



# PL1092

## Relinquishment report



Partners: Harbour Energy Norge AS & Aker BP ASA

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# Relinquishment Report PL1092

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# 1 License history

PL1092 was granted 19.02.2021 as part of APA2020 licensing round [1] (Fig. 1.1). The licence is located in quadrants 15/6 and 15/9 and the licensees are Aker BP (50%) and Harbour Energy Norge AS (50%).

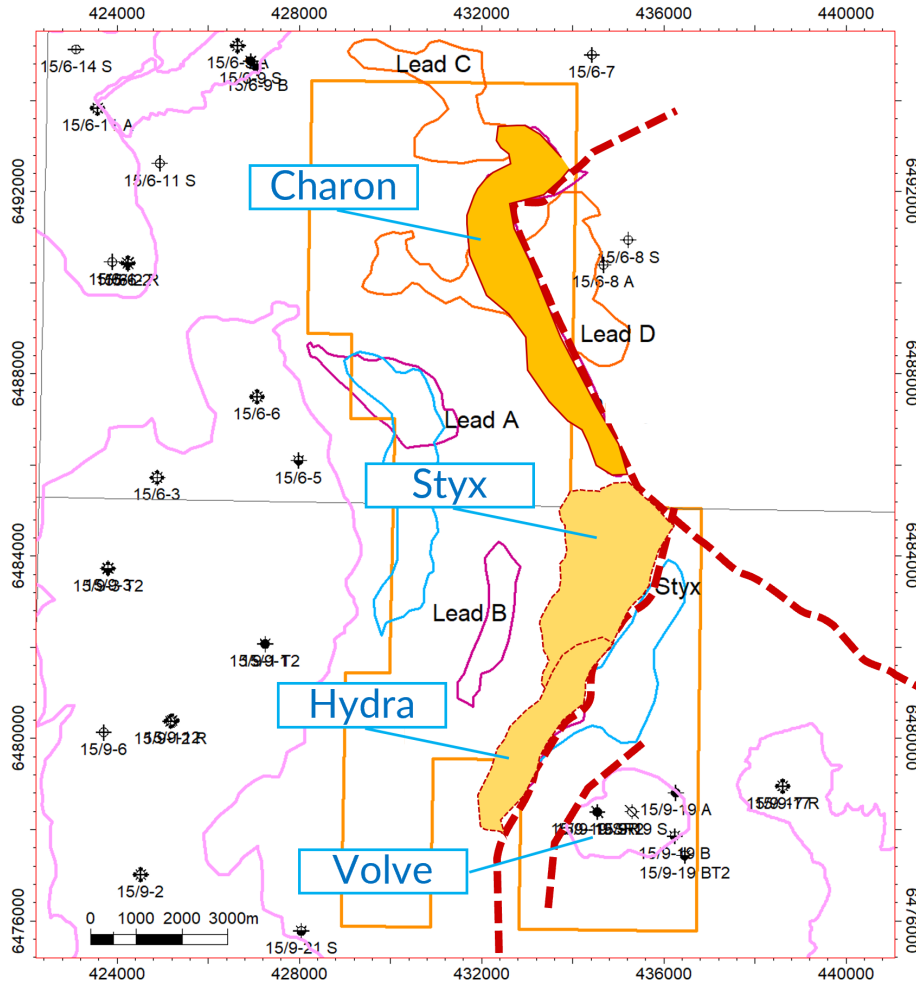


Fig. 1.1 PL1092 location with prospect and leads. PL1092 is located east of the Sleipner West Field, south-east of the Gina Krog Field and northwest of the Sleipner East Field.

The work commitments are to perform, within two years:

- Study of geology and geophysics
- Reprocessing of 3D seismic

A comprehensive work programme was undertaken since the award in 2021 including:

- Geophysics
  - Reprocessing of seismic 3D data (LU22M02)
  - Conditioning of seismic data, well tie and AVO modelling
  - Detailed seismic interpretation
  - Harbour in-house special reprocessing

- In-house seismic AVO and fluid indication study
- Geology
  - Well correlations, play analysis, basin modelling
  - Regional study of the structural evolution and development of accommodation space across the southwest flank of the Utsira High and the licence areas position in this regional setting. The prediction of accommodation space is closely linked to the prediction of the Vestland Group and hence presence of reservoir.
  - A regional study focused on the depositional setting of Mid Jurassic reservoir succession in the Gudrun Terrace
  - Fault seal analysis for the Charon Prospect
- Volume calculation and risk assessment of mapped prospects

The work commitments are fulfilled.

