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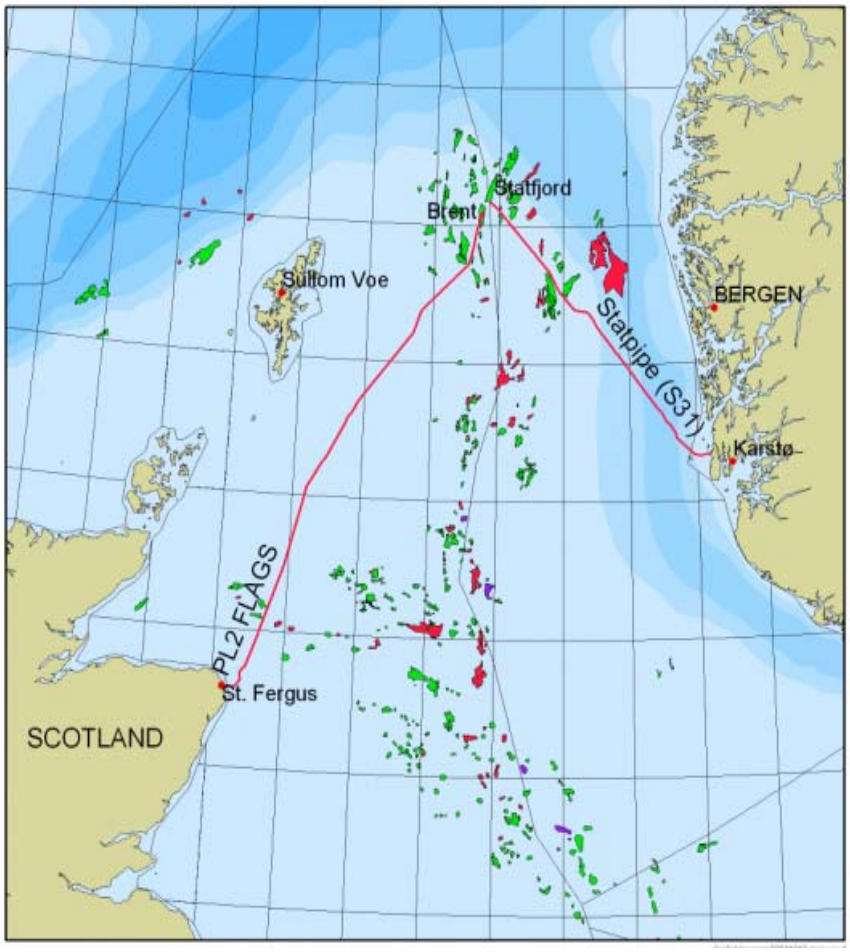

Environmental Statement for the Tampen Link gas export pipeline

December 2004

ExxonMobil Shell ConocoPhillips bp centrica

Standard Information Sheet

Project name:	Statfjord Late Life (SFLL) project; Tampen Link gas export pipeline
DTI Project reference:	D/2430/2004
Type of project:	Field Development
Undertaker Name:	Statoil ASA
Address:	Statoil ASA 4035 Stavanger Norway
Licensees/Owners:	Statoil ASA (operator) 44.34% Exxon Mobil Norge AS 21.37% Norske ConocoPhillips AS 10.33% AS Norske Shell 8.55% Enterprise Oil Norge AS (Shell) 0.89% ConocoPhillips (U.K.) Limited 4.84% Britoil 4.84% ChevronTexaco (U.K.) Limited 4.84%
Short description:	Statoil are proposing to install a new gas pipeline between the Statfjord B platform and FLAGS, the Tampen Link pipeline, as part of the SFLL project. The new export pipeline will be connected to the Statfjord B pipeline via a new 10" riser. A new 6" riser will be required at the Statfjord B platform to process the gas from Snorre and the Statfjord satellites. The pipeline will be connected to FLAGS via a new Hot Tap Tee-piece welded onto the existing FLAGS pipeline. All connections at Statfjord and at FLAGS will be stabilised using gravel and rock and will be fitted with protective structures.
Dates	
Anticipated commencement of works:	April 2005
Date and reference number of any earlier Statement related to this project:	Not applicable
Significant environmental impacts identified:	Presence of pipelay vessels Anchoring of vessels during pipeline installation Pipeline installation Physical presence of the pipeline and subsea structures Pipeline chemicals Accidental diesel spill
Statement Prepared By:	Statoil ASA BMT Cordah Limited, Aberdeen

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Abbreviations

AFEN	Atlantic Frontier Environmental Network
BA	Brent A
BAT	Best Available Techniques
BB	Brent B
bbls	barrels
BC	Brent C
BD	Brent D
BES	Briggs Environmental Services
BoG	Project Sanction (Statoil internal project milestone)
BoV	Provisional project sanction (Statoil-internal project milestone)
BREF	BAT Reference Documents
BTEX	Benzene Toulene Ethylene Xylene
CAPEX	Capital expenditure
CEFAS	The Centre for Fisheries and Aquaculture Science
CH_4	Methane
CITES I	Convention on International Trade in Endangered Species of Wild Flora and Fauna
cm	Centimetre
CO_2	Carbon dioxide
CPR	Continuous Plankton Recorder
cSAC	Candidate Special Area of Conservation
dB	decibels
DEFRA	Department of Environment, Food and Rural Affairs
DLE turbine	Dry low emission turbine
DP	Dynamically Positioned
DREAM	Dose-related Risk and Effects Assessment Model
DSV	Dive Support Vessel
DTI	Department of Trade and Industry
EA	Environmental Assessment
EC	European Community
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIF	Environmental Impact Factor
ERA	Environmental Risk Assessment
ES	Environmental Statement
ESP	Electrical submerged pump
EU	European Union
FDP	Field Development Plan (Norwegian PAD)
FEPA	Food and Environment Protection Act
FLAGS	Far northern liquids and associated gas system
FRS	Fisheries Research Services
GPS	Global Positioning System
GSm^3	Giga (109) standard cubic meter
H2S	Hydrogen Sulphide
HAB	Harmful Algal Blooms
HOCNS	Harmonised Offshore Chemical Notification Scheme
Hot-Tap	Hole drilled through pressure-barrier with welded connection, ensuring access without loss of fluid or pressure.
HSE	Health, safety and the environment
HTT	Hot Tap Tee-piece
Hz	hertz

ICES	International Council for the Exploration of the Seas
IPPC	Integrated Pollution Prevention Control
JNCC	Joint Nature Conservation Committee
km	kilometre
KP	kilometre point
KSm³/cd	Thousand (103) standard kubikkmeter per callender day
m	metres
m/s	metres Per Second
MARPOL	International Convention for the Prevention of Pollution from Ships
ME	Ministry of the Environment
MF	Ministry of Finance
MFi	Ministry of Fisheries
MOB	Minestry of Defence
MPE	Ministry of Petroleum and Energy
MSm³/cd	Million standard kubikkmeter per callender day
NAO	North Atlantic Oscillation
NGL	Natural Gas Liquid
NGO	Non-governmental organisation
NLGP	Northern Leg Gas Pipeline
nmVOC	Volatile organic compounds
NOK	Norwegian kroner
NO_X	Nitrogen oxides
NPCA	Norwegian Pollution Control Authority (SFT)
NPD	Norwegian Petroleum Directorate
o.e.	Oil equivalents
OD	Outer diameter
OPEX	Operating expenditure
OPOL	Oil Pollution Operator's Liability Fund
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OSPC	Oil Spill Contingency Plan
OSRL	Oil Spill Response Limited
OVI	Offshore Vulnerability Index
PAH	Polycyclic aromatic hydrocarbons
PDO	Plan for Development and Operation (Norwegian PUD)
PEC	Predicted Environmental Concentration
PIO	Plan for Installation and Operation
PLEM	Pipeline End Manifold
PNEC	Predicted no-effect concentration
PON	Petroleum Operations Notice
POPA	Prevention of Pollution Act
ppm	Parts per million
PROOF	Research Program for long-term impacts of discharges to sea from petroleum activities
PSAN	Petroleum Safety Authority Norway
PWA	Pipeline Work Authorisation,
RF	Rogaland Research
RFO	Ready for operation
RKU	Regional Impact Assessment
RNB	Revised National Budget
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SEERAD	Scottish Executive Environment and Rural Affairs Department
SF	Statfjord

SFA	Statfjord A
SFB	Statfjord B
SFC	Statfjord C
SFF	Scottish Fishermen's Federation
SFLL	Statfjord Late Life
SFØ	Statfjord øst (Statfjord East)
SMO	Environmentally sensitive area
SoS	Secretary of State
St.prp	Proposition to the Storting (Parliament)
STIG turbin	Steam-injected gas turbine
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
UN	United Nations
VOC	Volatile Organic Compounds
WHRU	Waste heat recovery unit

1 Non-Technical Summary

1.1 The Project

The Statfjord Field is located in the northern North Sea, approximately 140 km east of Shetland and 220 km west of Norway (Figure 1-1). The field crosses the UK/Norway median line, and encompasses Blocks 33/9 and 33/12 in the Norwegian Sector and Block 211/15 in the UKCS. Norway (appr. 85%) and the United Kingdom (appr. 15%) jointly exploit the Statfjord and Brent formations which comprise the Statfjord Field.

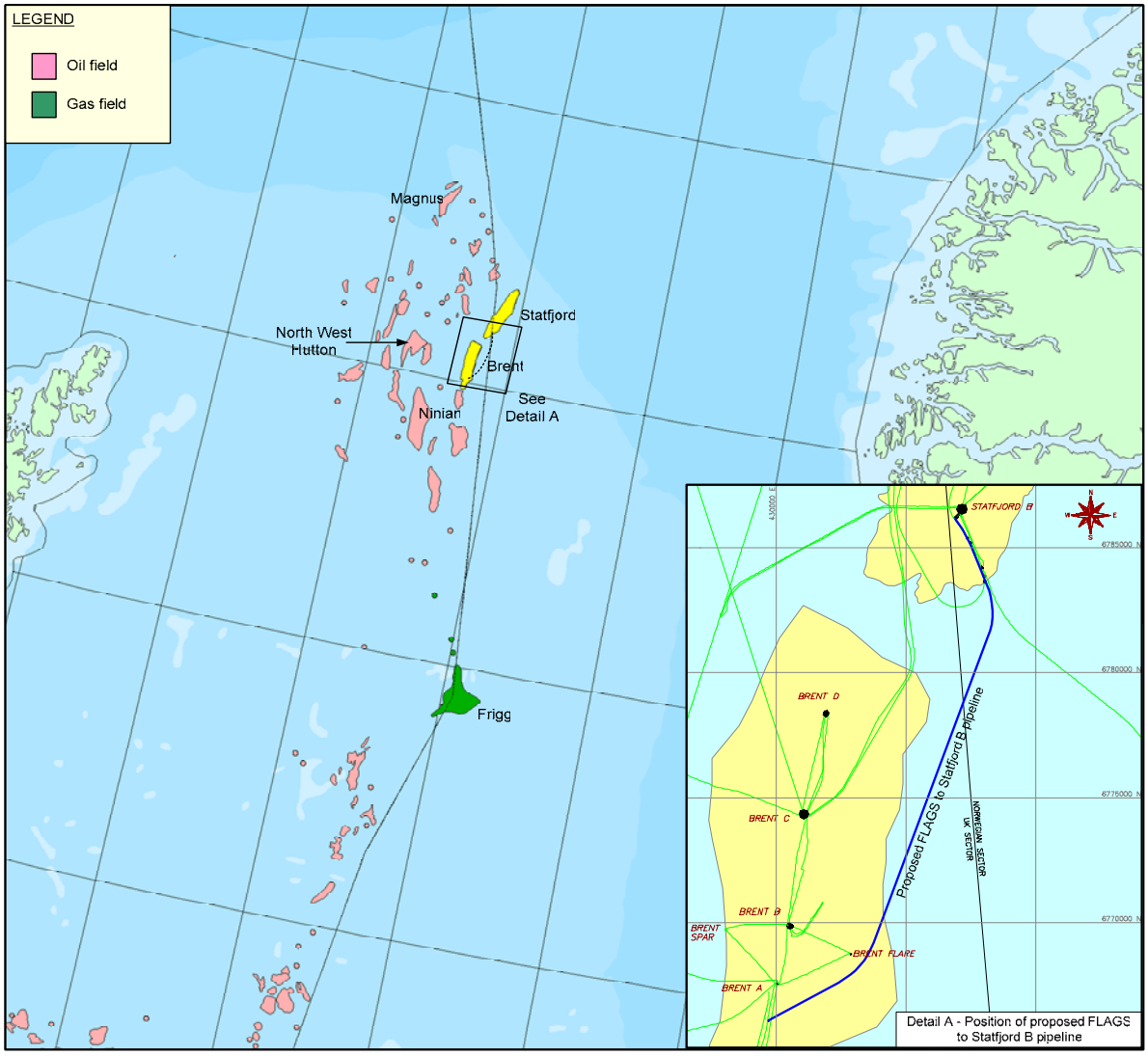

Figure 1-1: Location of the Statfjord Field and proposed pipeline

Production at the Statfjord Field started in 1979, and under present recovery strategies oil and gas production at the field is estimated to end in 2009. The Statfjord Late Life (SFLL) project will extend the oil and gas production at the Statfjord Field by a further nine years.

As part of the SFLL project Statoil, on behalf of the partners of the Statfjord Field, is proposing to install a new 23.2 km gas pipeline between the Statfjord Field and the Far North Liquids and Gas System (FLAGS) pipeline, 1.4km south of the Brent Alpha platform (Figure 1-2). Approximately 15.5km of the

new gas export pipeline will be laid in UK waters. The pipeline will have the capacity to transport all the gas produced at the Statfjord Field to the UK. Production from the SFLL project is scheduled to begin in October 2007.

