

Leadon Field Decommissioning Programme Close Out Report

This Revision

CR5318-LEA-000-PM-RE-5002

Revision History

Rev.	Date	Prepared By	Reviewed By	Approved By
R2	19/12/22			
Name		Alisdair Baghurst	Martin Simms	Greg Jones
Position		Subsea Decommissioning Lead	Project Manager	Subsea Leader



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Rev.	Date	Description
R1	22/11/22	Leadon Field DP Close Out report Issued for Review
R2	19/11/22	Incorporating OPRED pre-consultation comments

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Terms and Abbreviations

Abbreviation	Explanation
BEIS	Department for Business, Energy and Industrial Strategy
COP	Cessation of Production
DFPV	Depressurisation, Flushing, Purge and Venting
DOC	Depth of Cover
DPS	Decommissioning Programmes
EIA	Environmental Impact Assessment
ESDV	Emergency Shutdown Valve
FPSO	Floating, Production, Storage and Offloading Vessel
GPIII	Global Producer III
HSE	Health, Safety and Environment
LWIV	Light Well intervention unit
MBES	Multi-Beam Echo Sound
MLS	Mid Line Structure
NNS	Northern North Sea
NSTA	North Sea Transition Authority
OBM	Oil Based Mud
OGA	Oil and Gas Authority
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
P&A	Plug and Abandon
PWA	Pipeline Works Authorisation
SFF	Scottish Fisheries Federation

Appendices

Appendices	
Appendix A	Clear Seabed Certificate
Appendix B	Leadon Well Abandonment Summary



1 SUMMARY

The purpose of this document is to report on the execution of the decommissioning operations of the Leadon field from Cessation of Production through to the current status. This includes, pipelines, seabed infrastructure, wellheads and debris. This report details how the various stages of decommissioning were achieved, identifies variations from the approved Decommissioning Programme and provides information on managing legacy issues.

Measures taken to manage any potential risks arising from the remaining features are also described.

1.1 Summary of Approved Decommissioning Programme

- A cessation of production application was submitted in 2004 and approved in 2006.
- Cessation of production from the field was in 2006 at which time the FPSO and moorings were removed from field following DFPV and disconnection.
- The Decommissioning programme was formally approved by OPRED on 2nd March 2016

1.2 Associated Decommissioning Approvals

Table 1.1: Associated decommissioning Approvals	
Pipeline Preparatory works	All of the subsea infrastructure between the X tree master valves and the topsides ESDVs was flushed prior to FPSO disconnection and sail away. I.e: Trees, Spools, Bundles, Towheads, Riser bases and Risers. Approved by OPRED in 2006 (COP approval) Carried out in 2006
Removal of FPSO and Mooring System	Disconnected (following agreement with the Department of Trade & Industry (governing body at the time) per letter dated 22nd June 2006) and relocated to the Donan Field, UKCS
Riser Removal	Risers were removed from site in 2007 and disposed of onshore in agreement with DECC (governing body at the time).
Well P&A	Agreed by OGA (governing body at the time) in correspondence with DECC Completed July 2019



1.3 Overview of Infrastructure/pipelines Decommissioned

Table 1.2: Overview of Installation(s) decommissioned			
Surface Installation(s)			
Number	Type*	Topsides Weight (Te)	Jacket Weight (Te)
1	FPSO	217.8m in length, 38m wide with 17m draught. The dead weight tonnage was 85,943Te	N/A
Subsea Installation(s)		Number of Wells	
Number	Type**	Platform	Subsea
1	North Towhead Manifold		8
1	South Towhead Manifold		5
1	Midline, Riser Manifold Structure		N/A
6	Riser Bases		N/A
Drill Cuttings pile(s)			
Number of Piles	<p>Only two of the wells in the Leadon field are known to have been drilled with OBM discharge to sea.</p> <p>These two wells were drilled at some distance from each other and cannot be seen as contributing to a single cuttings pile as defined by the OSPAR recommendation.</p> <p>Although a number of wells have been drilled where the drilling history was unavailable, these were all either single well sites or drilled after the cessation of OBM discharge which is definitively known as being the 1st January 2001 in any field operated by Maersk Oil (At the time).</p>		

Table 1.3: Pipeline(s) Decommissioned	
Number of Pipeline(s) decommissioned	3
Total KM of Pipeline(s) decommissioned	11.7 Km
Total KM of Pipeline(s) decommissioned in Situ	4.6 Km



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Table 1.4: Completed Decommissioning Activity against proposed decommissioning solution	
1. Topsides	
Approved Decommissioning Solution	Completed Decommissioning Activity
GP3 FPSO Removed with Moorings in 2006 and re-deployed to Donan Field	GP3 FPSO Removed with Moorings in 2006 and re-deployed to Donan Field
2. Substructures (Jackets)	
Approved Decommissioning Solution	Completed Decommissioning Activity
N/A.	N/A
3. Subsea Installation(s)	
Approved Decommissioning Solution	Completed Decommissioning Activity
Wellhead Protection Structures to be removed to leave a clean seabed.	Wellhead protection frames where fitted, were of a design that was integrated into the tree structure and were removed with the Christmas Trees. Completed in December 2019.
6-off Riser Bases to be removed to leave a clean seabed	Riser Bases were recovered to shore and disposed of/ recycled in July 2017.
4. Pipelines, Flowlines & Umbilicals	
Approved Decommissioning Solution	Completed Decommissioning Activity
2 Bundles (PL1841 & PL1842) Bundle to be rendered over trawlable and left in place	Bundles have had the towheads removed, the cut ends rock dumped and have been left in place. Rock Dump was carried out in September 2019
Towhead structures will be removed to shore for disposal / recycling. The towheads structures are expected to be disconnected from the bundle using cutting tools and cut into smaller loads for recovery.	Towheads including all Mudmats and Riser structures appended to the Midline have been removed to shore and were disposed of/recycled. Towheads and midline structures were cut from the Bundles using Diamond Wire Cutting Machines in 2018. South Towhead and midline structure were recovered in 2018. North towhead and all Mudmats were recovered in 2019



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Gas import flowline (PL1895) Flowline, spools, mattresses, grout and control jumper all to be removed to shore for disposal / recycling	Gas Import Flowline was cut at the edge of the Beryl A 500m zone, recovered to shore and disposed of/recycled. The remaining 400m still in place will be recovered at Beryl A COP. All Risers and spools were recovered to shore and disposed of/recycled.
5. Pipeline stabilisation features	
Approved Decommissioning Solution	Completed Decommissioning Activity
Full Removal of concrete mattresses and grout bags to leave a clean seabed.	All mattresses were removed using ROVSV. Mattresses were generally found to be in good condition with only two failures during recovery. The two mattresses in question were recovered in their component parts during debris recovery phase. All grout and sandbags were removed from the seabed, once lifted from the seabed they were decanted into a subsea basket and recovered to deck.
6. Wells	
Approved Decommissioning Solution	Completed Decommissioning Activity
Abandoned in accordance with Oil and Gas UK Guidelines for Decommissioning of Wells	All Wells were P&A'd in accordance with Oil and Gas UK Guidelines for Decommissioning of Wells. Christmas trees were all recovered to shore and disposed of/recycled. (With integral WHPS structures where fitted). <u>South Cluster:</u> Wells P1, P2, P7, W2 & AQ2 Suspended Wells B1, B5, B6 & B7 Trees and Wellheads were recovered By Sedco 704 MODU in 2015. <u>North Cluster:</u> <ul style="list-style-type: none">P8, P5, P6, W1 and P10 Wells P&A was carried out by Maersk Gallant Jack-up Rig between August 2017 and May 2018



