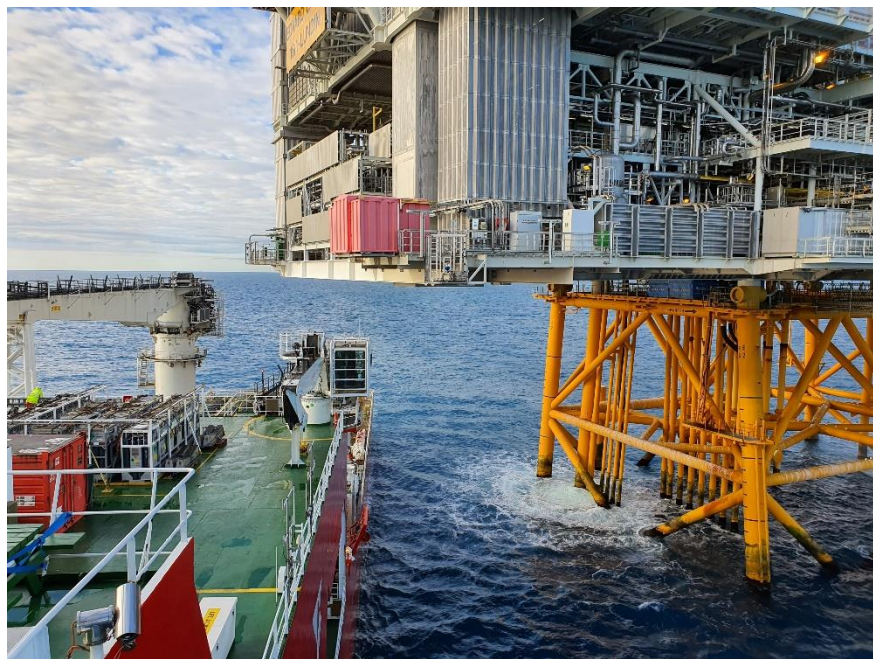
Divers working with bolt tensioning on 9.5inch flange

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

Campaign duration: 19,8 days  
Diving operations duration: 11,8 days  
WOW: < 24 hours  
Divers decompression: 6 days

Number of divers:	18
Working depth:	109m
Number of bell runs:	32
Total bell run time:	158:37
Total diver in water time:	233:42
Total manhours in Bell:	242:08
Total manhours in saturation:	5624

Scope successfully completed  
No injuries and no serious incidents!



*Thank you for your attention!*

**Lundin**  
Energy Norway