The Norwegian share of gas from the Statfjord field is currently transported via the Gassled pipeline to Kårstø (Gassled Area A) for processing, while the UK share is transported via the Spur pipeline and NGLP to FLAGS for processing at St. Fergus in Scotland. The development of Statfjord Late Life (SFLL) entails a 36 GSm^3 increase in the gas transport compared to the reference alternative (current drainage strategy). Several alternatives for gas export from SFLL have previously been assessed and compared. The evaluations have proven the alternative of exporting all gas to FLAGS via a new gas export pipeline (the Tampen Link) to be the best solution. The Tampen Link alternative has been established as the base case solution. The pipeline dimension needed to cover the SFLL gas production capacity is a pipeline diameter of at least 22" (OD-outer diameter).

After the selection of the field concept and gas transport solution for Statfjord Late Life (Tampen Link) several Norwegian 3rd party companies have expressed an interest in co-ownership of the new export pipeline. The background for this being the limited capacity for gas processing at Kårstø in relation to the total demand on the Norwegian Continental Shelf. A transport analysis carried out by Gassco (Operator of gas export pipelines on the Norwegian Continental Shelf) indicates that the demand for capacity in the Tampen Link will require a bigger pipeline diameter /27/. An increased capacity in Tampen Link will contribute to both increased flexibility for gas export from the Tampen area as a total and, at the same time, enable optimisation of the value of Norwegian gas by transporting the gas to the market with the highest price.

The outer diameter (OD) of the new pipeline will be either 22" or 32"; a final decision will be made in 2005. In this ES both dimensions are discussed on an equal basis. Whenever the impact assessment indicates there are significant differences between the alternatives, this will be highlighted in the text.

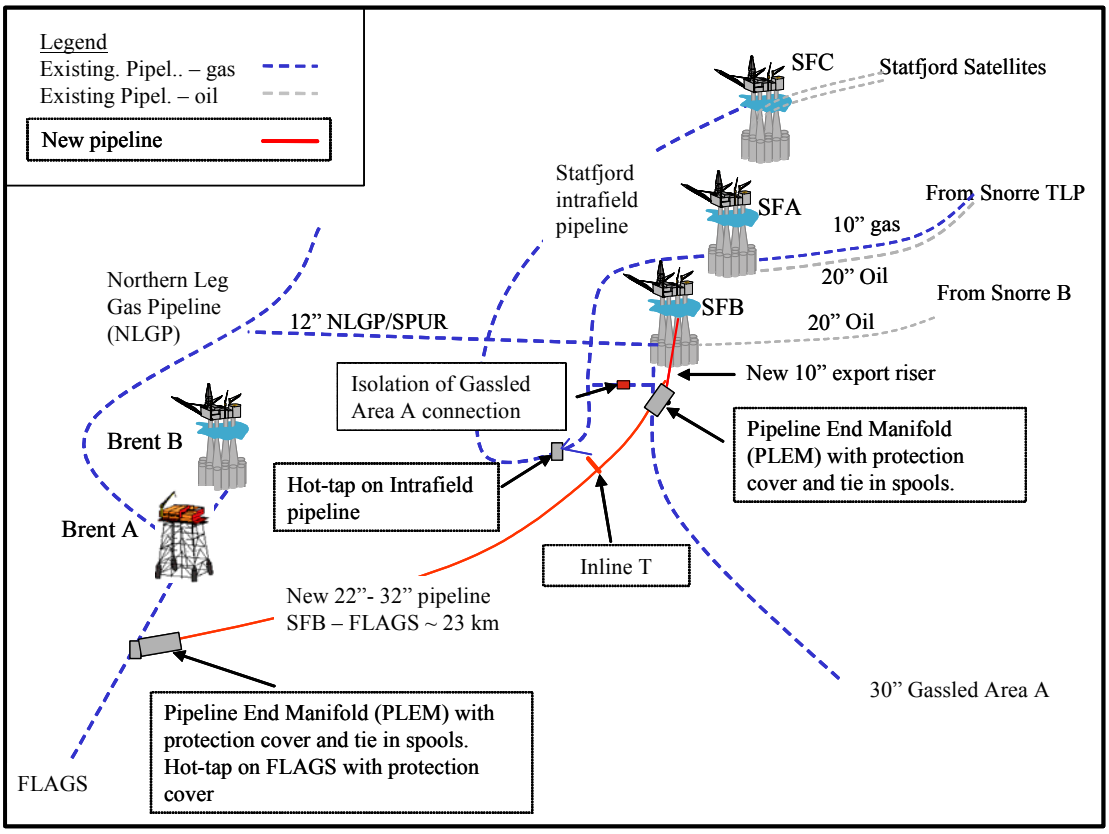

Figure 1-2: Proposed layout of the new gas export pipeline

The new pipeline will be made of carbon steel, with a protective coating of asphalt and a 40-60 mm thick coating of concrete, to prevent corrosion, protect the pipeline from external loads and provide stability. The pipeline will be laid directly onto the surface of the seabed in either a conventional manner (i.e. along a more or less straight line route between Statfjord and the FLAGS tie-in), or in a "snake-lay" formation in which the pipe is laid in a series of gentle curves. If the pipe is laid conventionally, approximately 27,000 m^3 (22" alternative) or 88,000 m^3 (32" alternative) of rock-dumping would be required at various locations along the route to stabilise the pipeline. If it is laid as a "snake-lay", only about 7,000/8,000 m^3 (22"/32") of rock-dumping would be required because the long sweeping curves will accommodate movement of the pipe and prevent buckling. At this stage of the planning of the project, it is not yet decided whether the pipeline will be laid from a vessel positioned using anchors, or a dynamically positioned (DP) vessel.

The new export pipeline will be connected to the Statfjord B platform via a new 0.5 km 10" riser and to the Statfjord A and C platforms via the existing Statfjord Intrafield pipeline. The new export pipeline will be connected to FLAGS via a new Hot Tap Tee-piece welded onto the existing FLAGS pipeline. All connections at Statfjord and at FLAGS will be stabilised using gravel and rock, and will be fitted with protective structures.

The pipeline installation will take place in August/September 2006 or April 2007. Tie-ins, hydrotesting, dewatering and commissioning in general will take place within the period April to October 2007.

1.2 The existing Environment and main Environmental Impact Statement

The environmental sensitivities and their seasonal variations in the zone of influence of the proposed pipeline are summarised in Table 1-1. It can be seen from Table 1-1 that sensitive biological resources and commercial interests (fishing activity) are represented within the zone of influence of the project throughout the year.

The SFLL project is located in the Mid North Sea. In this area both sensitive biological resources and the fishing efforts are relatively homogenously spread out over a large area. The directly affected area in the case of the SFLL pipeline installation and operation is small. The interaction with the environment and the commersial interests will be very localized accordingly.

It should also be noted that the construction phase when the interference with the surrounding environment is at its highest, is temporary and the duration is short.

It is therefore highly unlikely that biological resources will be significantly exposed to damage, or that commercial fisheries will be significantly impeded.

Table 1-1: Environmental Sensitivities in the zone of influence

KEY	
	Very high sensitivity
	High sensitivity
	Moderate sensitivity
	Low sensitivity
	Unsurveyed / No data available

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Likely Project Schedule : April 2006 to October 2007											
Plankton Plankton are vulnerable to oil and chemical discharges, but due to their wide distribution there is no direct threat to the viability of the populations. Indirect effects may exist for organisms further up the food chain. Main periods of bloom are in spring and summer. Any impacts from offshore oil and gas operations, including operations to install the pipeline, are likely to be small in comparison with natural variations.											
Benthic Fauna Benthic fauna are an important food resource for fish and shellfish, and are vulnerable to the disturbance of seabed sediments which is likely to occur during pipeline installation. However, no rare benthic species are known to occur in this area and the benthic communities in the development area are similar to those found throughout the surrounding area. Therefore, there is no direct threat to the viability of the local benthic community.											
Marine mammals Harbour porpoise are the most commonly recorded cetacean in this area; numbers are greatest in July. Few other species of cetaceans have been sighted along the route of the proposed pipeline, but killer whale, minke whale, white-beaked dolphin, white-sided dolphin and Risso's dolphin have been sighted in adjacent quadrants. Marine mammals are vulnerable to chemical discharges, acoustic disturbance from vessel operations, and injury from collisions with vessels. Marine mammals can easily avoid disturbed areas.											
Finfish Populations Fish are vulnerable to pollution, particularly during the egg, larval and juvenile stages of their lifecycle. The proposed pipeline is located in spawning grounds for cod, haddock, saithe and Norway pout. With the exception of cod, fish communities in this area are present throughout large areas of the North Sea, therefore there is no direct threat to the viability of the populations. However, this region of the North Sea constitutes an important area for cod spawning activity. The main schedule for the pipeline laying activities will not coincide with peak spawning (February and March) for this species.											
Fisheries The development area is of "moderate" commercial value; fishing occurs throughout the year, mainly in the autumn but effort is lower in December and January. The area is targeted for both pelagic and demersal species of fish. Although demersal trawling dominated fishing methods, pelagic species, such as mackerel and herring have dominated landings during recent years. From 1999 to 2003, pelagic landings occurred predominantly between October and December. The most important period for white-fish trawling on the Norwegian side is January-February.											
Seabird populations Seabird vulnerability to surface pollution have been described by the JNCC as "low" to "moderate" for most of the year, but is "high" in July, October and November. Vulnerabilities are related to the position of the proposed development area in relation to the Northern Isles (particularly Shetland) which are of significant importance for large numbers of birds during the breeding season. Important species in this area include fulmar gannet, kittiwake and skua.											
Conservation areas and species Based on generally available information and specific bathymetric survey data from the pipeline route there are no reef habitats or pockmark areas of conservation value or any other Annex I Habitats in the area of the proposed pipeline. Neither have any objects of cultural heritage importance been identified in the area of the proposed pipeline. The harbour porpoise is the only Annex II species known to occur in this region of the North Sea. The JNCC and other country agencies are currently analysing distribution data for harbour porpoise in UK waters to determine whether any suitable sites for SAC designation can be found. Currently no conservation designation.											

1.3 Significant Risks and Mitigating Measures

A risk assessment was undertaken to identify the range of impacts and risks that could arise as a result of the proposed development. The significant environmental effects and Statoil's planned mitigation measures are detailed in **Section 7** and summarised in Table 1-2, while Table 1-3 summarises the impacts and risks that were assessed to be non-significant (**Section 6.2**). No impacts were found to be highly significant.

Table 1-2: Significant environmental impacts and planned mitigation measures

Potential source of impact	Potential impact or risk to the environment	Planned mitigation measures
Physical presence of pipelay vessels	• Temporary restrictions to sea access during the construction period (0.8km^2 to 12.6km^2) in an area of moderate levels of fishing effort and shipping traffic in the UKCS and NCS.	• The pipelaying will be advertised through Notice to Mariners in the UK and Norway • The operational area will be monitored during pipelaying to alert shipping and fishing vessels on approach to the area • Activities and restrictions will only last for 2-3 months.
Anchoring of vessels during pipeline installation.	• Anchor mounds can form on clay seabed, and potentially become long-term, localised obstructions that could interact with fishing gear.	• Exact location of the anchors will be planned • An post-lay ROV (Remotely Operated Vehicle) inspection will be conducted to ensure anchors were placed on the seabed correctly • A survey of the pipeline route will be undertaken on completion of the activities to identify any seabed discontinuities • Statoil will ensure any significant mounds formed will be flattened using suitable methods.
Pipeline installation	• Installation will disturb the seabed sediments, and the benthic organisms living in or on the sediments, in a small area of seabed beneath the pipeline and rock dumps • The pipeline and rock dumps will create a new area of habitat for benthic organisms that live on hard surfaces, and provide additional habitat for crevice-dwelling fish • Potential impedance to commercial fishing (see also **Physical presence of pipelines**)	• A pipeline route survey has been conducted and has been used to plan the optimum pipeline route • A survey vessel will be on station during installation to ensure that the pipeline is laid in the correct location • Rock-dumping will be supervised by use of sonar, and will be post-dump surveyed by an ROV to ensure that material is placed accurately and in the correct location • Pipeline Works Authorisation (PWA) application will be made • Location and profile of rock dumps will be made available to fishermen and fishing interests • Characteristics and profiles of the rock dumps will be designed to minimise the risk of interference with fishing activity.
Physical presence of the pipeline and subsea structures	• Impedance to military exercises is not envisaged as the project area is not utilised for these purposes • Loss of access to fishing grounds will be insignificant as all subsea structures can be trawled over by demersal trawling gear • Marginal risk of damage or loss of fishing gear or vessel caused by gear entanglement on the pipeline, subsea structures or rock dumps.	• No mitigation planned • Mariners will be notified of the location, dimensions and heights of all seabed structures • Locations of all subsea structures, including pipelines, will be recorded on Admiralty charts • The pipeline, the HTT and PLEM and their protective structures, and the rock dumps will be designed to be over-trawlable and do not impede fishing activities • The seabed will be surveyed after the gas export pipeline has been laid and any significant obstructions will be levelled

Table 1-2 continued: Significant environmental impacts and planned mitigation measures

Potential source of impact	Potential impact	Planned mitigation measures
Pipeline chemicals	• Toxicity of chemicals in linefill. Dilution modelling results indicate there would only be a minor localised impact immediately around the discharge point at the PLEM 1.4 km south of Brent A.	• Further dilution modelling for the discharge of chemicals with the linefill water will be conducted in compliance with the **Offshore Chemicals Regulations 2002** • The permit application will be accompanied with a PON 15C which requires that only approved chemicals to be selected and risk assessments be carried out for the chemical discharges. Any conditions set by the authorities will be complied with • Pipeline flooding, gauging, testing, dewatering and drying operations will be designed and carried out by experienced, specialist contractors, whose performance will monitored by Statoil. • There will be a strict requirement for contractors to adhere to the conditions of the chemical permit • Discharges will be made from designated points, will be controlled by means of the appropriate equipment and procedures, and will be carried out according to specification • The spill contingency provisions will include response requirements for chemical spillage.
Accidental spill of diesel	• Diesel would disperse rapidly. No residual impacts would be expected on the local environment	Statoil will put in place a number of mitigation measures to reduce the risk of oil spills from the pipelaying vessels: • The pipelaying vessel will monitor the exclusion zone around the pipelaying vessel • The pipelay vessel will be equipped with all necessary navigation and communication equipment • All the relevant maritime authorities, and representative fishing organisations, will be notified of the proposed pipelaying activities • As required under MARPOL 73/92 Amended, the laybarge and other qualifying vessels will have in place Shipboard Oil Pollution Emergency Plans (SOPEPs) • The plans will detail the actions to be taken in the event of a loss of shipboard containment • Vessels will have sufficient equipment to enable them to respond, contain on board and clean up minor pollution events • In the unlikely event that a large release occurred, there is the capacity to engage specialist spill response organisations, who can provide an on-scene response, if required. These third party specialists would be brought in under the provisions that vessel operators have with their insurers • Statoil also have in place agreements with third party specialists

