



## **PL 961 – Licence status report**

## Table of contents

### Table of Contents

<b>1</b>	<b>Licence history</b> .....	<b>4</b>
<b>2</b>	<b>Database overviews</b> .....	<b>5</b>
<b>3</b>	<b>Results of geological and geophysical studies</b> .....	<b>6</b>
<b>4</b>	<b>Prospect update report</b> .....	<b>8</b>
<b>5</b>	<b>Technical assessment</b> .....	<b>11</b>
<b>6</b>	<b>Conclusion</b> .....	<b>11</b>
<b>7</b>	<b>References</b> .....	<b>11</b>

#### Tables

Table 2.1	PL961 Common seismic database.....	5
Table 2.2	PL961 Common well database .....	6
Table 4.1	Eocene Cohnka prospect. Oil case .....	<b>Error! Bookmark not defined.</b> 0
Table 4.2	Eocene Cohnka prospect. Gas case.....	<b>Error! Bookmark not defined.</b> 0
Table 4.3	Eocene Cohnka prospect. Play and prospect probabilities .....	<b>Error! Bookmark not defined.</b> 0
Table 4.4	Paleocene prospects. Oil cases.....	<b>Error! Bookmark not defined.</b> 1
Table 4.5	Paleocene prospects. Play and prospect probabilities.....	<b>Error! Bookmark not defined.</b> 1

#### Figures

Figure 2.1	PL961 seismic and well database .....	6
Figure 3.1	NW-SE Geoseismic section with play models.....	7
Figure 3.2	Cenomanian/Turonian AVO class IV amplitude map showing source rock development.....	8
Figure 3.3	Eocene submarine fan development.....	8
Figure 4.1	Eocene Cohnka prospect, depth and fluid cube amplitude map. ....	9
Figure 4.2	Near Top Paleocene depth and fluid cube amplitude map .....	<b>Error! Bookmark not defined.</b> 1

## 1 Licence history

<b><u>Licence:</u></b>	PL961 - blocks 7116/6,7117/4 and 7117/5	
<b><u>Awarded:</u></b>	June 22 <sup>nd</sup> , 2018	
<b><u>Licence period:</u></b>	Expires June 22 <sup>nd</sup> , 2024 Initial period: 6 years	
<b><u>Licence group:</u></b>	Equinor Energy AS	50% (Operator)
	Aker BP ASA	30%
	Petoro AS	20%
<b><u>Licence area:</u></b>	981,960 km <sup>2</sup>	
<b><u>Work program:</u></b>	Acquiring 3D seismic over the entire licence area, and decision to drill or drop within June 22 <sup>nd</sup> 2021.	
<b><u>Meetings held:</u></b>		
30.08.2018	EC/MC startup meeting	
19.11.2018	EC/MC meeting	
28.08.2019	EC meeting	
18.11.2019	EC/MC meeting	
27.10.2020	EC/MC meeting	
18.03.2021	MC meeting	
<b><u>Work performed:</u></b>		
2018:	Licence start-up, 3D seismic purchase.	
2019:	Geological/geophysical evaluation of prospectivity.	
2020:	Prospect evaluation.	
2018:	Decision made to surrender licence.	

### **Reason for surrender:**

The prospectivity in PL961 has been re-evaluated on good quality 3D seismic. All potential play models within the Cenozoic and Upper Cretaceous section have been evaluated with resource and risk assessment for the identified prospects. The common risk for all these prospects is related to presence of a working hydrocarbon systems. Detailed geological and geophysical evaluation have not been able derisk the presence of hydrocarbons within the identified prospect. In summary, no drillable prospects have been identified in the license. and it is difficult to derisk the prospects any further.

## 2 Database overviews

### Seismic data

An overview of the common seismic database is shown in Figure 2.1, and listed in Table 2.1. The Carlsen 3D cover a larger area than PL961 and overlaps the NH9803 survey with seismic tie to the key well 7216/11-1s. Together with the EL0001 survey this gives a continuous 3D coverage over large part of the Sørvestsnaget Basin. Within the PL961 partnership only Equinor has access to the full Carlsen survey.