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	<ul style="list-style-type: none">• P3, P9, P4 Wells P&A were carried out By Ocean Valliant Semi between October and December 2018• P4 Tree was recovered by Ocean Valliant.• P8, P5, P6, W1 Christmas trees were recovered by Maersk Inventor in 2018• P3, P9 and P10 Christmas Trees were recovered by the Maersk Installer <p>Wellheads were all severed at least 3m below seabed, recovered to shore and disposed of/recycled. (Maersk Installer 2019)</p> <p>Exceptions:</p> <p>Suspended Well A11 was cut at Seabed and Rock dumped as per Correspondence with OPRED dated 28th January 2019</p> <p>This is because a tool was stuck in the top of the Conductor and so preventing access for the internal Grit cutting tool.</p> <p>Severance was carried out using a Diamond Wire Cutting Machine in the Horizontal orientation in June 2019 (Maersk Installer)</p> <p>Rock Dump (600mm+ DOC) was carried out in September 2019</p> <p>Hole in seabed found next to Ex Well P6 location thought to have been caused by Grit Entrained Water Jet cutting method was filled and smoothed over with Rock Dump as per Correspondence with OPRED dated 30th July 2019</p> <p>Rock Dump was carried out in September 2019</p> <p>Ref Appendix B: Leadon Well Abandonment Summary</p>
6. Drill Cuttings	
Approved Decommissioning Solution	Completed Decommissioning Activity
Leave in place to degrade naturally.	Left undisturbed on seabed to degrade naturally.



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1.4 Schematic of Installation(s)/Pipeline(s) Being Decommissioned

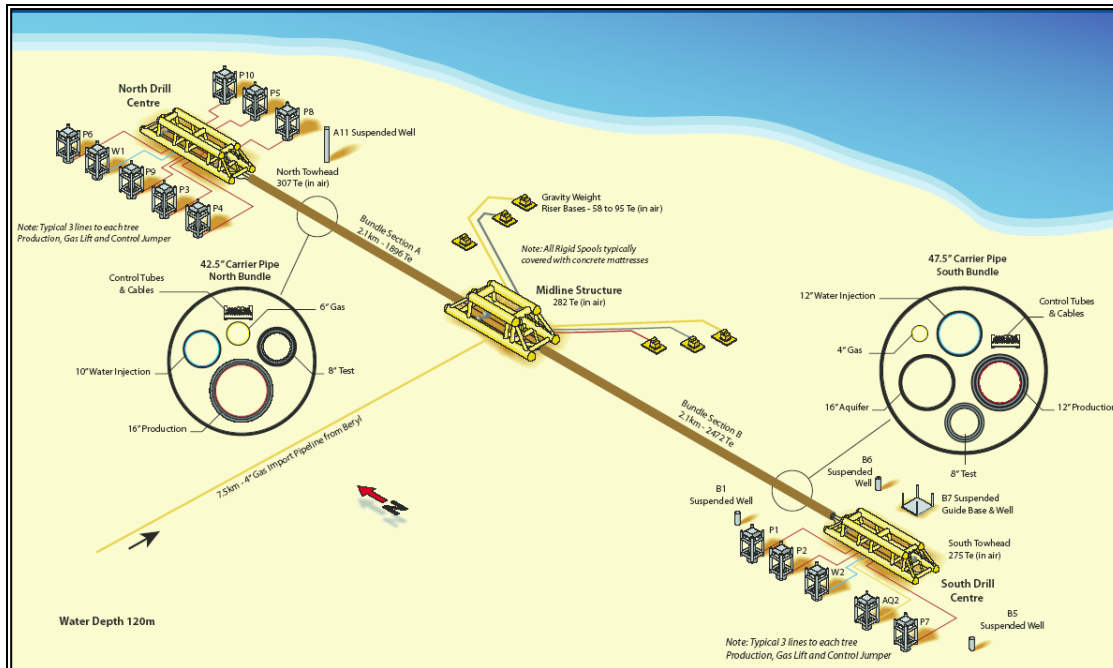


Figure 1: Leadon Subsea Field Layout

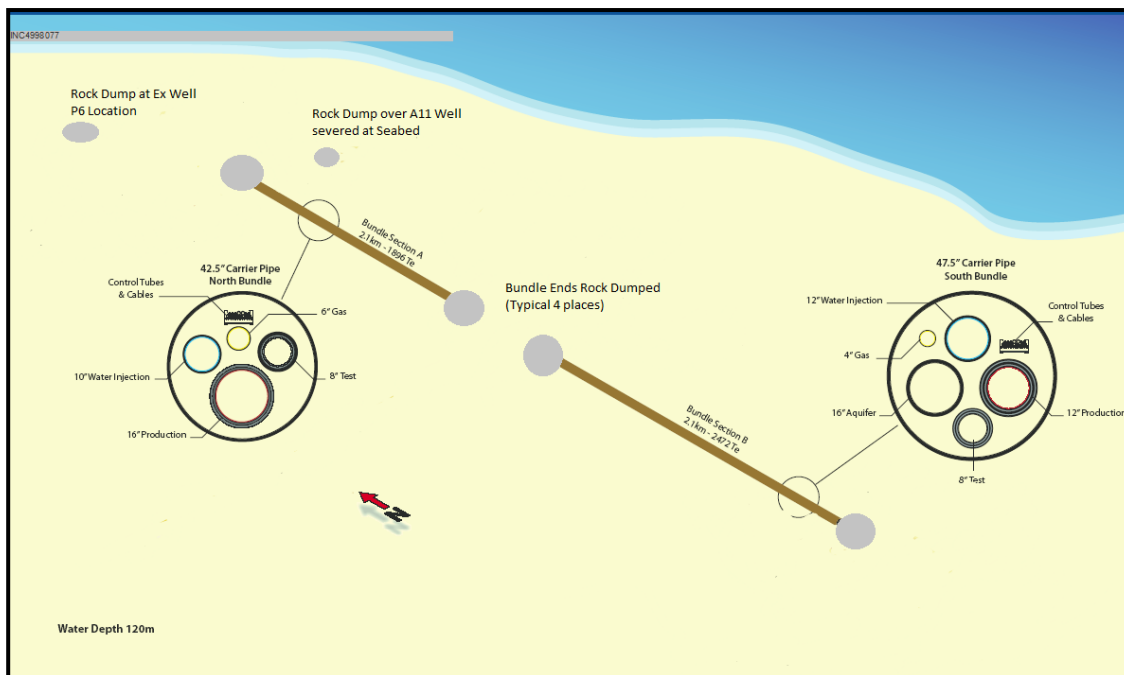


Figure 2 Leadon Subsea Layout Post Decom

The subsea decommissioning and well P&A was phased between 2014 and 2019 with strong decommissioning progress made during the 2016 - 2018 period, largely due to low rig rates resulting in cost effective P&A with the subsea decommissioning works completed by 2019. Acceptance of a clear seabed was not issued in 2019 by the SFF as the remaining presence of the bundle protection shrouds at 6 locations was considered to be a snagging risk. The protection shrouds did not form part of the scope under the approved Decommissioning Programme, however following onshore engineered over-trawl trials it was agreed to fully remove the protection shrouds which was completed in Q3 2022.