Table 1-3: Non-significant environmental impacts and planned mitigation measures

Potential source of impact	Potential impact or risk to the environment	Planned mitigation measures
Noise from vessels during pipelaying activities	• Noise could potentially disturb low densities of marine mammals in the area	• Noise will be minimised through well maintained equipment
Power generation on vessels during pipelaying and decommissioning activities	• Short-term, localised air quality deterioration around exhaust outlets.	• Emissions will be managed through the use of well maintained equipment • Compliance with IMO/MARPOL requirements
Discharge of treated bilge from vessels during pipelaying and decommissioning activities	• Localised deterioration in seawater quality around discharge point • Potential for minor oil slick formation, but local environmental conditions will rapidly disperse any hydrocarbon discharges	• Bilge treated prior to discharge. • Compliance with IMO/MARPOL requirements • Vessel audits
Sewage discharged from vessels during pipelaying and decommissioning activities	• Localised increase in biological oxygen demand around point of discharge • Increase in fish and plankton productivity • Offshore currents will readily disperse sewage	• Sewage treated prior to disposal or contained and shipped to shore • Compliance with IMO/MARPOL requirements • Vessel audits
Emissions from anodes during production activities	• Release of contaminants (metal ions) into water column and seabed • Concentrations of metal ions on the anodes are very low and would not cause toxic effects • Rapid dispersion and dilution in the offshore area.	• No particular mitigation planned
Dropped objects during production and decommissioning activities	• Possible obstruction to fishing • Creation of artificial substrata to be colonised by organisms.	• Adherence to procedures and use of certified equipment • Retrieval of major items of debris on seabed
Removal of PLEMs, HTTs and other forms of subsea intervention	• Temporary disturbance to seabed and benthos.	• Post operational seabed surveys to be conducted if judged necessary.

1.4 Socio-Economic Impacts and Employment

The major capital expenditures (capex) relating to the new gas export solution will be related to the pipeline itself and the pertaining gas export facilities at SFB. Based on the present cost estimates, the development will result in a total capex of more than NOK 1.5 billion (2004 NOK). Construction and installation of the gas export solution will provide opportunities for the delivery of goods and services by private companies during the period 2005 – 2007.

Calculation of the employment effect is based on an empirical model. In total, the gas export solution (22" Tampen Link) will create an employment effect for the three years in the range of 2,300 to 3,200 man-years including the consumption effect.

Increasing the dimensions of the Tampen Link to a 32"pipeline will increase capital expenditure by approximately NOK 130 million (2004 NOK) and the employment effect by approximately 200 man-years.

1.5 Conclusions

The environmental assessment undertaken for the Tampen Link gas export pipeline has established that sufficient information has been optained on both the environment and the proposed pipeline operations to evaluate the potential environmental consequences of the development.

The proposed pipeline chemicals will be subject to a separate permit under the **Offshore Chemical Regulations 2002**. The regulations require that operators use only approved chemicals, and support their permit application by providing detailed chemical information and environmental risk assessments for each chemical discharged. Statoil will comply in full with these regulations.

The potential environmental impacts of the project can be summed up as follows:

- The Tampen Link project will have an impact in a small area in the middle of the North Sea. In the area in question, both environmental resources and fishing activities are relatively evenly distributed over a large area. The area directly affected by the pipeline project is very small. Accordingly, the potential for coming into conflict with environmental or fishery interests is limited.

- The project activity with the greatest impact on the surroundings, will be the actual installation of the new pipeline. This phase will be transient and of short duration.

- The area of influence of the pipeline part of the Statfjord late life project does not include any habitats listed in Annex I to the **EU Habitat Directive**.

- Seabirds in the area in the middle of the North Sea may be particularly vulnerable to surface oil pollution in July and October/November. Statoil has established procedures to ensure that all necessary measures to prevent accidental spills will be implemented.

- Fishing activities in the area are limited. The most common fishing method is bottom trawling.
  It is considered that any conflicts with fishery interests in the operating phase of the Tampen Link pipeline will be minimal, since all subsea installations are designed to be over-trawlable. During the actual installation of the pipeline, certain traffic restrictions in the area must be expected, due to the presence of a pipelaying vessels, possibly with deployed anchor chains. Notification and monitoring procedures will be established, so that any conflict with the fishery interests and other shipping can be avoided as far as possible.

- For these reasons, there is little probability that the project will have any significant impacts on the environment or the fisheries.

2 Introduction

2.1 The Statfjord Field

The Statfjord field is located in the North Sea, 220 kilometres north-west of Bergen (at the latitude of the mouth of the Sognefjord) and northeast of Shetland. The field extends across the dividing line between Norway and the UK.

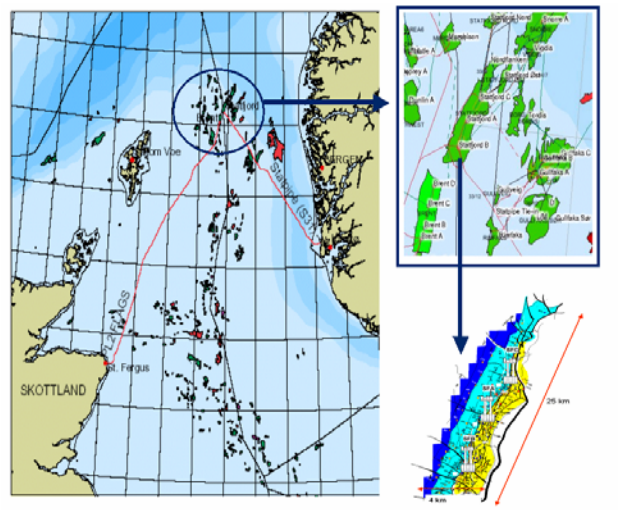

Figure 2-1: The Statfjord field with the Statfjord and Brent platforms

The field designated as the "Statfjord Unit" consists of the Statfjord and Brent formations and is exploited jointly by the Norwegian licence PL037 and the two UK licences P104 and P293. The Norwegian owner interest is currently approx. 85.5 per cent and the UK owner interest approx. 14.5 per cent.

Statfjord has been the largest oil-producing field on the Norwegian continental shelf and has been in production since 1979. Production of gas began in the autumn of 1985 and formed the basis for the development of the Statpipe gas pipeline (Gassled Area A). Statoil ASA took over as operator from Mobil in 1987. The highlights of the field's history can be summarised as follows:

- Award of licence 037: August 1973
- Start of exploration drilling: December 1973
- First find: February 1974
- Declaration of commerciality: August 1974
- Start of development Statfjord A: September 1974
- Start of production: 1979
- Start of gas sales: October 1985

The Statfjord field has been developed with three large, fixed concrete platforms for the production of oil and gas: Statfjord A (SFA), Statfjord B (SFB) and Statfjord C (SFC). These platforms are integrated platforms, with drilling and process plants, storage facilities for oil, and accommodation.

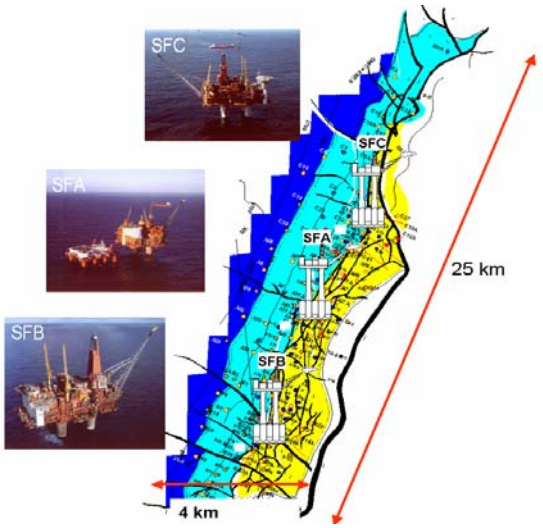

Figure 2-2: Statfjord A, Statfjord B and Statfjord C

SFA, SFB and SFC process petroleum from other fields in addition to their own oil and gas. Statfjord C processes oil and gas from the satellites Statfjord East, Statfjord North and Sygna, while Statfjord A finalise the processing of oil and gas from Snorre A. Statfjord B serves as storage and offloading centre for oil from Snorre B.

Processed oil from all platforms is offshore-loaded and transported to the recipients by oil tankers. The gas pipelines from Statfjord A, B and C converge at Statfjord B and the gas is transported by Gassled Area A pipeline to Kårstø (Norway) and via the FLAGS pipeline to St. Fergus (Scotland) for processing.

2.2 Background to the Statfjord Late Life Project and the Gas Export Pipeline Tampen Link

With the current drainage strategy, production at the Statfjord field is drawing to a close. Statfjord A, B and C will close down their own production in 2009.

By changing the drainage strategy so that less pressure is exerted on the reservoir (cessation of seawater and gas injection), it is possible to extend the life of the field and exploit a larger proportion of the remaining gas and oil resources, including the gas that was previously injected.

Since 2001, the Statfjord late life project has evaluated different development alternatives in order to secure such increased exploitation of the Statfjord field. Over 50 alternatives were originally considered. The number of alternatives in addition to the current drainage strategy was reduced to 16 in December 2001, to five in February 2002 and to three in September 2002.

A study for the three most promising development alternatives was concluded in June 2003. The alternatives were compared with each other and the current drainage strategy (the Statfjord reference alternative). The project recommended modifications to existing platforms (removal of bottlenecks) for development of the Statfjord field for late life production. This recommendation was made on the basis of an overall assessment of technical, financial, operational, environmental and resource-related factors. In connection with the selection of the development alternative, an environmental and socio-economic assessment of the various development alternatives was also carried out /49/.

After further optimisation of the recommended development alternative in the autumn of 2003, in which it was recommended, among other things, to carry out investment and work gradually over an extended period of time, the licence decided to develop this alternative in preparation for the Provisional Project Sanction in March 2004. The two other alternatives assessed, i.e. conversion of existing platforms to minimum processing platforms in combination with 1) construction of a new platform on Statfjord or 2) transporting oil and gas to the Brent platforms on the UK side and processing it there, were abandoned. The development alternatives and criteria for selection are discussed in further detail in the ES for Statfjord Late Life (field modifications) /48/.

In connection with the various development alternatives for processing oil and gas, alternative gas transport solutions were also considered. The alternative developed for the Provisional Project Sanction in March 2004 was the export of all gas to the United Kingdom through a new pipeline to FLAGS, but with the possibility of continued transport of gas to Kårstø via Gassled Area A and to the United Kingdom via Spur/NLGP. In the period leading up to the Project Sanction, other gas transport solutions were considered. These are discussed in greater detail in Section 4.2.

2.3 Plans for Development and Transport from the Statfjord Field and Treaties between the United Kingdom and Norway

The Statfjord Treaty of 1979 regulates the exploitation of petroleum from the Statfjord field, the requirements for documentation, and the approval of plans and agreements for the field by the public authorities in both countries. According to the "Agreement between the Government of the Kingdom of Norway and the Government of the United Kingdom of Great Britain and Northern Ireland on the Exploitation of the Statfjord Reservoirs and the Transport of Petroleum from these Reservoirs" (the "Statfjord Treaty"), cf. Proposition to the Storting (the Norwegian Parliament) no. 15, 1980-81, a field development plan will have to be prepared with subsequent approval by the public authorities of both countries.

In Norway, such a field development plan is referred to as a "Plan for Development and Operation of a petroleum deposit" (PDO). For Statfjord late life the PDO is referred to as a revised PDO, since Statfjord is a field already in operation and the plan involves modifications and not the development of a new field. The Norwegian PDO consists of 2 parts. Part 1 (technical/financial part) and part 2 (environmental impact assessment). In the United Kingdom an equivalent plan is called a "Field Development Plan" (FDP). In the United Kingdom the environmental impact assessment is not a part of the FDP, but is submitted as a basis for the approval of the FDP if the project is required to submit an Environmental Statement (ES). In consultation with the public authorities of both countries, it has been

decided to prepare a joint plan for the planned field modifications on Statfjord, satisfying both countries' guidelines for PDO (part 1) and FDP, respectively.

In connection with Statfjord late life, an export pipeline is planned for the transport of gas from the Statfjord field. The development of a new gas export pipeline from Statfjord B to FLAGS, the Tampen Link, is regulated by the framework agreement of 1998 between Norway and the United Kingdom (the "1998 Agreement"). This framework agreement also requires processing of plans and approval by the public authorities of both countries.

In Norway, such a plan is referred to as a "Plan for installation and operation of facilities for transport and utilisation of petroleum" (PIO). An equivalent plan for the laying and operation of pipelines is called a "Pipeline Work Authorisation" (PWA) in the UK. In consultation with the public authorities of both countries, it has been decided to prepare a joint plan for the planned pipeline, satisfying both countries' guidelines for PIO and PWA, respectively.

The EIA/ES documentation for the field modifications and the Tampen Link gas export pipeline will also be prepared jointly and will meet both British and Norwegian assessment requirements and guidelines. This ES will deal with the gas export pipeline the Tampen Link. The ES for the field modifications relating to Statfjord Late Life is discussed in a separate document /48/.

The basis of the EIA/ES in national legislation and the process in relation to the authorities of both countries will be the same for the two environmental impact assessments and is described in the following sections.