An application to extend the Decision to Drill by one year, to 19.02.2024, was granted 17.03.2023. A second extension of the Decision to Drill, to 19.02.2025 was granted 25.04.2024.

A unanimous decision was taken by the licensees to relinquish PL1092 before the Decision to Drill deadline. The main reason behind the relinquishment decision is a relatively high risk for trapping hydrocarbons and marginal economics in the current business case.

An overview of meetings held in the licence is shown in Table 1.1.

Table 1.1 Meetings held in the licence

Date	Licence meeting
06.04.2021	Exploration & Management Committee Meeting
29.11.2021	Exploration & Management Committee Meeting
31.05.2022	Exploration Committee Work Meeting
21.11.2022	Exploration & Management Committee Meeting
16.05.2023	Exploration Committee Work Meeting
16.06.2023	Exploration Committee Work Meeting
07.11.2023	Exploration Committee Work Meeting
12.11.2023	Exploration & Management Committee Meeting
15.12.2023	Exploration Committee Work Meeting
22.05.2024	Exploration Committee Work Meeting
18.11.2024	Exploration & Management Committee Meeting

The main prospectivity in PL1092 is related to a hanging-wall, fault bounded structure, called Charon, sitting on the east side of the Sleipner Basin. Reservoir is expected to be Hugin Formation sandstone reservoir of Middle Jurassic Vestland Group. The prospect evaluation has focused on hydrocarbon trapping. Seismic modelling shows that direct hydrocarbon identification from seismic data analysis is not favourable at Charon. One lead of Upper Jurassic age has been evaluated (Styx) and concluded to not be prospective due to high risk for reservoir presence. One lead (Hydra) of Middle Jurassic Vestland Group is also evaluated with special focus on fault seal.

Based on the prospect evaluation, no drillable candidates are identified within the licensed area.



The seismic was reprocessed by PGS as part of a larger processing effort by Aker BP in the area, LU22M02 (at that time Lundin Energy Norway). The licence decided later to reprocess parts of the area with a CRAM migration (Common Reflection Angle Migration).

Table 2.1 shows a list of the seismic surveys included in the seismic database.

Table 2.1 Seismic surveys included in the common seismic database

Seismic surveys included in the merge PGS16M03	NPDID
PGS15002	8245
PGS16002	8322
ST9305	3629
ST9407	3689

## 2.2 Well Data

A list of released wells were included in the common well database and used in the evaluation of PL1092. A list of wells are shown in Table 2.2.

Table 2.2 Common licence well database

Well name	NPDID
15/6-8S	3014
15/6-7	2084
15/9-11	329
15/6-9B	5571
15/6-11S	6488
15/6-5	320
15/6-9S	5571
15/6-6	38
15/6-9A	5566
15/6-11A	6526

### 3 Geological and geophysical studies

The main prospect, Charon, is a fault bounded prospect, located on the hanging wall side of the eastern boundary fault of the basin to the east of the Sleipner Vest Field. The prospect evaluation has focused on seismic mapping in a complex geological setting and fault sealing capacity of the bounding fault.

Work performed in licence includes:

- Reprocessing of 3D seismic data (LU22M02, 2022)
- In-house reprocessing of 3D seismic data (GRAM\_T34\_DeMul\_LF\_Full\_T, 2022)
- Seismic interpretation and G&G studies including
- Conditioning of seismic data
- Well tie
- AVO modelling
- Well correlations
- Play analysis
- Basin modelling
- Volume calculation
- Risking of mapped prospects

The evaluation has concluded that the Charon Prospect has a relatively high trapping risk and a limited hydrocarbon column present. A lead (Styx) of Upper Jurassic age is evaluated and concluded not prospective due to high risk for reservoir presence.

The work program and studies have not been able to limit the fault risk at Charon or the reservoir risk at Styx sufficiently to build a viable business case as a basis for a drilling decision.

# 4 Prospect update

The Charon Prospect is located in the eastern part of the Ve Sub-Basin and is defined by a three-way closure against the Sleipner Sub-Basin eastern boundary fault (Fig. 4.1). The higher pressure wells (15/6-7,8S) on the footwall block, situated to the east of Charon are dry with no hydrocarbon shows, indicating a sealing fault or a barrier towards the basin. The Gina Krog Field located to the northwest, is a geological analogue to the prospect, as shown in the figure. The reservoir is expected to be Hugin Formation sandstone of the Middle Jurassic Vestland Group. The Hugin Formation reservoir is found in many wells in the area and is a producing reservoir in the surrounding fields, with good reservoir properties. Hydrocarbon charge is expected to be sourced from the local Sleipner Basin. Phase is expected to be oil, but the presence of a gas cap cannot be excluded. There are two 3-way dip structures along the fault making up the Charon Prospect (North and South segments). For the resource estimation, these are modelled using a leak-connection method in GeoX.