Seismic survey	Survey type	Area	Year	Quality
Carlsen	3D	PL961 area	2017	Good
NH9803	3D	Full survey	1998	Good
EL0001	3D	Full survey	2001	Good

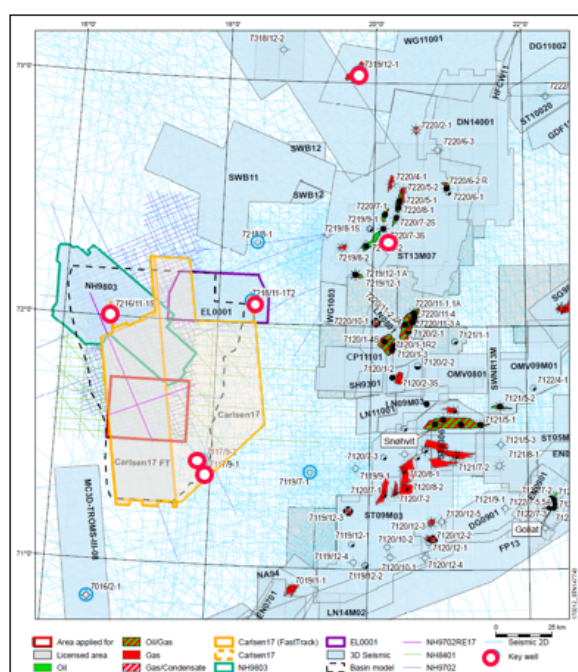
**Table 2.1 PL961 common seismic database**

### Well data

An overview of the common well database is shown in Figure 2.1 and Table 2.2.

Well	Year	Drilling operator	License	Status	Age at TD	Formation at TD
7016/2-1T2	2013	ENI Norge AS	PL529	P&A	Paleocene	Torsk Fm
7117/9-1	1982	Norsk Hydro Produksjon AS	PL063	P&A	Early Cretaceous	Kolje Fm
7117/9-2	1983	Norsk Hydro Produksjon AS	PL063	P&A	Early Cretaceous	Kolje Fm
7119/7-1	1983	Norsk Hydro Produksjon AS	PL076	P&A	Permian	undef.
7216/11-1S	2000	Norsk Hydro Produksjon AS	PL221	P&A	Paleocene	Torsk Fm
7218/11-1T2	2013	Repsol Exploration Norge AS	PL531	P&A	Early Cretaceous	Kolmule Fm
7218/8-1	1981	GDF Suez E&P Norge AS	PL607	P&A	Early Cretaceous	Kolmule Fm

**Table 2.2 PL961 common well database**



**Figure 2.1 PL961 seismic and well database**

#### Key seismic survey:

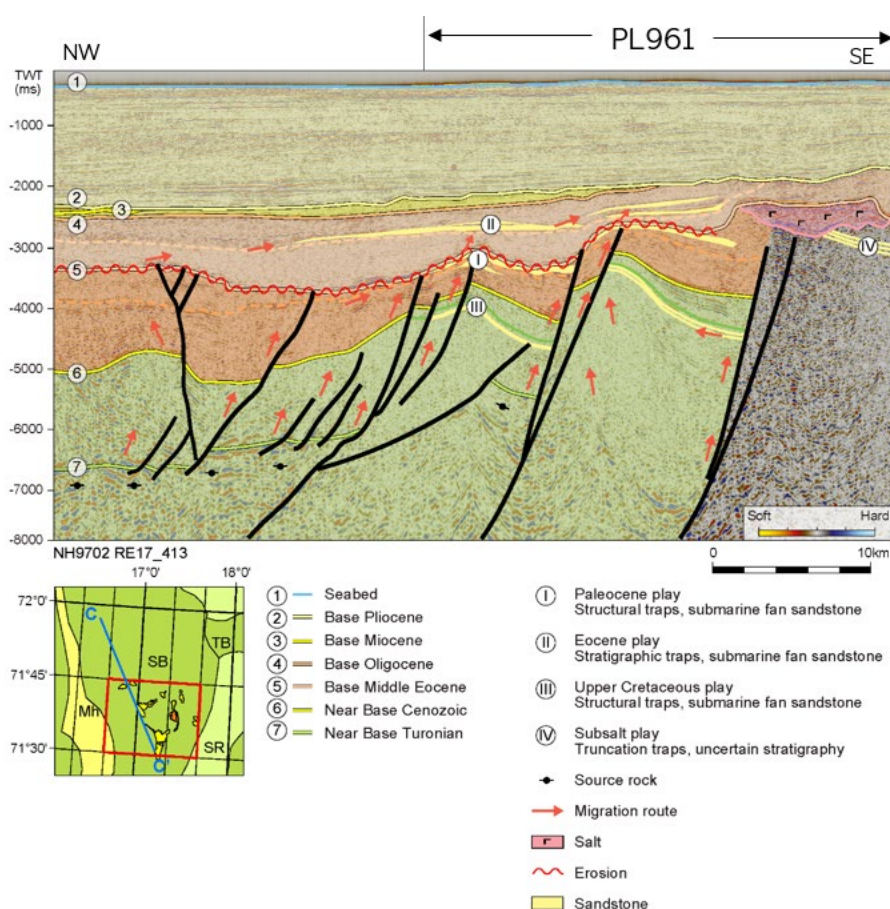
- Carlsen – 3D
  - Sørvestsnaget Basin and Senja Ridge
  - PL961 and tie to key wells