2.4 The Purpose of the Environmental Impact Assessment

In Norway, the Environmental Impact Assessment (EIA) is an integrated part of the planning of major development projects, and included in the PDO and PIO. The EIA is intended to ensure that factors associated with the environment, society and natural resources are included in the planning work on a par with technical, financial and safety-related factors.

The EIA is intended to contribute to shedding light on matters that are relevant to both the internal and external decision-making processes, and to guarantee the general public information on the projects. The process must be an open one, whereby the various players have the opportunity to express their opinions and influence the design of the project.

The purpose of the Environmental Statement (ES) in the United Kingdom is similar to that of the EIA in Norway; it is meant to ensure consideration by the Secretary of State for Trade and Industry (SoS) of factors associated with the environment and natural resources, before consent to offshore activities is given. The ES is a means of submitting to the regulatory authority, statutory consultees, non-government organisations and the wider public the findings of an assessment of the likely affects on the environment of the proposed activity. The size and scope of the environmental assessment will be related to the size and nature of the activity but it should always examine thoroughly all the proposed activities and their consequences /21/.

In the UK, the ES is not part of the FDP or the PWA, but the environmental impact assessment obligation must be met before these plans can be approved. Several other approvals and consents must also be in place before the FDP and PWA can be approved. These are further refered to in section 2.8.

2.5 Legislative EIA Requirements

2.5.1 International Legislation

The requirement for an environmental impact assessment is reflected in the EU regulations that both Norway and the UK have implemented. EU Council Directive 97/11/EC, which is a Directive amending Council Directive 85/337/EEC, requires an environmental impact assessment for public and private projects that may have significant environmental and/or economic impacts

Possible transboundary environmental impacts are regulated by the UN "Convention on Environmental Impact Assessment in a Transboundary Context" (ESPOO (EIA) Convention, 1991) /23/

2.5.2 Norwegian Legislation

The planned project, including the planned gas export pipeline to the United Kingdom, is subject to an environmental impact assessment obligation pursuant to the provisions of the Norwegian Petroleum Act sections 4.2 and 4.3.

The Norwegian Petroleum Act's Regulations sections 20, 22, 22a, 22b, 22c and 29 regulate the contents of an environmental impact assessment. The Norwegian Pollution Control Act section 13 also has provisions on notification (assessment programme) and environmental impact assessment in connection with the planning of activities that may cause pollution.

2.5.3 UK Legislation

The requirement for an ES is regulated by the Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations (1999) /43/.

Based on the ESPOO Convention and the Statfjord Treaty among others, the Department of Trade and Industry (DTI), which is the regulatory authority for oil and gas developments, requires a joint Environmental Statement for Norway and the United Kingdom, as well as an EIA process in the United Kingdom.

2.6 The Relationship between UK and Norwegian Legislation and formal Requirements for EIA/ES Documentation

In a Norwegian EIA, meant for the Norwegian authorities and consultation bodies only, the environmental assessment process and the requirements for documentation are known. The same applies to the ES in relation to the UK authorities and consultation bodies. For this reason the environmental assessment process and requirements for the contents of the EIA/ES documents are not normally discussed in detail. In this joint environmental impact assessment, however, which is meant for both the Norwegian and the UK authorities, it is necessary to outline the processes in each country and the requirements relating to the contents of the documents. This section describes the requirements for ES/EIA documentation in the UK and Norway, while section 2.7 outlines the environmental assessement processes.

2.6.1 Environmental Impact Assessment Programme

Norway has requirements for consultation on an assessment programme prior to preparing the environmental impact assessment. The Norwegian Petroleum Act Regulations section 22 regulate the requirements for an assessment programme:

"The licensee must, in good time before submitting the plan for developing and operating a petroleum deposit, send the Ministry a draft assessment programme. The draft must provide a brief description of the development, relevant development solutions and, on the basis of available knowledge, expected effects on other businesses and the environment, including any transboundary environmental effects. Moreover, the draft must clarify the requirements for documentation. If an environmental impact assessment has been prepared for the area in which the development is planned to be implemented, the draft must clarify the requirements for further documentation or updating."

The purpose of the EIA programme is to give public authorities and other consultation bodies information and notice of what is planned for development and where and how the development is planned. The assessment programme forms the basis for the environmental impact assessment and is adopted by the competent authority (the Ministry of Petroleum and Energy) after prior public consultation.

By commenting on the programme, both public authorities and other consultation bodies are given the opportunity to influence what is to be assessed in the EIA and thus also what is to be used as the basis for the decisions to be taken.

There are no formal requirements in UK legislation for consultation prior to the preparation of an environmental impact assessment. However, the operator is strongly encouraged to engage in informal consultations with the interested parties such as the local authorities, conservation groups, naturalists, special interest groups, users of the sea and where appropriate, the interested public, during the environmental assessment. The relevant environmental authorities should also be involved in

this process. Experience of the Regulations /21/ has clearly demonstrated that such informal consultation can identify potential difficulties before the ES is prepared and hence reduce or eliminate delay at the formal consultation stage of the process. It is, moreover, confirmed by the guidelines to the Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations (1999) that the preparation of a Scoping Document, summarising the proposed activity, highlighting the sensitivities and proposed mitigating measures has been found to be a very valuable aid in the early, informal consultations and can be considered best practice, particularly for large projects or those in potentially sensitive locations /21/.

Since the UK consultations prior to preparing the ES are informal, there are no formal requirements stipulating how a document in that connection is to be prepared. Norwegian legislation, on the other hand, requires an extensive assessment programme in accordance with certain requirements concerning its contents and the consultation process.

The UK authorities have requested a joint environmental impact assessment that includes measures on both the Norwegian and UK sides and an associated consultation process in the UK. It was therefore deemed expedient to also prepare a joint document in connection with the consultation prior to the impact assessment (the scoping phase) in order to agree on the content of the further assessment process and to ensure that those consulted in both countries have a good overview of the interconnectedness of the project.

The assessment programme/50/ which was sent out for consultation in both the United Kingdom and Norway comprised both the field modifications and the new gas export pipeline. The programme and the consultation statements received are described in more detail in section 3 and appendix B.

2.6.2 *Regional and strategic Impact Assessments*

2.6.2.1 *Regional Impact Assessment for the North Sea*

The regional impact assessment for the petroleum activities in the North Sea (the "North Sea RIA") was approved by the Norwegian public authorities in 1999. In accordance with the guidelines issued by the Norwegian Ministry of Petroleum and Energy (MPE), the obligation to prepare an environmental impact assessment for new development projects may be met by means of a field-specific environmental impact assessment, a combination of a field-specific assessment and a regional assessment or, in some cases, a regional environmental impact assessment alone.

For Statfjord late life, a field-specific environmental impact assessment has been prepared, but with reference to the North Sea RIA for some assessment items /51/.

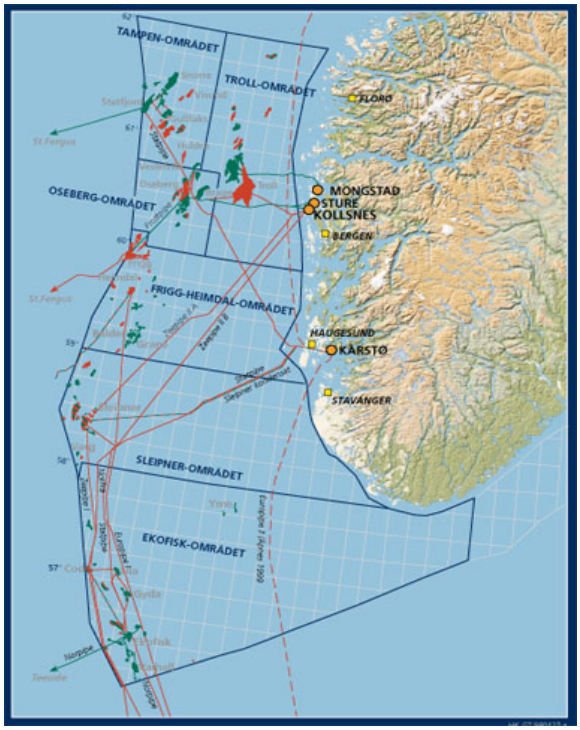

Figure 2-3: North Sea RIA

The North Sea RIA (figure 2-3) discusses the total impact of the petroleum activities on the Norwegian continental shelf south of 62 °N. The area is divided into six sub-areas: The Tampen area, in which the Statfjord platforms are located, and the Troll, Oseberg, Frigg-Heimdal, Sleipner and Ekofisk areas. The following sources of discharges and emissions and other environmental impacts are included in the RIA:

- Developed fields and fields planned for development
- All transport activity by ship and helicopter

- Pipelines on and between fields and major export pipelines
- Planned exploration drilling.

2.6.2.2 Strategic Impact Assessment in the United Kingdom

No equivalent regional impact assessment is prepared for the UK sector. However, strategic environmental impact assessments have been prepared.

The Strategic Environmental Assessment (SEA) is a process for predicting and evaluating the environmental implications of a policy, plan or programme. SEA is conducted at a strategic level - this contrasts with Environmental Impact Assessment (EIA) which is carried out for a specific development or activity.

In 1999 the DTI instituted the practice of carrying out Strategic Environmental Assessments (SEA), as part of the offshore licensing process, as an aid to determining which areas should be offered for licensing for oil & gas development. In doing this, the DTI was anticipating the implementation of the EU directive, the Environmental Assessment of Plans and Programmes Directive, 2001/42/EC which will become mandatory for a very wide range of activities, mostly onshore, in 2004. This now means that environmental assessments carried out for individual projects can take advantage of additional data and information on the regional context of their proposals specific to the E&P industry.

In this environmental impact assessment for the gas export pipeline Tampen Link, information from the SEA has been used.

2.6.3 Contents and Structure of the EIA Documents

The content of the EIA documents for field modifications and the gas export pipeline Tampen Link /48/ is determined by each country's requirements and guidelines, the assessment programme and comments to the programme. Applicanle guidelines are: "Guidance Notes on the Offshore Petroleum Production an Pipelines (Assessment of Environmental Effects) Regulations" /21/ and in "Guidelines to plan for development and operation of a petroleum deposit (PDO) and in "Guidelines to plan for installation and operation of facilities for transport and utilisation of petroleum (PIO) /41/.

The topics assessed and the level of detail may therefore deviate somewhat from the typical UK ES and the typical Norwegian EIA. Socio-economic consequences are, for example, not usually a topic for assessment in the UK ES. On the other hand, environmental impacts may be examined in somewhat greater detail in the UK than in Norway.

The guidelines and requirements for the contents of the EIA/ES in Norway and the UK are considered to be relatively similar and can be summed up as follows:

- Summary ("Non technical summary" in the UK)
- Legislation
- Comments to the environmental assessment programme (the results of informal consultations in the UK)
- Development alternatives
- Substantiation for the selection of the development alternative in terms of technical, financial, safety-related and environmental criteria
- Description of the selected alternative
- Description of
  - the environment
  - natural resources (for offshore development projects - fisheries)
  - other user interests
  - sosio-economic considerations (in Norway only)
- Impacts of the chosen alternative on
  - the environment
  - natural resources
  - other user interests
  - socio-economics
- Proposed mitigating measures are to be described in the context of an environmental programme, in which the selection of mitigating measures is described on the basis of safety and cost-efficiency.

2.7 The Impact Assessment Process towards British and Norwegian Authorities

The administration of the EIA process and approval of the plans for field modifications (PDO/FDP) and the gas export pipeline Tampen Link (PIO/PWA) by the Norwegian and UK authorities, respectively, will

be in accordance with the national legislation in each country.

The process towards British and Norwegian autorities has been established based on on the guidelines prepared for the EIA process as described in appendix A, agreements between Norway and the United Kingdom, including the Statfjord treaty and the 1998 Agreement, experience of previous developments and conversations and meetings between the Norwegian and UK authorities. The process is shown in Figure 2-4.

The figure shows that, in addition to the formal EIA/ES documents, the process started in 2003 with the preparation of an environmental impact assessment to evaluate and compare the different development alternatives, which were: 1) New platform, 2) Field modifications (bottleneck removal) and 3) Processing on Brent. This environmental impact assessment /49/, was sent to both the Norwegian MPE and the UK DTI for information purposes. The purpose of the assessment was to shed light on the environmental and socio-economic impacts of the alternative development solutions, and to support the further discussion of the process in relation to the Norwegian and UK authorities, respectively. This was followed by the environmental assessment programme and the final EIA/ES document. This document will be considered by the Storting in Norway and by the Secretary of State in the UK. Regular meetings have taken place with both the UK and Norwegian authorities during the process.

Figure 2-5 and Figure 2-6 show the timetable for the process in relation to the Norwegian and UK authorities respectively. The timetable for the project is shown in section 3.