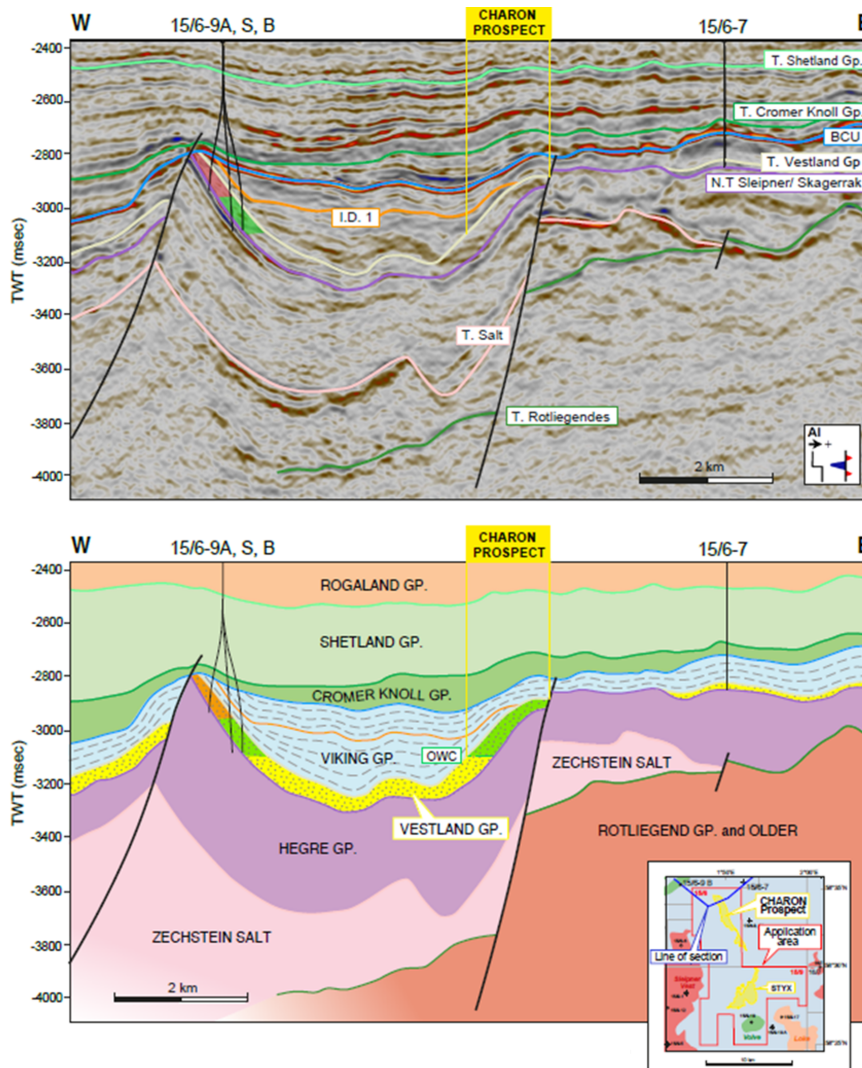


Fig. 4.1 The Charon Prospect The Charon Prospect defined as a three-way closure against the Sleipner Sub-Basin eastern boundary fault. The higher-pressure wells (15/6-7,8S) just to the east of Charon are dry with no shows, indicating a sealing fault or a barrier towards the basin.

