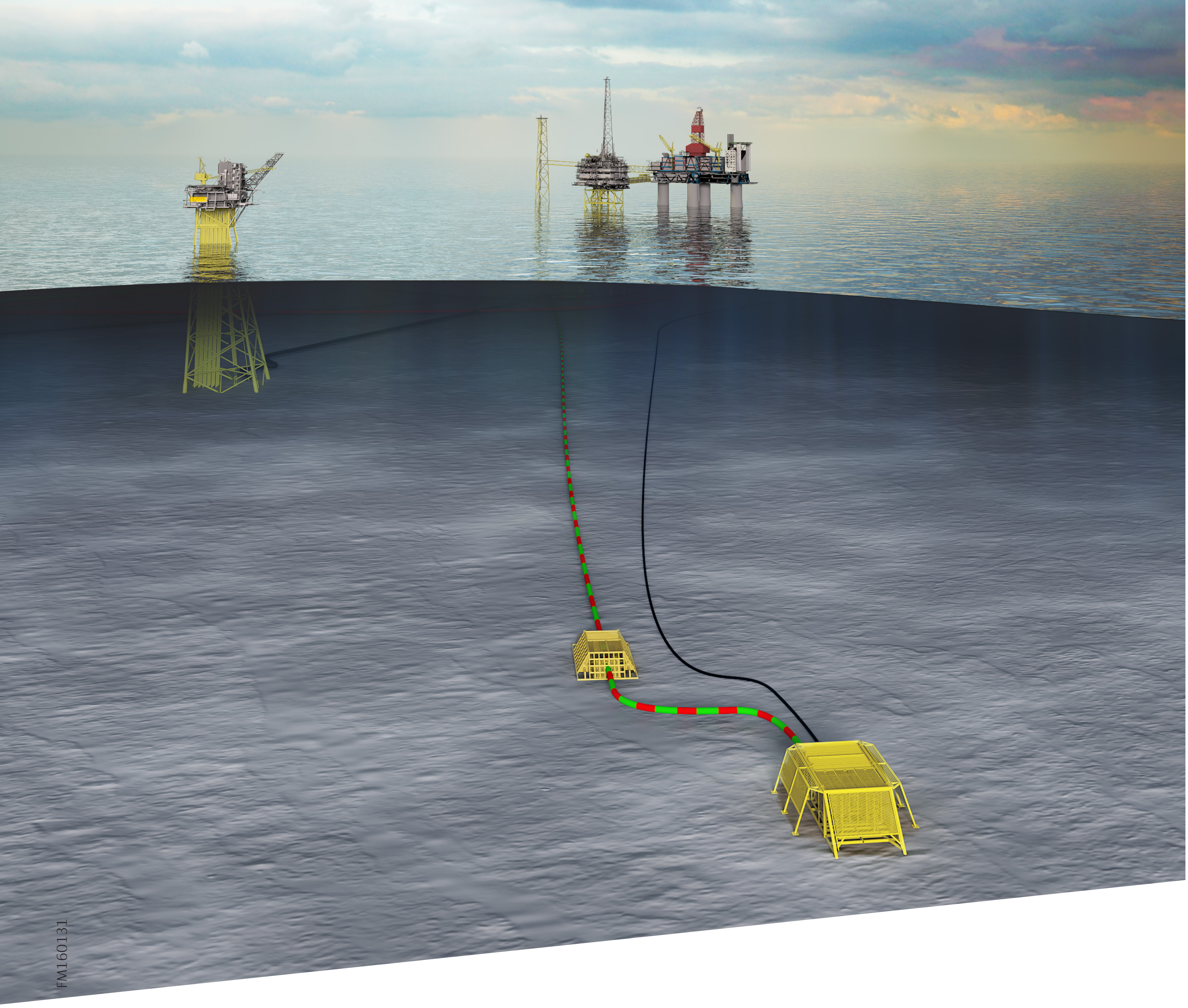
Utgard

Environmental Statement
Utgard Unit P.312 (UKCS), PL046E (NCS) and PL046F (NCS)



JX Nippon Exploration and Production (U.K.) Limited

LOTOS

TOTAL

Statoil

INFORMATION PAGE

Project name:	Utgard		
DECC Project reference:	D/4188/2016		
Type of Project:	Field Development		
Undertaker Name:	Statoil Petroleum AS		
Address	Forusbeen 50 4035 Stavanger Norway		
Licensees/Owners:		PL046 E/F Block 15/8 (Norway)	P.312 Block 16/18a (U.K.)
	Statoil Petroleum AS	62.0%	
	Lotos Exploration and Production Norge AS	28.0%	
	Total E&P Norge AS	10.0%	
	JX Nippon Exploration and Production (U.K.) Limited		45.0%
	Statoil (U.K.) Limited		55.0%
Short Description:	Statoil and its licence partners propose to develop the Utgard offshore gas condensate field, which is a trans-boundary field located in the central North Sea in Block 15/8 of the NCS and Block 16/18a of the UKCS. It is proposed to develop the field by means of two or possibly three wells drilled through a 4-slot template located on the NCS approx. 450 metres to the east of the median line. The wells would be drilled using a mobile offshore drilling unit. The template would be tied-back by pipeline to existing installations on the Sleipner field on the NCS, where the Utgard gas and condensate would be processed (principally to separate gas and condensate and to remove excess carbon dioxide from the Utgard gas) and then exported via existing infrastructure. The removed CO_2 would be injected into the Utsira formation.		
Anticipated commencement of works:	2018		
Date and reference number of any earlier Statement related to this project:	D/4050/2009 (withdrawn)		
Significant environmental impacts identified:	None		
Statement prepared by:	Statoil Petroleum AS		

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1 Non-Technical Summary

1.1 Introduction

The Utgard field is a trans-boundary gas and condensate field with a portion of the total reserves located on the UK side of the border. The field is located in Blocks 15/8 (NCS) and 16/18a (UKCS) in the central North Sea, about 21 km west of the Sleipner complex. Utgard will be developed from a four slot subsea template with 2 wells, and a 21 km pipeline connecting the wells to the Sleipner T platform (SLT). All processing will take place at SLT, and all the infrastructures will be placed on the Norwegian side of the border. Although one of the two well targets is on the UKCS, this target will be reached from the drilling location on NCS.

The gas in the Utgard field has a CO_2 content of about 16%. To reduce this to a level suitable for blending with the Sleipner export stream, the gas will be routed through the existing CO_2-removal facilities at SLT (CO_2 reduction to 3-5%). Separated CO_2 will be injected into the Utsira formation for permanent disposal. Remaining CO_2 will be blended in the SLT export gas stream.

The Sleipner area includes the gas and condensate fields Sleipner East and Sleipner West with the satellite fields Gungne, Loke, Alfa Nord and the 3rd party tie-in fields Sigyn, Gudrun and Gina Krog. Condensate from Sleipner is transported through pipeline for treatment at Kårstø in South West Norway. The gas is mixed with gas from the Kollsnes and Nyhamna terminals at the Sleipner riser platform and transported to the European market in the Gassled pipeline system.

The environmental and social impacts from oil- and gas activities in the Sleipner area, including Utgard, are already described in the Regional Impact Assessment (RIA) of the North Sea from 2006 and in the Integrated Management Plan for the North Sea and Skagerrak (Management Plan) from 2013. An application has been submitted to The Norwegian Ministry of Petroleum and Energy asking the Ministry’s acknowledgement that the Norwegian legal requirements for impact assessment are already fulfilled by the existing RIA-North Sea and the Integrated Management Plan, and that a new field specific impact assessment is not required.

Statoil as the operator of the Utgard field has prepared this Environmental Statement. The Environmental Statement (ES) presents the findings of the assessment of environmental consequences of construction and operation of the Utgard field.

The submission of this ES is required under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 as amended by the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) (Amendment) Regulations 2007 because the UK share of the production exceeds the threshold set in the regulations, which is 500 tonnes or more per day of oil or 500,000 cubic metres or more per day of gas.

Notwithstanding the regulatory requirements, internal impact assessments are routinely carried out by Statoil for all offshore development activities as a matter of Company policy.

1.2 Operations Summary

The production on Sleipner is now below plateau and yearly production is declining. Utgard will use production capacity that has become available at the Sleipner facilities. Production of the Utgard resources will cause no significant change to emissions and discharges at Sleipner compared with those currently allowed under the regulatory permits that are in place for the Sleipner field operations, or compared to the emission forecasts that were considered within the Regional Environmental Impact Assessment (RIA) of the North Sea (2006) and the Management Plan of the North Sea and Skagerrak (2013).

Start-up of Utgard is scheduled in December 2019 with peak production in the years 2020-22. The production period at the Utgard field is estimated to be approximately 12 years.

1.3 Environmental Management

Statoil has established an environmental policy which supports the goals of zero harm to the environment and sustainable development. Statoil’s environmental policy has been adopted by the Company’s top management and applies to all the Company’s activities and to all employees.

The commitments that follow from the environmental policy are realised through Statoil’s implementation of mechanisms and systems for efficient execution, measurement, control and improvement of all the activities and processes carried out by the Company and its suppliers.

This Environmental Statement identifies mitigating measures and possible improvements that will be assessed in the further planning work for Utgard. These measures will be followed up continuously by the project during the development and production phases.

1.4 Environmental Sensitivities

All infrastructures, activities, emissions to air and discharges to sea associated with the development and operation of Utgard will take place on the Norwegian continental shelf in the North Sea.

The proposed development is located in an area that is typical of the offshore regions of the central North Sea where hydrographical, meteorological, geological and biological characteristics are relatively uniform over large areas. Users of the area are mainly those associated with oil and gas exploration and development, shipping and fishing. Table 1-1 provides a summary of the key features of the offshore environment in this area, and their seasonal patterns of activity or sensitivity, based on descriptions and referenced information sources in Section 6.

Table 1-1. *Seasonal environmental sensitivities in the influenced area*

<table>
<tr><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td colspan="12">Plankton
The planktonic community is potentially sensitive to chemical releases into the sea. The planktonic community in the vicinity of the proposed activities is typical of the central North Sea and has the capacity to recover quickly because there is a continual exchange of individuals with surrounding waters. Any impacts associated with the proposed operations are likely to be small in comparison with natural variations.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="12">Benthic Fauna
Benthic communities in the area of the proposed activities are similar to those found throughout the surrounding area of the central North Sea and no rare species are known to occur in this area. Benthic faunal communities are vulnerable to physical and chemical disturbances to the sediment.</td></tr>
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<tr><td colspan="12">Fish
Juvenile fish, in particular ecologically sensitive demersal spawning species such as sand eels, herring and Norway lobster, are vulnerable to any physical disturbance of their spawning and nursery grounds. Finfish and shellfish are vulnerable to pollution, such as oil and chemical discharges, especially during the egg, larval and juvenile stages of their lifecycle. The proposed activities lies within spawning grounds for cod, haddock, saithe and Norway pout. Most of these species are considered to be less sensitive because of their widespread distribution and extensive spawning areas.</td></tr>
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<tr><td colspan="12">Marine Mammals
Harbour porpoise is the most commonly recorded cetacean in this area; numbers are greatest in July. Other species of cetaceans recorded in the area are killer whale, minke whale, white-beaked dolphin, white-sided dolphin and Risso’s dolphin. Marine mammals are vulnerable to chemical discharges, acoustic disturbance from vessel operations, and injury from collisions with vessels.</td></tr>
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<tr><td colspan="12">Seabirds
Seabird populations are vulnerable to surface pollution, particularly oil. However, Utgard is a gas and condensate field and potential negative impacts on seabirds from the planned activities are therefore regarded to be low.</td></tr>
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<tr><td colspan="12">Fishing Activity
Fishing activity is considered to be low in the eastern part of the influenced area and somewhat higher/moderate in the western part around the template.</td></tr>
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<tr><td colspan="12">Conservation Areas and Species
There are no protected areas that may be influenced by the planned development of Utgard. Based on generally available information and survey data from the pipeline route there are no coral reef habitats in the area of the proposed pipeline. Neither have any objects of cultural heritage importance been identified in the area. The harbour porpoise (mentioned above) is the only Annex II species known to occur in this region of the North Sea.</td></tr>
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</table>

Key to Level of Sensitivity / Activity	
	Very high
	High
	Moderate
	Low

1.5 Evaluation of Potential Environmental Impacts

Offshore developments have the potential to affect the environment in different ways. This may include physical disturbance of the seabed, and the creation of gaseous emissions, aqueous discharges and solid wastes. An evaluation of the relative significance of these potential environmental effects for the activities proposed in connection with the development of Utgard has been undertaken so that any potentially significant impacts can be assessed and mitigated. The evaluation takes account of the activity causing the impact or risk associated with the main project activities and the sensitivity of the location. Consideration was also given to the routine, non-routine and potential accidental/emergency events.

Particular emphasis has been placed on the matters raised in the Supplementary Guidance issued by the Department of Energy and Climate Change (DECC) following the Macondo well incident in the Gulf of Mexico (Deepwater Horizon).

1.6 Assessment of Potential Significant Environmental Impacts

This assessment concludes that the development of Utgard will have only minor to negligible environmental impacts within the Norwegian continental shelf and negligible to no impact on the UK continental shelf.

1.7 Mitigation Measures

The activities associated with the Utgard development will be conducted in accordance with Statoil's environmental policy. A summary of the main commitments for the Utgard field development are as follows:

- Energy optimisation to reduce fuel consumption and associated emissions to air.
- Environmentally harmful chemicals (black or red categories, ref. Section 5.1) will not be used. Chemical selection shall be based on best available techniques (BAT) principles.
- Cuttings from drilling with oil based mud will not be released to sea, but transported to shore for handling.
- The drilling programme will comply with Statoil's Emergency Procedures and Oil Spill Contingency Plan.
- All subsea infrastructures will be made over-trawlable.
- All activities will be carried out in line with Statoil's HSE policy and current Norwegian legislation.

Utgard will use available capacity in the existing topside process facilities on SLT. No new power production equipment will be needed. Total environmental emissions from the Sleipner field facilities will not increase as a result of the Utgard tie-in, but will decrease at a slower pace than might otherwise be the case. Existing environmental standards and mitigating measures will apply also for the Utgard part of the production.

1.8 Conclusion

All facilities related to the Utgard development are to be installed on the Norwegian Continental Shelf (NCS). There are no planned activities on the UK Continental Shelf (UKCS).

In overall terms, the proposed activities at the Utgard field and at the Sleipner complex are not expected to cause any significant adverse environmental impacts. The Utgard field and the Sleipner complex are located in an area which is typical of the central North Sea in terms of habitats and marine life. None of the environmental receptors is assessed as being particularly sensitive to the type of activities proposed.

The activities associated with the Utgard development will be included in the Company's environmental measurement and monitoring programmes, which track performance against corporate targets for important categories of emissions and discharges.

This assessment demonstrates that the planned drilling of the two Utgard wells, the marine installation work, and the processing of the Utgard reserves at the Sleipner complex will have no significant effects on environmental resources in the central North Sea. It is concluded that the Utgard field development and operation can be implemented without significant adverse effects on the environment.

Statoil believes that the mitigating measures that will be taken represent an appropriate balance between protecting the environment and securing the economic benefits of the planned production.

2 Introduction

Utgard is a cross-boundary gas and condensate field covered by licences PL046E and PL046F in the NCS (Block 15/8) and P.312 in the UKCS (Block 16/18a).

Statoil Petroleum AS is the operator of the Norwegian licence, with licence partners Lotos and Total. JX Nippon Exploration and Production (U.K.) Limited is the operator of the UK licence, with licence partner Statoil (U.K.) Limited. The Statoil Petroleum AS is leading the development activities, and has prepared this Environmental Statement.

Utgard is planned to be developed with a four slot subsea template, 21 km of pipeline and tie-in to the Sleipner T platform. Two wells will be drilled, with one target each side of the UK/Norway border. All installations and infrastructure will be located on the Norwegian side of the median line - the UK well being directionally drilled from the template location on the NCS. The distance from the template to the border line will be approximately 450 m. Utgard will use existing available process capacity at the Sleipner facilities.

The CO_2 content of the Utgard well stream is high (ca. 16%). Since the Gassled system requirement is 2.5 mol% CO_2, the gas will be routed through the existing CO_2-removal facilities at SLT. Separated CO_2 will be injected into the Utsira formation for permanent disposal.

On the Norwegian continental shelf the necessary environmental impact assessments for Utgard have already been completed by inclusion in regional assessments covering the Sleipner area. These regional assessments are:

- Integrated Management of the Marine Environment of the North Sea and Skagerrak (Management Plan), 2013
- Regional Impact Assessment (RIA) of the North Sea from 2006

The production (Norwegian part), emissions and discharges from the development of the Utgard are specifically included in both these regional assessments.

Based on a case-specific application from the operator, the Ministry of Petroleum and Energy (MPE) may grant approval that Norwegian legal requirements for Environmental Impact Assessment are fulfilled by existing impact assessments as listed above. Statoil has submitted such an application to the Ministry.

This Environmental Statement (ES) presents an assessment of the environmental consequences of the construction of the Utgard subsea infrastructure and the production of the Utgard reserves at the Sleipner installations.

The submission of this ES is required under the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 as amended by the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) (Amendment) Regulations 2007 because the UK share of the production exceeds the threshold set in the regulations, which is 500 tonnes or more per day of oil or 500,000 cubic metres or more per day of gas.

3 Project Description

3.1 Location

Utgard is a cross-boundary gas and condensate field which is located in block 15/8 on the Norwegian Continental Shelf (NCS) and in block 16/18a on the UK Continental Shelf. Relevant licences are PL046E and PL046F on the NCS and P.312 on the UKCS. The field is located about 21 km west of the Sleipner field centre (Sleipner A platform) (Figure 3-1).

Water depth in the Utgard area is 110-120 m.