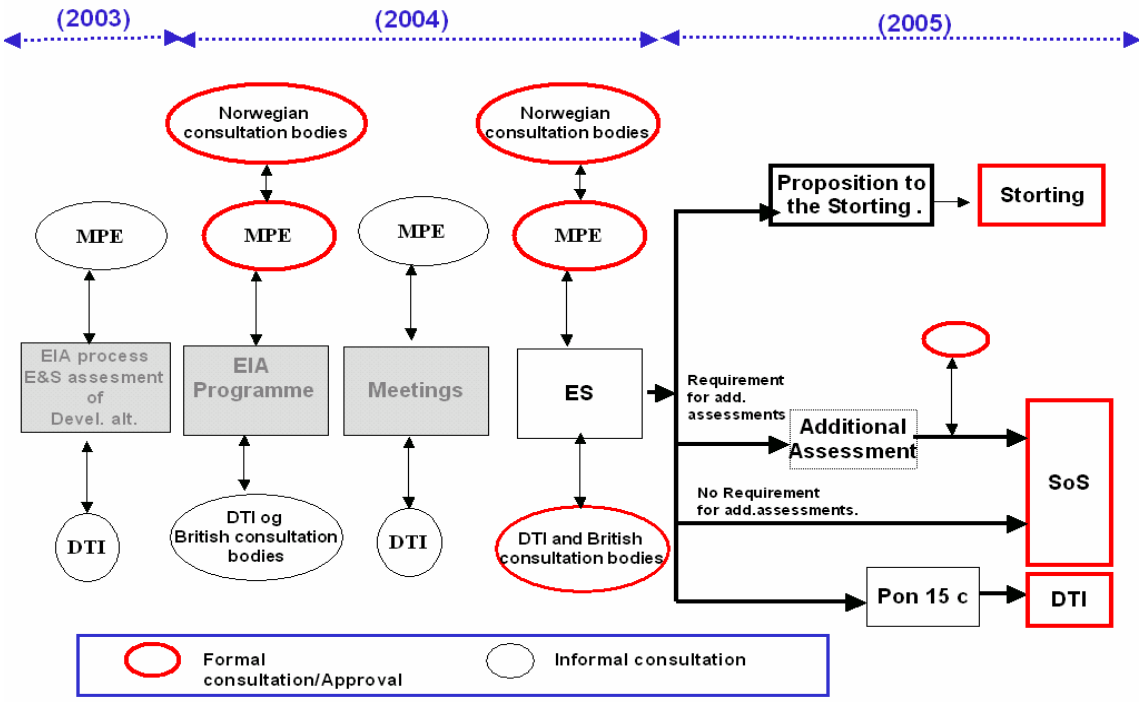

Figure 2-4: EIA process for Statfjord late life and the new gas export pipeline

Activity / Milestone	Time period/date
Meeting with the MPE to discuss the process and the legal basis for the EIA	18 February 2003
Environmental impact assessment of development alternatives	1 July 2003
Draft EIA programme	2 April 2004
Consultation on EIA programme	April-Early July 2004
Meetings with MPE for status review and discussion of the process	9 and 14 June 2004
Proposal for EIA document structure	6 September
Approval of EIA programme	13 october 2004
Draft EIA available for comment	1 November 2004
Submission of EIA (PDO/PIO part 2) to MPE	19 November 2004
Consultation on EIA	End Nov'04-End Feb'05
Discussion of comments and feedback to OED	Primo mars
Submission of revised PDO/FDP and PIO/PWA	25 February 2005
Deliberation by the Storting expected before.....	15 June 2005

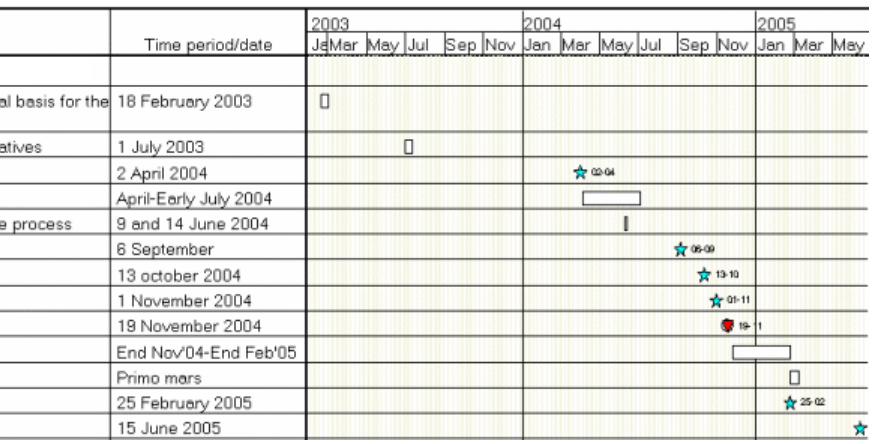

Figure 2-5: Schedule for EIA process in relation to the Norwegian authorities

Activity / Milestone	Time period/date
Meeting with the DTI to discuss the process and the legal basis for the EIA (MPE present)	7 May 2003
Environmental impact assessment of development alternatives	1 July 2003
Meeting with DTI to discuss the EIA process for the chosen development alternative	12 January 2004
Draft EIA programme	5 April 2004
Informal consultation on EIA programme	April-May 2004
Meeting with DTI for status review and discussion of the process (MPE present)	2 July 2004
Proposal for ES document structure	6 September
Meeting with DTI for status review of the new gas export pipeline SFB-FLAGS and discussion of ES document structure/format. MPE, FRS and JNCC present at the meeting	7 September 2009
Draft ES available for comment	1 November 2004
Submission of ES for consultation, submission of PON 18 and publication in the UK press.	14 December 2004
Consultation on ES (minimum four weeks)	Dec'04 - Jan'05
Submission of draft PWA	23 December 2004
Submission of application for use of chemicals (PON 15c)	1 February 2005
Discussion of any comments and feedback to the DTI	February 2005
Submission of FDP and final PWA/PIO	25 February 2005
Studies required for any additional assessments	March 2005
Feedback from DTI/SoS on whether the ES is acceptable/ the assessment obligation has been fulfilled, or further assessment is required	March 2005
Consultation on any additional assessments	April 2005
Discussion of any new comments and feedback to the DTI	May 2005
A decision to grant consent can be expected from the SoS before.....	15 June 2005

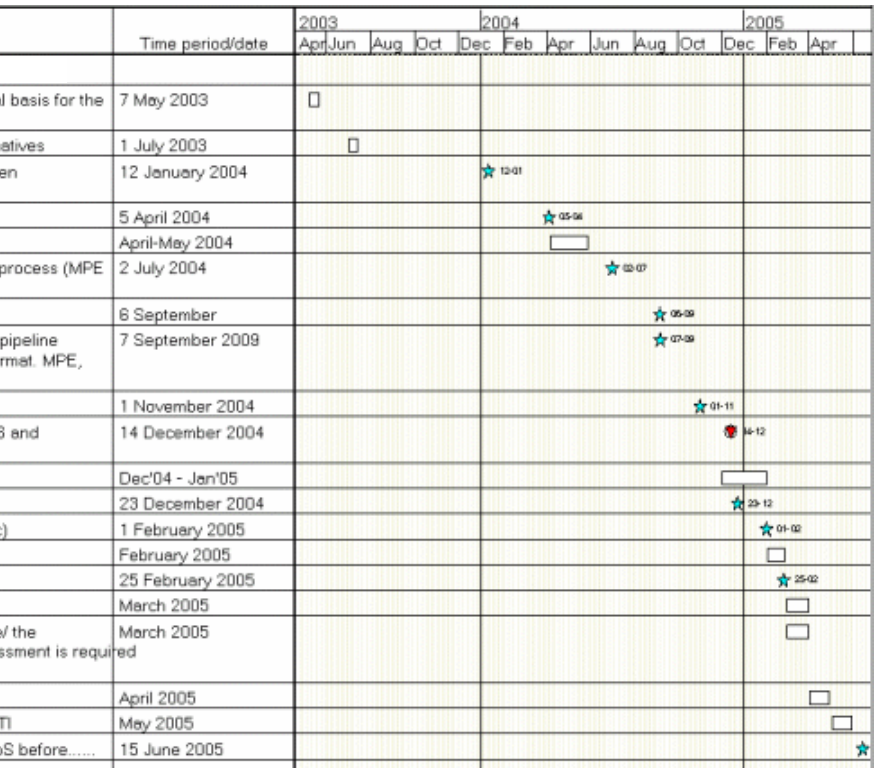

Figure 2-6: Schedule for the EIA process in relation to the UK authorities

2.8 Necessary Approvals/Applications, Concents and Information Requirements in addition to PIO/PWA

In addition to the approved PAD/PWA, licences and consents must be obtained from both the Norwegian and the UK planning and licensing authorities. Some of these licences will have to be obtained in the planning phase, others are not required before the development phase, and some are only relevant for the abandonment and decommissioning phase.

It has been clarified with the Norwegian and British authorities which licences and and consents are required.

3 The Environmental Impact Assessment Programme

3.1 Consultation Process

The impact assessment programme was sent out for consultation in the beginning of April. The organisations were consulted by letter on the 19th March and 5th April 2004, requesting their comments on the proposed project.

The following UK consultation bodies received the programme for consultation:

1. Department of Trade and Industry (DTI),
2. Department of Environment Food and Rural Affairs, Rural and Marine Environment Division (DEFRA),
3. The Centre for Environment, Fisheries and Aquaculture Science (CEFAS),
4. European Wildlife Division (EWD) of DETR (Department of Environment, Transport and the Regions)
5. Fisheries Research Services Marine Laboratory (FRS),
6. Joint Nature Conservation Committee (JNCC),
7. Maritime Coastguard Agency (MCA),
8. Ministry of Defence Liaison,
9. National Federation of Fishermen's Organisations (NFFO),
10. Chief Fisheries Liaison Officer,
11. Scottish Fishermen's Federation (SFF),
12. Royal Society for the Protection of Birds (RSPB),
13. Scottish Environmental Protection Agency (SEPA),
14. Scottish Environment Link,
15. Scottish Natural Heritage (SNH),

The following Norwegian consultation bodies received the programme, and consultation bodies 1-13 submitted comments:

1. Ministry of Fisheries and Coastal Administration (MFi)
2. Directorate of Fisheries (DFi)
3. Norwegian Coast Directorate (NCD)
4. Institute of Marine Research (IMR)
5. Norwegian Fishermen's Association (NFL)
6. Ministry of the Environment (ME)
7. State Pollution Control Authority (SFT)
8. Directorate for Nature Management (DNM)
9. County Department of Environmental Affairs in Rogaland
10. Sogn og Fjordane County
11. Ministry of Labour and Administration (MLA)
12. Petroleum Safety Authority Norway (PSA)
13. County Department of Environmental Affairs in Sogn og Fjordane
14. Ministry of Defence
15. Directorate of Labour
16. Labour Inspection Authority
17. Norwegian Petroleum Directorate
18. Directorate of Cultural Heritage
19. County Department of Environmental Affairs in Hordaland
20. Hordaland County
21. Rogaland County
22. Norwegian Nature Conservation Association
23. Nature and Youth
24. Norwegian Bellona Foundation
25. Norwegian Institute for Urban and Regional Research
26. Norwegian Association for Environmental Protection

The comments of the UK consultation bodies were received in April-May 2004. The Norwegian consultation bodies submitted their comments in June 2004, after a three-month consultation period.

The comments of the Norwegian consultation bodies are mainly linked to the field modifications and not to the new gas export pipeline. None of the UK consultation bodies have commented on the field modifications. The comments of the UK consultation bodies are linked to the planned gas export pipeline from Statfjord to FLAGS (the Tampen Link). The comments on the field modifications are discussed in the ES/EIA for field modifications /48/. Section 3.2 summarises the comments of the UK and Norwegian consultation bodies relating to the new gas export pipeline Tampen Link.

The final assessment programme, adopted by the MPE in a letter of 13. October 2004, is enclosed as appendix C to this Environmental Impact Assessment.

3.2 Concerns and Issues

Table 3-1 identifies the main issues raised during the consultation exercise and summarises how Statoil is planning to address these issues. Where appropriate the relevant section of the ES has been highlighted in bold.

Table 3-1: Summary of the consultation exercise

Consultee	Consultees comments / concerns	Statoil's response to comments / concerns
The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Scientific research and advisory centre working in fisheries management, environmental protection and aquaculture.	Consultation letter and scoping document sent on 19th March and 5th April 2004. The following concerns were raised in response to the letter and scoping document: The potential effects of the development on the spawning areas of cod, haddock and Norway pout should be outlined in the ES.	Potential effects on fish spawning areas are discussed in Section 7.
Department of Trade and Industry (DTI) Statutory responsibility to ensure that the licence conditions are met.	Meetings were held with the DTI in May 2003, January, July and September 2004. No concerns regarding the project were raised during the consultation process. DTI initially requested the PON15C for the SFLL pipeline be submitted with the ES if the detailed information for the project was available. DTI requested that the PON15C for the SFLL pipeline should be submitted by 1st February 2005 at the latest.	Statoil are unable to submit a PON15C at this time, as the detailed information is not available at this time. Statoil will submit the PON15C by the requested date.

Table 3-1 continued: Summary of the consultation exercise

Consultee	Consultees comments / concerns	Statoil's response to comments / concerns
Department for Environment Food and Rural Affairs (DEFRA) Statutory body which aims to Improve the environment and the sustainable use of natural resources	Consultation letter and scoping document sent on 19th March and 5th April 2004. The following concerns were raised in response to the letter and scoping document: Fishing activity by UK and foreign vessels might be encountered in the proposed area, therefore there could be potential interaction between fishermen and subsea structures. Statoil should ensure that the relevant fishing interests are fully informed of the proposed programme of work to minimise interference. Ongoing operational liaison with fishermen should be undertaken, including the appointment of a fisheries liaison officer as appropriate.Vessels engaged in operations at sea should endeavour to contact any fishing vessels encountered in the immediate area, and full information should be passed to reduce interference.	Section 7.4 addresses the impacts of the proposed pipeline on commercial fishing. Relevant fishing interests have been informed during the consultation process . Statoil will appoint a fisheries liaison officer.
Department of the Environment, Transport and the Regions (DETR)	Consultation letter and scoping document sent on 19th March and 5th April 2004. No response received to consultation letter and scoping document.	
Fisheries Research Services (FRS) Statutory responsibilities for commercial fishing.	Consultation letter and scoping document sent on 19th March and 5th April 2004. The following concerns were raised in response to the letter and scoping document: Trenching and burial of the pipeline could further minimise fisheries interaction, but could have additional economic decommissioning consequences. Therefore, recommend that all pipeline options, their impacts and wider consequences, are discussed throughout the ES. A meeting was also held with FRS in September 2004. During the meeting the following concerns were raised: FRS would prefer the pipeline were trenched. If the pipeline cannot be trenched, then the ES must include technical reasons why this option cannot be undertaken. FRS requested that the discharge depth of the pipeline pressure testing be described in the ES.	Section 4.4.3 discusses the pipeline options. Potential impacts of the proposed pipeline are discussed in Sections 7. Section 4.4.3.1 describes the technical and economic reasons why the pipeline could not be trenched. Section 7.5 describe the discharge location of the proposed pressure testing.