A comprehensive fault seal study has been conducted during the licence period. Fig. 4.2 shows a sketch of the fault model developed for the Charon Prospect. It shows the complex juxtaposition between the hanging-wall and foot-wall side of the prospect. In summary the fault study concludes that:

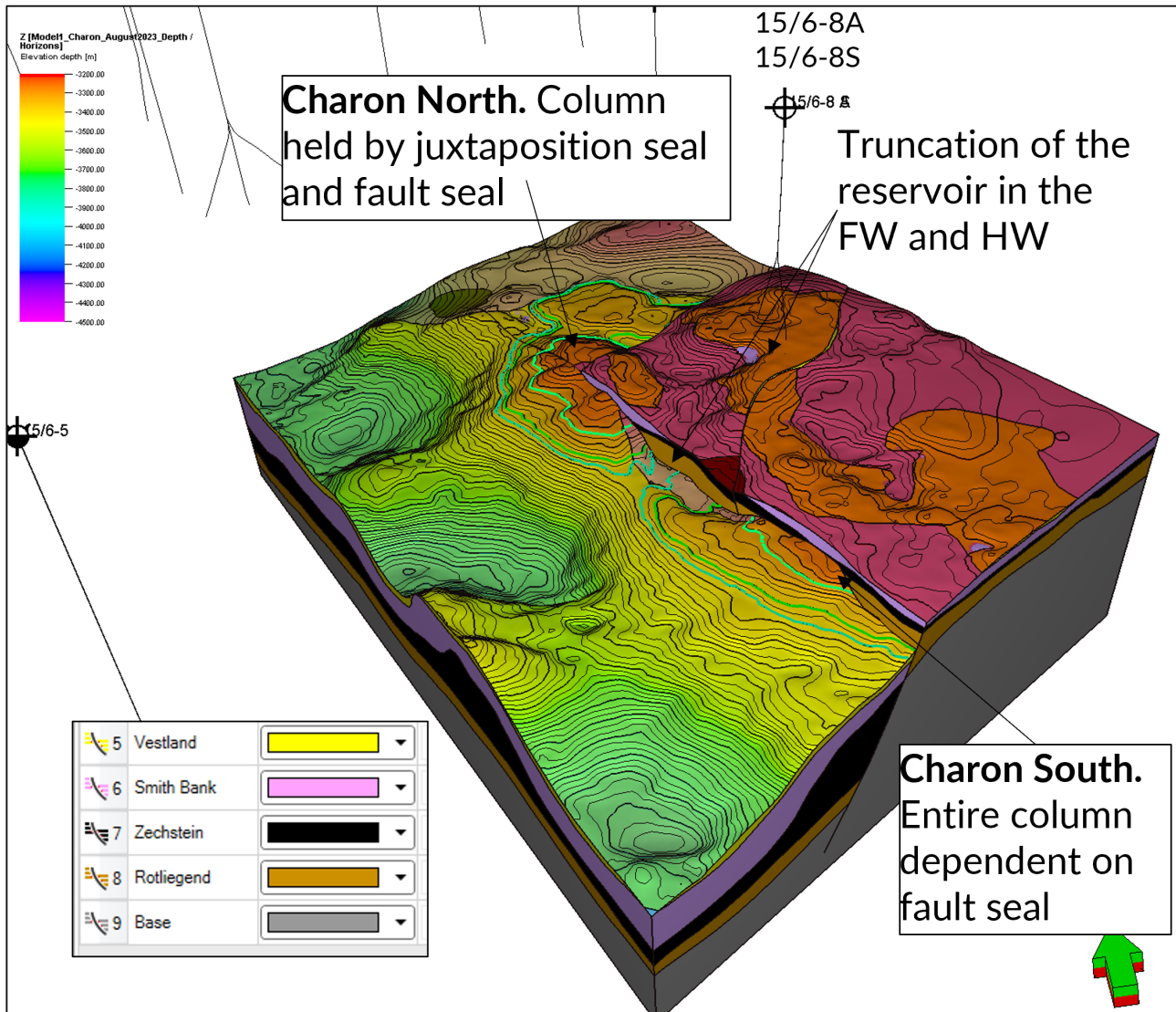


Fig. 4.2 Charon fault model

- The Charon Prospect is a salt-cored monocline where the trapping mechanism will be a combination of stratigraphic (truncation), fault seal, and salt smear
- In Charon North, minimum accumulation will be dependent on juxtaposition seal (reservoir against Smith Bank and Zechstein). Deeper contacts will depend on truncation trap or/and fault seal (reservoir against Rotliegend). Column heights in the most likely case and high case are 100 and 135 m respectively
- In Charon South, most of the hydrocarbon column will depend on fault seal. Column heights in the most likely case and high case are 164 and 199m respectively
- Higher overpressure in Charon could decrease column heights to the minimum case

A hydrocarbon column distribution is set up based on the fault seal study. The minimum case for the Charon North segment is defined by juxtaposition of Hugin against Rotliegendes, in case of Hugin not being eroded in the saddle. The most likely case for the Charon North segment is that

it spills towards the Charon South segment. The high case for Charon North is the southern-most spill point. Fig. 4.3 shows the resulting hydrocarbon contacts for the high, medium and low cases.