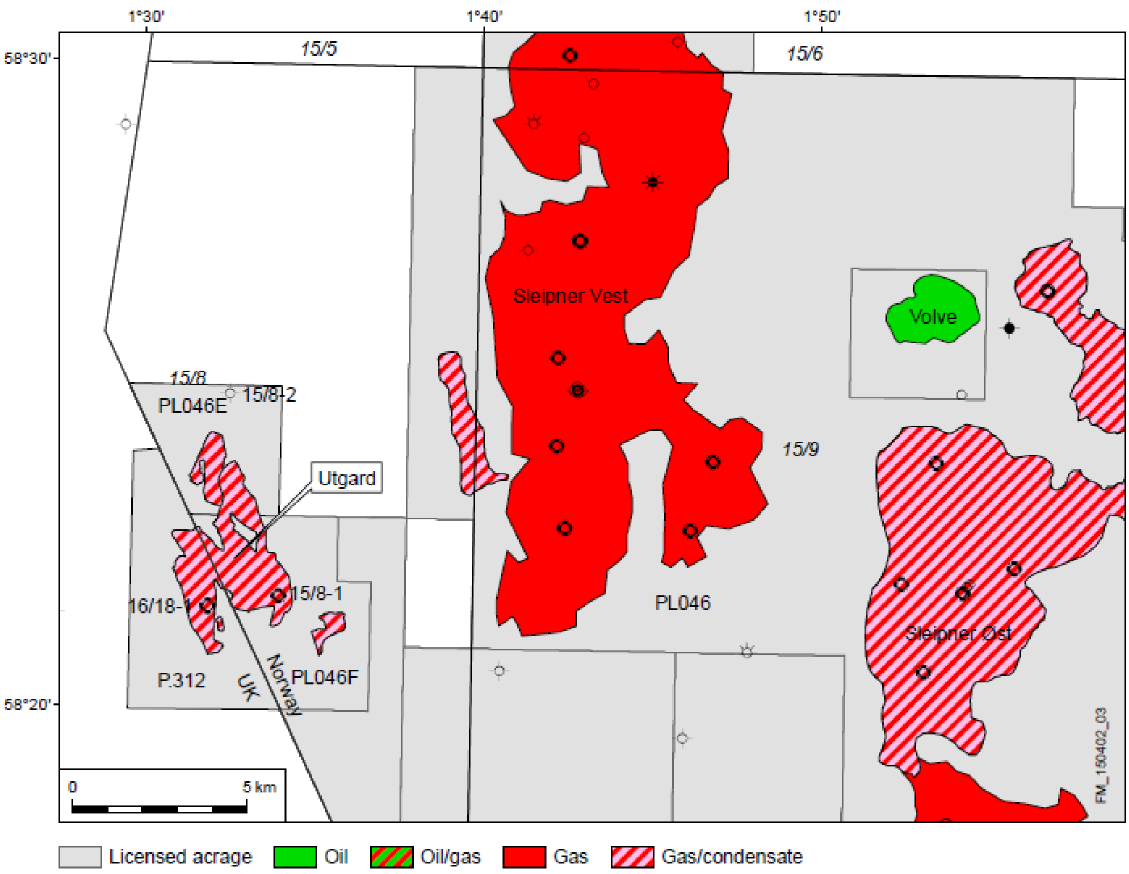


Figure 3-1. *Location of the Utgard field in relation to the Sleipner field centre*

3.2 Conditions on the host platform

Sleipner production has declined from plateau rates, and as a result the processing capacity at the Sleipner T platform is now sufficient to receive the production from Utgard.

3.3 Existing development and infrastructure in the Sleipner Area

The Sleipner area includes the gas and condensate fields Sleipner East and Sleipner West with the satellite fields Gungne, Loke, Alfa Nord and the 3rd party tie-in fields Sigyn, Gudrun and Gina Krog. Condensate from Sleipner is transported through pipeline for treatment at Kårstø in South West Norway. The gas is mixed with gas from the Kollsnes and Nyhamna terminals at the Sleipner riser platform and transported to the European market in the Gassled pipeline system.

Sleipner East
The Sleipner East Field has been developed using an integrated process, drilling and living quarter platform (Sleipner A, SLA). In addition a riser platform has been installed, (Sleipner R, which ties the SLA to pipelines for gas transport), and a flare tower (Sleipner F). Two subsea templates have also been installed, one for the production of the northern part of Sleipner East and one for the production of the Loke deposit. In addition, three wells from Sigyn are tied to SLA.

Production on Sleipner East started in August 1993.

Sleipner West
Sleipner West is connected to Sleipner East, and both fields are operated by the same operation organization.

Sleipner West has been developed using a wellhead platform (Sleipner B) that is remotely controlled from the Sleipner A platform on the Sleipner East field, and a process facility (Sleipner T) that is connected with Sleipner A by walkway.

Untreated well stream from Sleipner West is transported in a 12 kilometre long pipeline to the Sleipner T platform. Gas and condensate from Sleipner West is processed on Sleipner T. CO_2 is separated from the gas in two 20 meter high towers on the Sleipner T platform. In the towers the CO_2 from the gas is absorbed into liquid amine and then separated from the amine in a recycle plant. From here, both gas and CO_2 is led to Sleipner A. Processed gas from Sleipner West goes to further export. Separated CO_2 is injected in the Utsira formation via a separate injection well. Unstable condensate from Sleipner West and Sleipner East is mixed at Sleipner A, and is then transported to Kårstø for the production of stable condensate and NGL products.

Production on Sleipner West started in August 1996.

The Alfa Nord segment was developed in 2004 with a template connected to the Sleipner T through an 18 kilometre long pipeline.

The Sleipner Area with existing infrastructure is shown in
Figure ***3-2*** and
Figure 3-3.

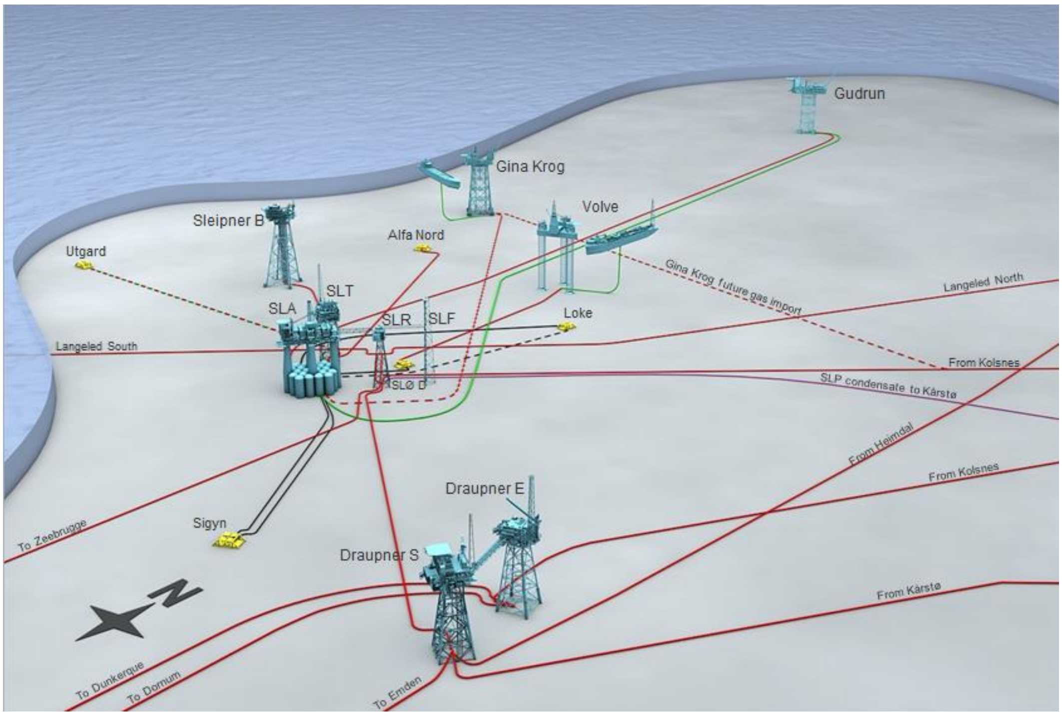


Figure 3-2. *The Sleipner fields with existing infrastructure*

Figure 3-3. *Photo showing the Sleipner A platform in front left with Sleipner T platform in the back*

3.4 Ownership and Operatorship

The current ownership of licence interests is as stated in Table 3-1 below. As indicated in the table, Statoil Petroleum AS is the designated operator of the Norwegian licences, and JX Nippon Exploration and Production (U.K.) Limited is the designated operator of the UK licence. The Statoil Petroleum AS is leading the development activities.

Table 3-1. *Current Owner composition in percentage*

	PL046E	PL046F	P312	Utgard Unit
Statoil Petroleum AS	62	62		
Lotos Exploration and Production Norge AS	28	28		
Total E&P Norge AS	10	10		
JX Nippon Exploration and Production (U.K.) Limited			45	
Statoil (U.K.) Limited			55	
Part of Utgard Unit				100%

3.5 Resources and Development Solutions

3.5.1 General

The gas condensate in Utgard is contained in the Upper and Lower Hugin and the Sleipner formations, Upper Hugin being the main reservoir. Top reservoir is at a depth of about 3600m below sea level.

The resources will be recovered by primary depletion of the reservoir. The plan entails development of the field using a new subsea template with four well slots. The primary development plan is based on two wells drilled from the template, with the possibility of a third well in the field if needed. The fourth well slot would be available for development of a nearby prospect, although this is not a firm plan, and is not addressed by this Environmental Statement. The template with connections, a PLET (Pipeline End Terminator) and a connecting spool piece, will all be fully covered and over-trawlable.

In earlier phases of the project several different tie-in alternatives were evaluated:

- Sleipner B (SLB)
- Hot Tap to the pipeline between SLB and Sleipner T
- Direct tie in to Sleipner T (SLT)
- Sleipner A (SLA)

The selected option is a direct connection to SLT, with the umbilical connected to SLA (Figure 3-5).

The pipeline is being designed based on a pipe-in-pipe concept, with an inner pipe and an outer pipe (Figure 3-4). With this concept the outer pipeline insulates and protects the inner production pipeline, which is necessary to prevent hydrate formation. The internal diameter will be 10”. The outer pipeline will be in the range 15” to 16” depending on the choice of installation method. The outer pipe is designed and sized for unprotected installation on the seabed. Protection by rock-dumping will not be required. The pipeline will be over-trawlable.

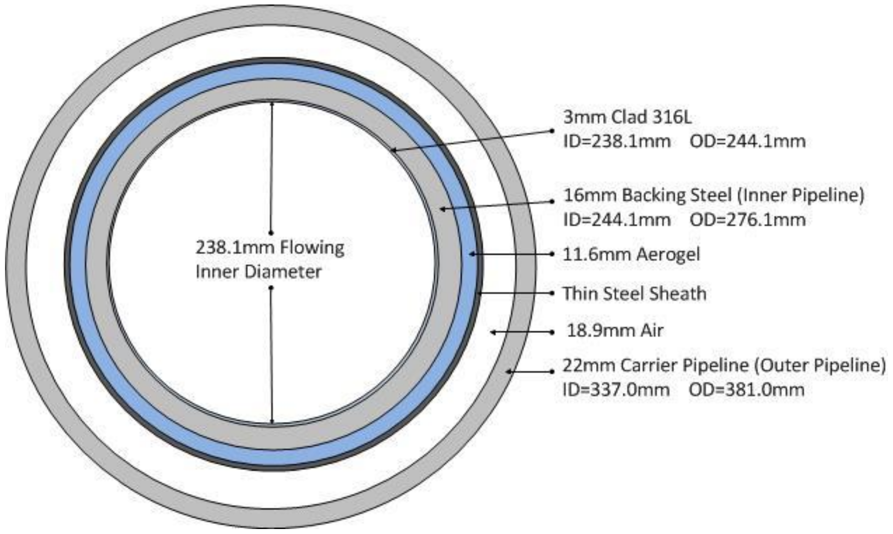


Figure 3-4. *The Pipe-in-Pipe concept at Utgard (schematic sketch)*

An umbilical will provide for the transfer of hydraulics, production chemicals, MEG (Mono Ethylene Glycol), electric power and signals to the subsea installation. The umbilical will be placed in the same corridor as the pipeline and will be trenched along its entire length. Trenching is expected to be readily achievable in the Utgard-Sleipner area. However, if problems with successful trenching are faced, some rock dumping for protection of the umbilical may be required.

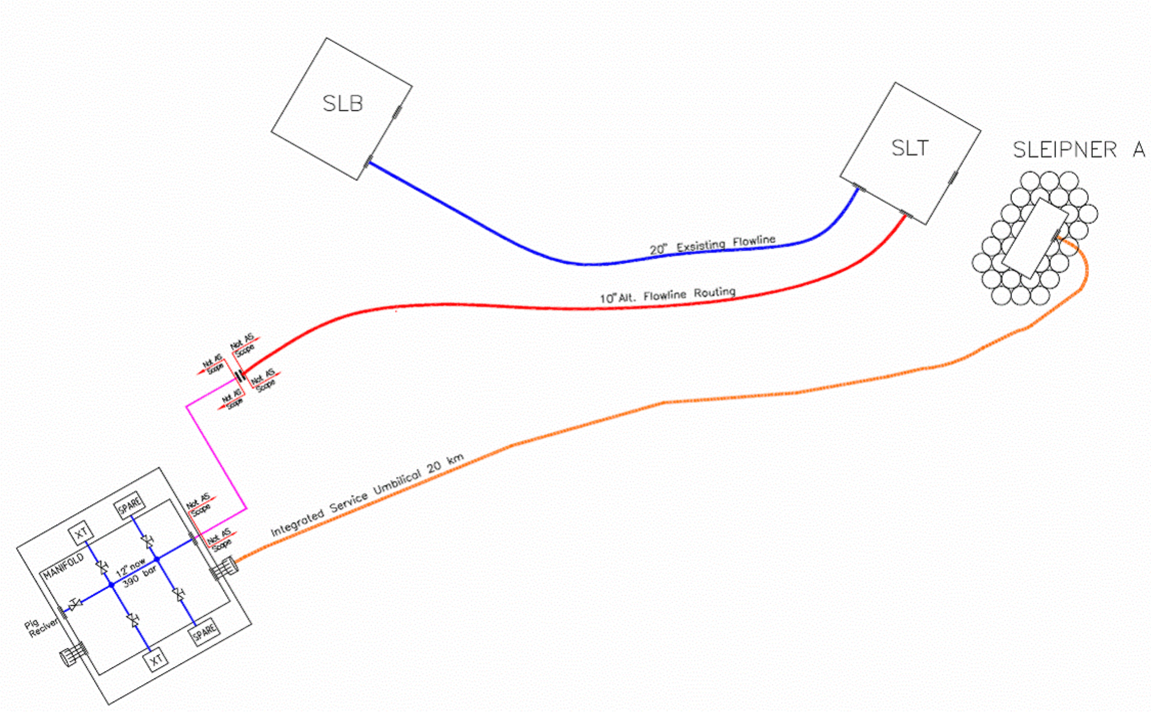


Figure 3-5. *Utgard template with pipeline tie in to Sleipner T and umbilical to Sleipner A*

The total footprint of the subsea infrastructure (template, PLET, connecting spool piece, pipeline and umbilical) and planned seabed interventions is estimated to be approximately 0.5 km^2.

3.5.2 Template Location

The planned template location is at a mid-point between the two proposed gas producer down-hole targets. This location is given in Table 3-2. The final location will be defined following a site survey.

Table 3-2. *Planned location of template*

Projection: ED_1950_UTM_Zone_31N		
Geographic	Lat: 58° 22' 05,1" N	01° 33' 01,2" E
Projected	N: 6 470 604 m	E: 415 197 m

3.5.3 Drilling

Two wells are planned from a central template location, ref.Table 3-2, both with similar inclination but with opposite azimuths. Gas producer GP1 has a well length of 4338 m (4300 m TVD (Total Vertical Depth)) with its final depth located in the UKCS. Gas producer GP3 has a well length of 4310 m (4272 m TVD) and has its final depth located in the NCS.

The wells will be deviated below the conductor at a rate of 1 to 2 degrees per 30 metres until an angle of 15 degrees is reached. Thereafter, the wells will be drilled straight to their final depths (Total Depth; TD).

The following hole sizes and casings are planned in the wells:

- 42" hole 30" casing set approx. 200 m TVDSS
- 26" hole 20" casing set below Utsira Fm. ~1200 m TVDSS
- 17 ½" hole 13 3/8" casing set below Heimal Fm. ~2800 m TVDSS
- 12 ¼" hole 9 5/8" casing set below Cromer Knoll group/ Top of reservoir ~3600 m TVDSS
- 8 ½" hole (lower completion yet to be decided) to base Sleipner Fm. ~4300 m TVDSS

(Note: TVDSS = Total Vertical Depth below Sea Surface, Fm=formation)

Drilling fluids will be selected according to Statoil governing documentation. Most likely water based drilling fluids will be used for well sections from the sea floor down to 1200 m (42", 26" and 17½" sections) and oil based drilling fluids thereafter (12 ¼" and 8 ½" sections). Cuttings from drilling with oil based mud will not be released to sea. These oily cuttings will be shipped to shore for proper handling, treatment and disposal.

Discharges to sea from drilling of the upper well sections with water based mud (WBM) are shown in Table 3-3. The discharges will happen at, or in the immediate vicinity of the Utgard template.

Table 3-3. *Discharges to sea from drilling with water based mud systems (WBM)*

WBM cuttings	GP1 (UK)			GP3 (Norway)			Total
Section diameter (inches)	42"	26"	17.5"	42"	26"	17.5"	
Theoretical hole volume (m^3)	46	358	260	46	353	255	1318
Hole volume incl. outwash (m^3)	56	429	286	56	423	280	1530
Volume mud adherence incl. outwash (m^3)	56	429	286	56	423	280	1530
Cuttings generated (tonnes)	121	930	676	121	917	662	3428
Cuttings generated incl. outwash (tonnes)	145	1116	744	145	1101	729	3979
Cuttings generated incl. outwash and mud adherence (tonnes)	202	1558	1159	202	1537	1135	5793

The Drilling Rig will most likely be of a semisubmersible type. However, should availability and commercial issues dictate, it would be technically possible to develop the Utgard field using a Jack Up type rig. An indicative mooring layout map for drilling operations using a semi-submersible is given in
Figure ***3***-6. Each line in the figure is 2550 m in length. Two or three anchors would most likely be placed on the UK side of the border line.

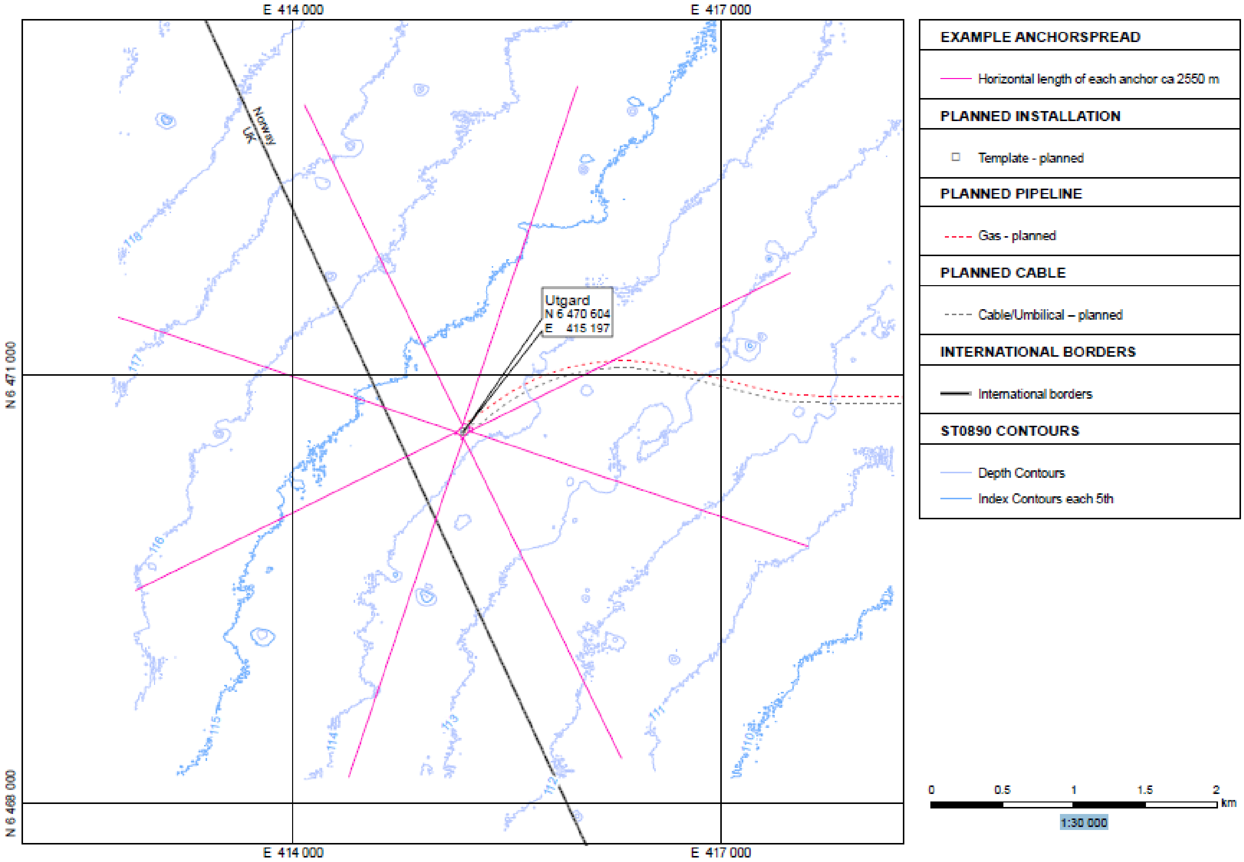


Figure 3-6. *Mooring layout map for drilling operations at Utgard*

Initial testing and clean-up of the wells is planned to be via the Sleipner T production facilities, minimising the need for operating on a live well with well stream to the drilling rig.