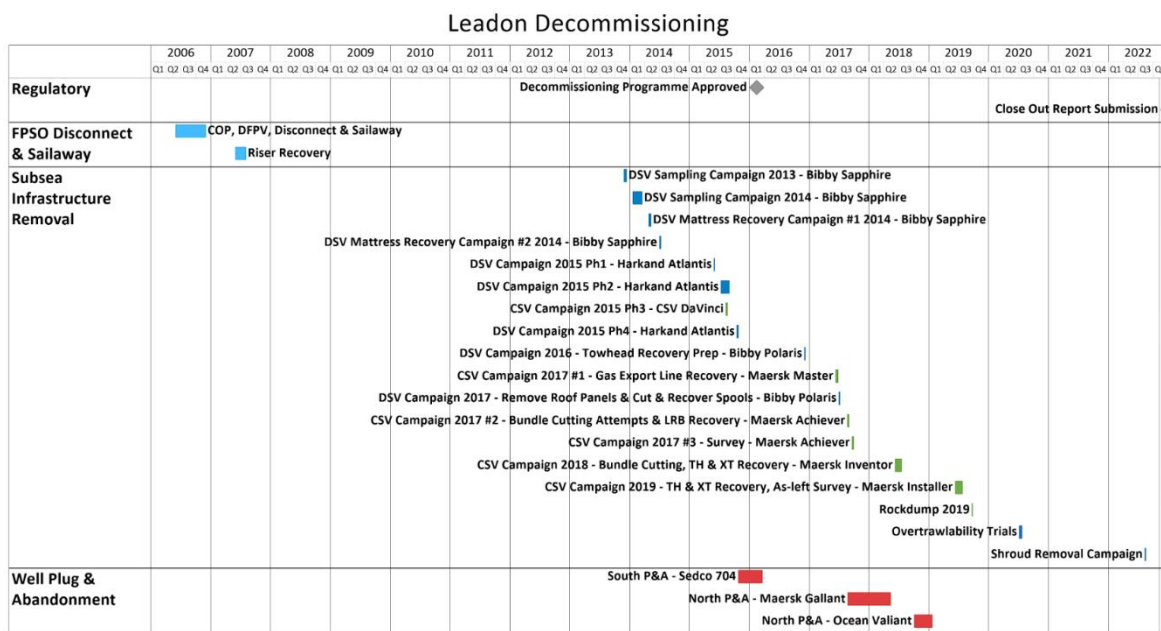


Figure 3 As-Built Schedule



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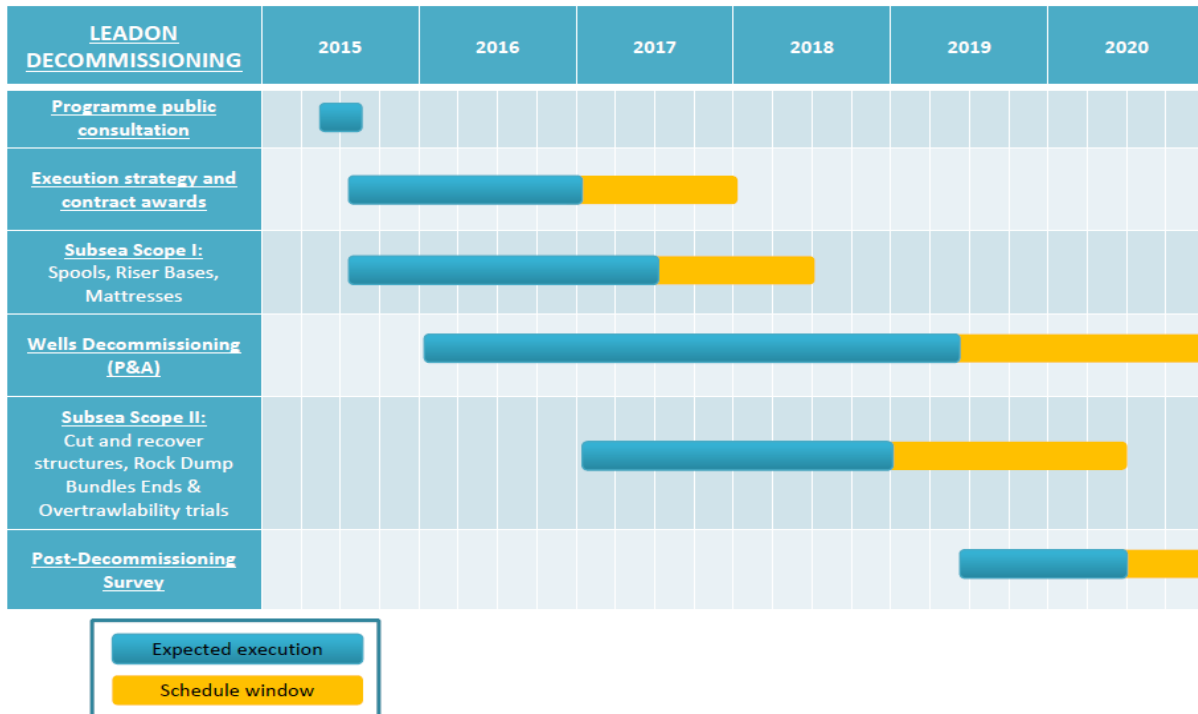


Figure 4 Decommissioning Programme Schedule



2 AS-LEFT STATUS

Table 1.5: As Left status of infrastructure / pipelines left in situ	
1. Substructures (Jackets)	
Not Applicable	
2. Pipelines, Flowlines & Umbilicals	
<p>The 4" gas import pipeline running to Beryl was recovered leaving a shallow depression where the pipe was pulled out of it's trench through natural backfill. (400m of this pipeline remains in place in the Beryl 500m zone).</p> <p>Upon completion of the pipeline removal, the pipeline corridor (50m either side) was subject to side scan sonar searches for debris. All oilfield debris measuring greater than 300mm in any dimension was recovered to shore and disposed of by a waste management contractor.</p> <p>The remaining section in the Beryl A 500m Safety zone will remain in situ until Beryl A comes to be decommissioned.</p> <p>North Bundle Section PL 1841 (42,5" carrier) and South Bundle Section PL1842 (47.5" carrier) have been left in situ with the ends rock dumped for stability and to prevent snagging.</p> <p>The 2013 inspection data shows some settlement and self-burial of the carrier pipes with no free spans and the debris surveys carried out in 2019 confirmed no material change.</p> <p>We believe that with the over-trawlable design of the bundle and it's confirmed partial settlement into the seabed, there is a low likelihood of snagging on the Bundle structure.</p>	



3. Pipeline stabilisation features

The four bundle ends have been Rock dumped with +600mm DOC (See Figures below). All mattresses have been recovered.

The type of fishing activity in the area is such that there is a low likelihood of snagging on obstructions on the seabed.



Figure 5 North Towhead Area Post Rock dump

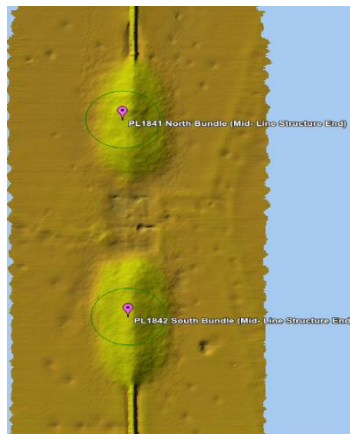


Figure 6 Midline Towhead Area Post Rock Dump



Figure 7 South Towhead Area Post Rockdump



6. Drill Cuttings
Leave in place to degrade naturally. Cuttings pile is small, thin and widely dispersed and falls below both of OSPAR 2006/5 thresholds.
7. Debris Clearance Survey
Upon completion of the decommissioning works, pipeline corridors 50m either side of the pipelines and the 500m safety zones were subject to side scan sonar searches for debris. All oilfield debris measuring greater than 300mm in any dimension was recovered to shore and disposed of by waste management contractor.