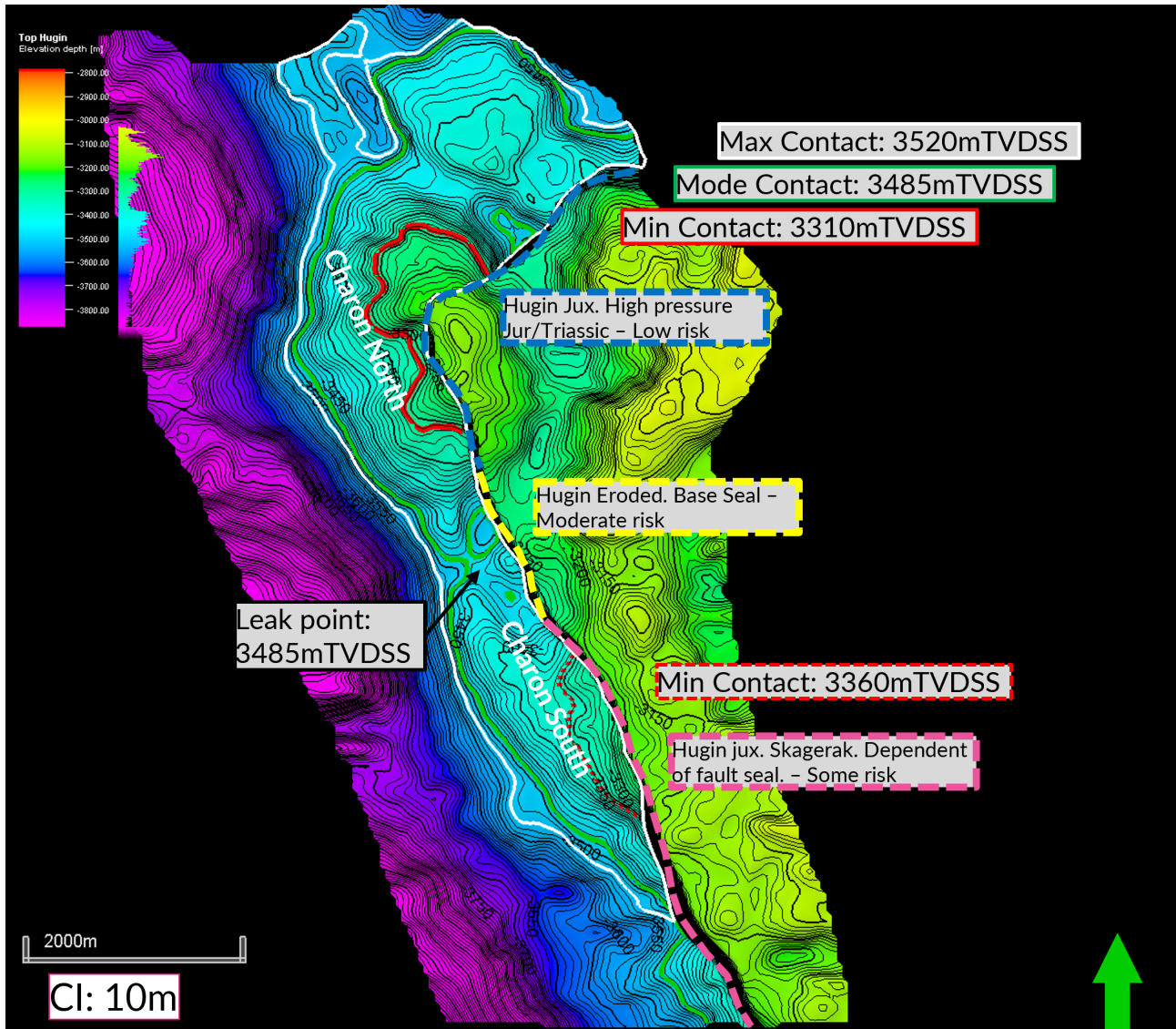


Fig. 4.3 Charon hydrocarbon column distribution based on the fault seal study

The hydrocarbon recoverable resource base is reduced since the APA application, whereas the geological chance of success is within the same range. The main reason for this resource decrease is an expected lower recovery factor due to a formation water with likely high Barium content. This can lead to scaling of production pipes if sea-water is used for injection and hence the revised recovery factor range reflects only depletion drive. The revised prospect parameters, resources and risk assessment are summarized in Table 4.1

The Styx Lead has been downgraded from prospect during the licence period and hence not reported here. The main reason for this is that no evidence of Upper Jurassic Draupne Formation sandstone is found.