3.5.4 Sub Sea Production System

The subsea production solution proposed for Utgard comprises one subsea template structure and a pipeline tied back to Sleipner T located in the NCS as host platform. The design life of the subsea production system is 20 years.

The subsea structure will comprise a 4-well slot, overtrawlable template, xmas trees, manifold pipework and control system to facilitate production to the pipeline system.

A control umbilical will run between Utgard and the Sleipner A platform to provide power and communication, chemicals and hydraulic fluid for operation of the Subsea Production System. Power signals, chemicals and hydraulic fluid will be distributed to each well slot at the subsea manifold.

The umbilical system will be designed to transfer high pressure (HP) and low pressure (LP) control fluids, chemical injection fluids, annulus fluids, electrical power/signal and optical signals. The umbilical will contain a service line for well service and carriage of larger amounts of chemical fluids.

The subsea control system will be of an open loop design provided from Sleipner A with provision for the hydraulic fluid to be discharged to sea.

The manifold will allow for connection of the subsea pig launcher/receiver for later pipeline pigging & decommissioning.

3.5.5 Flow Assurance

The strategy for hydrate and wax control is to use a well-insulated flow-line to maintain the fluid temperature in the transport system above the hydrate equilibrium temperature (HET) and wax appearance temperature (WAT) during normal production. No additional measures for wax control will be required for shut-down and restart.

The cool-down time for the pipeline is long, and short planned or unplanned shutdowns can be managed without any need for further hydrate-prevention measures. The end zones must be inhibited with a hydrate inhibitor. MEG will be used at the inhibitor for the wellhead, template piping and spool, while methanol will be used for the riser. For a long planned or unplanned shutdown the pipeline will be inhibited with MEG. Depressurisation of the pipeline will be a backup solution for hydrate control and hydrate removal if necessary.

During restart the wellstream will be inhibited with MEG at a high rate until the wellhead temperature is sufficiently high. If the pipeline is depressurised MEG will be injected at maximum rate towards low topside pressure until the pipeline is inhibited.

Equipment will be provided to allow for scale inhibitor injection in the well and wellhead at a rate of 100 ppm of the water production rate. A new injection pump system for scale inhibitor may be installed. New storage capacity will be required. Equipment will also be provided for asphaltene inhibitor injection in the well at a rate of 100 ppm of the condensate production rate, as a back-up solution.

Injection equipment for scale inhibitor, emulsion breaker and wax inhibitor will be included in the topside inlet facilities.

3.5.6 Pipeline

The pipeline is being designed as a Pipe in Pipe system, with an inner pipe and an outer pipe. Several alternatives for inner pipe material selection are being considered, including clad/lined material and stainless steel. The internal diameter will be 10”. The outer pipe will be a 15” to 16” carbon steel pipe with a design lifetime of 20 years. The pipeline may be installed by reeling or S-lay method, placed on the seabed. A DP vessel is preferable due to the congested seabed at Sleipner, but an anchored pipelay vessel may be feasible. At the Sleipner T platform the pipe will be pulled into an existing 20” J-tube on the West side of the platform.

A PLET, Pipeline End Terminator, will be installed at the end of the pipeline. A spool piece will be installed to connect the pipeline and template together. Protection will be installed to make the spool and termination over-trawlable.

3.5.7 Topside

The main principle for the Utgard tie-in to Sleipner is to use the existing processing and utility facilities so far as possible. All process and utility systems will be reviewed and any need for modifications identified. A new riser will be pulled in and emergency valves and flow meter will be installed. The flow will be routed to the existing inlet separator and the gas further routed to the existing CO_2-removal facilities. The gas will then be exported to the Gassled system, and the condensate will be exported to Kårstø, Norway.

3.6 Schedule

<u>The internal decision-making process for the Utgard is as follows:</u>

DG1 (feasibility):	29.07.2013
DG2 (Concept selection)	01.08.2015
DG3 (Sanction):	01.07.2016
Submission of PDO/FDP:	01.07.2016

<u>Abbreviations</u>

DG:	Decision Gate
PDO:	Plan for Development and Operations (to Norwegian authorities)
FDP:	Field Development Plan (to UK authorities)

<u>The planned schedule for development activities is as follows:</u>

Start modifications at Sleipner	Second quarter 2017
Installation of template:	Second quarter 2018
Drilling (two wells):	Third quarter 2018
Installation of manifold:	Second quarter 2019
Laying of pipeline and umbilical:	Second quarter 2019
Start-up production:	Fourth quarter 2019

4 Reserves and Production

4.1 Reserves

The Utgard reservoir contains gas condensate. The presented estimates of recoverable reserves are considered as the maximum case. Establishing the expected (mean) case is ongoing.

Table 4-1. *Maximum recoverable reserves in the Utgard field per April 2016*

	Condensate (MSm^3)	**NGL** (Mill. tons)	**Gas** (GSm^3)
Maximum	3,40	1,40	5,23

4.2 Production

The presented profile is considered as a high production forecast (maximum case). A gas capacity of 3 MSm^3/d for Utgard at Sleipner is assumed. This results in a plateau production period for the gas of three years from 2020 to 2022. The production period is estimated to approximately 12 years. Due to the gas capacity constraint, the expected (mean) production profile will have a similar gas production plateau but is likely go off plateau slightly earlier and have a more rapid decline in the tail end of the production profile. The maximum production profile is shown in Table 4-2.

Table 4-2. Simulated maximum production profile (per April 2016). Average pr calendar day

Year	Gas production Mill Sm³/day	Condensate production K Sm³/day	Water production Sm³/day
2020	2,71	4,77	7,26
2021	2,71	4,38	207,63
2022	2,68	2,93	476,83
2023	2,08	2,74	562,95
2024	1,37	1,86	742,55
2025	1,32	1,15	641,99
2026	1,21	0,77	342,69
2027	0,88	0,30	390,68
2028	0,47	0,27	259,37
2029	0,41	0,08	215,86
2030	0,22	0,22	194,58
2031	0,25	0,14	32,99

4.3 Production Change at Sleipner

The production from the Sleipner field has left plateau and is declining. The tie in of Utgard will not provide any increase in production compared to the current conditions, but will slow down the decline in production. Figure 4-1 shows the P10 production forecast for Utgard, meaning a high production forecast based on 10% probability, together with a recent production forecast for the Sleipner field.

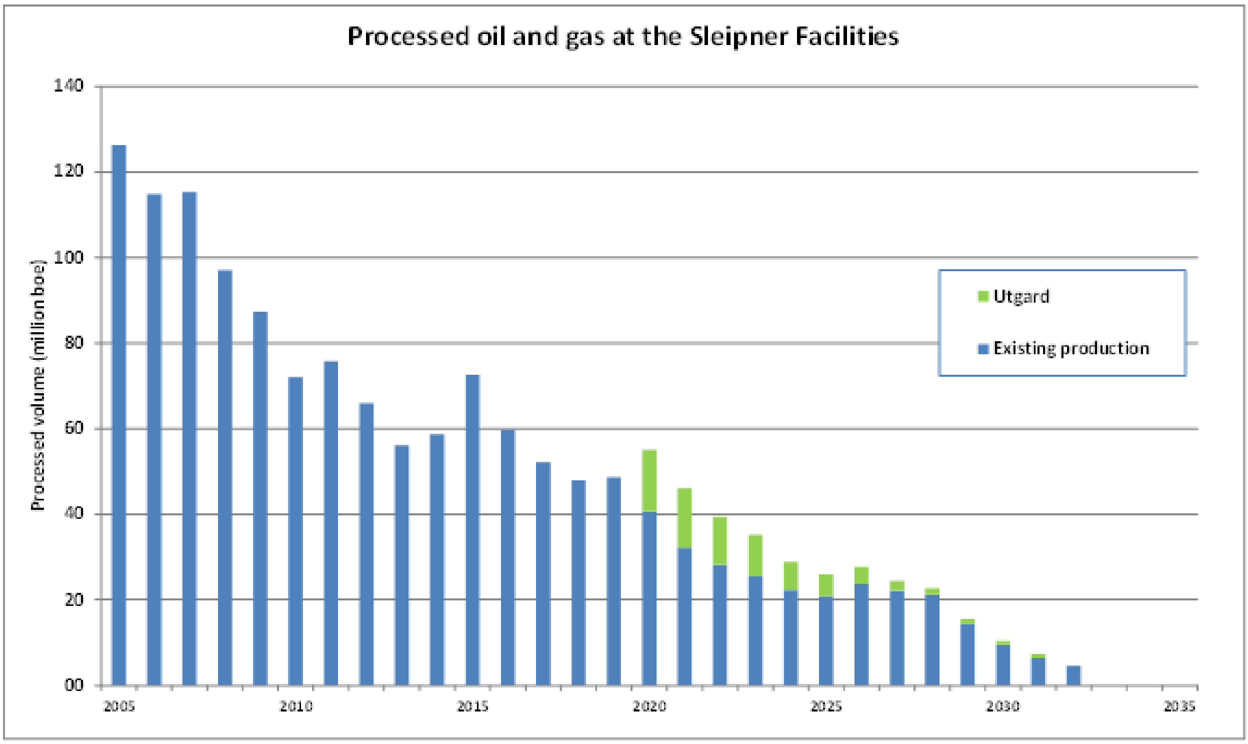


Figure 4-1. Historical production and recent production forecast of the Sleipner field and the Utgard field presented as barrels of oil equivalents (boe). The Utgard production estimate represents a high production forecast based on a 10% probability.

4.4 Produced Water

Simulations indicate a maximum water production of 740 m^3/day from the Utgard field around 2024. In comparison, water production at Sleipner West and Sleipner East were forecasted at 1100 m^3/day and 550 m^3/day in 2011 respectively (RIA-North Sea 2006). The total capacity of the produced water system at the Sleipner field is 3200 m^3/day.

In 2009 Sleipner initiated re-injection of produced water into the Utsira geological formation. The up-time of the re-injection is high. The water production from Utgard will be injected together with produced water from the greater Sleipner field. The concentration of oil in discharged produced water, based on historical data from 2010-2014, was 29 mg/l on average, see also Section 7.3.1.

Produced water production and discharge to sea after treatment are shown in Table 4-3.

Table 4-3. *Produced water production and discharge to sea from Utgard (m^3/year)*

Utgard - Produced water [m^3/year]		
Year	Production of produced water (PW) from reservoir	Discharge of produced water (PW) to sea after treatment
2020	2 396	60
2021	68 518	1 713
2022	157 354	3 934
2023	185 774	4 644
2024	245 042	6 126
2025	211 857	5 296
2026	113 088	2 827
2027	128 924	3 223
2028	85 592	2 140
2029	71 234	1 781
2030	64 211	1 605
2031	10 887	272
TOTAL	1 344 875	33 622

5 Measures to Minimize Environmental Impacts

5.1 Chemicals

Under Norwegian legislation, chemicals used in the petroleum industry on the Norwegian continental shelf are categorised as follows based on ecological toxicity:

- Black: Chemicals that normally are not allowed into the environment.
- Red: Chemicals presenting a potential environmental risk, which therefore should be replaced if possible.
- Yellow: All chemicals that are not covered by the other categories.
- Green (PLONOR): Chemicals on the OSPAR's (Oslo-Paris Convention) PLONOR list, which are considered to pose little or no risk to the environment.

No chemicals categorised as black or red will be used in connection with the development of Utgard. In addition, selection of specific chemicals will be based on best available techniques (BAT) principle.

5.2 Drill Cuttings and Oily Drainage Water

Cuttings from drilling with water based drilling fluid will be discharged to sea. Cuttings from drilling with oil based drilling fluid will be transported to shore for proper handling, treatment and disposal.

Oily drainage water will be injected or discharged to the sea. If drainage water is discharged to the sea, the oil in water concentration will be below 30 mg/l.

5.3 Subsea Infrastructure

All subsea infrastructures will be made over-trawlable according to current Norwegian regulations and internal Statoil requirements. There will be no subsea installations on the UK side of the border line.

A pipe-in-pipe concept for the production pipeline has been chosen. The outer pipe protects the inner production pipeline and will be installed unprotected on the seabed. No rock dumping is required.

5.4 Pipeline pre-commissioning/commissioning

In connection with pipeline pre-commissioning/commissioning chemicals will be used to prevent corrosion and fouling. Dyes will be used for pressure testing and leakage detection. These chemicals and dyes will be environmentally friendly; only green and yellow chemicals will be used.

6 Environmental Aspects in the Influenced Area

Environmental aspects in the influenced area on the Norwegian continental shelf are described in the Integrated Management of the Marine Environment of the North Sea and Skagerrak (Management Plan) 2013 issued by the Norwegian Government and the Regional Impact Assessment of the North Sea (RIA-North Sea) from 2006. As well as describing the environmental conditions of the North Sea, the Management Plan 2013 and the RIA 2006 also describes present and planned oil and gas developments and production in the North Sea region, and assesses potential and significant environmental impacts. The RIA-North Sea was approved by the Ministry of Petroleum and Energy in 2007. The whole RIA document with subject reports in Norwegian language is available at: http://www.statoil.com

The Management Plan of the North Sea and Skagerrak 2013 complete with all subject reports in Norwegian and English language is available at the following web page: https://www.regjeringen.no/no/dokumenter/meld-st-37-20122013/id724746/

The area that is assessed for environmental impacts is represented by the “activity area” (i.e. the area where there will be oil development activity), as well as a greater area that could be affected by activities in the activity area. Together, these areas are referred to as the “influenced area”. The extent of the influenced area will vary between different types of activities.

Environmental baseline data for the Norwegian Continental Shelf (NCS) is for the most collected from the Management Plan 2013 and the RIA-North Sea 2006. Where other sources are used they are referenced in the text. The Management Plan and the RIA-North Sea covers the sea areas between Norway's southern continental shelf boundary and 62° N. For some subjects this area is divided into four sub regions: North, Central, Southeast and Southwest. Sleipner and Utgard are located in the sub region referred to as "Central" (Figure 6-1).

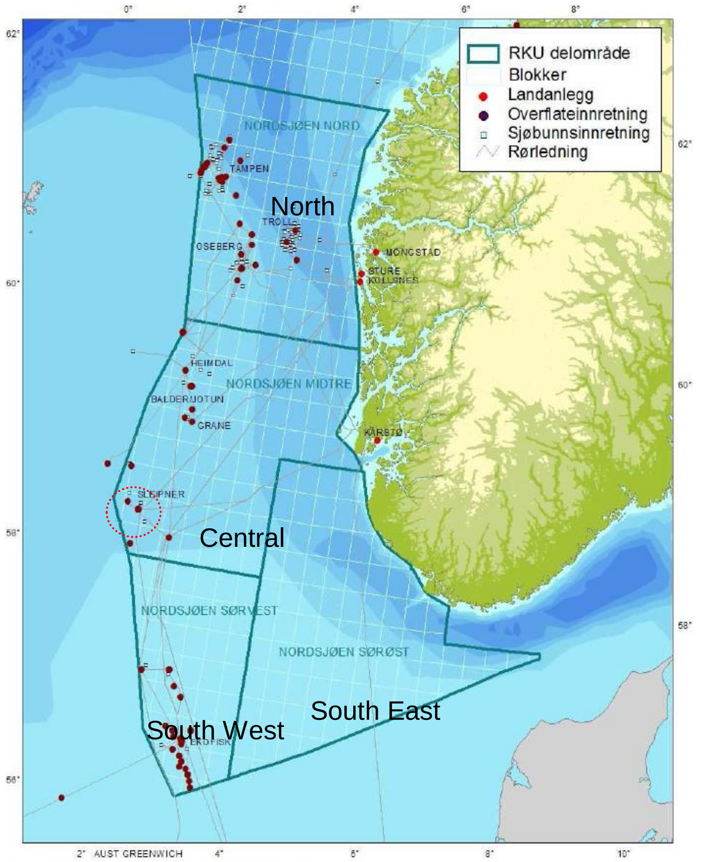


Figure 6-1. *Activity area for RIA-North Sea. The Sleipner marked by a circle is located in the sub region referred to as Central*

In UK the Offshore Energy Strategic Environmental Assessment (OE SEA) is the process of appraisal through which environmental protection and sustainable development is considered. The OE SEA reports are factored into national and local decisions regarding Government and other plans and programmes – such as oil and gas licensing rounds. On the UK continental shelf the area that potentially can be influenced by the development of Utgard lies within the Regional SEA (RSA) 1 (Figure 6-2). RSA 1 includes the majority of existing oil and gas fields in the North Sea. Environmental baseline data for the UKCS is largely collected from the Offshore Energy SEA, Environmental Report (DECC, 2009).