3 FUTURE MONITORING AND MANAGEMENT PLAN

Table 1.6: Future Surveys and Monitoring proposals
1. Substructures (Jackets)
Not Applicable.
2. Pipelines, Flowlines & Umbilicals
Given the stable nature of the seabed in the Leadon Field demonstrated during the service and decommissioning phases of the project it is proposed to perform a survey 5 years after the previous survey i.e. in 2025. It is similarly proposed that any future survey thereafter survey should incorporate the results of the 2025 survey to determine a suitable risk-based frequency. Bundle Survey shall include GVI and Seabed profile so that both Bundle condition and state of burial can be assessed and compared to previous surveys.
3. Pipeline stabilisation features
Rock Dump Berms shall include GVI to check there are no gross anomalies and a bathymetric profile to compare berm profiles to as-installed data.
4. Drill Cuttings
No surveys of drill cuttings are planned.
5. Environmental Surveys
The bundle's as left status being clearly defined and with no environmental impact beyond it's own footprint (and the footprint of the rock dump berms) it is proposed that no post decom environmental surveys be undertaken.



4 SEABED CLEARANCE VERIFICATION

Following the removal of the subsea infrastructure and towheads, full MBES side-scan survey of the Safety zones and pipeline corridors (50m either side of pipelines/bundles) was carried out. All oilfield debris measuring greater than 300mm in any dimension was recovered to shore and disposed of by waste management contractor. This survey data and debris recovery was submitted to BEIS for review and acceptance. Following review of the submitted data, BEIS opted to request that over-trawl trials be carried out. These were carried out in 2020 and a clear seabed notification was issued “with exceptions”. These exceptions were specifically due to SFF not being satisfied that the flood up valve protection shrouds (6 places) were of a suitable design to ensure snag free trawling. TotalEnergies subsequently removed the appurtenances and shrouds in 2022 and SFF issued an addendum note confirming clear seabed attached in Appendix A.

5 ENVIRONMENTAL IMPACTS

A decommissioning field OPEP (OPRED ref. 180134) and was in place to cover the operations, this was supported by a well abandonment TOOPEP (OPRED ref. 180169 and 190058).

Permits to carry out the preparation for field decommissioning, involved cutting and disconnection of spools and jumpers and the recovery of mattresses; marine licence, chemical permit, oil discharge permit and consent to locate were all submitted and approved under PLA/12. Permits were valid for operations carried out from 2014 to 2016.

Permits to carry out the recovery of the Leadon 4” gas line; marine licence, chemical permit, oil discharge permit and EIA direction were all submitted and approved under PLA/367. Permits were valid for operations carried out during 2017.

The final decommissioning activities were covered by DCA/71 (2018 and 2019); marine licences (ML/333 and ML/444) were obtained for the removal of the Leadon subsea infrastructure. Marine licence ML/444 also covered the addition of rock dump. In line with the approved decommissioning programme rock placement to protect the cut ends and ensure these are over trawlable. An oil discharge permit and chemical permit were put in place to cover the discharge of residual oil and chemicals within the bundle post-flushing operations.

North cluster and South cluster well abandonment operations were carried out over different well P&A campaigns, operations were covered separately under well intervention MATs (WIA/239, WIA/332, WIA/437, and WIA/518). Well abandonment operations were undertaken between 2015 and 2018.

6 MATERIALS/WASTE

All subsea infrastructure and concrete mattresses recovered were returned to shore for handling. Total E&P North Sea UK Ltd contracted appropriately licensed waste management and recycling contractors; Scotoil and Veolia (UK).



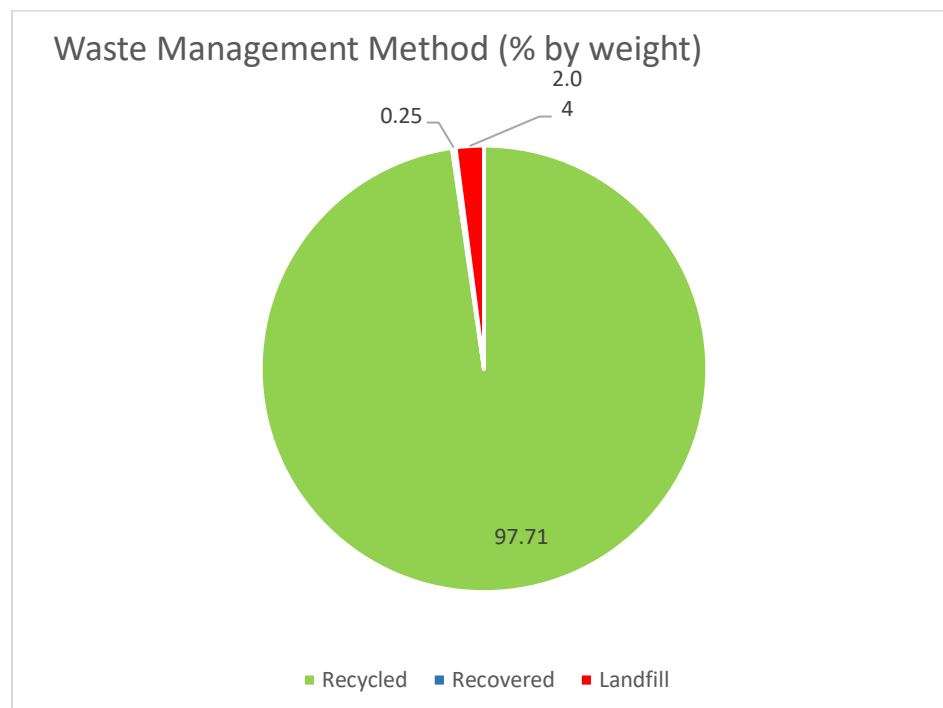
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Waste was dealt with in accordance with the Waste Framework Directive, as such re-use is the first order of preferred decommissioning options, with this in mind the FPSO and moorings were re-used at the Donan, Lochranza and Balloch fields (as such these structures are not included in the figures below).

The following amount of waste was generated and disposed from the decommissioning:

Table 1.7: Waste generated and disposed of following decommissioning Activity		
Steel from subsea structures and wells	3,365.63 tonnes	Recycled
Concrete mattresses	893.13 tonnes	Recycled
Non-hazardous waste (mixed demolition waste/general waste)	88.83 tonnes	Landfill
Non-hazardous waste (mixed demolition waste/general waste)	5 tonnes	Recovered
Hazardous waste (waste oil)	6 tonnes	Recovered

In total, 4,358.6 tonnes of waste generated during decommissioning, 97.7% was recycled. Hazardous waste accounted for ~0.1% of total waste generated.



There is some variance between the weights quoted and those estimated in the approved Decommissioning Programme. This variance can be explained by the fact that the DP quantities would



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be based on assumptions from design documentation and approved deposit consents and the as-built weights being actuals from the weighbridge at the recycling centre.

There has been some 85te more steel recycled than expected (this is most likely due to actual wellhead cut depths being deeper than the 10 foot minimum) and 120te less concrete mattresses (this is most likely due to the deposit consent permits being applied to cover worst case design conditions including contingencies which would not have been required during the construction phase).



7 LESSONS LEARNED

Onshore cutting trials: Extensive cutting trials were carried out while investigating best way to release the Towheads from the bundle for recovery. Diamond wire cutting proved to be the most reliable, repeatable method.

Concrete mattresses: Using speed loaders for recovery, (while less efficient due to the requirement to double handle the mattresses), proved to be the best way to recover because of the resulting safer transition through the splash zone.