Table 4.1 Final assesment of the Charon prospect

Table 4: Discovery and Prospect data (Enclose map)									
Block	15/6	Prospect name	Charon	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NOD will insert value	NPD approved (Y/N)	
Play name	NOD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company	Aker BP	Reference document	Relinquishment report PL1092			Assessment year	2025
This is case no.:		Structural element	Viking Graben	Type of trap	Combination	Water depth [m MSL] (>0)	105	Seismic database (2D/3D)	3D
<b>Resources IN PLACE and RECOVERABLE</b>		<b>Main phase</b>			<b>Associated phase</b>				
<b>Volumes, this case</b>		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10 <sup>9</sup> Sm <sup>3</sup> ] (>0.00)	3,52	4,75	11,80	21,10				
	Gas [10 <sup>9</sup> Sm <sup>3</sup> ] (>0.00)					0,50	0,80	1,70	2,95
Recoverable resources	Oil [10 <sup>9</sup> Sm <sup>3</sup> ] (>0.00)	1,33	1,17	3,37	5,87				
	Gas [10 <sup>9</sup> Sm <sup>3</sup> ] (>0.00)					0,19	0,21	0,47	0,82
Reservoir Chrono (from)	Early Callovian	Reservoir litho (from)	Hugin Fm	Source Rock, chrono primary	Kimmeridgian/Volgia	Source Rock, litho primary	Draupne Fm	Seal, Chrono	Late Jurassic
Reservoir Chrono (to)	Late Callovian	Reservoir litho (to)	Hugin Fm	Source Rock, chrono secondary	Oxfordian	Source Rock, litho secondary	Heather	Seal, Litho	Viking Gp
<b>Probability [fraction]</b>									
Total (oil + gas + oil & gas case) (0.00-1.00)	0.39	Oil case (0.00-1.00)	1.00	Gas case (0.00-1.00)	0.00	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.72	Trap (P2) (0.00-1.00)	0.60	Charge (P3) (0.00-1.00)	0.90	Retention (P4) (0.00-1.00)	1.00		
<b>Parametres:</b>									
	Low (P90)	Base	High (P10)	Comments					
Depth to top of prospect [m MSL] (> 0)			3230						
Area of closure [km <sup>2</sup> ] (> 0.0)	1,0	5,5	11,0						
Reservoir thickness [m] (> 0)	22	39	54						
HC column in prospect [m] (> 0)	80	255	290						
Gross rock vol. [10 <sup>9</sup> m <sup>3</sup> ] (> 0.000)	50,400	166,000	288,000						
Net / Gross [fraction] (0.00-1.00)	0,65	0,71	0,80						
Porosity [fraction] (0.00-1.00)	0,17	0,19	0,21						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,23	0,25	0,28						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0,68	0,69	0,71						
GOR, free gas [Sm <sup>3</sup> /Sm <sup>3</sup> ] (> 0)									
GOR, oil [Sm <sup>3</sup> /Sm <sup>3</sup> ] (> 0)	128	142	152						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,20	0,25	0,30						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,20	0,25	0,30						
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)									
For NPD use:									
Temperature, top res [°C] (>0)	115			Innrappr. av geolog-init.	NPD will insert value	Registrert - init.	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)	430			Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1. 8% porosity	2. 50% clay	3. 1mD permeability					Kart nr	NPD will insert value

## 5 Technical evaluation

There has not been any technical evaluations done in the licence period regarding possible development due to the lack of positive exploration drilling decision.

## 6 Conclusion

The prospectivity in the license has been thoroughly evaluated. Focus within the licence acreage has been prospectivity within the Jurassic level. The main prospect, Charon, is interpreted as a hanging-wall, fault-dependent structure. The risked volume potential for this prospect is deemed too low to justify an exploration well at the current stage and consequently the license group have decided to relinquish PL1092 at this time. The license has been extended twice by one year. The first was due to the late delivery of seismic reprocessing, the second, for the Ametyst well (15/9-25) to be drilled in the neighbouring PL1138 licence. The results of the Ametyst well have been incorporated into the prospect evaluation but unfortunately the well itself was dry in the Jurassic and hence gave no benefit in terms of development synergies.

## References

- 1 APA2021 Charon application