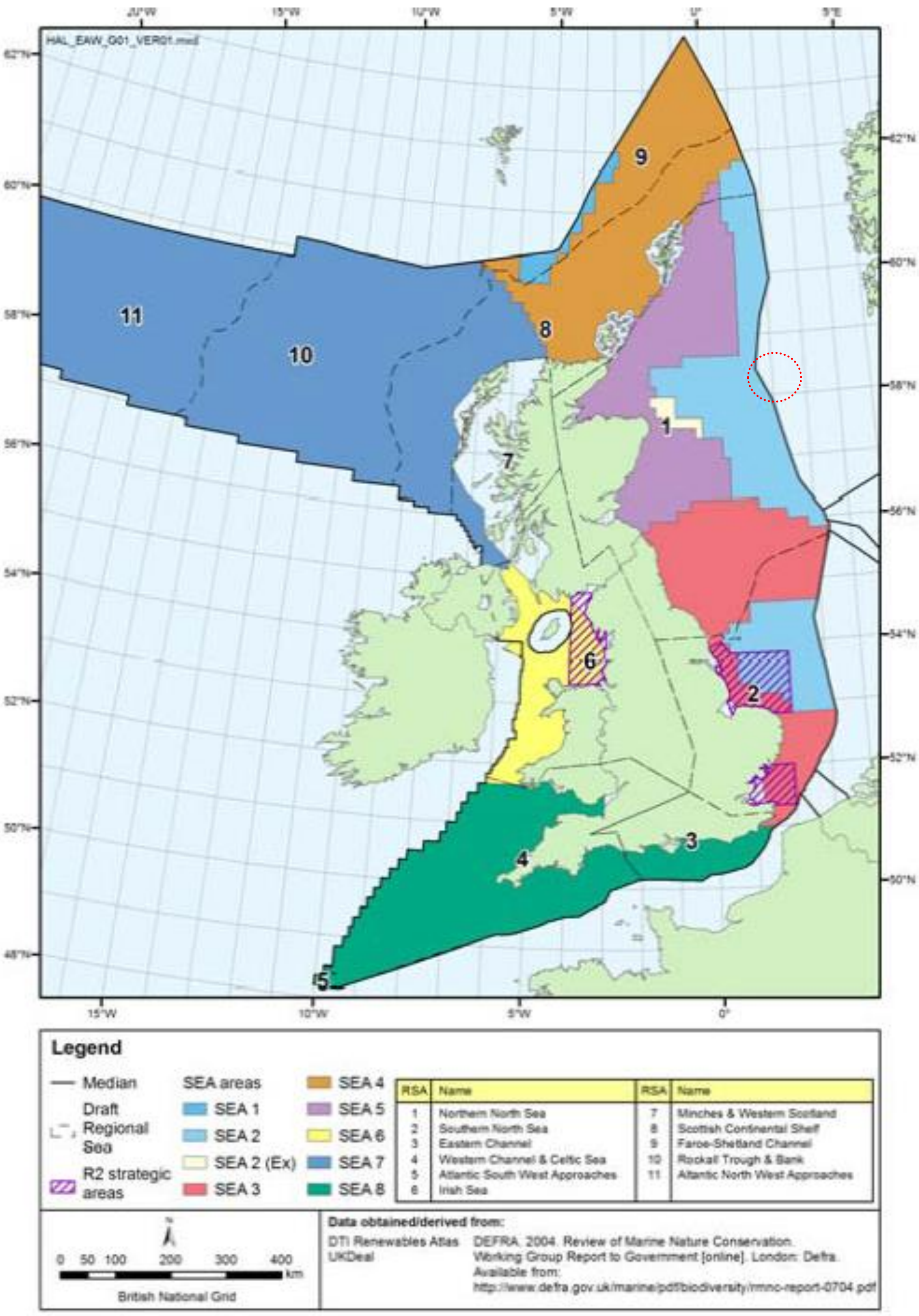


Figure 6-2*. Regions covered by the Strategic Environmental Assessment (SEA). The area potentially influenced by Utgard on the UK continental shelf lies within the Regional Sea 1 (previously SEA 2 region). Utgard/Sleipner area indicated by a circle*

6.1 Environmental Conditions and Natural Resources

6.1.1 Physical Conditions

The North Sea is a shallow sea compared with the Norwegian Sea and the Barents Sea. Two-thirds of the North Sea is shallower than 100 m. The water depth at the Utgard template location is 115 m. The deepest part is the

Trough near the Norwegian Coast, which has depths of more than 700 m (in the Skagerrak), and which extends from the Skagerrak along the west coast of Norway. The depth of the Norwegian Trench is 270 m outside Jæren, while it is deeper, both further north and further south (Figure 6-3). Depth conditions are important for circulation, since the topography to a major extent governs the water mass movement.

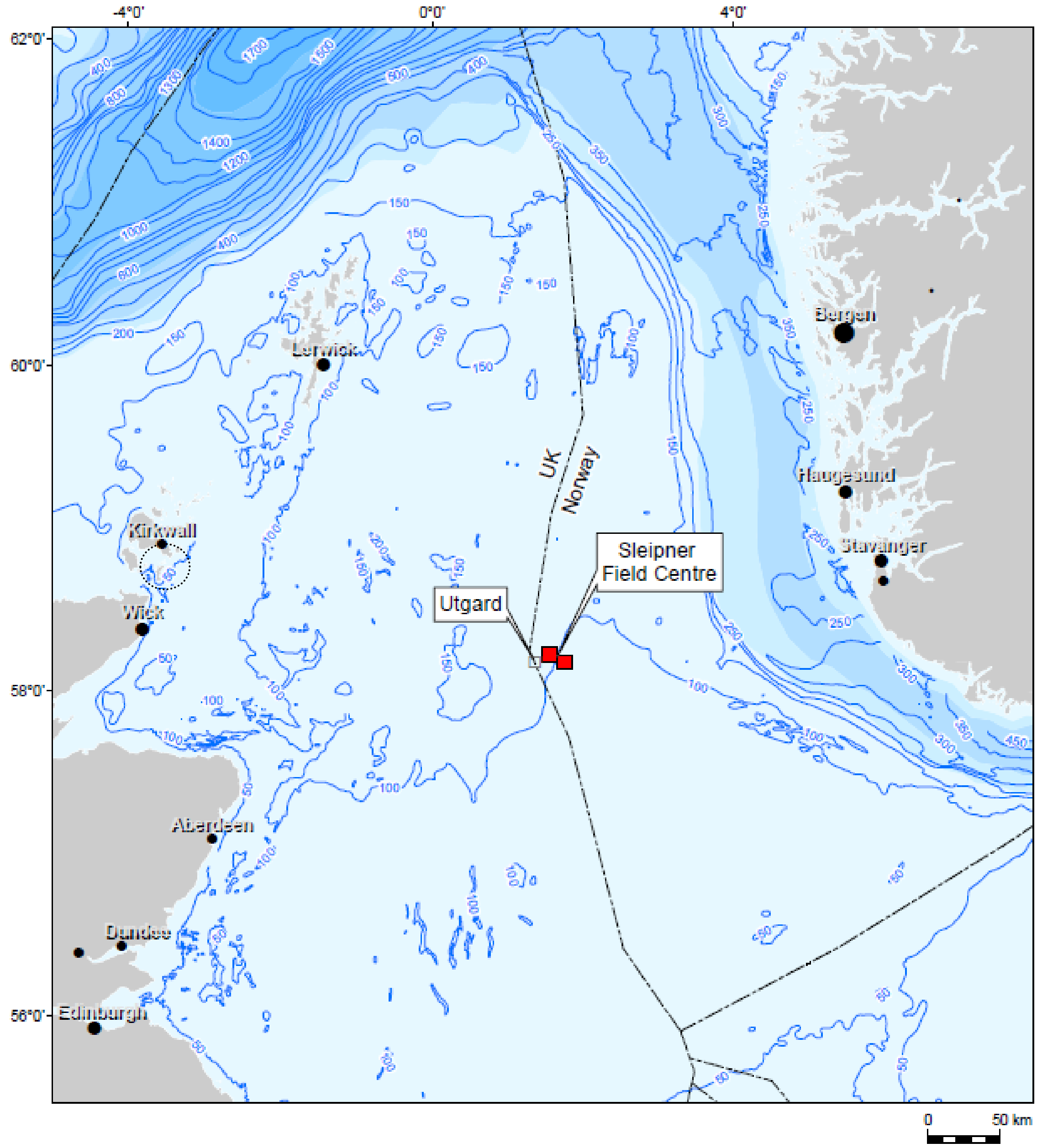


__Figure 6-3.__ Water depths in the North Sea. The Utgard/Sleipner area indicated

The North Sea and Skagerrak is a meeting place for Atlantic water and freshwater, which initially have different properties with respect to specific gravity, salinity and temperature. The water in the North Sea moves mainly anti-clockwise - it turns into the Skagerrak and then continues north as part of the Norwegian coastal current (Figure 6-4). Variations in the currents have great impact on the ecosystem in the North Sea. In the winter vertical circulation is high in most areas, which implies very low difference in water mass properties between the upper and lower layers. In summer, the warming of upper water layer causes a clear temperature change at 20-50 m depth.

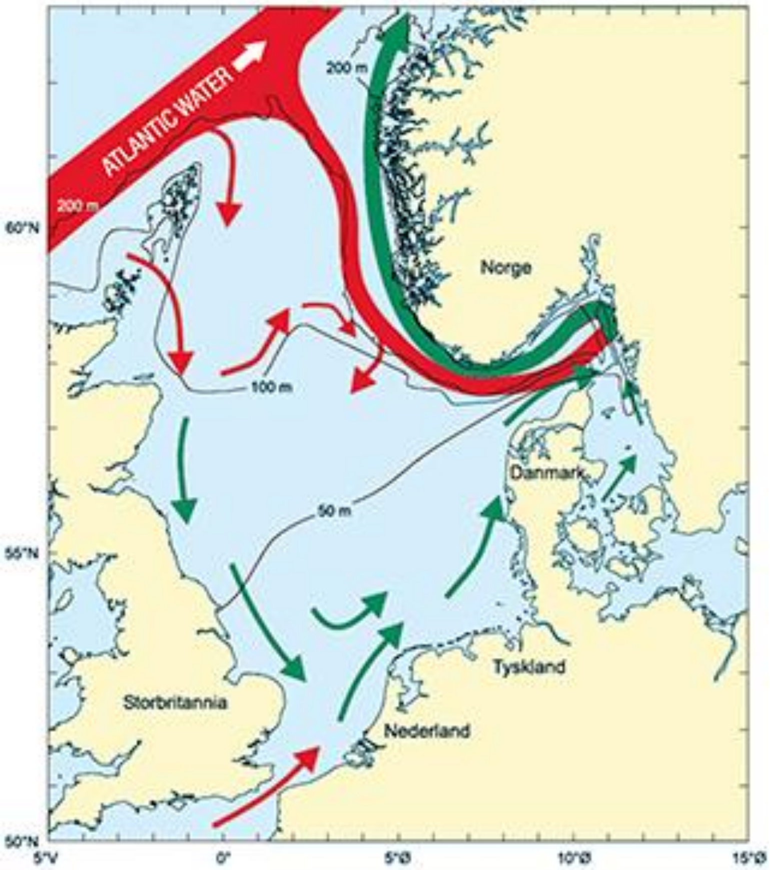


Figure 6-4. *The most important features of the circulation patterns and depth conditions in the North Sea and Skagerrak. Red arrows: Atlantic water. Green arrows: coastal waters*

6.1.2 Human Influence

The ecosystem of the North Sea is significantly influenced by human activity. There is much traffic and the area has many activities such as a large fishery, development of oil and gas, extract of sand and gravel and dumping of sludge. Around the North Sea lie densely populated and highly industrialised states, with the consequence that the eco system is influenced by pollution from construction, agriculture and industry. Pollution largely originates from the rivers that flow into the North Sea. The North Sea is also affected by the inflow from the Baltic Sea.

6.1.3 Plankton

The planktonic community comprises a range of microscopic plants (phytoplankton) and animals (zooplankton) that drift with the oceanic currents. These organisms form the basis of marine ecosystem food chains and many species of larger animals such as fish, birds and cetaceans are dependent upon them. The distribution of plankton, therefore, directly influences the movement and distribution of other marine species.

The most common phytoplankton groups are the diatoms, dinoflagellates and the smaller flagellates. Together they are responsible for most of the primary production in the North Sea. The most abundant group of zooplankton is the copepods, dominated by Calanus spp. The larger zooplankton (or megaplankton) includes the euphausiids (krill), thaliacea (salps and doloids), siphonophores and medusa (jellyfish). Blooms of salps and doloids produce large swarms of individuals in late summer to October, which deplete food sources for other herbivorous plankton. Krill is abundant throughout the North Sea and is a primary food source for fish and whales (DECC 2009).

Plankton communities in the vicinity of Sleipner and the Utgard field are expected to be typical of those of the central North Sea.

6.1.4 Benthic Communities

Seabed sediments are used as a habitat and nutrient source by organisms living either in, on or in close association with the seabed. The distribution of benthic fauna is influenced by water depth and sediment type. Other important factors include the influence of different water masses and the food supply to the benthos. Fluctuations in benthic populations may also be caused by natural spatial or temporal variations in the environment, as well as by pollution-induced effects. For example, the typical infaunal community response to organic disturbance is a reduction in species richness and diversity, usually accompanied by an increase in the density of species which are able to exploit disturbed environments.

Benthic communities in the vicinity of Sleipner and the Utgard field are expected to be typical of those of the central North Sea.

A seabed survey of the pipeline route for Utgard was conducted in 2009. In general, such surveys are mainly geotechnical, and does not provide for collection of environmental data unless particular environmental sensitivities or polluted areas are expected along the route. This was not the case for the Utgard pipeline. However, the survey did confirm that there are no coral reefs or shipwrecks along the route. Environmental data are collected by the Regional Environmental- and Baseline Surveys which are conducted every third year on the Norwegian continental shelf. These surveys include analyses of the sediments and of the benthic communities (DNV 2013). Utgard is located in the Region II and will be specifically included for a detailed baseline data collection in the 2018 survey program, i.e. before any drilling at the location.

Pockmarks are depressions or craters in the seabed. In the North Sea they range from less than 0.5 m to approximately 20 m in depth and from 1 m to more than 1 km long (Hovland & Judd, 1988). The North Sea pockmarks are typically roughly circular or ellipsoidal at the top and cone-shaped in cross-section, although they may also be irregular in cross-section, with the long axis being typically parallel to the bottom current direction. It is generally believed that pockmarks are formed by the expulsion of fluid, either gas or water through seafloor sediments. Most pockmarks are relict features, but a few continue to leak natural gas and may contain carbonate structures.

The leaking of hydrocarbons in pockmarks leads to local enrichment of organic material, which in turn gives the foundation for increased local production. Such enrichment of nourishment has been connected to the presence of cold water corals (Hovland & Mortensen 1999).

There are no known pockmarks in the vicinity of the Utgard field. The closest registered pockmarks are in the UK sector; the 20 m deep "Scanner" pockmark in block 15/25 (60 km from Utgard) and the “Braemar” pockmarks in block 16/3 (110 km from Utgard) (JNCC 2015).

No coral reefs have been found in the open waters of the North Sea. The Utgard pipeline route survey in 2009 confirmed that there are no coral reefs along the route. Thus, it is not likely that any coral reefs will be affected by the Utgard development.

6.1.5 Fish

Fish constitute the largest part of the living resources in the North Sea. The pelagic component is dominated by herring and sprat, which are located in the North Sea all year. Mackerel (Scomber scomrus) and horse mackerel

(Trachurus trachurus) are mainly present in summer when they enter the North Sea from the south and northwest. The dominant gadoid fishes are cod (Gadus morrhua), haddock (Melangrammus aeglefinus), whiting (Merlangius merlangus) and saithe (Pollachius virens), while the most important flat fishes are plaice (Pleuronectes platessa), American plaice (Hippoglossoides platessoides), dab (Limanda limanda), common sole (Solea solea) and lemon sole (Microstomus kitt). The most important prey fishes are great sand eel (Hyperoplus lanceolatus), herring (Clupea harengus), sprat (Sprattus sprattus) and Norway pout (Trisopterus esmarkii). The total amount of fish in the North Sea has varied between 11 and 15 million tonnes in the last 20 years. In addition to the variation in total biomass, there is a variation in the relative distribution of biomass between species. Maps showing the likelihood of presence of ‘0 group’ fish for selected species are shown in Figure 6-5 (Aires et al. 2014)

Several vulnerable fish species that previously were quite common in the North Sea have completely disappeared (e.g. tuna), or become very rare (e.g. halibut). Most cartilaginous fish are at a low population level. Spiny dogfish was previously common in the North Sea, but now the biomass is only about 5% of the original population size. Most ray species are also at a low level and have disappeared from large parts of the North Sea. These problems are mostly related to high fishing pressure, but also the ongoing temperature increase that causes many southern species to move their territory northward.

Of commercially important fish species, Norway pout and mackerel spawn in the regions around Sleipner. The Sleipner Area is centrally located in the North Sea, and current conditions imply that the eggs and larvae of other fish species can drift into the area. This applies, for instance, for saithe and haddock, which spawn north of Sleipner.

Juvenile fish, in particular ecologically sensitive demersal spawning species such as sand eels, herring and Norway lobster (Nephrops norwegicus), are vulnerable to any physical disturbance of their spawning and nursery grounds that may be caused by operations to install the template and the pipeline. The proposed activities lies within spawning grounds for cod, haddock, saithe, mackerel and Norway pout. Most of these species are considered to be less sensitive because of their widespread distribution and extensive spawning areas. However, this region of the North Sea constitutes an important area for cod and mackerel spawning activity. There are no spawning grounds for sensitive demersal spawning, species such as sand eels, herring and Norway lobster (Nephrops norwegicus), within the influenced area for Utgard.

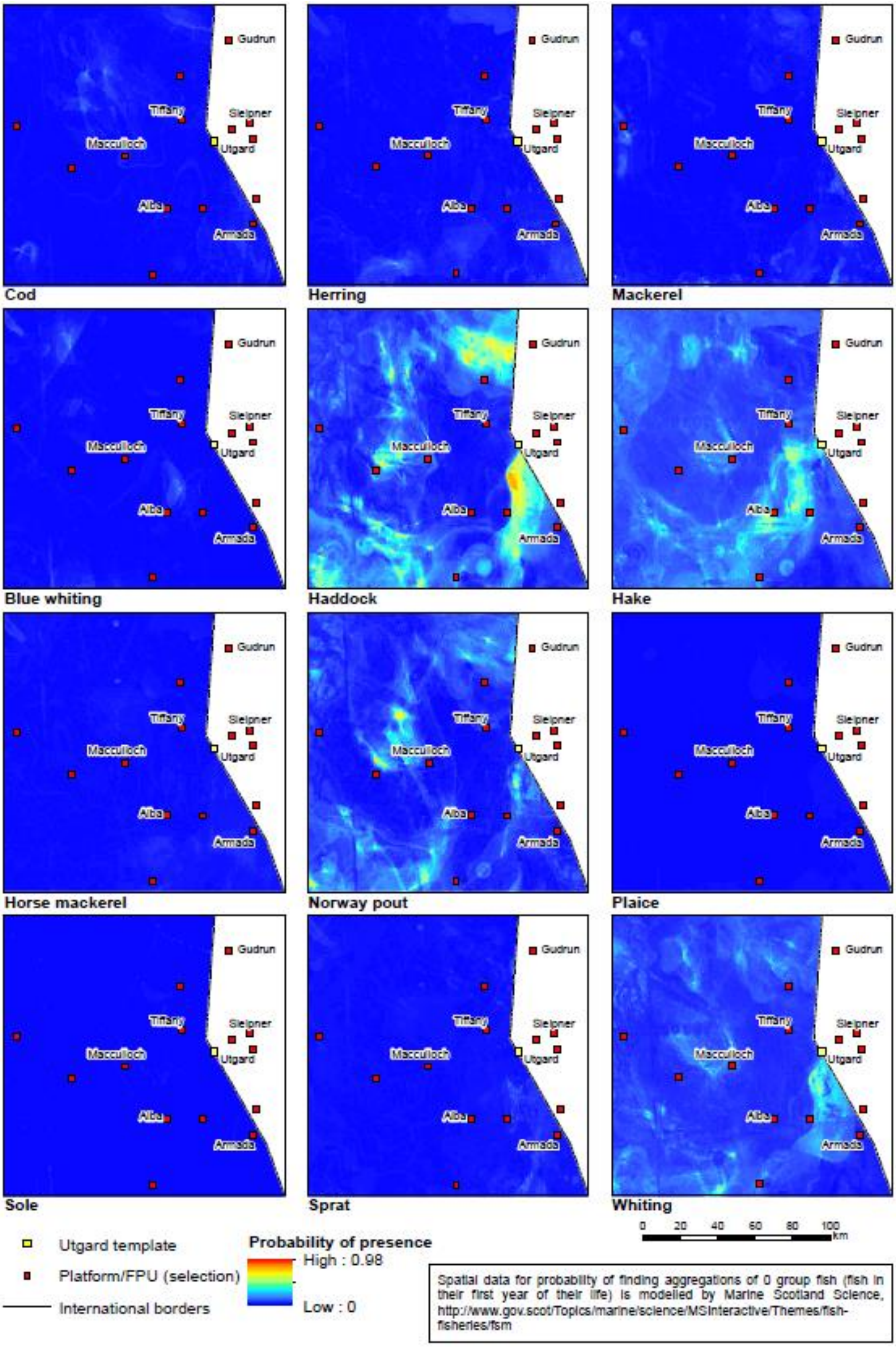


Figure 6-5 *Probability of presence of age group 0 of selected fish species (Aires et.al)*

6.1.6 Seabirds

Internationally important numbers of seabirds breed on the coastal margin of the North Sea, and rely on the marine North Sea environment for their food supply and habitat.