#### Key wells:

- 7216/11-1s Sørvestsnaget Basin:
  - Main seismic tie well – Cenozoik strata.
  - Eocene reservoir development.
- 7218/11-1T2 Veslemøy High:
  - Cenoman/Turon source rock.
- 7117/9-1 and 9-2 Senja Ridge:
  - Paleocene reservoir antiodels.
- 7319/12-1 Bjørnøya Basin and Mist:
  - Paleocene reservoir development.

### 3 Results of geological and geophysical studies

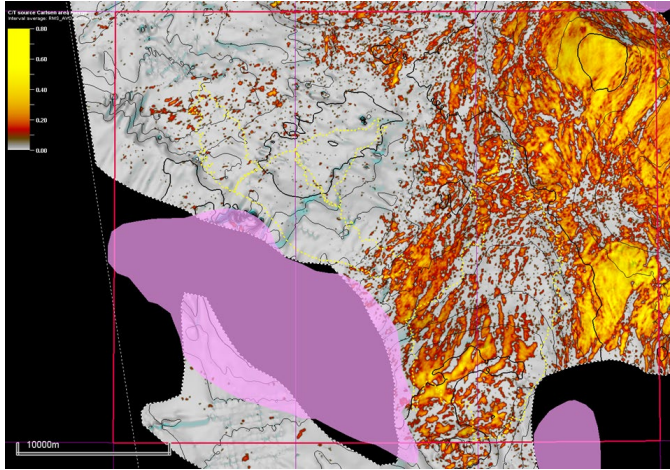
The regional geological framework is described in the application for blocks 7116/6, 7117/4 and 7117/5 (Equinor 2017). PL961 is located within the southern part of the Sørvestsnaget Basin, and only one well (7216/11-1S) has been drilled within this play area, testing Eocene and Paleocene play models. The well showed reservoir development within Eocene submarine fan deposits, but encountered no hydrocarbons. Play models related to PL961 are Eocene submarine fans within stratigraphic traps, and Paleocene/Upper Cretaceous structural closures related to rifting and opening of the Norwegian-Greenland Sea (Figure 3.1).



**Figure 3.1** NW-SE Geoseismic section through southern Sørvestsnaget Basin showing key stratigraphic horizons and play models within PL961

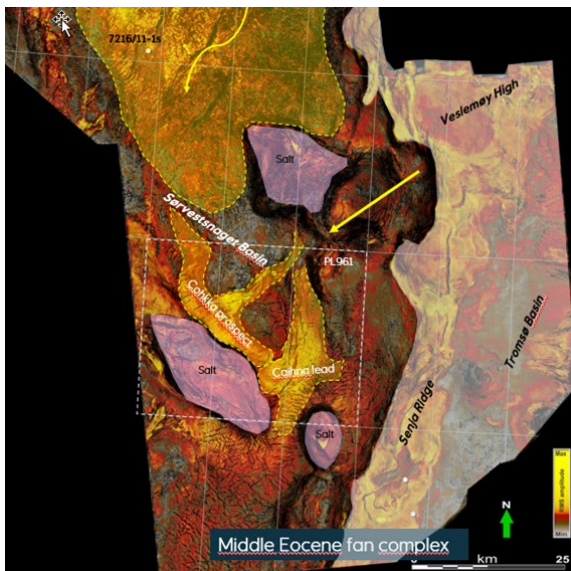
Common critical factor is an unproven Upper Cretaceous (Cenomanian/Turonian) hydrocarbon system, due to a too deeply buried Upper Jurassic source rock within the western margin of the Barents Sea. In addition, reservoir development represents a key risk factor, especially for the Paleocene strata.

A series of geological and geophysical studies have been undertaken to derisk these critical factors. A full suite of AVO cubes focusing litho- and fluid- predictions have been produced. Seismic tie of the Cenomanian/Turonian source rock proven in well 7218/11-1T2 (Veslemøy High) into the Sørvestsnaget Basin, including AVO class IV mapping, strongly indicate the presence of source rock within the license drainage area (Figure 3.2).