Using an anchor handler to winch aboard the 4" disused pipeline proved to be far more expedient and cost effective than recovering by conventional shears "sausage factory" method. There was an added advantage of having far fewer open ends to manage during the recovery from seabed to shore and so making containment of any residual hydrocarbons easier to manage.

Using Grit entrained water jetting cutting worked well from the construction vessel for final wellhead severance and recovery. Timings were comparable with doing the work from the rig but with a lower cost base.

Tree recovery using the Construction vessel worked well. The advantages were more with the logistics of handling more than one or two trees with the rig rather than with the disconnection works.

Thorough flushing and conditioning of subsea infrastructure at COP and disconnect phase stood the project in good stead during the debris removal and recovery phase with little entrained residual hydrocarbons being released.

The Towheads and midline manifold were challenging to recover due to the added mass of entrained water trapped in the main chords/tanks. A lot of time was spent cutting drainage holes in the tanks to allow water to escape at surface. This could be addressed at the design phase by adding knock out panels or similar.

Cutting the towheads clear of the bundles was very problematic because of ancillary structures which prevented access to the required cut locations. This could be addressed at the design phase by leaving clear vertical access of 2-3m bundle length at the required cut location.

The recovery of dead/uncommunicative transponders needs to be planned and engineered because of the uncertainty of the batteries condition and volatility.



8 COST

Costs have been submitted to OPRED.

9 PHOTOGRAPHS

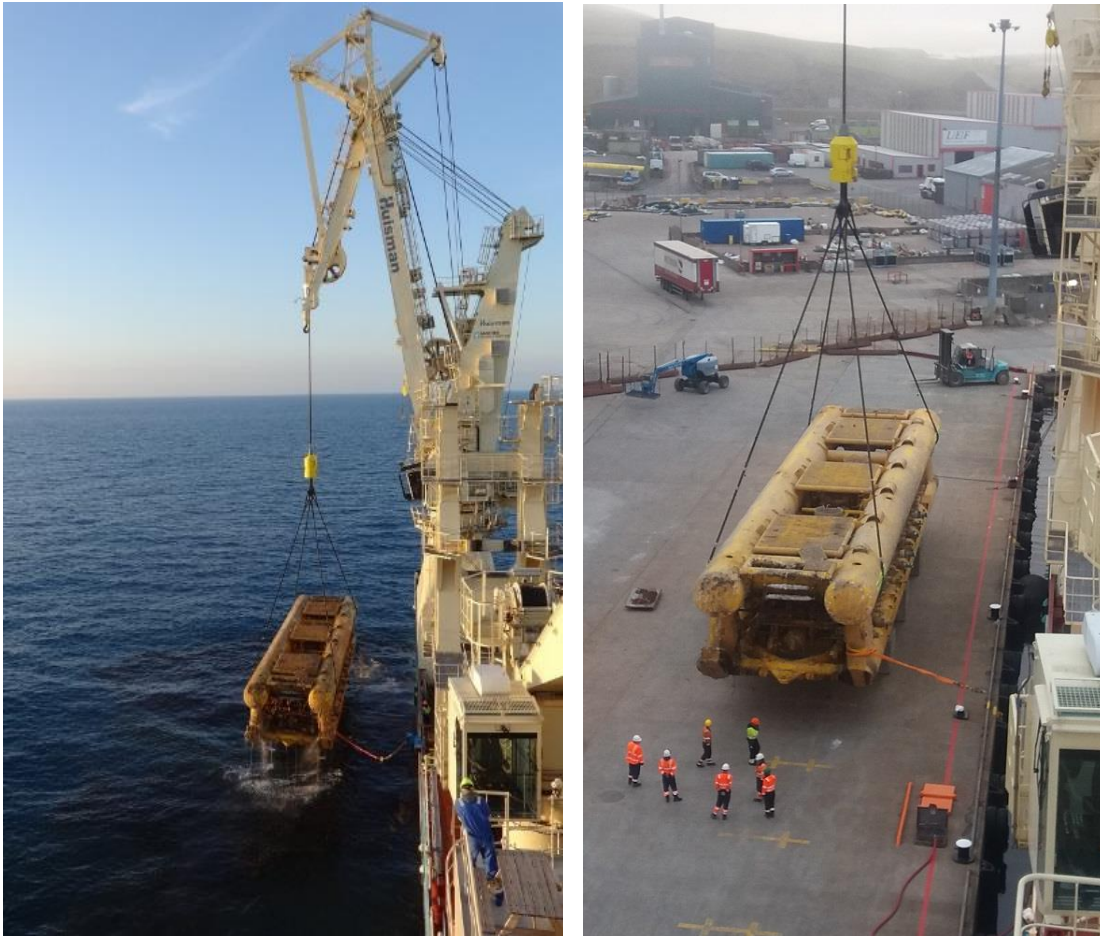


Figure 8: North Towhead Recovery & Offload in Lerwick



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Figure 9: A11 Conductor Seabed Cutting

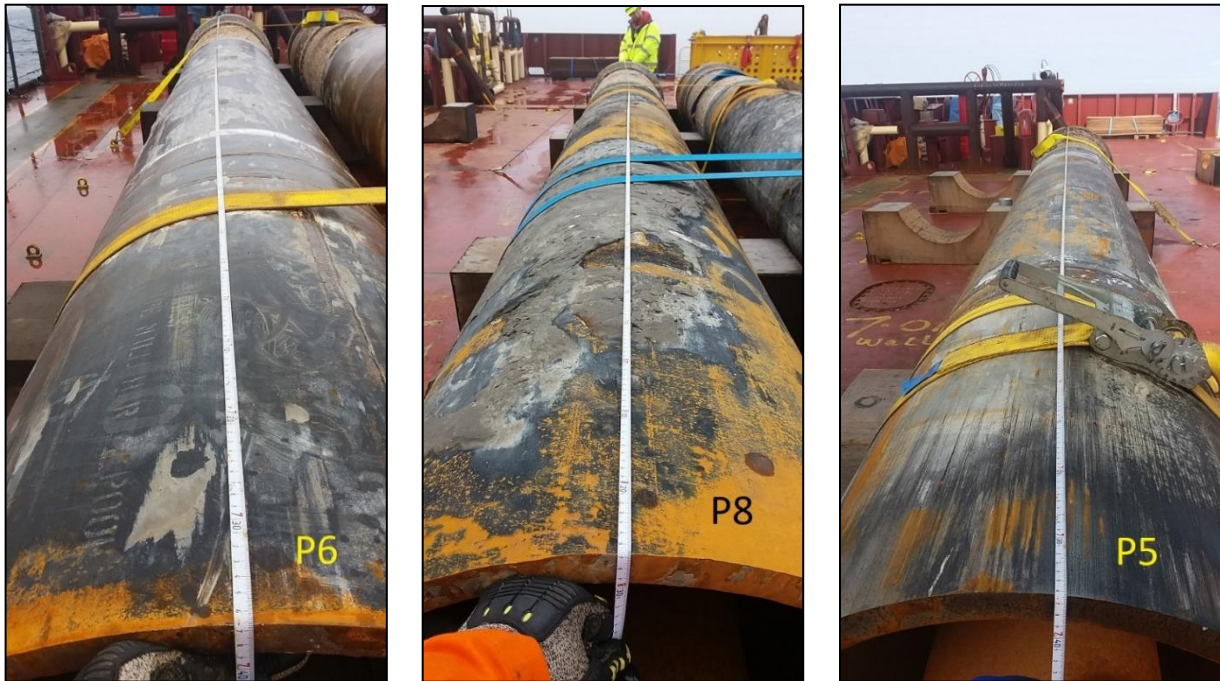


Figure 10: P5, P6 & P8 Recovered Conductors



Figure 8: P10, W1 & P9 Recovered Conductors



Figure 9: Tree Recovery



Figure 13: Debris Baskets






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10 APPENDICES

APPENDIX A: SITE CLEARANCE LETTERS



SFF
SERVICES
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Date: 15/11/2022

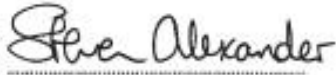
**TOTALENERGIES E&P UK LIMITED: LEADON FIELD POST DECOMMISSIONING CLEARANCE / VERIFICATION
TRAWL SWEEPS**

In July-August 2020 MV "Valhalla" FR268 carried out a post decommissioning sea bed / trawl verification sweep of the Leadoon Oil Field. Due to concerns regarding 6x protection cages installed along the pipeline bundle, two of which were located outside the 500 metre safety zones, trawl sweep operations avoided the positions below by 100 metres.