Table 3-1 continued: Summary of the consultation exercise

Consultee	Consultees comments / concerns	Statoil's response to comments / concerns
Joint Nature Conservation Committee (JNCC)	Consultation letter and scoping document sent on 19th March and 5th April 2004. A meeting was also held with the JNCC in September 2004. No concerns regarding the project were raised during the consultation process. JNCC requested the ES included a map depicting the location of the project in relation to "pockmarks" in the North Sea.	Section 5.5.1 includes the requested map.
Maritime Coastguard Agency (MCA) Statutory responsibilities for pollution control and response.	Consultation letter and scoping document sent on 19th March and 5th April 2004. No response received to consultation letter and scoping document.	
Ministry of Defence Liaison (MOD)	Consultation letter and scoping document sent on 19th March and 5th April 2004. No concerns on the proposals presented. MOD requested further information should be provided on: -the precise co-ordinates of the proposed pipeline route; -the date on which the proposed pipeline installation operations will begin; and -details of the construction methodology to be used.	
National Federation of Fisherman's Organisation (NFFO) Non-statutory group that represents the interests of Fishermen.	Consultation letter and scoping document sent on 19th March and 5th April 2004. No response received to consultation letter and scoping document.	
Royal Society for the Protection of Birds (RSPB) Non-statutory interest in bird populations and habitats.	Consultation letter and scoping document sent on 19th March and 5th April 2004. No concerns on the proposals presented. Requested to be informed as the ES progressed.	
Scottish Environment Protection Agency (SEPA) Statutory responsibility for pollution prevention in nearshore waters, and waste management.	Consultation letter and scoping document sent on 19th March and 5th April 2004. No response received to consultation letter and scoping document.	
Scottish Environment Link	Consultation letter and scoping document sent on 19th March and 5th April 2004. No response received to consultation letter and scoping document.	

Table 3-1 continued: Summary of the consultation exercise

Consultee	Consultees comments / concerns	Statoil's response to comments / concerns
Scottish Fisherman's Federation (SFF) Represents commercial fishing interests.	Consultation letter and scoping document sent on 19th March and 5th April 2004. The following concerns were raised in response to the letter and scoping document: SFF suggested a preference towards a trenched / buried pipeline as opposed to one that is laid directly on the seabed. SFF have concerns regarding pipeline decommissioning and questioned whether there will be a commitment to removal.	Statoil have looked into the option of trenching the pipeline (Section 4.4.3). However, upheaval buckling of the pipeline could occur as a result of the sediment composition and the temperature of the pipeline if the pipeline were to be trenched. Decomissioning methods will be decided at a later stage. See ref section 4.7. Impacts in the decommissioning phase are briefly discussed in section 6 based on generic information of typical activities involved.
Scottish National Heritage (SNH) Statutory responsibility for wildlife and conservation issues.	Consultation letter and scoping document sent on 19th March and 5th April 2004. No response received to consultation letter and scoping document.	
The Institute of Marine Resarch (IMR). The IMR is advisor to the Ministry of Fisheries and Coastal Affairs, and plays a central role in the inspection and monitoring of fish stocks and marine mammals, the marine and coastal environment and in the work on aquaculture and sea ranching.	In connection with the preparation of pipelines it is important to involve the IMR as early as possible in the planning phase with a view to offering advice on the most critical time periods for discharges.	Discharges to sea in connection with the preparation of the new gas export pipeline will mainly take place in the UK sector, except for marginal discharges in connection with the preparation of risers and tie-in spools on the Norwegian side. In connection with the discharges on the UK side, a PON (Petroleum Operation Notice)15C will be prepared, which will describe the chemicals used and the environmental impact of the discharges. The impacts will be determined on the basis of toxicity data, dilution modelling and data on vulnerable biological resources. Emptying of pipelines will take place in October 2007 outside the most sensitive periods for biological resources in the area. The impacts of the the pipeline commissioning activities are described in more detail in section 7.5.

3.3 Scope of the Environmental Assessment

As part of the SFLL project (Figure 3-1), Statoil, the present operators of the Statfjord Field are proposing to install a new 23.2 km gas pipeline between the approaches of the Statfjord B platform and a point in the FLAGS pipeline some 1.4km south of the Brent Alpha platform.

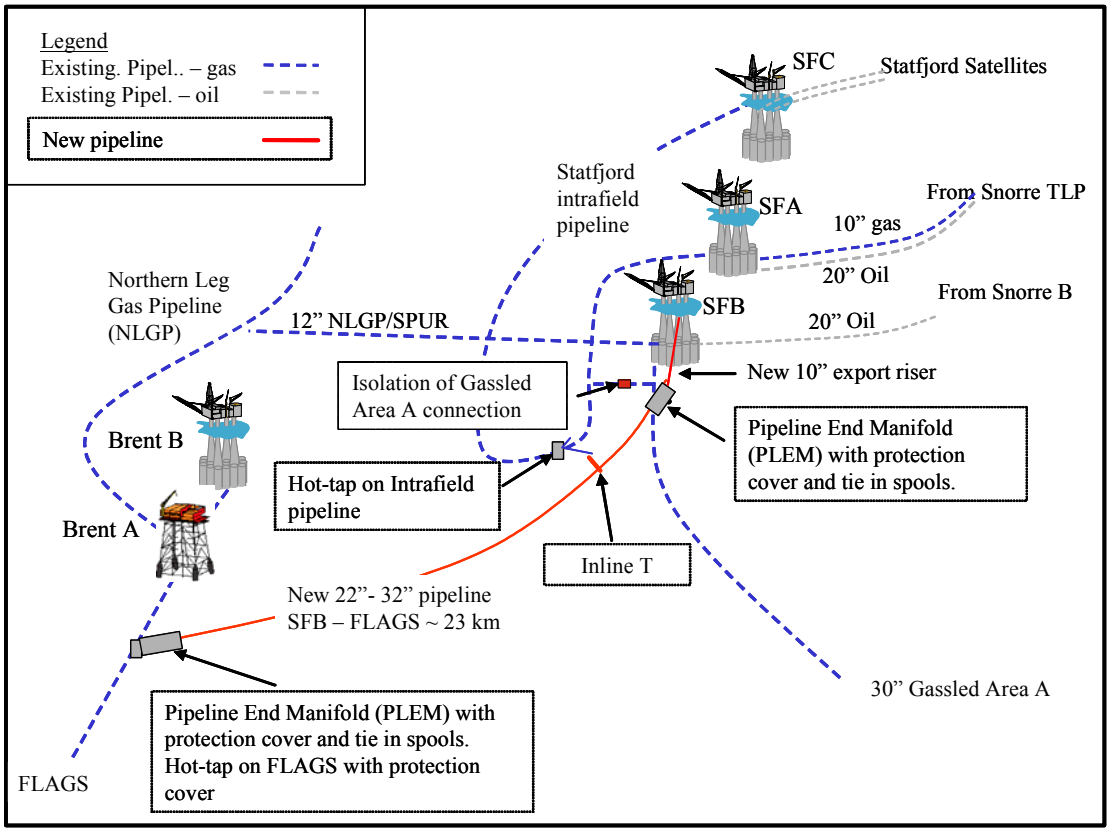

Figure 3-1: Proposed layout of the SFLL project gas export pipeline and associated risers

The proposed project involves modifying the Statfjord B and Statfjord C platforms to remove bottlenecks for processing the increased gas volume, and the installation and commissioning of the new gas export pipeline to St Fergus via the FLAGS pipeline (Figure 3-1). The new pipeline will have an overall diameter (OD) of 22" or 32", and will be approximately 23.2 km long, with 15.5km in the UKCS. The pipeline will have the capacity to transport all the gas produced at the Statfjord wells to the UK. The third-party gas from Snorre and the Statfjord satellite wells will continue to be exported to Kårstø, via Statpipe.

The new export pipeline will be connected to the Statfjord B platform via a new 10" riser. A new 6" riser will be required at the Statfjord B platform to import gas from Snorre and the Statfjord satellites (Figure 2-1). The new export pipeline will be connected to FLAGS via a new Hot Tap Tee-piece welded onto the existing FLAGS pipeline. All the connections at Statfjord and FLAGS will be stabilised using gravel and rock, and will be fitted with protective structures.

The environmental assessment covers all the elements described above and has been carried out in line with the following UK requirements:

- Offshore Petroleum Production and Pipe-Line (Assessment of Environmental Effects) Regulations 1999
- Petroleum Act 1998 (in support of the Field Development Plan)
- Offshore Chemical Regulations 2002
- Offshore Petroleum Activities (Conservation of Habitats) Regulations 2002

- Department of Trade and Industry Guidance Notes (DTI) 2002Background Documents

3.4 Background Documents

Supporting reports prepared as a part of the ES/EIA documentation to describe the impact of field modifications are shown in Table 3-2.

Table 3-2: Supporting reports for the EIA/ES for the new gas export pipeline Tampen Link

Study	Institution reporting	Key words	Reference
Impact of the gas pipeline in the UK sector	BMT Cordah	The main input to the new gas-export pipeline Tampen Link	/11/
Impact on fisheries on the Norwegian continental shelf	Acona/Aaserød		/2/
Description of natural resources and environmental risk assessment	Alpha Miljørådgivning (environmental consultants)	Oil drift modeling for an accidental diesel spill	/5/
Socio-economic impact	Rogaland Research	The economy Deliveries of goods and services Employment	*

The entire report is included in section 8 of this document

3.5 Methodology-Environmental Assessment

The environmental assessment methodology systematically identifies the significant environmental impacts and risks (potential impacts), assesses the requirement for risk-reduction measures, and provides an Environmental Management Plan to facilitate the adoption of these measures throughout the project. It aligns with the requirements set out in the Schedule to the Offshore Petroleum Production and Pipe-Lines (Assessment of Environmental Effects) Regulations 1999 , and the Department of Trade and Industry Guidance Notes on the Interpretation of the Regulations (DTI, 2000), as well as Norwegian legislative requirements. Figure 3-2 illustrates the principal stages in the environmental assessment process.

In the present context, a significant impact or risk can be defined as one requiring management action to be taken to:

- avoid or minimise potentially adverse consequences for the environment, the public or the project;
- resolve the concerns of stakeholders; or
- fulfil the requirements of environmental legislation and Company policy.

Management actions would include:

- controls, i.e. methods of preventing or reducing the likelihood of the events that would lead to environmental impact (e.g. vessel collisions causing oil spills);
- mitigation, i.e. methods of preventing or reducing adverse environmental consequences (e.g. oil spill clean-up and response techniques); and,
- other action (e.g. awareness and training).

The approach has been adapted from the British Standard BS8800 (BSI, 1996a), the UKOOA Guidelines on Risk Assessment (UKOOA, 1999 and 2000), and the international environmental management standard BS EN ISO 14001 (BSI, 1996b).

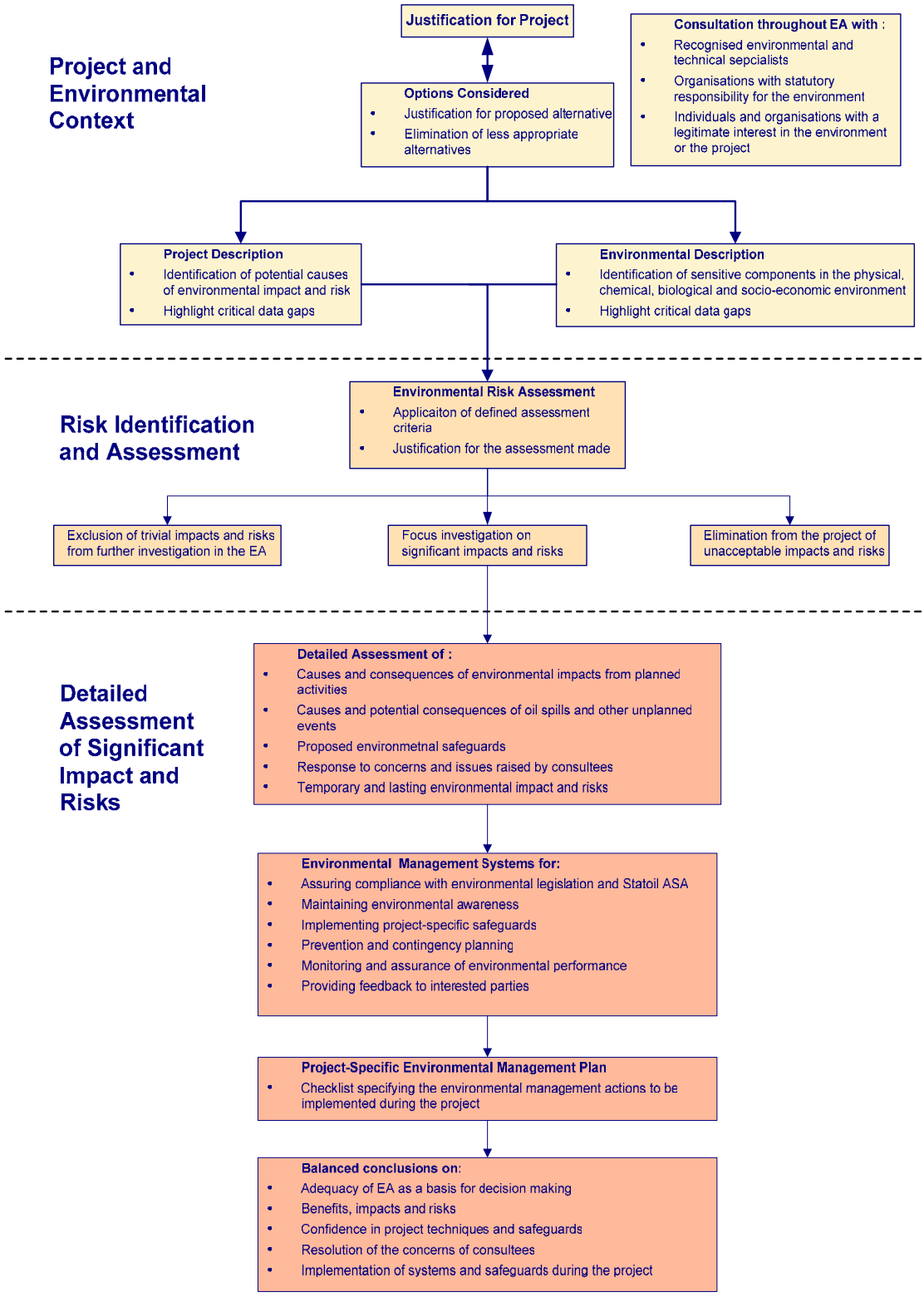

Figure 3-2: Principal stages in the environmental assessment process

4 Project Description

The environmental assessment programme described a solution in the form of a new 20" export pipeline for the transportation of all gas to FLAGS. It was also made clear that the final solution for gas transport from Statfjord would be based on future downstream capacity and the companies' preferences with respect to transport routes and markets.