**Figure 3.2** Cenomanin/Turonian AVO class IV amplitude map indicating the Upper Cretaceous source rock development within the Carlsen 3D area (PL961 outline in red)

Large uncertainty still remains regarding thickness and quality of the source rock, and represents a high risk linked to generated and migrated hydrocarbons (both amount of hydrocarbons and oil versus gas distribution). Semi-regional mapping of the Eocene sub-marine fans indicate a large fan-system with reservoir potential within PL961 (Figure 3.2).



**Figure 3.3** Eocene submarine fan development within the western Barents Sea. Fans within PL961 seems to be linked to an eastern provenance area

These fan deposits are slightly younger, and with a different provenance area than the one proven in well 7216/11-1S. Most likely the PL961 strata is sourced from structural high to the east (Veslemøy High and/or Loppa High), while the ones proven in the well is sourced from the north with Stappen High as the provenance area. Geophysical analysis supports reservoir presence, but most likely relatively thin sandstone units within this package of submarine fan deposits. For the Paleocene strata the geophysical mapping gives no support for reservoir development, and together with no sands in the nearby wells this still remains a high risk factor.

## 4 Prospect update report

### Eocene - Main play model:

The main prospect complex in the license is the Middle Eocene Cohnkka fan, which is divided into Eocene Upper Fan and Eocene Lower Fan prospects. Both represents pinch out traps against salt to the west, combined with stratigraphic trapping/shale out towards south. The prospect outline/container is further defined by amplitude shout offs downflank (Figure 4.1). Detailed mapping shows weak-medium amplitude anomalies, lack of clear downdip brine responses and consistent depth conform areas which indicate that anomalous amplitudes are mainly caused by lithological effects (thinning of sediment/sand and porosity changes). The chance of having HC in the system is possible, but is not directly supported by the amplitude observations.

An overview of in-place and recoverable resources for both the Cohnkka Upper and Cohnkka Lower Fan is shown in Table 4.1 and 4.2. The most likely scenario for both fans is based on a mean hydrocarbon filling down to shut off of the main amplitude for both levels (Figure 4.1). Reservoir thickness is based on isochore mapping calibrated against geophysical modelling of the observed seismic response. Recoverable resources in the range of 30-40 MSm<sup>3</sup> oil is regarded as marginal with respect to the needed stand alone potential for a positive break even value (see value evaluation below). Sealing related to thief sands along the stratigraphic pinch outs, and a working hydrocarbon system because of the unproven source rock is regarded as the main risk factors ( Table 4.3). Probability for hydrocarbons is set to 11%, and with an oil versus gas probability of 30/70 this gives in the range of 3% probability for an oil discovery.