# 1 Cage: 59° 34.7669'N, 001° 39.2257'E	# 2 Cage: 59° 34.2585'N, 001° 39.2631'E
# 3 Cage: 59° 34.2542'N, 001° 39.2514'E	# 4 Cage: 59° 33.1279'N, 001° 39.3476'E
# 5 Cage: 59° 33.1236'N, 001° 39.3480'E	# 6 Cage: 59° 32.5552'N, 001° 39.3937'E

Evidence was received from TotalEnergies on 14th November 2022 confirming that the protection cages have been removed. Fishermen are therefore no longer advised to keep clear of these positions.

Signed for on behalf of SFF Services Limited


Steven Alexander, Managing Director

SFFSL-QU-T-5 Rev 10, Nov-22
A company wholly owned by the Scottish Fishermen's Federation
VAT Reg. No: 498 420 807
Registered in Scotland Company No: SC 090561
Registered Office: 24 Rishielaw Terrace Aberdeen, UK, AB10 1RE





Fishermen are therefore also advised to keep clear of these positions:

59° 34.640'N, 001° 40.440'E
59° 35.120'N, 001° 39.770'E
59° 32.750'N, 001° 36.180'E

2. PL1895 Route

Various North and South crossings outside 500m safety zones completed (shown in the image below), to confirm there are no concerns over seabed disturbance in relation to the removal of the pipeline.



SUMMARY

To the best of our knowledge the swept areas, with the exception of the previously noted areas of concern, have been successfully cleared of all equipment / infrastructure and are considered safe to allow normal fishing operations to proceed.

Signed for on behalf of the Owners of MV "Valhalla" FR268

Michael Clark Skipper
Michael Clark Skipper

Signed for on behalf of SFF Services Limited

Andrew Third, Industry Advisor

SFFSL-OUT-5 Rev 7, Jun-19



A company wholly owned by the Turkish Government has been selected to build the 100,000-ton shipyard.



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where δ is defined as:

TOTAL E&P UK LIMITED: LEADON FIELD POST DECOMMISSIONING CLEARANCE / VERIFICATION TRAWL SWEEPS

This is to certify that the MV "Valhalla" FR268 has carried out a post decommissioning sea bed / trawl verification sweep of the Leaden O3 Field at the following locations:

1. 500 metre safety zones

Leadon North centre position;
Leadon Midline centre position;
Leadon South centre position;

59° 34.824'N, 001° 39.223'E
59° 33.684'N, 001° 39.393'E
59° 32.529'N, 001° 39.394'E

Sweeps were carried out as a grid pattern designed to ensure 50% overlap between passes. The grid was extended to also include the following anchor positions:

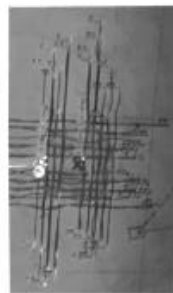
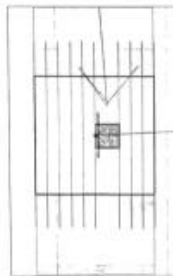
1 Anchor: 59° 34.250'N, 001° 39.507'E
3 Anchor: 59° 33.802'N, 001° 40.482'E
5 Anchor: 59° 33.199'N, 001° 39.945'E
7 Anchor: 59° 33.265'N, 001° 38.656'E
9 Anchor: 59° 33.915'N, 001° 38.424'E

2 Anchor: 59° 34.198'N, 001° 39.839'E
4 Anchor: 59° 33.626'N, 001° 40.508'E
6 Anchor: 59° 33.127'N, 001° 39.628'E
8 Anchor: 59° 33.397'N, 001° 38.433'E
#10 Anchor: 59° 34.060'N, 001° 38.562'E

NOTE 1: Due to concerns regarding 6x protection cages installed along the bundle, two of which are located outside the 500 metre safety zones, trawl sweep operations avoided the positions below by 100 metres.

Fishermen are therefore advised to keep at least 100 metres clear of these positions.

1 Cage: 59° 34.7669'N, 001° 39.2157'E
2 Cage: 59° 34.7585'N, 001° 39.2631'E
3 Cage: 59° 34.2542'N, 001° 39.2514'E
4 Cage: 59° 33.1279'N, 001° 39.3476'E
5 Cage: 59° 33.1736'N, 001° 39.3480'E
6 Cage: 59° 31.5552'N, 001° 39.3937'E



Images provide as examples to show area avoided around protection cages

SEESI-CH1-T-5 Rev 7, Jun-19



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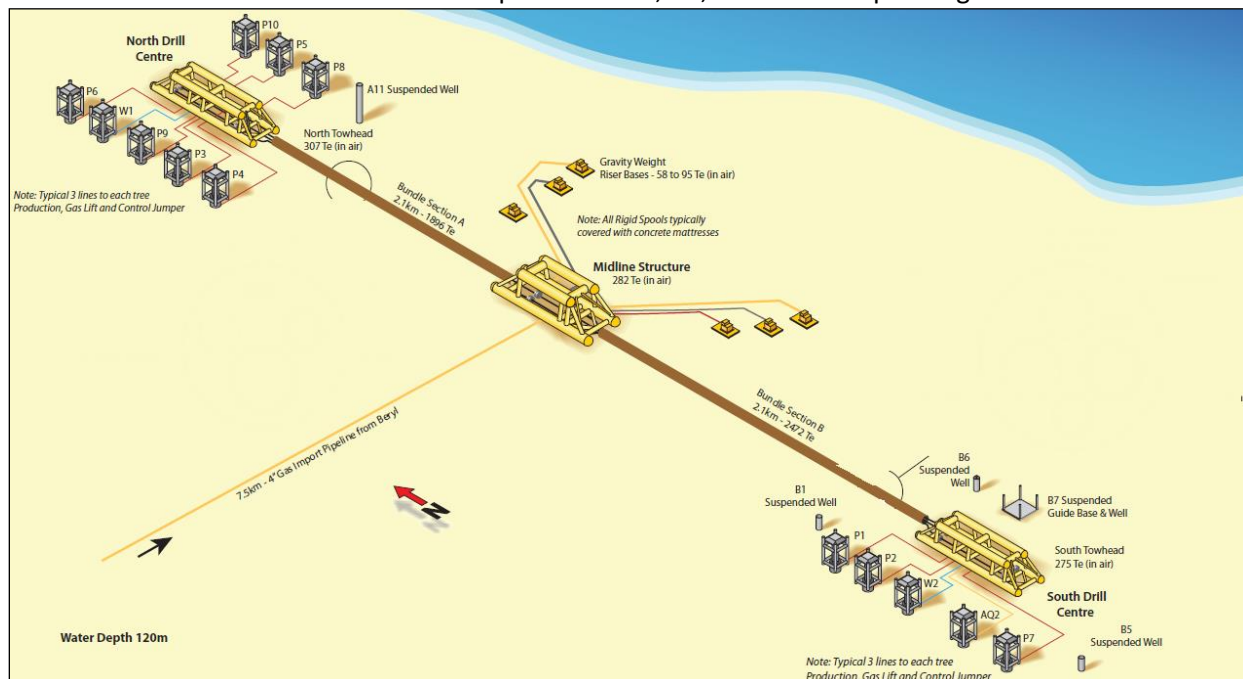


APPENDIX B: LEADON WELL ABANDONMENT SUMMARY

Pre-Decommissioning Well Status

The Leadon field is located in blocks 9/14a and 9/14b, 8km east of the Beryl facilities and 23km to the north of the Gryphon development. It lies in a water depth of 392-399ft, 166km from the UK coastline and 8.5km from the Norwegian trans-boundary line. Leadon wells were shut-in and suspended at the DHSV and XMT valves since June 2006.