Front End Engineering and Design (FEED) conducted subsequent to the submission of the "Environmental Impact Assessment programme" has resulted in certain changes to the design basis for the pipeline. The outer diameter of the new pipeline will be either 22" or 32"; a final decision will be taken in 2005. Both alternatives are covered by this EIA/ES.

This chapter starts with a description of ownership and operatorship of the pipeline (Tampen Link). Section 4.2 continues with a brief description of the grounds for selection and the final design of the gas transport solution for Statfjord late life (SFLL). Section 4.3 sums up the conclusions of Gassco's transport analysis /27/, which includes requirements for gas transport in the Tampen Link over and above the requirements of SFLL, and the dimensioning of the Tampen Link is explained on the basis of these conclusions. Section 4.4 onwards discusses the selected solution and the two alternative dimensions in more detail

4.1 Ownership and Operatorship of the Export Pipeline

A new export pipeline between Statfjord and FLAGS, primarily dimensioned to provide for the capacity requirements of Statfjord Late Life will be owned by the Norwegian licensees in the Statfjord field, i.e. Statoil ASA, ExxonMobil Norge AS, Norwegian ConocoPhillips AS, AS Norwegian Shell and Enterprise Oil Norge AS (Shell).

Alternatively, the new export pipeline will be dimensioned to provide for capacity demands over and above those of Statfjord Late Life. In this case, the pipeline licensees will include other companies on the Norwegian continental shelf, in addition to the Norwegian licensees in the Statfjord field.

In both cases a separate partnership will be established. Statoil will be the operator of the gas export pipeline in the development and construction phases and Gassco will be the operator in the production phase.

4.2 Gas Transport from Statfjord Late Life

This subsection will first explain the structure of today's gas transport system from the Statfjord field, with pipelines to the processing plants in Norway (Kårstø) and the UK (St. Fergus). Next, it will look at the alternative gas transport solutions for SFLL discussed in the 'environmental impact assessment programme' and the reasons for selecting the preferred solution. Finally, the selected solution for SFLL is described.

4.2.1 The Current Gas Transport and Value Chain

The Statfjord field produces wet gas. The current gas transport and value chain are illustrated in Figure 4-1.

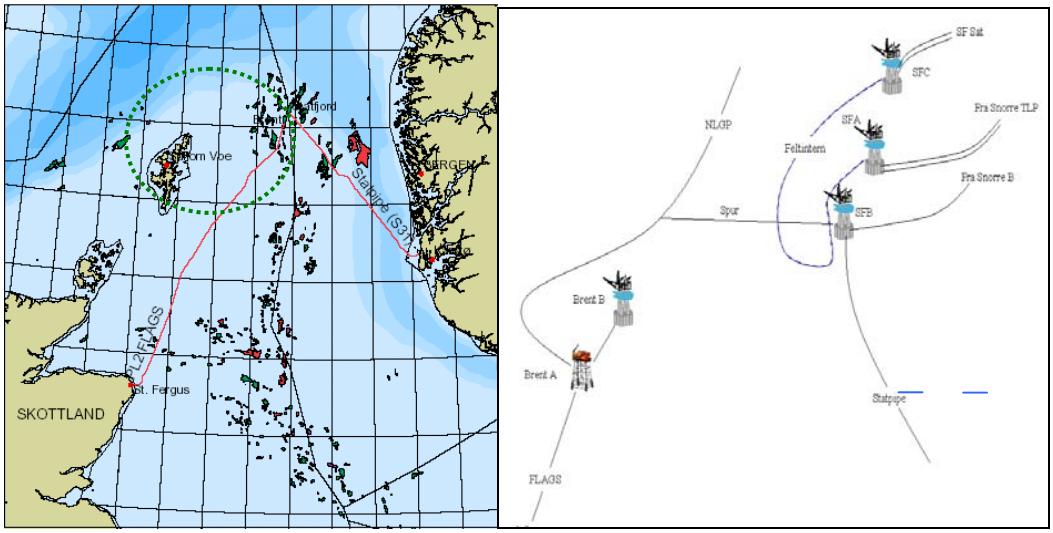

Figure 4-1: Current gas transport from the Statfjord field

Today, gas is transported from SFA and SFC via the intra-field pipeline to the Gassled Area A pipeline and onwards to Kårstø in Norway for processing. From SFB the gas is transported directly into the Gassled Area A pipeline. The UK share of the Statfjord gas (appr. 15 per cent) is transported in the Spur pipeline, which is connected to NLGP (Northern Leg Gas Pipeline), and onwards via Brent A to FLAGS (Far North Liquids and Gas System). The FLAGS pipeline to Scotland comes ashore at St. Fergus.

At Kårstø, dry gas/sales gas, primarily methane, is separated from the NGL components ethane, propane, isobutane and regular butane. The dry gas is transported to continental Europe, while the NGL is shipped by sea to various customers. All ethane from Kårstø is currently shipped by sea to the petrochemical plants at Rafnes/Bamble and in Stenungsund.

At the St. Fergus gas processing plant, dry gas is separated from wet gas. The dry gas from St. Fergus is distributed to consumer through the national gas system, while the NGL products are transported in pipelines to the Fife plant at Mossmorran, just north of Edinburgh. The NGL products are fractioned and further refined. Ethane is used as a raw material in the petrochemical industry (ethylene factories), and propane, butane and condensate are shipped out to various customers.

4.2.2 Gas Transport Solutions for Statfjord Late Life

The development of SFLL entails that gas exports from Statfjord will increase, from approx. 7,7 GSm3 wet gas in the reference alternative (today's drainage strategy for the Statfjord field with production until 2009 and termination of gas transport in 2007) to a total of approx. 42,5 GSm3 wet gas in SFLL for the period from 2004 to 2018. This also entails an extension of the gas export period by 11 years, from the planned termination of gas exports in 2007 in the reference alternative to the cessation of production in SFLL in 2018. Production in SFLL will be at its highest level in the first year (2007), with approx. 14 MSm3/d.

In Figure 4-2 the gas production and export profiles are shown. Table 4-1 shows economically recoverable reserves in place.

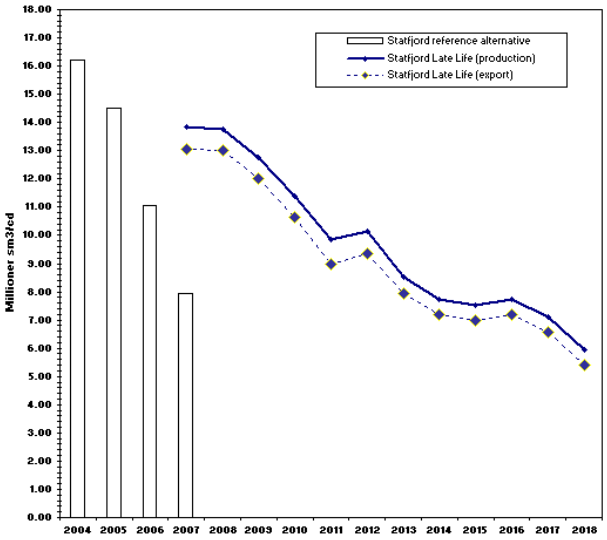

Figure 4-2: Gas production profiles for SFLL and the reference alternative without satellite production

Table 4-1: Recorverable reserves

Recoverable reserves	Reference case (2004-09)	SFLL (2006-18)	Increased recovery
Oil (MSm3)	31,7	35,1	3,4
Dry gas (GSm3)	6,3	36,7	30,4
NGL(mill. tonnes)	2,3	11,6	9,3

Before the environmental impact assessment programme was submitted, the following gas transport alternatives were assessed, technically and in terms of project economics.

a. Export of gas to FLAGS via a new export pipeline and to Kårstø via the Gassled Area A pipeline (50/50 distribution)
b. Export of all gas to Kårstø via the Gassled Area A pipeline
c. Export of all gas to FLAGS via a new export pipeline
d. Export of all gas to FLAGS via Spur/NLGP and to Kårstø via the Gassled Area A pipeline

The selection of the base case solution for gas transport was made on the basis of several technical and commercial factors, including:

- Capacity in existing pipelines and processing plants
- Commercial tenders
- Investment costs
- Pressure conditions, flexibility
- Third-party access
- Risks
- Environmental considerations - emissions to air

Net present value calculations proved alternative c) to be the best solution in terms of project economy. This was on account of relatively high tariffs in the Gassled system and Spur compared with the capital cost of building a new export pipeline in combination with lower tariffs in FLAGS. It was essential to evaluate SFLL in terms of project economy, since the project is relatively marginal in financial terms. Based on the above evaluations, alternative c) was selected as the base case solution for SFLL.

For the selected alternative, it has been documented that FLAGS (with a capacity of 33 MSm^3/d) has the available capacity to transport all gas from the Statfjord field and that St. Fergus (with a total gas processing capacity of approx. 45 MSm^3/d) has sufficient capacity for the Statfjord gas. It will still be possible to transport gas in the existing pipeline systems, through the Gassled Area A pipeline to Kårstø and through Spur/NLGP and FLAGS to St. Fergus, but such transport will be limited by pipeline and processing capacity.

4.2.3 Description of the selected Gas Transport Solution for SFLL

The technical solution selected involves exporting all SFLL gas to the UK, tying in to FLAGS downstream of Brent A. The assumption so far is that the UK share of the gas will be transported to FLAGS via Spur and NLGP. This alternative includes the possibility of transporting gas to Kårstø using the Gassled Area A pipeline.

The figure below shows the selected gas transport solution (new export pipeline and infrastructure).

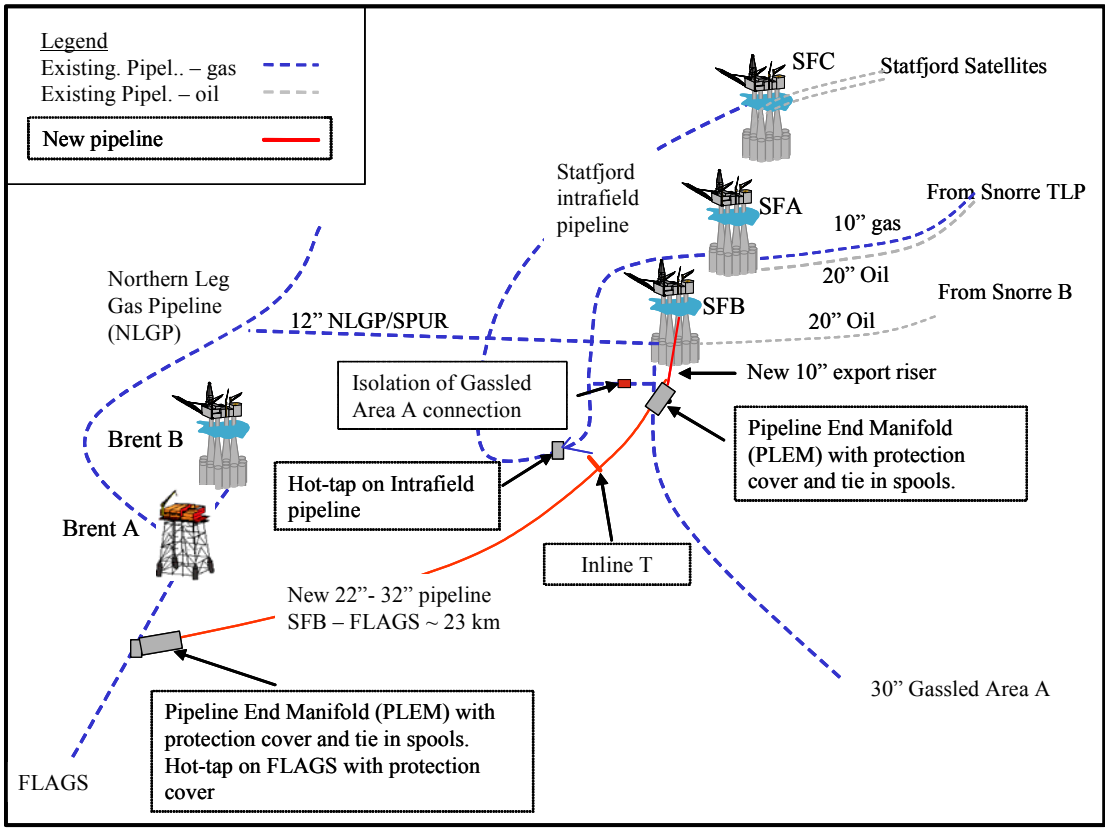

Figure 4-3 New export pipeline and other infrastructure for alternative export solutions from SFLL

Transporting rich gas from Statfjord Late Life to FLAGS requires a new pipeline of at least 22" diameter. It will be connected to SFA and SFC via the intra-field pipeline at Statfjord and a connecting pipeline 2.5 km south of SFB. The new export pipeline will be 23.2 km long and tied in to SFB via a 10" riser.

Tie-in to FLAGS will be via a new hot-tapped T-piece welded onto the existing pipeline. All connections at Statfjord (two) and at FLAGS (one) will be fitted with protective structures, and stabilised using gravel and rock.

Pig launchers for pigging in connection with water filling, water emptying and gas filling are included at both ends of the export pipeline and at the SFB platform for the risers.