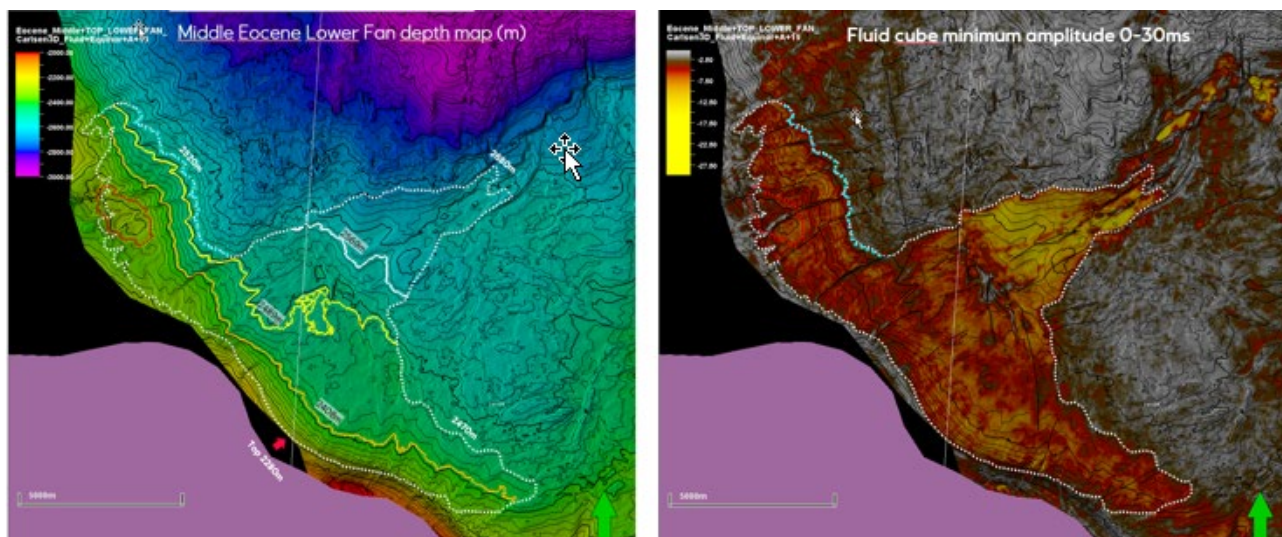


Figure 4.1 Eocene Cohnkka prospect, depth and fluid cube amplitude map

License	Prospect	In-place oil (MSm3)			Recoverable oil (MSm3)			Poil	Within licence %
		P90	Mean	P10	P90	Mean	P10		
PL961	Upper Fan	34	67	108	13	27	44	0,04	100
	Lower Fan	39	110	212	16	44	84	0,03	100

**Table 4.1 Eocene Cokhka prospect. Oil case**

License	Prospect	In-place gas (GSm3)			Recoverable gas (GSm3)			Pgas	Within licence %
		P90	Mean	P10	P90	Mean	P10		
PL961	Upper Fan	10	19	30	7	12	21	0,1	100
	Lower Fan	11	30	58	8	21	40	0,08	100

**Table 4.2 Eocene Cokhka prospect. Gas cases**

License	Prospect	P-play			P-prospect/segment							P-discovery	
		Reservoir	Source	Seal	Reservoir		Source			Trap		P(oil)	P(gas)
					presence	producibility	presence	migration	HC phase	geometry	seal		
PL961	Upper Fan	1	0,7	1	0,8	1	0,8	0,8	1	1	0,4	0,04	0,1
	Lower Fan	1	0,7	1	0,8	1	0,8	0,8	1	1	0,3	0,03	0,08

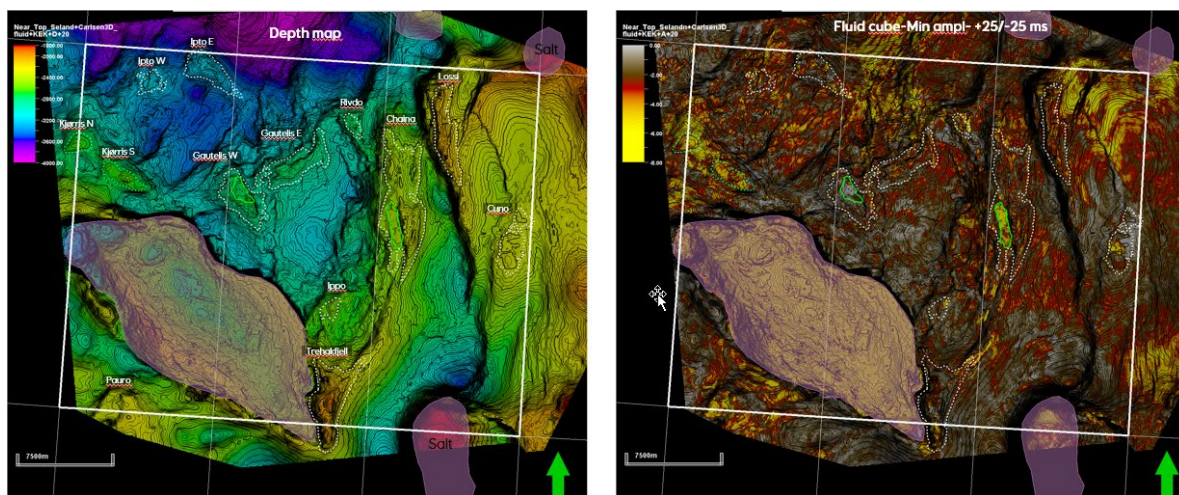
**Table 4.3 Eocene Cokkka prospect. Play and prospect probabilities**

In addition the Chaina Fan Complex (Figure 3.3) is defined as a lead within this play model due to an inconsistent amplitude pattern, and lack of mappable trapping mechanism. The Chaina fan represent an interesting follow up potential given a better understanding of the nature of the geophysical anomalies, and sealing for these Eocene deposits.