The Leadon North cluster consisted of 6 production wells and 2 water injection wells. The North cluster also had a suspended well with only a conductor installed, with running tool cemented in place (A11). The Leadon South cluster consisted of 3 production wells, 1 water injection well and 1 water production well. The South cluster also had three suspended wells, B1, B5 and B6 as per diagram below.





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Table 1: Leadon Wells Summary

Wellbore Registration No.	Operator Reference (Production / Slot)	Well Type	Location (ED50)	Water Depth (ft)	Date Drilled	Date Abandoned
Leadon North						
9/14a-N1Z	P9 / A3	Producer	59° 34' 52.023" N 1° 39' 17.676" E	399	26/04/2001	17/07/2019
9/14a-N2	P3 / A4	Producer	59° 34' 51.535" N 1° 39' 17.755" E	399	09/01/2001	22/07/2019
9/14a-N3Y	P5 / A10	Producer	59° 34' 51.599" N 1° 39' 20.976" E	399	03/03/2001	21/07/2019
9/14a-N4	P6 / A1	Injector	59° 34' 52.998" N 1° 39' 17.624" E	399	20-Mar-01	22/07/2019
9/14a-N5	W1 / A2	Injector	59° 34' 52.501" N 1° 39' 17.606" E	399	25/03/2001	18/07/2019
9/14a-N6Y	P8 / A11a	Producer	59° 34' 51.303" N 1° 39' 20.943" E	399	26/10/2001	20/07/2019
9/14a-N7	P10 / A9	Producer	59° 34' 52.077" N 1° 39' 20.86" E	399	31/08/2001	19/07/2019
9/14a-9	P4 / A5	Producer	59° 34' 51.044" N 1° 39' 17.766" E	392	05/07/2000	23/07/2019



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Leadon South						
9/14b-S1Z	P2 / B2	Producer	59° 32' 33.657" N 1° 39' 28.012" E	392	28/01/2001	18/03/2016
9/14b-S2X	B5	Producer	59° 32' 34.165" N 1° 39' 27.998" E	392	26/03/2002	19/03/2016
09/14b-S3	B1	Conductor	59° 32' 34.151" N 1° 39' 27.973" E	392	23/02/2001	7/03/2016
9/14b-S3a	P1	Producer	59° 32' 33.989" N 1° 39' 27.979" E	392	16/03/2001	17/03/2016
9/14b-S4	W2 / B3	Injector	59° 32' 33.193" N 1° 39' 28.023" E	392	18/05/2001	19/03/2016
9/14b-S5	AQ2 / B4	Producer	59° 32' 32.711" N 1° 39' 28.115" E	395	27/06/2001	24/03/2016
9/14b-S6	AQ1 / B6	Producer	59° 32' 34.191" N 1° 39' 31.154" E	395	19/09/2001	23/03/2016
9/14b-S7	P7 / B5	Producer	59° 32' 32.151" N 1° 39' 27.365" E	392	04/09/2002	21/03/2016
9/14b-W3sat	W3 / B7	Conductor and guidebase only	59° 32' 33.610" N 1° 39' 31.140" E	392	01/2002	03/2016



Well Abandonment Operations

10.1.1 Overview of Campaigns

The Leadon field abandonment was completed with two DSV campaigns, three rig campaigns and one vessel campaign.

A DSV attended the Leadon location in 2015 and 2016 to inspect and prepare the wells for rig operations.

The DSV scope included:

1. Remove protection mattresses from XT connecting spools, prove barriers, and disconnect and recover spools
2. Install blind flanges on XT production and annulus flanges and leak test
3. Disconnect and recover power cable and jumper between XTs and towhead
4. Install long-term stab plate covers
5. Remove debris cap and clean AX gasket profile and ITC void
6. Clean ROV panel including TDU docking points
7. Record XT heading and inclination and measure offsets between adjacent XTs
8. Install trash cap c/w transponder bucket or bullseye
9. Survey spud can locations

The Leadon South cluster wells were abandoned in a single campaign using the semi-submersible Transocean Sedco 704, this completed abandonment operations up to AB3. The use of a semi-submersible allowed skidding between all wells, facilitating skidding of the BOP subsea between wells. Operations commenced in October 2015 and were completed in March 2016.

The Leadon North cluster wells were abandoned in two campaigns using the jack-up Maersk Gallant and the semi-submersible Diamond Offshore Ocean Valiant, completing abandonment up to AB2. Wells N3Y, N4, N5, N6Y and N7 were abandoned using the jack-up Maersk Gallant. This required rig moves between wells and the use of a bespoke high-pressure riser. Operations with the Maersk Gallant commenced in September 2017 and were completed in May 2018. The remaining wells N1Z, N2 and -9 were abandoned using the Diamond Offshore Ocean Valiant. This again allowed skidding between all wells, facilitating skidding of the BOP subsea between wells. Operations with the Diamond Offshore Ocean Valiant commenced in October 2018 and were completed in January 2019. A vessel campaign took place in 2019 to remove the production XTs and wellheads from the Leadon North cluster wells and complete abandonment to AB3.

10.1.2 Overview of Well Abandonment

All Leadon wells contained two zones requiring isolation; the Balder reservoir interval (hydrostatic, gas & oil bearing) and the Grid sandstone (hydrostatic, water bearing). The production/intermediate casing annulus contained oil-based mud which required environmental isolation. The abandonment requirements for Leadon wells are outlined in Figure 11. The Leadon field operatorship lay with Maersk Oil North Sea UK prior to the acquisition by Total. Abandonment design was therefore in accordance with Maersk Oil internal standards, later verified against Total internal standards, and with due cognisance of Oil & Gas UK guidelines for well abandonment.