Pelagic diving seabirds might be found in the influenced area during both summer and winter, but the areas around Sleipner and Utgard are not characterised by any greater significance than any other open sea areas. Highest seabird vulnerability in this area is identified from September to February (Figures 6-6, 6-7 and 6-8).

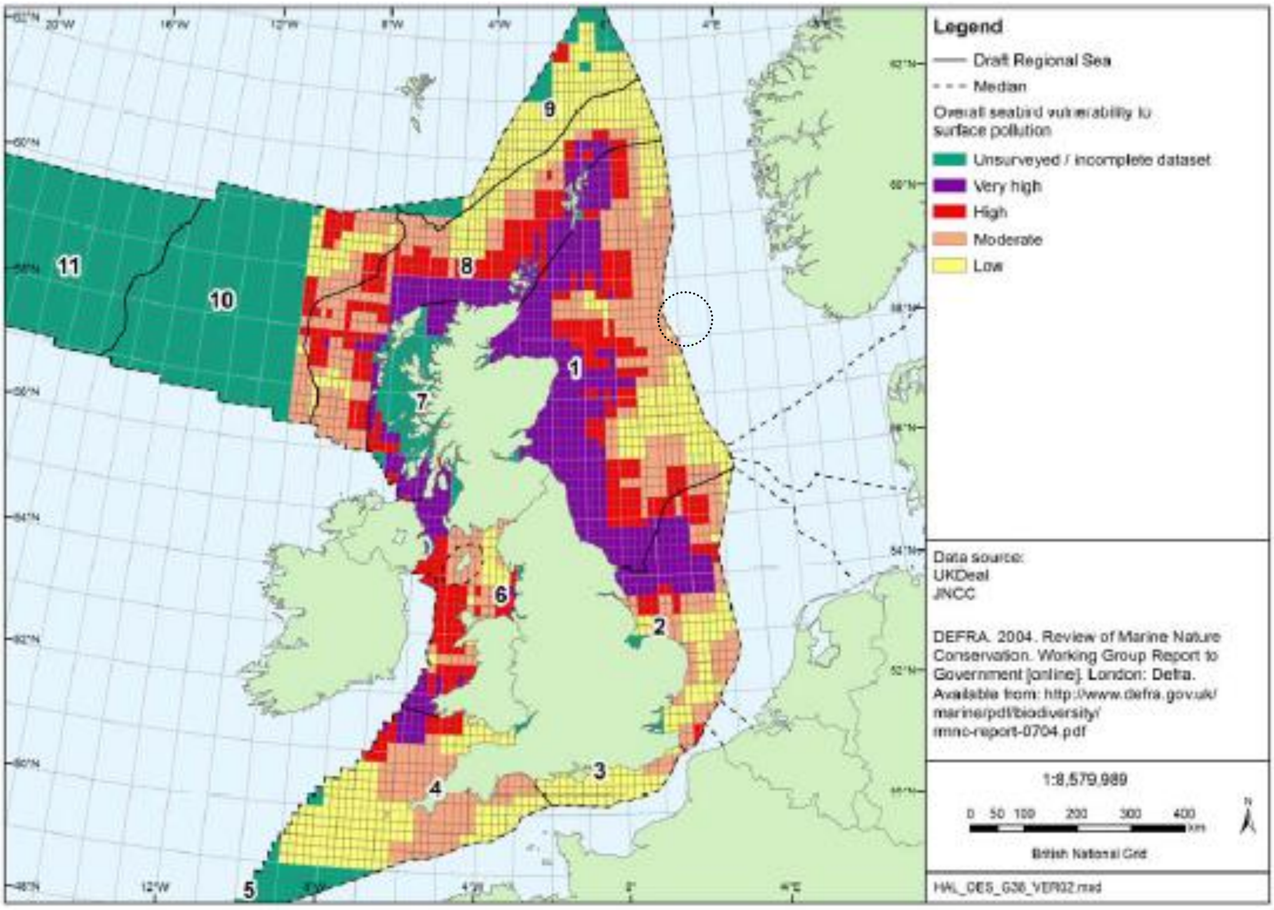
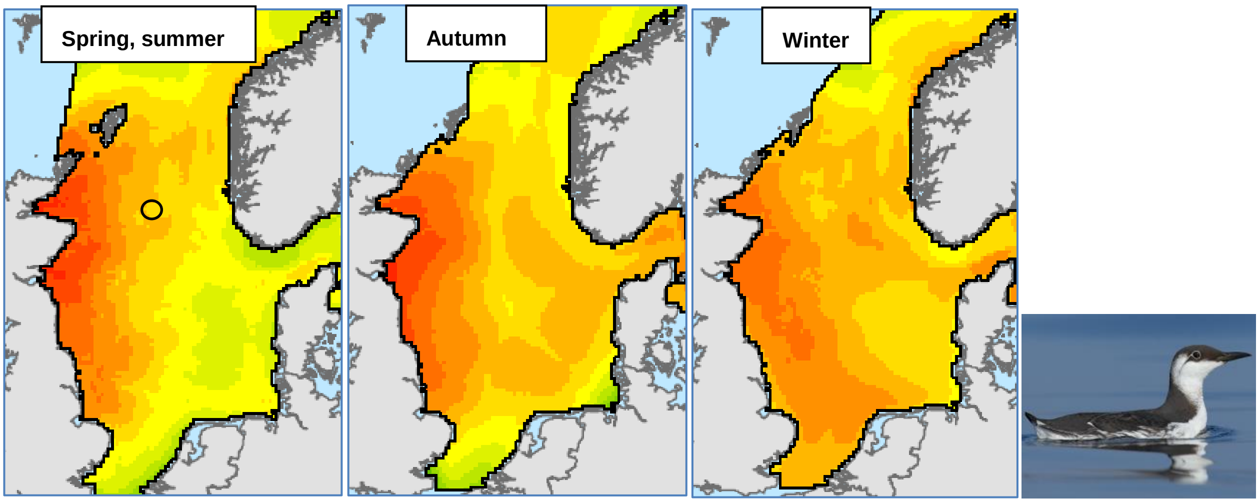


Figure 6-6. *Overall vulnerability of seabirds to surface pollution (Source: OESEA, DECC 2009) The area of Utgard and Sleipner is indicated by a circle*

Seabird vulnerability to surface pollution varies throughout the year with peaks in late summer following breeding when the birds disperse into the North Sea, and during the winter months with the arrival of over wintering birds (RIA North Sea 2006 (updated), DECC 2009) See Figure 6-6, Figure 6-7 and Figure 6-8.

Seabirds populations are vulnerable to surface pollution, particularly oil. Guillemot, razorbill and puffin are at their most vulnerable to oil pollution in their moulting season, when they become flightless and spend long periods on the water surface. As the Utgard is a gas and condensate field the potential impact on seabirds is regarded as very low at an individual level and negligible at a population level.

Common Guillemot *Uria aalge* – Estimated density



Atlantic puffin *Fratercula arctica* – Estimated density

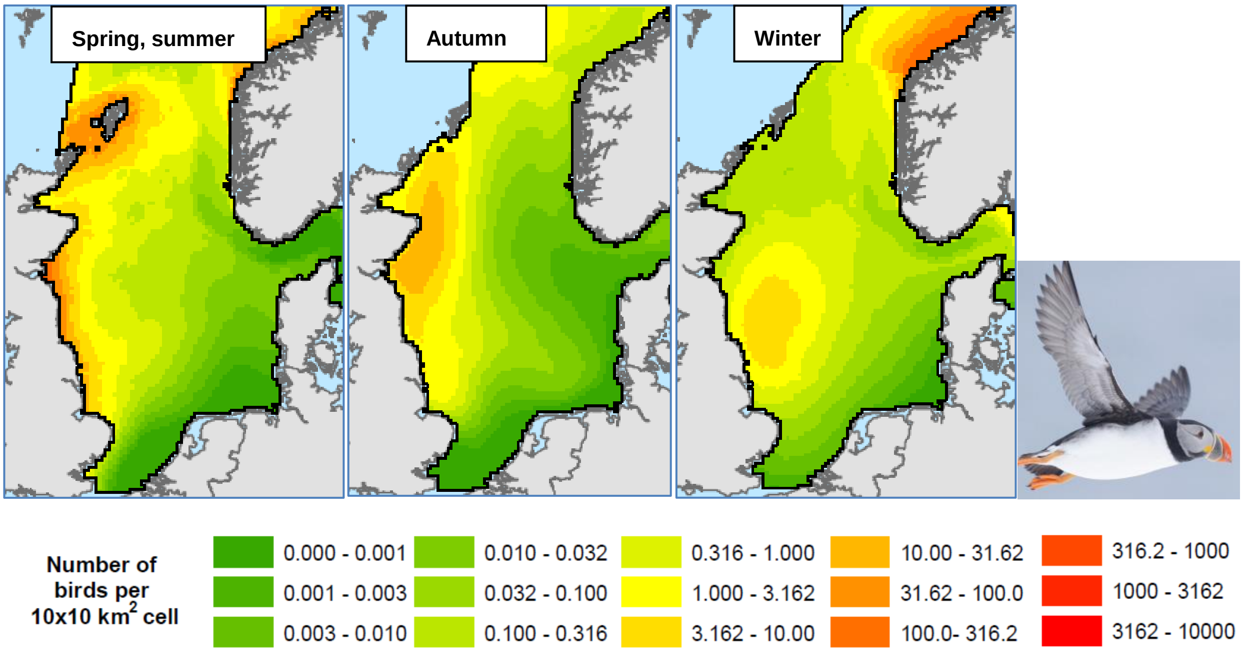
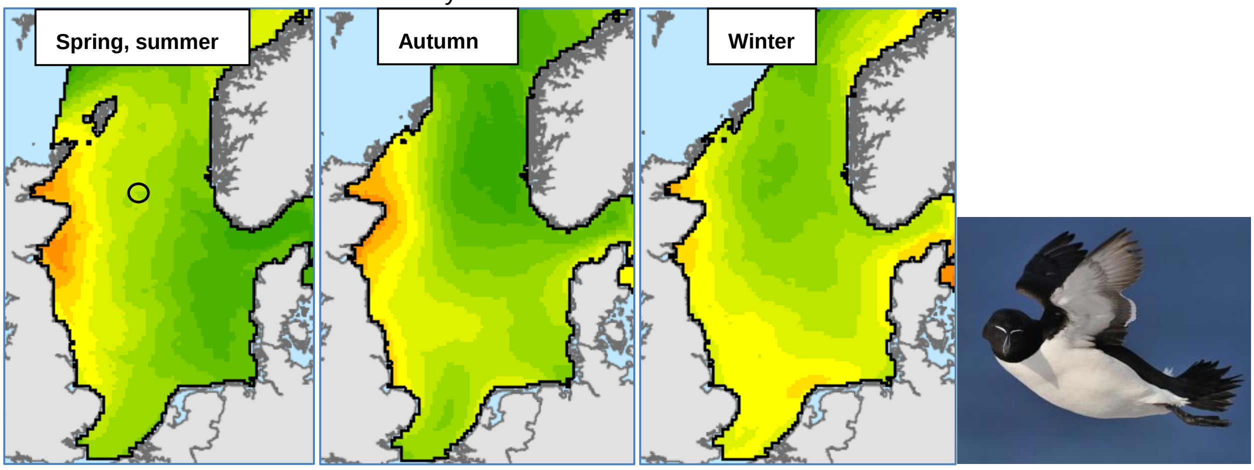
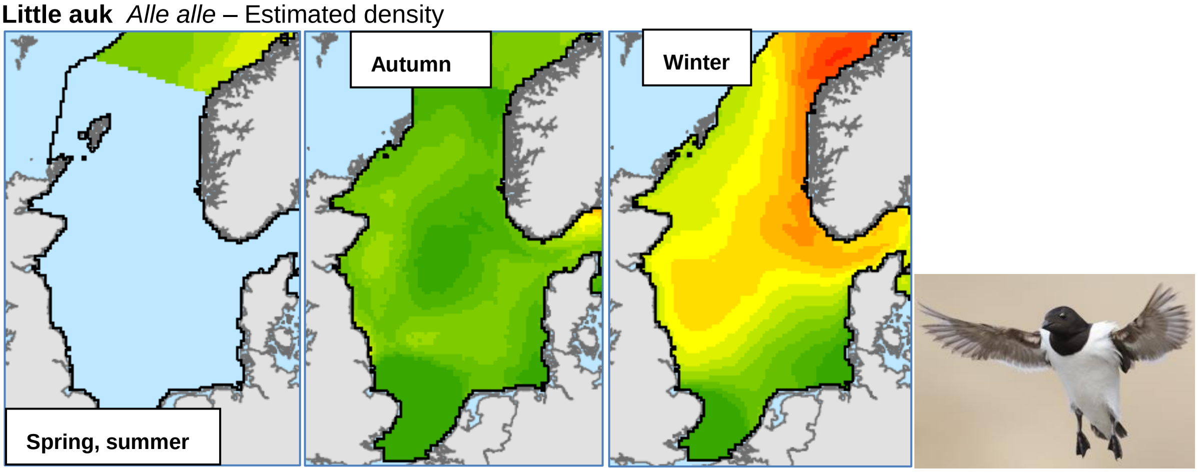


Figure 6-7. *Areas in the open sea of relative importance to seabirds at open sea (selected auks) in different seasons of the year (Source: RIA North Sea 2006 – updated Seapop 2015). The area of Utgard and Sleipner is indicated by a circle in the first map.*

Razorbill *Alca torda* – Estimated density



Little auk *Alle alle* – Estimated density



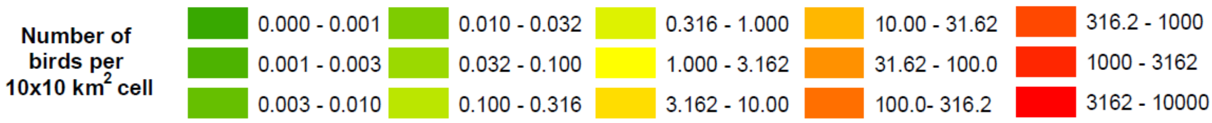


Figure 6-8. *Areas in the open sea of relative importance to seabirds at open sea (selected auks) in different seasons of the year (Source: RIA North Sea 2006 – updated Seapop 2015). The area of Utgard and Sleipner is indicated by a circle in the first map.*

6.2 Marine Mammals

The waters of the North Sea support a wide variety of marine mammals, with internationally important numbers of grey and common seals. A wide range of cetaceans has been sighted in the North Sea, the most common being the harbour porpoise, minke whale and white beaked dolphin. Bottlenose dolphins from the nearshore population of the Moray Firth are rarely seen far offshore (JNCC, 2003).

Marine mammals are vulnerable to chemical discharges, acoustic disturbance from vessel operations and injury from collisions with vessels. The effects of noise on marine mammals range from mild irritation through impairment of foraging behaviour to hearing loss, and in extreme cases injury or death (DECC 2009). Although there is no evidence to show that vessel noise adversely affects seals or small cetaceans, there are indications that large whales may avoid areas of intense activity (DECC, 2009).

6.3 Protected and particularly valuable and vulnerable areas

There are no declared or proposed marine protected areas that may be directly affected by the development of Utgard. However, there are protected and potentially sensitive marine areas in the vicinity of the development both on the UK and the Norwegian side of the border. Offshore Marine Protected Areas in the UK Northern North Sea are shown in Figure 6-9.

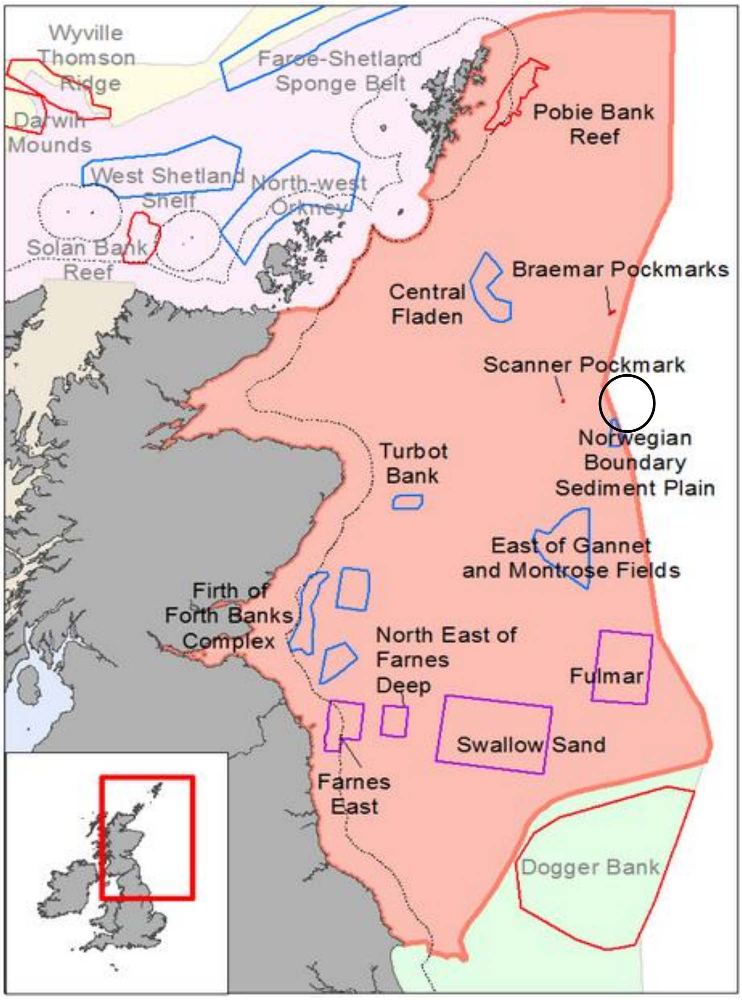


Figure 6-9 *Offshore Marine Protected Areas (MPAs, SACs and MCZs) in the UK Northern North Sea (JNCC 2015). The Utgard/Sleipner area is indicated by a circle.*

The Norwegian Boundary Sediment Plain (Nature Conservation MPA) is located immediately south of the Utgard subsea template location. This is a sandy plain in relatively shallow waters. The MPA includes records of the OSPAR Threatened and/or Declining species – ocean quahog (Arctica islandica). This thick-shelled clam can live for more than 400 years, making it one of the longest-living creatures on Earth. Like tree rings, the age of ocean quahog can be determined by counting the shell layers that form each year, which also provide information on how our climate has changed over time (JNCC 2015).

Figure 6-10 shows particularly valuable and vulnerable marine areas on NCS (Norw. Gov. 2013). In particular, a relatively large area of importance for mackerel spawning is identified in the vicinity of the Sleipner area.