#### **Paleocene and Upper Cretaceous - Secondary play models:**

Structural traps within Paleocene and Upper Cretaceous section represents secondary play models. In total 11 closures have been mapped within the license area, and some are located directly below the outline of the Eocene Fan Complexes. Figure 4.2 shows the mapped closures at Near Top Selandian level, representative for structuring of the Paleocene and Upper Cretaceous strata. Critical factor, in addition to presence of a working hydrocarbon system, is reservoir development due to lack of sands in nearby wells. Paleoenvironmental interpretation from well data clearly indicate deposition in a deep marine environment. Amplitude mapping does not show any signs of submarine fan system to support reservoir development within this area (Figure 4.2).





**Figure 4.2** Near Top Paleocene depth and fluid cube amplitude map with prospect outlines

Recoverable resources and prospect probabilities is summarized in Table 4.4 and 4.5. Due to lack of any amplitude shut offs supporting hydrocarbon filling, a histogram hydrocarbon column distribution with decreasing probability towards depth has been used for all prospects. The mean recoverable resource estimates are small in relation to the remote location as stand alone candidates. Also the maximum cases, where each structure has been filled to spill, shows that the structural traps only represents secondary prospectivity within this license. In addition all Paleocene and Upper Cretaceous prospects have a low probability for discovery related to uncertainty in source rock and reservoir development. The prospect probability for an oil case within these strata are in the order of 3% with a 30/70 oil versus gas probability.

License	Prospect	In-place oil (MSm3)			Recoverable oil (MSm3)				Poil	Within licence %
		P90	Mean	P10	P90	Mean	P10	Max (spill)		
PL961	Gautelis West	7	15	25	3	6	11	13	0,03	100
	Gautelis East	5	11	20	3	5	9	12	0,03	100
	Chaina	14	29	50	6	12	22	32	0,03	100
	Lossi	3	10	20	1	4	9	16	0,03	100
	Cuno	3	6	10	1	2	4	6	0,03	100
	Trehakfjell	8	27	48	4	12	22	30	0,02	100
	Ipto East	4	8	12	2	3	5	6	0,03	100

**Table 4.4** Paleocene prospect. Oil cases

License	Prospect	P-play			P-prospect/segment						P-discovery		
		Reservoir	Source	Seal	Reservoir		Source			Trap		P(oil)	P(gas)
					presence	productibility	presence	migration	HC phase	geometry	seal		
PL961	Gautelis West	0,6	0,7	1	0,6	1	0,8	0,8	1	1	0,7	0,03	0,08
	Gautelis East	0,6	0,7	1	0,6	1	0,8	0,8	1	1	0,7	0,03	0,08
	Chaina	0,6	0,7	1	0,6	1	0,8	0,8	1	1	0,7	0,03	0,08
	Lossi	0,6	0,7	1	0,6	1	0,8	0,8	1	1	0,7	0,03	0,08
	Cuno	0,6	0,7	1	0,6	1	0,8	0,8	1	1	0,7	0,03	0,08
	Trehakfjell	0,6	0,7	1	0,5	1	0,8	0,8	1	1	0,7	0,02	0,07
	Ipto East	0,6	0,7	1	0,6	1	0,8	0,8	1	1	0,7	0,03	0,08

**Table 4.5** Paleocene prospect. Play and prospect probabilities

## 5 Technical assessment

PL961 is located ca 120 km from Castberg and Snøhvit fields, too far for any tie back solutions. Within the licence the Eocene Cøhka Fan is the only prospect with potential for a stand alone development. Both Cøhka Upper and Lower Fan have a relatively low resource density (large area, thin reservoir and expected variable N/G) that would require many production wells. [REDACTED]

[REDACTED]

The remaining prospectivity within structural traps in Paleocene has a significantly lower volume potential and can only represent tie in resources to a nearby field. The evaluated gas volumes are also too small for any positive economic field development solution.

## 6 Conclusion

The final processed Carlsen 3D covering the PL961 area has confirmed the play models applied for in the 23<sup>rd</sup> Consession round (Equinor 2017). The main prospects at Eocene level within submarine fan deposits contain interesting volumes with potential for an economic development. Detailed interpretation, included amplitude extractions from a full set of AVO cubes, have not succeeded in derisking the main uncertainty related to presence of hydrocarbons. Consequently, Eocene prospect probabilities remains below 5% for an oil case which gives a marginal positive economic case. Secondary prospectivity related to structural traps within the Paleocene and Upper Cretaceous strata shows too small volumes for a stand alone development and share the same play risk elements linked to the quality of source rocks. In addition, reservoir development linked to these strata is highly uncertain.

In summary, because of very high risk related to any potential economic accumulations no drillable prospects have been identified in the licence.

## 7 References

Equinor 2017: 24<sup>th</sup> round application for blocks 7116/6, 7117/4 and 7117/5.