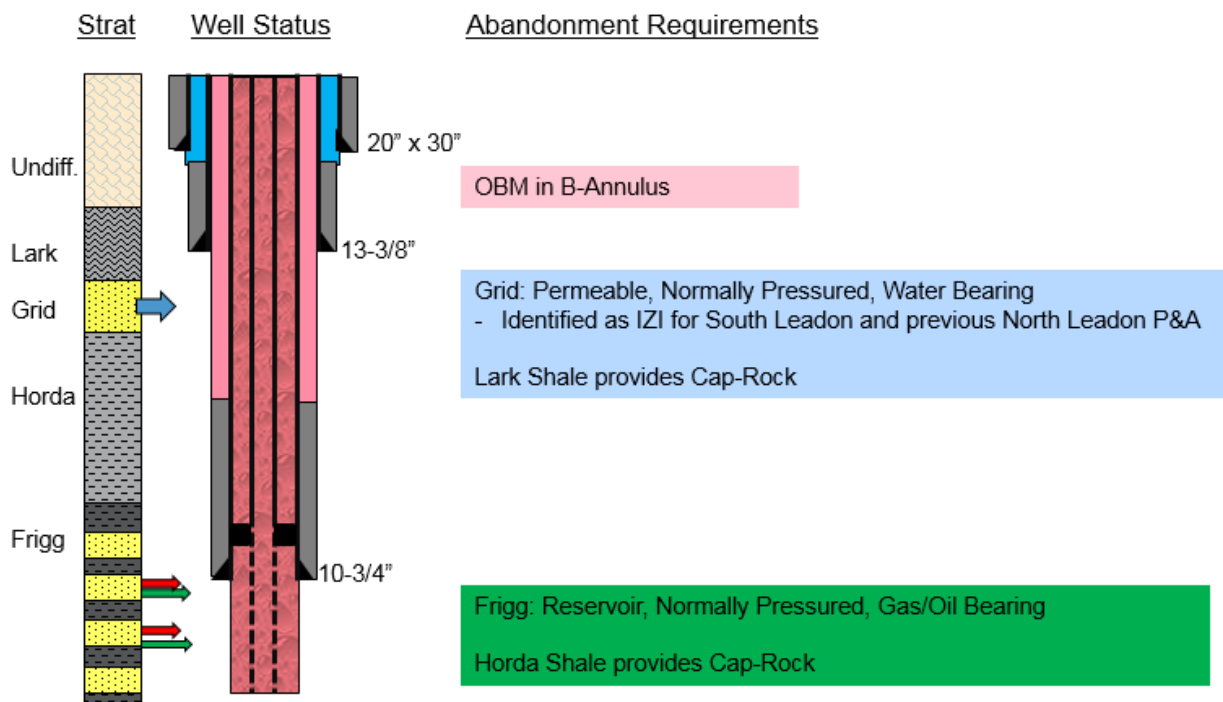


Figure 11: Overview of Leadon Well Abandonment Requirements

Well abandonment was split into four phases:

- Phase 1 – Latch on to well and pull completion.
- Phase 2 – Reservoir isolation
- Phase 3 – Overburden and environmental isolation
- Phase 4 – XT recovery and wellhead removal

10.1.2.1 Latch on to Well and Pull Completion

The first stage of rig operations was to run the BOP and confirm XT valve integrity. The Leadon field used horizontal drill-through XTs so required through-XT abandonment. The wells were re-entered through the XT, drifted to below the production packer, before setting a deep-set plug in the tail-pipe to isolate the reservoir. The completion was then recovered by cutting the tubing above the production packer.

10.1.2.2 Reservoir Isolation

Reservoir isolation was achieved by establishing a cross-sectional well barrier against the Horda formation, a sealing shale. The annulus cement behind the production casing was verified using the cement job reports, the criteria included: no losses, job going to plan, plugs bumping and adequate lift pressure. In the cases where the original cement job was verified an internal cement plug was set on top of the production packer, against the verified annulus cement. This established the primary and secondary well barrier envelopes to the Balder reservoir.

Where any indications of poor annulus cement existed, a cement evaluation log was completed. Based on the results of the cement evaluation log the annulus cement would be verified as containing barrier-quality cement or require remediation through a technology known as Perf & Wash provided by Archer. The cement evaluation log enabled identification of an area of poor cement suitable for washing. The production casing was then perforated across a 50m interval using TCP guns. The Archer washing tool was then run which allowed jetting between two sealing cups and created a closed-circulation path behind the production casing and back into the well above the cups, this allowed removal of the poorly bonded cement. Cement was then set in the production casing annulus before setting an internal cement plug against the verified annulus cement to establish the primary and secondary well barrier envelopes to the Balder reservoir.



10.1.2.3 Overburden and Environmental Isolation

The overburden and environmental isolation sought to isolate the normally pressured, water-bearing Grid formation and isolate the oil-based mud left in the production/intermediate casing annulus.

This barrier was set across the cross-section of the well above the intermediate casing shoe depth, across the Lark formation, a sealing shale. The production casing was perforated immediately below the wellhead and close to the intermediate casing shoe, to create a circulation pathway behind the casing. The oil-based mud in the production/intermediate casing annulus was then circulated out using a variety of cleaning pills. Cement was then placed in this annulus to create a cement plug between the production and intermediate casings. An internal cement plug was then set on a bridge plug to complete cross-sectional isolation of the wellbore.

Contingency options were available where the cement plug established using the above method failed pressure test verification. On one occasion the internal cement plug was drilled out and the production casing and annulus cement removed by section milling. An internal cement plug within the intermediate casing was then set to isolate the wellbore internal cross-sectional area, with the intermediate casing annulus cement providing the annulus barrier. On another occasion the internal cement plug was again drilled out, a log indicated highly channelled cement which was suitable for removal by Perf & Wash. Perf & Wash was performed, using the procedure detailed in section 10.1.2.2, successfully establishing the overburden and environmental barrier.

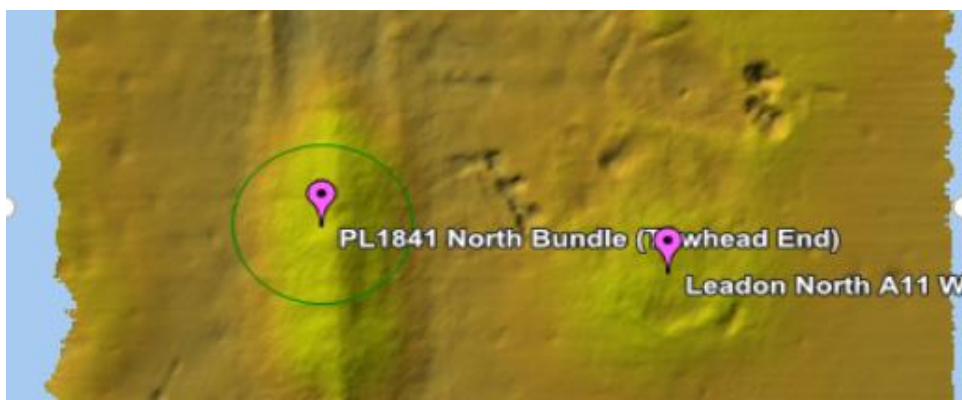
The BOP (high-pressure riser for the Maersk Gallant) was then pulled or skidded to the next well (semi-submersible rigs only).

10.1.2.4 XT Recovery and Wellhead Removal

On the Leadon South cluster abandonment campaign all XTs and wellheads were recovered by the rig following well abandonment operations. This involved unlatching the XT and recovering to surface. The casing strings and wellhead were then cut a minimum of 3m below seabed and recovered to surface.

On the Leadon North cluster abandonment campaigns the XTs and wellheads were left in place following well abandonment operations for later recovery using a vessel. The XTs were first unlatched from the wellhead and left on the wellhead in the closed position to prevent re-latching. This allowed the vessel to lift the XTs off the wellhead without the requirement to interact with the XT hydraulic controls. The casing strings and wellheads were then cut a minimum of 3m below seabed using an abrasive cutter, and recovered.

Once each wellhead and associated casings were removed, an approximately 30" diameter hole remains in the seabed which will be naturally filled by sediment deposition over time, leaving a shallow depression. It was not possible to re-enter the A11 well conductor as the running tool was cemented in place, therefore an external cut was performed as close to seabed as possible using a diamond wire cutter. The conductor stump was then covered by rock-dumping to prevent a snagging hazard.





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