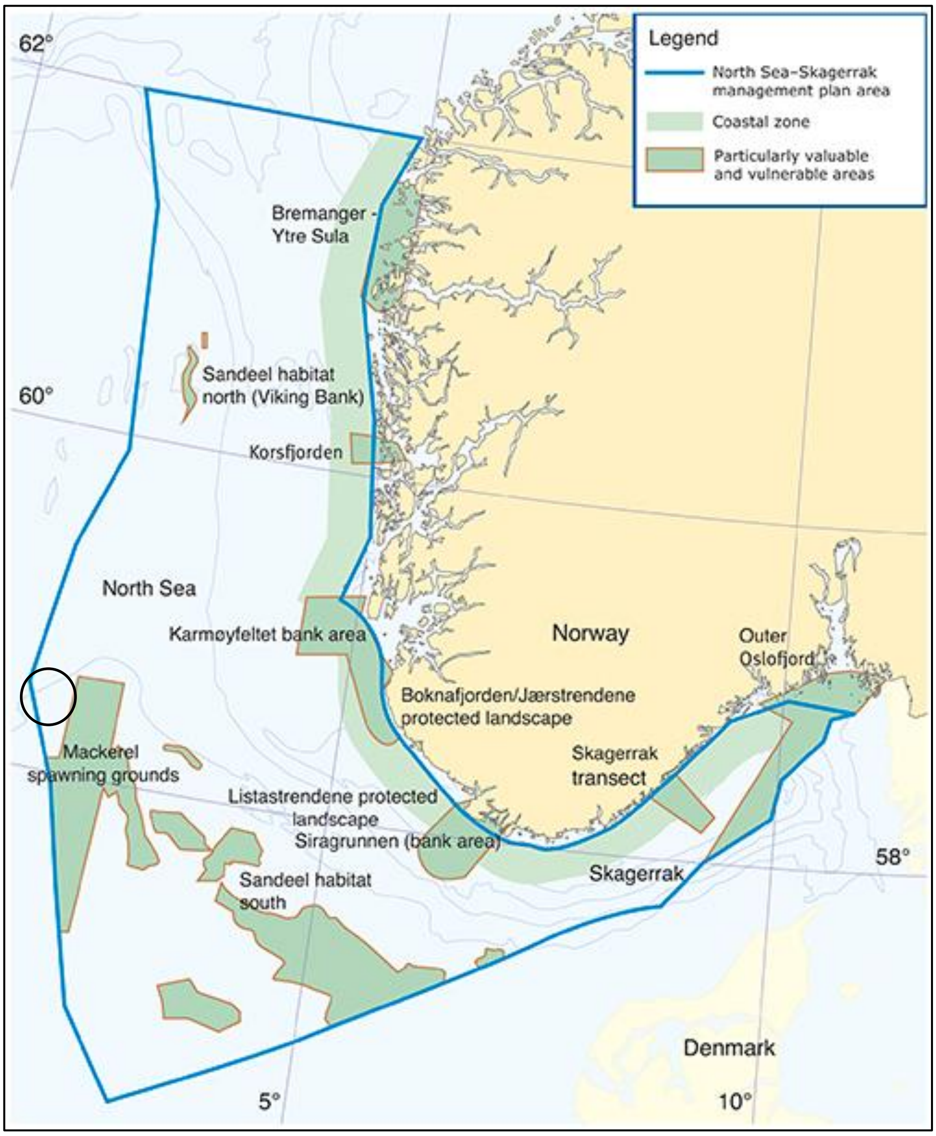


Figure 6-10 *particularly valuable and vulnerable areas on the Norwegian North Sea (Norw. Gov. 2013). The Utgard/Sleipner area is indicated by a circle.*

6.4 Fishing Areas

Data regarding fisheries have been extracted from the Management Plan 2013 and the Fisheries Assessment Report, a subject report to the RIA-North Sea 2006. Utgard is located within the fishery location 42-14 (Figure 6-6). Fishing activity is considered to be low in the eastern part of the Sleipner area and somewhat higher/moderate in the western part around the template. The fishing activity in the Norwegian part of North Sea is shown in Figure 6-11. The activity in the Sleipner area is generally regarded as low, but may vary somewhat from year to year.

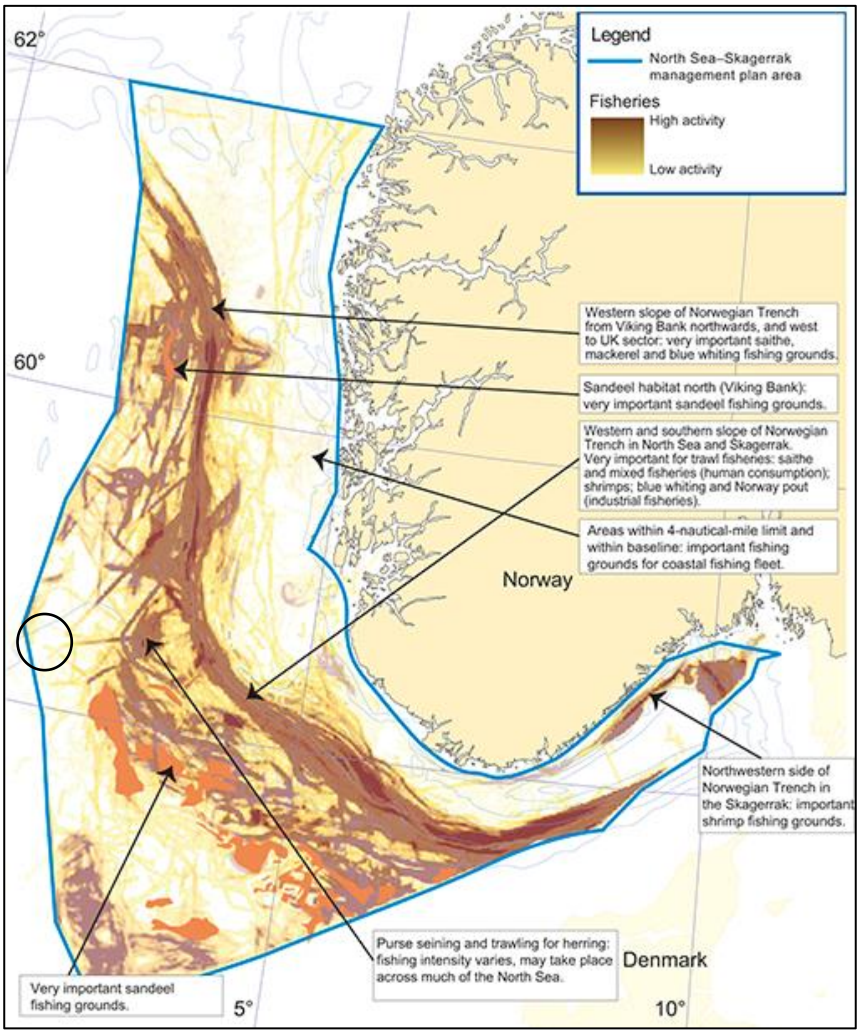


Figure 6-11. *Fishing activity in the Norwegian North Sea area (Norw. Gov. 2013). Utgard/Sleipner indicated by a circle.*

Catch data from this report show that within the Main areas (Figure 6-12) in the Norwegian sector there is mainly Norwegian fishing activity. Norwegian catches constituted around 75% of the total catch, while the Danish and UK catches represented approximately 15% and 10%, respectively. In the main area 8 (coloured grey in Figure 6-12) the majority of the catch was taken by bottom trawl and seine net, each with a share of more than 40%. In the west, in area 42 where Utgard is located, more diverse fishing gear is being used. The contribution from bottom trawling is considerably lower than in the Main area 8.

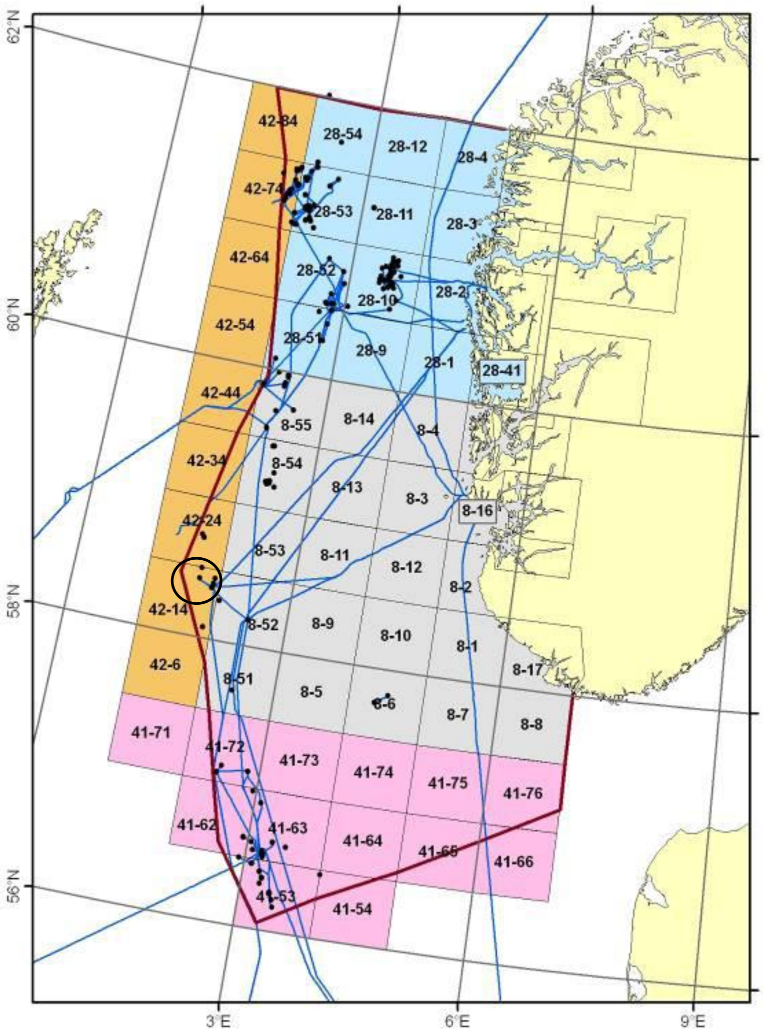
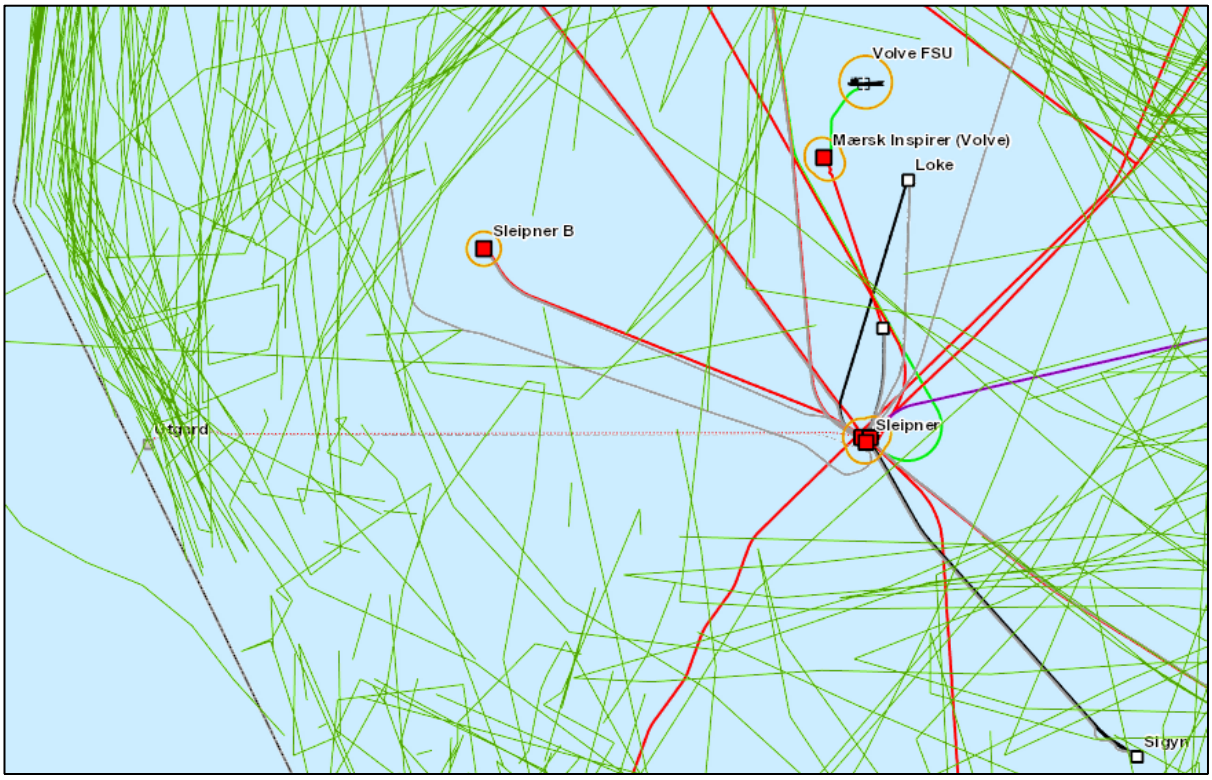
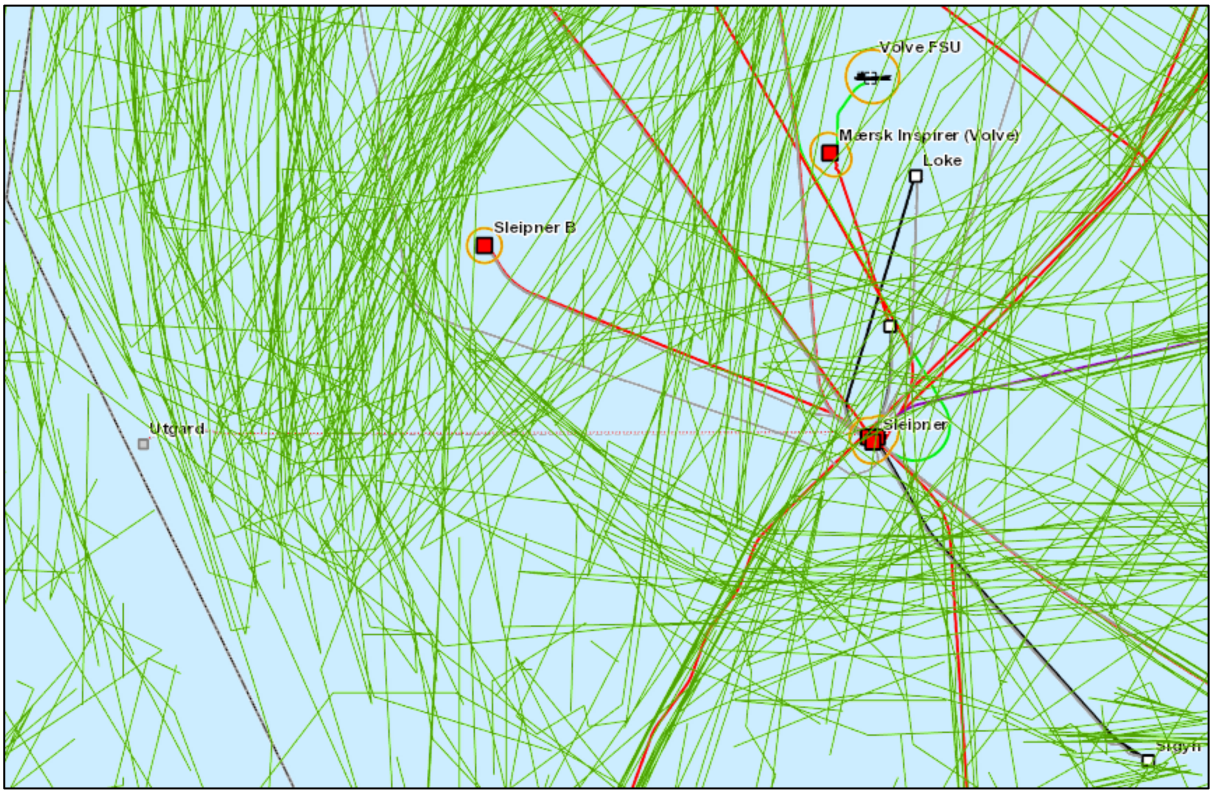


Figure 6-12. *Main areas and locations for the reporting of fish catches (Standards of ICES and Norwegian Directorate of Fisheries). The fishing areas are shown in different colours. Each single square represents one Fishing location. Utgard is situated in the fishing location 42-14 (orange). The area of Sleipner and Utgard is marked by a circle.*

Tracking data from the area around the Utgard suggest that the fishing activity primarily consists of foreign vessels, mainly British and some Danish. A separate tracking map with data on fishing activity in this area is shown in Figure 6-13.





Figur 6-13. *Tracking data for fishing vessels (trawlers) in the Sleipner/Utgard-area for the years 2011-13 (top) and 2014-15 (bottom)*

6.5 Shipping

The North Sea area is one of the most heavily trafficked ocean areas in the world. There are several important transport routes, for example for vessels in UK waters, traffic in transit along the Norwegian coast to northern waters, traffic to and from the Baltic Sea, and traffic between the major ports in Norway and other North Sea countries. The North Sea is used by every vessel category and to transport all kinds of cargo. The Utgard/Sleipner area can be characterised by moderate shipping activity (Gov.uk). Figure 6-14 shows an example of traffic density in the North Sea area (June 2011).

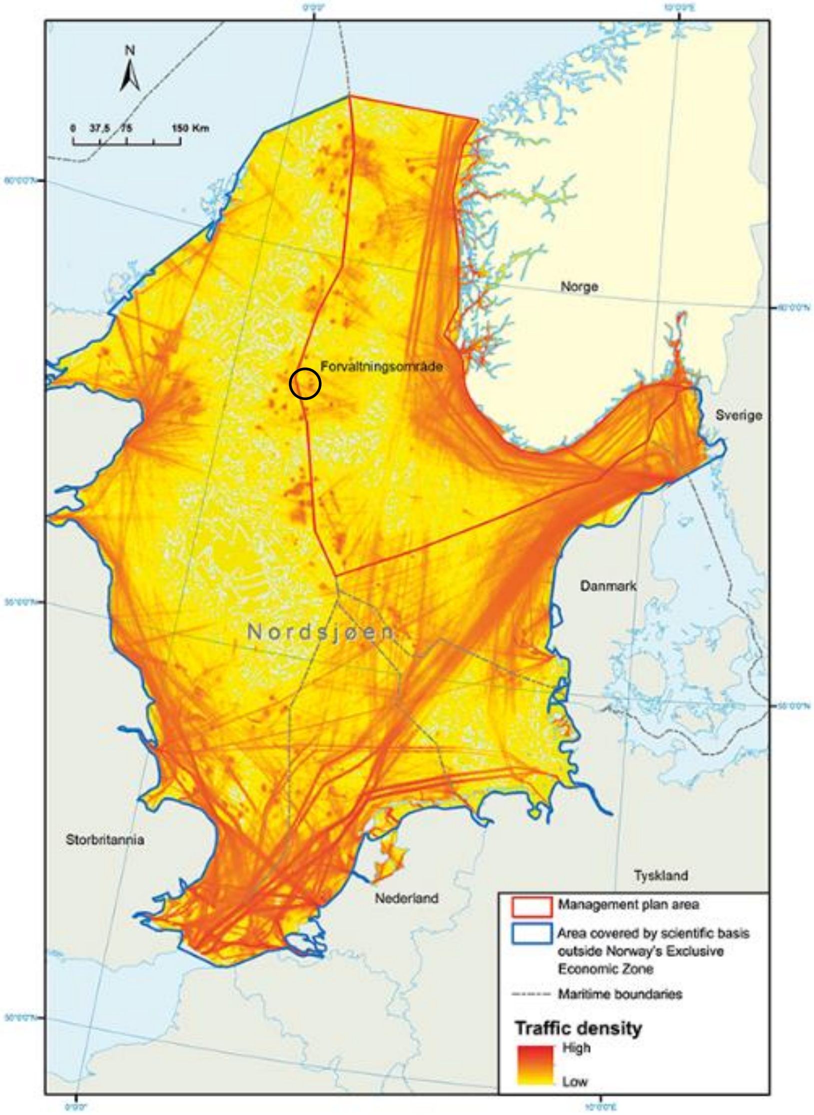


Figure 6-14. *Ship traffic in the North Sea (AIS (Automatic Identification System) data June 2011). Utgard/Sleipner area indicated by a circle*

6.6 Cultural Heritage and Relicts of the Past

There are no registered cultural relicts in the Utgard Area. Generally two types of cultural heritage can occur on the Norwegian Shelf: findings from the Stone Age and shipwrecks. In the REIA-North Sea the assumed depth limit for the possible discovery of Stone Age relicts is about 140 m. Utgard is located at 110-120 m depth, and there is therefore a theoretical potential for discoveries from the Stone Age.

6.7 Environmental sensitivities

Table 6-1 provides a summary of the key features of the offshore environment in this area, and their seasonal patterns of activity or sensitivity, based on descriptions and referenced information sources in this section of the ES.

Table 6-1. *Seasonal environmental sensitivities in the influenced area*

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plankton The planktonic community is potentially sensitive to chemical releases into the sea. The planktonic community in the vicinity of the proposed activities is typical of the central North Sea and has the capacity to recover quickly because there is a continual exchange of individuals with surrounding waters. Any impacts associated with the proposed operations are likely to be small in comparison with natural variations.											
Benthic Fauna Benthic communities in the area of the proposed activities are similar to those found throughout the surrounding area of the central North Sea and no rare species are known to occur in this area. Benthic faunal communities are vulnerable to physical and chemical disturbances to the sediment.											
Fish Juvenile fish, in particular ecologically sensitive demersal spawning species such as sandeels, herring and Norway lobster, are vulnerable to any physical disturbance of their spawning and nursery grounds. Finfish and shellfish are vulnerable to pollution, such as oil and chemical discharges, especially during the egg, larval and juvenile stages of their lifecycle. The proposed activities lies within spawning grounds for cod, haddock, saithe and Norway pout. Most of these species are considered to be less sensitive because of their widespread distribution and extensive spawning areas.											
Marine Mammals Harbour porpoise is the most commonly recorded cetacean in this area; numbers are greatest in July. Other species of cetaceans recorded in the area are killer whale, minke whale, white-beaked dolphin, white-sided dolphin and Risso's dolphin. Marine mammals are vulnerable to chemical discharges, acoustic disturbance from vessel operations, and injury from collisions with vessels.											
Seabirds Seabird populations are vulnerable to surface pollution, particularly oil. However, Utgard is a gas and condensate field and potential negative impacts on seabirds from the planned activities are therefore regarded to be low.											
Fishing Activity Fishing activity is considered to be low in the eastern part of the influenced area and somewhat higher/moderate in the western part around the template.											
Conservation Areas and Species There are no protected areas that may be influenced by the planned development of Utgard. Based on generally available information and survey data from the pipeline route there are no reef habitats in the area of the proposed pipeline. Neither have any objects of cultural heritage importance been identified in the area. The harbour porpoise (mentioned above) is the only Annex II species known to occur in this region of the North Sea.											

Key to Level of Sensitivity / Activity	
	Very high
	High
	Moderate
	Low

7 Potential Environmental Impacts

This chapter gives an estimate for emissions to air and discharges to sea from Utgard. It also describes the physical impacts on the seabed from the planned interventions and installation works and the physical presence of the subsea infrastructure. The potential environmental impacts are described. Accidental events are thoroughly considered in cognisance of the Supplementary Guidance issued by DECC to the operators on UKCS following the Deepwater Horizon accident.

In general the development of Utgard will result in only minor potential environmental impact. During the construction phase there will be activities from vessels and drilling close to the UK border. During the production phase all emissions to air will come from the existing Sleipner complex. Produced water from Utgard will be sent for injection together with the produced water from the Sleipner fields.

7.1 Emissions to Air

Sleipner development production has fallen below plateau levels, and processing of the well stream from Utgard will use free capacity on the Sleipner complex. This implies that Utgard will not cause any increase of emissions to air from Sleipner compared with the existing conditions. No new process equipment or power producing equipment will be needed for production of the Utgard reserves.

The well stream in the Utgard field has high CO_2 content and will be routed through the CO_2-removal facilities at SLT in order to reduce the CO_2 content. Separated CO_2 will be injected into the subsurface Utsira-formation for permanent disposal - about 1 million tonnes of CO_2 from the Sleipner field have been injected every year since start-up of the Sleipner West field in 1996. After CO_2-removal the gas from Utgard will be blended into other gas volumes at the Sleipner facilities before it is exported to the market.

The following activities will cause emissions to air:

- Drilling and well operations
- Marine operations (installation of template, pipeline, etc.)
- Operation/processing at Sleipner
- Injection of CO_2 and produced water
- Transport of gas and condensate

For drilling and completion, a separate, drilling rig will be used (probably a semi-semisubmersible unit, although a jack-up unit could be used). Emissions to air will occur from the drilling unit. The drilling unit will produce emissions of CO_2 and NO_X, as well as smaller amounts of SO_2 from diesel engines. Testing and cleaning of the wells will be routed to the inlet separator at the SLT platform, and hence, no emissions to air from testing and cleaning will take place at the drilling rig.

Marine operations in connection with the installation of subsea equipment and pipeline laying and cables will give emissions of CO_2, NO_X and SO_2 from diesel engines on the transport and construction vessels.

In the operational phase, all emissions to air will occur from the Sleipner installations. The main components that will be released into the air are CO_2, NOx, CH_4, nmVOC (non-methane Volatile Organic Compounds), from the following sources:

- Gas turbines
- Diesel engines (fire water pumps and emergency generators etc.)
- Diffuse emissions from processing
- Emissions from flaring

Processing, injection and transportation require energy, which in turn will lead to emissions. In particular the compression and pumping of gas and condensate for export requires energy. However, there will be no need for installation of new power production or process equipment at Sleipner as a result of the development of the Utgard.

There are 11 turbines on the Sleipner Installations. Sleipner A has 3 Dual Fuel (DF) LM2500 generator drivers, of which one is prepared for low-NO_X (DLE). Sleipner A has 5 Single Fuel (SF) LM2500 PE compressor drivers. Sleipner T has 3 SF LM2500 PE compressor drivers which all are prepared for low- NO_X. At present none of the turbines have low- NO_X technology. The Norwegian Environmental Directorate stated in the current Frame Discharge Permit for Sleipner that they consider the technology used in the energy plants on the Sleipner Field as satisfactory in relation to Best Available Techniques (BAT).

The development of Utgard will use the existing processing capacity and export capacity at Sleipner, and thus contribute to the total emissions from the Sleipner installations.

Potential environmental impacts of the emissions to air are summarized in table 7-1.

Table 7-1: *Potential Environmental Impacts of Atmospheric Emissions*

Type of Emission	**Environmental Impact**
Carbon Dioxide (CO_2)	A Greenhouse Gas (GHG) with potential climate effects
Methane (CH_4)	Contributes to Low-level ozone production, along with other hydrocarbons and NO_X. Methane as a Greenhouse Gas (GHG) with potential climate effects
Carbon Monoxide (CO)	Can be oxidised to CO_2, a GHG, but is primarily a local air pollutant that can be toxic at high concentrations.
Oxides of Nitrogen (NO and NO_2)	Contribute to acid deposition, fertilizing of soil, and may also contribute to ozone formation when mixed with volatile organic compounds in sunlight.
Oxides of Sulphur (SO_X)	Contributes to acid deposition and toxic gas.
Nitrous Oxide (N_2O)	A Greenhouse Gas (GHG) with potential climate effects
Volatile Organic Compounds (VOC)	May promote the formation of photochemical oxidants (ozone)

7.1.1 Emissions to Air from Utgard at the host facilities

This section presents the estimated emissions to air from Utgard at the host facilities.

Main sources of emissions to air from Utgard are:

- Turbines driving generators (electrical power generation)
- Turbines driving compressors (compressor work)
- Flaring

Emissions to air from the above combustion processes include CO_2, NO_X, CH_4 and nmVOC.

Note that for power generation, only emissions related to main power generation are included in this budget. Emissions to air in connection with emergency power, fire water generators etc. are not included in the budget due to a relatively low contribution to the overall emissions.

7.1.1.1 Emissions to air in connection with power generation

There will only be a small increase in electrical load due to the tie-in of Utgard. The increase in electric load is mainly from power supply to new HPU, new chemical pumps, heat tracing, metering control panel and lightning. SLT receives electric power from SLA through a subsea cable. Currently about 14MW is transferred from SLA to SLT. The estimated increase due to Utgard will be around 0.2 MW.

Sleipner A has three 20 MW turbine driven generators to produce the required power.

In addition Sleipner T has two Pelton generators that run on energy released from the amine CO_2 removal plant. There are no emissions from fuel gas combustion related to energy production from the Pelton generators. Each generator is producing a maximum of 3.85 MW. The "profits" from this emission-free energy production have not been accounted for in this budget.

Turbine fuel gas consumption in connection with generating the required power is calculated from the formula:

$$Fuel\ gas\ consumption = \frac{Operational\ time\left[days\ /\ year\right] \times Electric\ load\left[MW\right]}{Lower\ \ heating\ value\left[MJ\ /\ Sm^3\right] \times Turbine\ power\ \ efficiency}$$

The operational time of the turbines, i.e. number of days running per year, depends on the availability of the turbines and generators. For simplicity it is assumed that the availability of the turbines/generators is 90%, i.e. the operational time is assumed to be 329 days per year at full load.

The dual fuel turbines on occasion run on diesel – this is mainly during turnarounds for maintenance. As the power consumption on SLT during revision stops is low, emissions from diesel combustion is omitted from the budget.

A Lower Heating Value of 43.2 MJ/Sm^3 has been used for SLA fuel gas with 3.1 mol% CO_2 content.

Turbine power efficiency is assumed to be 35%.

The estimated fuel gas consumption is used to calculate the emissions to air. The total increase in emissions to air from power generation for Utgard over the operational lifetime is calculated to be 12 ktonnes CO_2 total with an average of 1 ktonnes per year during the operational lifetime. Corresponding numbers for NO_X are 54 tonnes in total and 5 tonnes per year average.

7.1.1.2 Emissions to air in connection with compressor work

Estimates for emissions to air associated with turbine driven compressors are based on expected compressor load figures for:

- Pre compressor
- Export compressor
- CO_2-injection compressor

All turbine driven compressors are equipped with variable speed drives (VSD).

Turbine fuel gas consumption and related emissions to air for the compressor work are calculated following the same method as for power generation, ref. Section 7.3.

Utgard's share of the total emissions to air from compressor work is calculated as 740 ktonnes CO_2 over the operational lifetime for Utgard, with an average of 61.5 ktonnes per year. Corresponding numbers for NOx are 3300 tonnes in total and 275 tonnes per year average.

7.1.1.3 Emissions to air from flaring

Emissions to air from flaring are based on an estimate of flare volumes for Utgard during the operational lifetime.

Total emissions from Utgard flaring over the operational lifetime are calculated as 25.5 ktonnes CO_2 with an average of 2.1 ktonnes per year. Corresponding numbers for NOx are 9.4 tonnes in total and 0.8 tonne per year average.

7.1.1.4 Total emissions to air

Table 7-2 below shows total emissions to air from power generation, compressor work and flaring:

Note: The production period assumed is from 2020 until 2031.

Table 7-2 *Total emissions to air from Utgard*

Year	Total emissions to air from Utgard [tonnes/year]				
	CO_2	NO_x	CH_4	nmVOC	Greenhouse Gas (GHG) - CO_2 equivalents
2020	24 501	88	127	32	27 259
2021	71 624	296	142	36	74 707
2022	81 764	344	125	32	84 477
2023	103 014	441	114	29	105 480
2024	112 754	486	103	26	114 992
2025	107 403	464	90	23	109 368
2026	79 912	345	68	17	81 382
2027	62 300	269	54	14	63 473
2028	49 563	214	43	11	50 505
2029	40 974	177	35	9	41 734
2030	34 808	151	27	7	35 400
2031	20 906	92	8	2	21 070
Total	**789 523**	**3 367**	**936**	**239**	**809 847**
Average	**65 794**	**281**	**78**	**20**	**67 487**

7.2 CO_2 injection

A total of about 1.5 million tonnes of CO_2 from the CO_2 removal from Utgard gas will be re-injected into the Utsira formation for permanent geological storage.

7.3 Discharges to Sea

Development and operation of Utgard will cause discharges to sea, normally comprising:

- Discharges from drilling and well operations (water based drilling fluid and cuttings)
- Discharges of control fluid, from the operations of valves on subsea installations
- Discharges from the commissioning of pipelines (RFO – Ready For Operation)

Produced water from Utgard will be re-injected into the Utsira subsurface formation after treatment, and will normally not be discharged to sea. Note: Re-injection of produced water started at the Sleipner field in 2009, and the up-time of this system has been above 97%.

There might be a minor increase in other operational discharges from Sleipner T and Sleipner A, caused by increased processing (e.g. cooling water).

Discharges to sea from the drilling of the two wells at Utgard are documented in Section 3.5.3 of this document, see table 3-3.

The environmental impact associated with discharges from the drilling will largely be restricted to the direct effect on benthic animals as a result of the physical coverage of bottom sediments. The main ingredients in water based drilling fluid are not considered toxic, but the particles may have some physical effect on the planktonic organisms and the benthic animal society. Such consequences are local. When drilling with oil based mud, cuttings will not be released to the sea, but shipped to shore for final handling, treatment and disposal.

In connection with the preparation and tie in of pipelines, there will be discharges of water containing chemicals that have been used to prevent corrosion/fouling, and the dyes used for pressure testing and leakage detection. The discharges will have local and short term effects only.

The control system at Utgard will be an integrated part of the Sleipner control system. This is an open hydraulic system with discharge to sea. The hydraulic fluid (Oceanic HW 443 ND) in this system is judged as environmentally acceptable by Norwegian authorities (yellow environmental category). Based on the experience from a similar subsea installation a yearly discharge of approximately 1 m^3 of control fluid is expected.

In summary, no significant environmental impacts are expected from the planned discharges to sea from the development of Utgard.

7.3.1 Discharges to Sea from Utgard at the host facilities

This section presents the estimated discharges to sea from Utgard at the host facilities.

Estimated discharges of produced water to sea are given in Section 4.4 of this document, see Table 4-3.

The produced water from Utgard will be separated from gas and condensate in the inlet separator at SLT and will be sent to the produced water flash drum which includes automatic skimming and removal of the oil phase separated by flotation. Produced water at Sleipner (including Utgard) will be re-injected into the Utsira formation after treatment. The produced water injection system up-time has been above 97% for the entire period since re-injection started in 2009, i.e. less than 3% of the produced water has been discharged overboard during these years. The very limited produced water discharged to sea related to the Utgard production will contain small amounts of oil and scale inhibitor.

The following oil in water and scale inhibitor concentrations, based on historical data from 2010-2014, can be assumed:

- Oil in produced water: 29 mg/l
- Scale inhibitor in produced water: 175 mg/l

The discharge permit issued by the Norwegian Environmental Directorate sets a discharge limitation of 1100 kg of oil to sea per year from the Sleipner installations in total. In 2015 the actual discharge from the Sleipner field with all its satellites was reported around 650 kg. The concentrations of oil or other components in the produced water discharge are not specifically regulated by the discharge permit.

7.4 Waste Handling

Since generation of different types of waste in connection with operations and maintenance is unavoidable the primary aim regarding waste handling during Utgard operations is to minimise the amounts of waste and to maximize the degree of reprocessing, reuse or recycling.

Utgard is expected to generate a small increase in waste production, which will be handled by the existing waste segregation system on Sleipner. An environmental station is located in M12 on SLT main deck, where segregation of the different types of waste is possible, including hazardous waste. On SLA there are several environmental stations, with the main station for segregation of hazardous waste located on the Weather Deck.

During the installation phase there might be need for extended waste disposal capacity. In this case, skips will be ordered for waste handling as deemed necessary and located in laydown areas on lower and upper mezzanine decks or weather deck.

Produced sand shall either be handled as hazardous waste or cleaned and discharged to sea according to Norwegian regulations. Furthermore, according to the Norwegian regulations, sand shall not be discharged to sea if the oil content is more than ten grams per kilogram of dry matter. Sand from Utgard will be trapped in Alfa Nord sand trap and drained to drip tray. The rest of the sand will be sedimented in inlet separator G-20-VA01. There is no sand jetting system in G-20-VA01, hence trapped sand has to be dug out for disposal during maintenance turnarounds. Sand production from Utgard is expected to be low.

7.5 Physical Impacts and Presence of Subsea Infrastructure

Physical impacts will be related to installation of template, drilling of two wells and installation of 21 km of pipeline and umbilical. In the production phase the Utgard template and the 21 km pipeline and umbilical will represent a physical presence at the seabed.

<u>Marine Protected Areas</u>
No marine protected areas are directly affected by the Utgard development. However, there are protected and potentially sensitive marine areas in the vicinity of the development both on the UK and the Norwegian side of the border. The planned activity at Utgard is limited, and no significant impacts in these areas are anticipated.

<u>Fisheries</u>
Field activities connected to drilling, installation of subsea facilities and laying of pipelines, can potentially impact fishing more than the production phase operations. These activities can create a temporary area of exclusion for fishing vessels that moves with the ongoing work. However, since these activities take place within a limited time period, they are not expected to cause any significant loss of catch.

Exclusion from areas of sea by the presence of rigs or installations could result in effects on commercial fishing, as could the presence of snagging hazards associated with pipelines or debris. However, the small scale of the Utgard infrastructures implies that this is unlikely to cause significant economic impacts. In addition, the template and pipeline will be over-trawlable.

Shipping
The Utgard/Sleipner area is characterised by moderate shipping activity. As discussed above for fisheries, field activities at Utgard can create a temporary area of exclusion for shipping that moves with the ongoing work. However, since these activities take place within a limited time period, they are not expected to cause any significant economic impact.

Corals
Cold water corals are sensitive to physical interference from seabed intervention work. However, no cold water coral reefs have been found in the open waters of the North Sea. The likelihood of corals being affected by the planned activities is therefore minimal.

Cultural Heritage and Relicts from the Past
Activities affecting the seabed may cause direct or indirect impact on cultural heritage and relicts from the past. This relates mainly to activities such as the placement of wells / subsea templates and the laying of pipelines.

Investigations of the locations and corridors for template and pipelines will reveal possible discoveries of cultural relics. A subsea survey of the Utgard pipeline corridor in 2009 did not reveal any such objects. If cultural relics are found in the impacted area, the Norwegian cultural heritage authorities will be contacted and further handling of the discoveries will be clarified.

7.6 Accidental Emissions and Discharges

Accidental emissions and discharges may occur due to accidents in the following categories:

- Blow-out from drilling rig or field installations during operation
- Accidental emissions from drilling rig
- Leaks from pipelines
- Leaks from subsea installations
- Leaks from processing

The most severe environmental impacts are generally associated with acute accidental discharges of oil and the subsequent damages of seabirds. For gas/condensate fields like Utgard, the potential impacts from possible acute discharges are considerably less severe.

The following assessment has given particular attention to the matters raised in the Supplementary Guidance issued by the Department of Energy and Climate Change (DECC) following the Macondo well incident in the Gulf of Mexico (Deepwater Horizon).

The main driver, as all infrastructure and activities are on the Norwegian side of the border, is meeting the Norwegian regulatory requirements for documentation of environmental risk from accidental spills, and the corresponding design and dimensioning of the oil spill response system.

Utgard is included in the latest update of the Environmental Risk Analysis for the Sleipner Field (DNV 2009). This analysis was specifically reviewed and re-confirmed in 2014. The analysis is based on the discharge frequency for activities on the installations Sleipner A, Sleipner B, Sigyn, Alfa Nord and Utgard. The production at the Sleipner field is primarily gas and condensate, one single well produces light oil (Sigyn). A typical light oil (density 793 kg/m^3) has been assumed for the oil drift modelling throughout the analysis. For Utgard this is a conservative assumption.

Both surface and subsea blow-outs have been considered. In both cases 5 different blow-out durations and 5 different blow-out rates have been considered. The longest duration is related to the time it would take to drill a relief well and kill the well, which is estimated to be 98 days. The duration is based on average drilling time for a well in the Sleipner area, and includes the time needed for mobilisation of the rig.

Specific modelling has been conducted to establish oil-slick thickness when surfacing from a subsea blow-out case. In the oil spill modelling for oil on the sea surface, oil drift statistics were generated for 3600 randomly selected simulations (different starting dates) for all duration and rate combinations, throughout the year.

Blowout frequencies are derived from available recognized statistics, e.g. the Scandpower Risk Management- Blowout and Well Release Frequencies and the SINTEF-Offshore Blowout Database.

Probability distributions for different blow-out rates and durations for a subsea and a surface blow-out scenario are shown in Table 7-3.

Table 7-3. *Probability distribution for different combinations of blow-out rates and durations for blow-out scenarios subsea and at the sea surface. Input to oil drift modelling for the Sleipner field. (StatoilHydro 2009)*

Scenario	Rate (Sm3/d)	Duration (days)				
		2	5	15	35	98
Surface	50	0,342	0,120	0,090	0,030	0,018
Surface	200	0,137	0,048	0,036	0,012	0,007
Surface	450	0,034	0,012	0,009	0,003	0,002
Surface	3300	0.051	0,018	0,014	0,005	0,003
Surface	9500	0,006	0,002	0,002	0,001	0,000
Subsea	50	0,193	0,085	0,089	0,042	0,061
Subsea	275	0,160	0,070	0,074	0,035	0,051
Subsea	830	0,008	0,004	0,004	0,002	0,003
Subsea	3300	0,025	0,011	0,011	0,005	0,008
Subsea	9500	0,025	0,011	0,011	0,005	0,008

The probability distribution data shows that the worst case scenario has a negligible to nil probability of occurrence compared with other more realistic combinations of rates and duration. A weighted average duration can be deduced from the data to be around 10 days for the surface blow-out case and 20 days for the subsea blow-out case. Similarly the weighted average blowout rates would be around 500 Sm^3/d for the surface case and 900 Sm^3/d subsea.

Oil drift modelling results are shown in Figure 7-1 and Figure 7-2. The results of the oil drift modelling clearly show that there is a higher probability of sea-surface oiling in an easterly direction rather than in a westerly direction. The modelling shows that UK waters may be impacted in an accidental oil spill scenario from the Sleipner area, although at a lower probability than Norwegian waters.

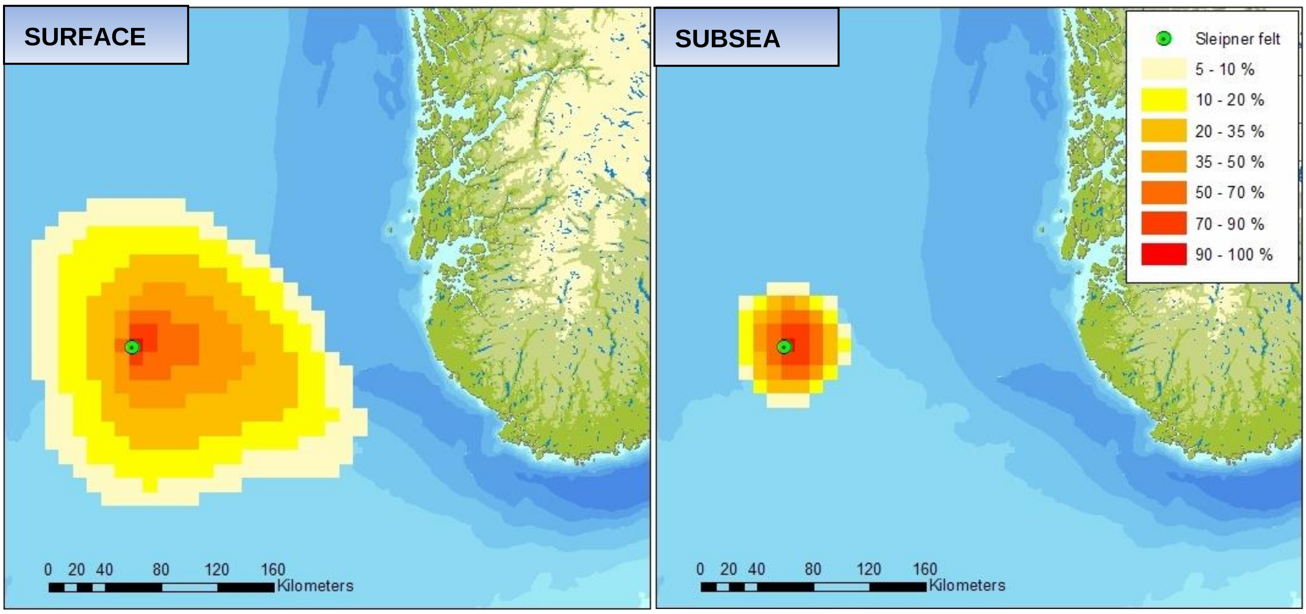


Figure 7-1. *Possibly affected area (influence area) in case of a surface or subsea blow-out at the Sleipner field. Areas with a probability ≥ 5% of presence of oil within a 10 x 10 km area in the case of a surface blow-out (left) and a subsea blow-out (right) are shown. Please take special notice that the area indicated is not picturing the spread of oil in a single oil spill case, but shows the probabilities of oiling based on the running of 3600 single-simulations (randomly selected from Table 7-3) throughout the year.*

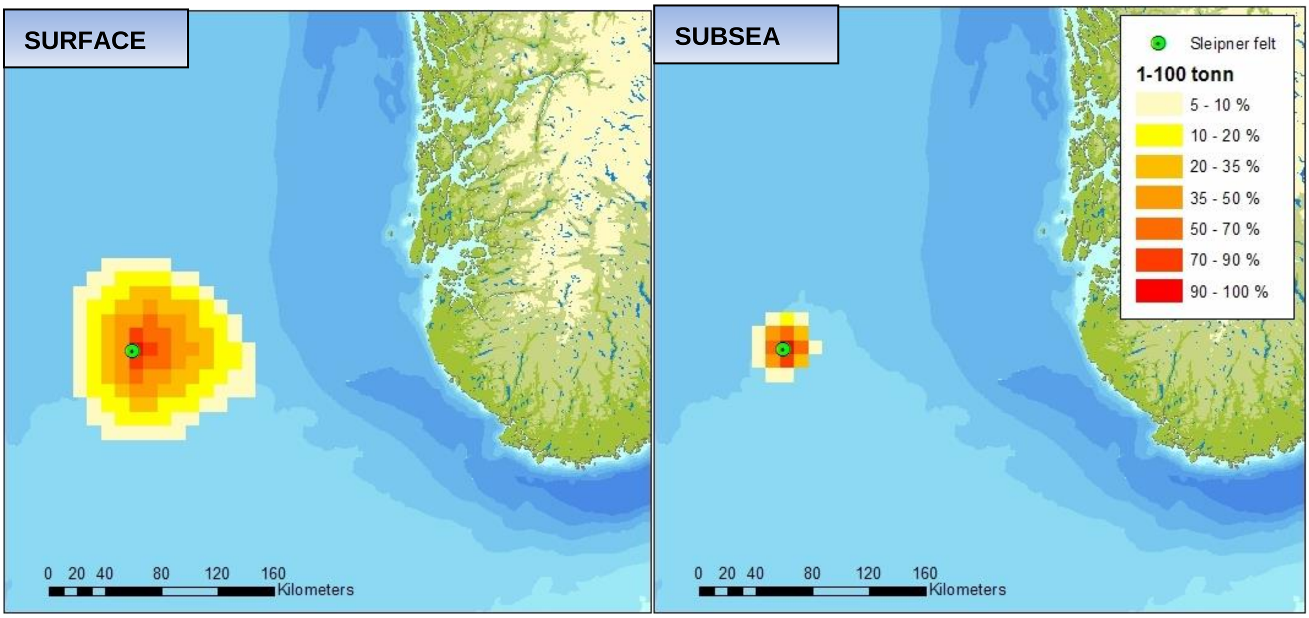


Figure 7-2. *Probability of presence of 1-100 tonnes of oil within a 10 x 10 km area in the case of a surface blow-out (left) and a subsea blow-out (right) are shown. Probabilities of hit are shown for the weighted rates and duration indicated in the text. Please take special notice that the area indicated is not picturing the spread of oil in a single oil spill case, but shows the probabilities of 1-100 tonnes of oil within a 10 x 10 km square in more than 5% of 3600 single-simulations (randomly selected from Table 7-3) throughout the year.*

Environmental risks in connection with blowouts have been analysed for a selection of seabirds and marine mammals. Because the field is located far from shore and the specific oil type from these fields will have only a short lifespan on the sea, the influenced area does not include the coastline. The modelling shows that there is no possibility of beaching of oil either in UK or Norway.

Even for resources at open sea, the environmental risk analysis shows limited risk with a maximum impact of 0.4% of Statoil's field specific acceptance criteria. In this case seabird populations at sea are the most exposed resource, and dominate the assigned level of environmental risk. The maximum environmental risk contribution is identified for Guillemot in August with a probability of Moderate impact (1-3 year recovery time) with a probability of 3.3x10-6.

Drilling of the two wells at Utgard will take place in third quarter 2018. This is essentially outside the periods of highest vulnerability of seabirds at sea during autumn/winter. The oil spill response resources at the Sleipner field will be specifically mobilised and prepared for handling the increased environmental risk during drilling and completion of the two wells at the Utgard template location. Because of the well stream composition at the Utgard field (gas/condensate), it is unlikely that oil or oil emulsion will accumulate on the sea surface to a degree that makes it possible to respond to by means of ordinary oil spill booms and collection systems. Careful surveillance of the fate of the spill will be conducted, and any retrievable debris will be collected.

8 Assessment of Environmental Impacts

This section evaluates the relative significance of the potential environmental impacts (Chapter 7) that might arise as a result of the construction and production of Utgard. Its purpose is to identify those potential impacts that might cause significant effects, so that they can be more fully assessed and mitigated as necessary. Potential effects are evaluated in terms of the environmental impact or risk of the activity and the sensitivity of the location (where applicable).

To facilitate the evaluation of consequences for UK stakeholders the area which has been assessed is divided between the Norwegian continental shelf and UK continental shelf – sections 8.1 and 8.2 respectively.

8.1 Norwegian Continental Shelf (NCS)

8.1.1 Emissions to Air

Potential environmental effects of greenhouse gas emissions are global by nature, and the potential effects of acidifying gaseous emissions (e.g. NO_x) are regional. In general, local environmental effects of atmospheric emissions are not expected to be significant in view of the efficient atmospheric dispersion associated with offshore locations. Due to the limited emissions from both the construction and production of Utgard, the incremental contribution to global and regional effects will not be significant.

8.1.2 Discharges to Sea

As no toxic chemicals or oil based mud will be released to sea, the environmental impact associated with discharges from the drilling will be restricted to the direct effect on benthic organisms as a result of the physical coverage of bottom sediments. The main components in water based drilling fluid are not considered toxic, but the particles may have some physical effect on the planktonic and benthic organisms. Such consequences are local, generally within a range of a maximum of 100 m from the drilling location, although some studies indicate that small particles may spread further away and settle at the seabed at quite some distance from the drilling location (Frost & Rye 2002). The amount of particles that may settle out from the water column in this case is limited, and no significant environmental effects are anticipated.

During preparation and tie-in of pipelines, there will be a discharge of the chemicals used to prevent corrosion and fouling and of the dyes used for pressure testing and leakage detection. The chemicals and their methods of use are selected to reduce discharge volumes and environmental risk, and the discharge is expected to provide only local impacts within a limited time period. Those organisms that would be at risk include planktonic organisms (i.e. those drifting in the near-seabed currents); epibenthic organisms (e.g. demersal fish and shellfish) and sediment dwelling filter feeders.

Produced water at Sleipner (including Utgard produced water) will be re-injected into the Utsira formation after treatment. The injection regularity (up-time) for the produced water has been above 97% for the period 2009-2015, i.e. less than 3% of the produced water has been discharged overboard over these years. The discharge permit limitation for discharge to sea of oil with produced water is set at a maximum of 1100 kg oil/year from the Sleipner field in total (Norwegian Environmental Directorate). This will include Utgard. No significant impact from discharge of produced water is anticipated.

During operation there will be a small discharge of control fluid to sea from the template. It is estimated that approximately 1 m^3 of control fluid will be discharged each year. As a consequence of low toxicity and the low discharge volume, the environmentally impact is regarded as negligible.

8.1.3 Physical Impacts

Installation of the template, drilling of the wells, and laying of the pipeline and umbilical including some rock dumping will disturb the seabed sediments and benthic organisms living in or on these sediments. The total footprint from these structures (around 0.5 km^2) will, however, be small in relation to the area of undisturbed benthic habitat, and the overall ecological impact will be very small.

The pipeline, pipeline crossings and rock dump areas will create new habitats for benthic organisms that live on hard surfaces. Such organisms typically include tubeworms, barnacles, hydroids, tunicates and bryozoans, which are commonly found on submerged rocky outcrops, boulders and offshore structures. These structures could also provide habitats for crevice-dwelling fish (e.g. ling) and crustaceans (e.g. squat lobsters and crabs). The overall ecological benefit would be negligible, however, because these structures cover only a small area.

A very small number of demersal and pelagic fish might be temporarily disturbed by the pipe-laying operations.

Subsea installations, pipelines and cables will be made so as to minimize negative impact on trawling activity. Loss of area due to the subsea installations are not expected to cause any significant catch reductions. Even though pipelines and template will be over-trawlable, trawling vessels may want to avoid crossing them, and thus they could represent some restrictions to fishing activities.

For pelagic fisheries in the area it is assumed that the development of Utgard will have no negative impacts during the production phase.

8.2 United Kingdom Continental Shelf (UKCS)

The main water movements are influxes of Atlantic water through the Fair Isle Channel (between Orkney and Shetland) and to the east of Shetland, and a major outflow through the Norwegian Trough. Water circulation in the North Sea is anticlockwise, with an eddy forming over the Fladen Ground.

Meteorological Office wind data for the Regional Sea 1 area (OESEA) of the North Sea where the Utgard area is located show the occurrence of winds from all directions, although dominated by winds from south-west and north-north-east (DECC 2009).

The prevailing winds and the residual water circulation are more likely to cause discharges to water (including particulates) and atmospheric emissions to disperse from the UK continental shelf to the Norwegian continental shelf rather than the other way round.

8.2.1 Emissions to Air

There will be no sources of emissions to air from Utgard on the UK continental shelf. The atmospheric emissions caused by the construction and production of Utgard are small compared to the current emissions at the Sleipner complex, and compared to the overall emissions in the North Sea. The contribution to regional and global effects will not be significant.

8.2.2 Discharges to Sea

All sources of planned discharges and possible accidental spills from Utgard are located on the Norwegian continental shelf. As low to negligible environmental impacts has been concluded on the Norwegian side, any impacts on the UK side will be minimal.

Environmental effects caused by discharges from drilling will be limited to the immediate proximity of the wells. As the wells top-hole locations will be located approximately 450 m from the UK border no significant environmental impacts are expected on the UK continental shelf.

Flooding and integrity testing are a routine part of pipeline installation, during which permitted discharges of chemicals to the marine environment will take place. The discharges will take place in Norwegian waters, most likely close to the template location approximately 450 m from the border line. There might be a local impact in the immediate vicinity of the discharge points, however, no significant impacts are expected in UK waters.

Small amounts of control fluid will be discharged to sea at the template. As the amounts of fluid discharged will be limited and the toxicity of the chemicals is low, no significant environmental impacts in UK waters are expected from these discharges.

The discharge of produced water from the Utgard will be low due to the established re-injection of produced water at the Sleipner field. The up-time of the re-injection is high (more than 97%). The limited discharges associated with down-time of the re-injection, would take place on the NCS approximately 20 km from the UK border. No significant environmental impacts are expected in UK waters.

8.2.3 Physical Impacts

There will be no subsea infrastructure on the UK continental shelf. However, during drilling operations typically eight anchors will be used to secure the rig and two or three of these anchors may be on the UK side of the border line.

Depending on the nature of the seabed anchors can create mounds up to 1m high, and anchor chains lying on, and sweeping over, the sediments can create gouges and scour marks. On a clay seabed, such anchor mounds can potentially become an obstruction when mobile fishing gear is used. The seabed in the Utgard area is sandy, and significant anchor mounds are less likely to result from the anchor operations.

Anchor mounds and scours also have the potential to cause disruption to benthic communities. The deployment and retrieval of anchors would cause some direct impact of invertebrates living on and in the sediments, and some physical disturbance of their environment as a result both of the ploughing of sediments and of the covering of sediments by material. The magnitude of this disturbance will, however, be very low. In all cases, the affected sediments would be clean, and re-colonisation from adjacent unaffected communities would begin very quickly after the disturbance has ceased. The area of seabed that could be physically impacted by such operations would be very small in relation to the adjacent areas of similar seabed. The seabed will be surveyed after the drilling operations are completed. In the unlikely case of any significant anchor mounds, measures to smooth/flatten these will be considered.

9 Conclusions

Overall, the proposed activities for the Utgard field development are not expected to lead to environmentally significant effects.

The Utgard field is located in an area with habitats and marine life typical for the central North Sea, and none of the environmental receptors is assessed as being particularly sensitive to the type of activities proposed.

The activities associated with the Utgard development will be included in the Statoil Petroleum AS environmental measurement and monitoring programmes, which track performance against corporate targets for important emissions and discharges.

This assessment demonstrates that the planned installation of the Utgard template, drilling of the two wells, the laying of the pipeline and subsequent increased production at the Sleipner facilities will have no significant effects on environmental resources in the central North Sea. The controls on operations have been designed to ensure that robust environmental safeguards will be put in place and preventive measures have been designed to minimise any potential environmental risks. It is concluded that the Utgard activities could be implemented without significant adverse effects on the environment.

There will be no subsea infrastructure, discharges to sea or emissions to air on the UK side of the border line. The only direct effects on the UK continental shelf are the potential physical impact from 2 or 3 anchors in connection with anchoring of the drilling rig. Mounds from anchors may be seen as temporary obstructions for demersal trawling. However, no significant environmental impacts are expected in relation to this.

Statoil believes that the measures that will be taken to minimise the environmental effects associated with the Utgard activities represent an appropriate balance between protecting the environment and securing the economic benefits of the planned production.

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