Due to differences between export pressure at Statfjord and import pressure at FLAGS, it is also necessary to install a safety system in the new pipeline, so that the export pressure complies with the design pressure in FLAGS. The existing connection from the intra-field pipelines to Statpipe will be closed, thereby protecting the new gas export pipeline against the high pressure in Gassled.

This is a flexible alternative that makes it possible to connect the export pipeline without the intra-field pipeline having to be cut and filled with water. This means that the work can be carried out independent of turnarounds. It is also a robust solution in relation to the implementation plan.

4.3 Dimensioning of the Tampen Link based on Gassco's Transport Analysis

After the selection of the field concept and gas transport solution for Statfjord Late Life (new export pipeline between Statfjord and FLAGS) several 3rd party companies have expressed an interest in co-ownership of the new export pipeline, now called the Tampen Link. Among other things, this is due to the fact that in some years the gas processing capacity at Kårstø will be lower than the total processing capacity needed for gas from the Halten/Nordland and the Tampen areas. An expansion of the Tampen Link will enable Norwegian surplus volumes of gas to be produced and exported, provided that FLAGS and St. Fergus have sufficient capacity.

To meet the capacity requirements of SFLL, the Tampen Link must have a pipeline diameter of 22". To provide for gas transport requirements over and above those of SFLL, it will be necessary to increase this diameter further. In this context, Gassco has carried out a transport analysis to identify the demand for extra capacity in Tampen Link, over and above that required by SFLL /27/. The evaluations are based on three elements:

1. *The demand for capacity in the Tampen Link reported by shippers* (licensees with a demand for transporting gas through the gas transport system). The reported volumes are physical volumes from existing fields or prospects, and apply to demands for capacity in the Tampen Link, over and above the capacity required by SFLL. Gassco has considered these reports to be robust.
2. *Forecasts from the shippers* relating to future demands for transport capacity in all of Gassled's systems over a 15-year period until 2019.
3. *Information from field operators* relating to planned gas production from the individual fields, including capacity, gas composition and operational preconditions. This information has been provided for fields already in production, sanctioned fields, fields under consideration and prospects. New volumes categorised in resource class 5 are not included.

Forecasts based on items 2 and 3 above, indicate that the collective demand for gas processing capacity will be in excess of the total capacity of 88 MSm^3/d in Gassled Area C (Kårstø) and the surplus capacity in FLAGS.

To carry out an analysis of the specific demand for capacity in the Tampen Link (as a supplement to the shippers' reports) Gassco has analysed several different scenarios also including other fields at the Norwegian continental shelf. The scenarios include both the gas export solution for Skarv (Haltenbanken), the timing of new gas being phased in from Tampen and potential new capacity in the Gassled Area A pipeline and at Kårstø. The results of these scenarios show a demand for capacity in the Tampen Link in the range of 25-33 MSm^3/d. In comparison, a 22" pipeline would offer a capacity of approx. 17 MSm^3/d, while a 32" pipeline would offer a capacity of approx. 25 MSm^3/d and the possibility of upgrading to 33 MSm^3/d at a later date.The evaluations based on items 2 and 3 above are in accordance with the evaluations based on the shippers' reports (item 1 above).

The conclusion of this transport analysis /27/ is that the demand for capacity in the Tampen Link, based on several different types of evaluation, exceeds the capacity offered by a 22" pipeline. A 32" diameter pipe in the Tampen Link seems to be advantageous both technically and financially, while also offering a flexible solution. The difference in costs between a 22" and a 32" pipe is relatively marginal compared with the increase resulting from an even larger increase in diameter. A 32" pipe also corresponds well to the capacity in FLAGS (33 MSm^3/d).

In addition to supporting the demand for transport capacity over and above that of SFLL, a 32" pipe will contribute to increased flexibility for gas transport from the Tampen area on a day-to-day basis. This flexibility can be utilised to optimise the value of Norwegian gas by transporting the gas to the market that is offering the highest price.

Capacity limitations at Kårstø or in FLAGS may occur during maintenance periods, unplanned shutdowns or other activities requiring limitation or shutting down of the export systems. The capacity in the Tampen Link can then be utilised for export from existing fields, thereby increasing the regularity of production and the reliability of supplies to the market. In the event of limitations in the UK transport systems, gas from SFLL can be transported via Kårstø. In this way the Tampen Link will act as a HUB for market and capacity optimisation.

4.4 Base Case Description for the new Export Pipeline Tampen Link from Statfjord to FLAGS.

4.4.1 Site Survey

A series of bathymetric route surveys were undertaken along the proposed pipeline route in April 2004.

The objective of the bathymetry surveys was to provide detailed bathymetric and geological data for the new pipeline routes and to identify any significant features/obstacles along the proposed

routes. The visual surveys were undertaken to identify crossing locations and the design requirements for crossings over existing pipelines. The visual surveys also provided information about tie-in locations. The results from these surveys are described in **Section 5** and have been used in the risk assessment of the proposed pipeline operations (**Sections 6** and **7**).

4.4.2 Crossings

The installation of the proposed 22" / 32" gas export pipeline will require the construction of pipeline crossings, as detailed in Table 4-2 and Table 4-3. There are crossings both on the Norwegian continental shelf and on the UK side. The location of the crossings may be altered slightly during the detailed design of the pipeline.

Table 4-2: Locations of pipeline crossing for 22" pipeline

Crossing	Distance from Statfjord B (Km)	Easting	Northing
20" intra-field pipeline	0.815	437 431.32	6 785 302.92
20" intra-field pipeline	2.529	458 063.91	6 783 709.82
10" Brent oil pipeline	23.003	429 817.40	6 766 115.56
8" Brent Water injector / umbilical	23.051	429 775.79	6 766 091.82

Table 4-3: Locations of pipeline crossing for 32" pipeline

Crossing	Distance from Statfjord B (Km)	Easting	Northing
20" intra-field pipeline	2.529	458 063.91	6 783 709.82
10" Brent oil pipeline	23.003	429 817.40	6 766 115.56
8" Brent Water injector / umbilical	23.051	429 775.79	6 766 091.82

It is anticipated that rock-dumping will be undertaken during the construction of all crossings, to protect and stabilise the crossings and the ends of the pipelines. In all cases the material used will be graded crushed rock ranging in diameter from 3.2cm to 12.5cm in diameter. The graded rock will be placed onto the seabed in carefully controlled operations by using a dedicated rock dumping vessel equipped with a dynamically positioned fall pipe. In this technique, the graded rock is fed into the fall pipe at a controlled rate using a hopper system. The length of the fall pipe is adjusted, depending on the water depth at the site, to keep the end of the pipe within 5m of the seabed. This ensures that material is placed accurately at the required location, and the operation will be monitored by an ROV (post dumping) to confirm that the material is deposited in the correct position on the seabed.

It is expected that the crossings will be similar to other crossings in the central North Sea, which use a pre-lay rock dumping to support the *crossing* pipeline and protect the *crossed* pipeline. The pipelines will be surrounded and covered by a gently sloped, protective post-lay layer of rock. At each crossing it is planned that the crossed pipeline will remain "live" during installation. The crossing(s) of the 20" intra-field pipeline will have a size in the order of 60-100m by 10m and a height of approximately 1.5m for the 22" pipeline and 2.0m for the 32" pipeline. The rock dumps at the other crossings will have a size of 20m by 15m and with the same height. The crossings will be generally flat with slopes of 1:2.5 at the edges. Typical details of a pipeline crossing are shown in Figure 4-4.

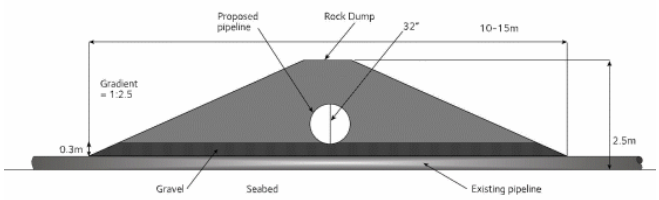

Figure 4-4: Section through the UK and Norwegian pipeline crossings

4.4.3 Pipeline Installation

4.4.3.1 22"/32" Gas Export Pipeline

There are currently two options for the size of the new gas export pipeline; an OD of 22" and an OD of 32". The new pipeline will be laid directly onto the surface of the seabed and may be installed in a conventional manner or in a "snake-lay" formation (Figure 4-5).

Statoil have looked into the option of trenching the pipeline, however, the coarse sand / shale seabed overlying very stiff clay in the proposed area makes this technically challenging. Trenching under such conditions would most likely result in the pipeline

trench being uneven**.** The unevenness of the trench could easily initiate upheaval buckling and creating free spans on the pipeline due to high temperature and pressure resulting in pipeline expansion. To control this buckling, large lengths of the trenched pipeline would have to be rock dumped**.** Therefore, to accommodate the pipeline expansion, the pipeline will be surface laid, allowing controlled lateral movements on the seabed within intervals of rock dumps for control and stability at approximately 10 places along the pipeline (somewhat dependant on the pipe dimension).

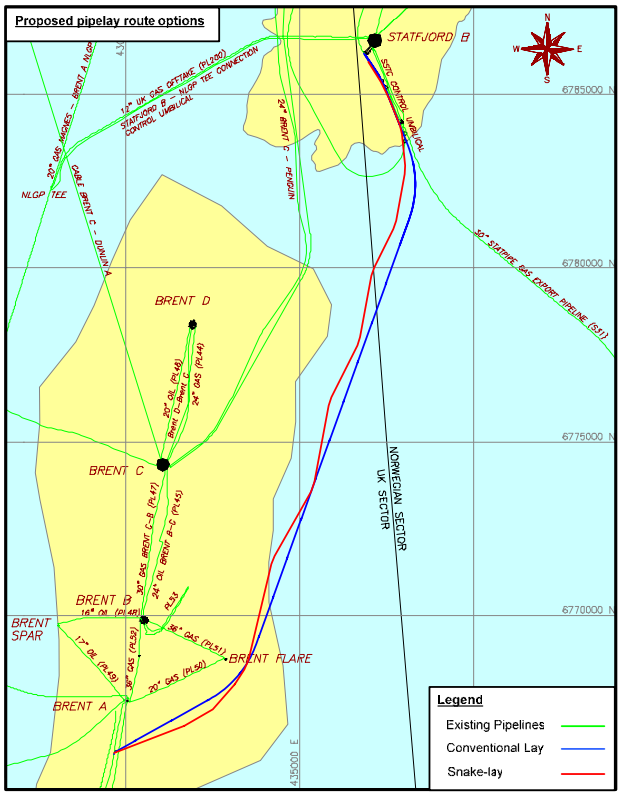

Figure 4-5: Options for the route of the proposed pipeline

If the pipeline is laid in a conventional line laid manner approximately 88,000m^3 of intermittent rock-dumping over a distance of 23.2km to stabilise it and prevent buckling will be required in the 32 " alternative. The corresponding rock volume for the 22" alternative is 27,000 m^3. Alternatively, if the pipeline is laid in a "snake-like" formation of long sweeping curves this would accommodate lateral buckling, with any movement taken up by the "snake" rather than causing buckling. Statoil anticipate the "snake-lay" option will require approximately 8,000m^3 of intermittent rock-dumping to provide additional stability in the 32" alternative and 7,000m^3 in the 22" alternative. Most of the rock will be placed as pre-laid rock carpets with a dimension of 100m by 10m and with a height of 0.3m. This will provide additional friction between the pipeline and the seabed.

Depending on whether the pipeline is laid conventionally or 'snake'laid and depending on the final decision regarding pipeline dimension, the pipeline will have to be rock-dumped at certain intervals for complete anchoring. Between 5 and 15 anchor points are anticipated. The number of anchor points required will be lower in the the 'snake'laid option than if the pipeline is laid conventionally, and will be lower in the 22" than in the 32" alternative.

Rock dumps for anchoring purposes will typically have a height of approximately 1,5 m in the 22" alternative and 2.0 m in the 32" alternative (1 m rock cover over the pipeline). The rock dumps will be flat on the top with a typical slopes along the edges of 1:2.5. Figure 4-6 illustrates the proposed rock dumping along the conventional and snake-lay formation options.

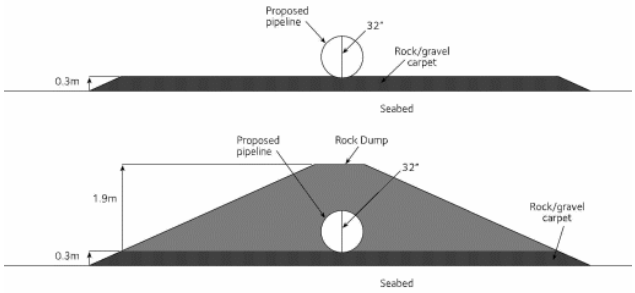

Figure 4-6: Rock dump options for the snake-lay and conventional pipelaying

The new pipeline will be made of carbon steel, SAW 450 I (similar to X65), with an asphalt coating to prevent corrosion, and a 40-60mm concrete coating which would provide stability and protection against impacts from trawling gear.

At this stage it is not decided whether the pipeline will be installed using an anchored lay barge or a dynamically positioned (DP) vessel. If an anchored lay-barge were to be used, it would be moved forward by deploying, tensioning and re-deploying between 10 and 14 anchors, which would be positioned on the seabed in a pre-determined 'anchor pattern'. The anchors will be placed and pulled several times during the laying operation. This type of lay-barge requires up to three anchor-handling vessels to manoeuvre the anchors, and

supply vessels to maintain the supply of pipe sections. During installation, pre-fabricated sections of pipeline would be welded together on the lay-barge, and the welded joints would be coated. The line would be deployed into the sea via a 'stinger' (guide frame) and the rate at which pipe would be laid would correspond to the forward speed of the vessel. In contrast, a reel barge (used to lay the 10" export riser between SFB and the northern PLEM) is self-propelled and would deploy the pre-fabricated pipeline by unreeling the entire line from a large drum on board the vessel.

The use of DP would avoid the use of anchors and so prevent localised disruption to the seabed caused by the repeated placement and retrieval of anchors, but will result in higher fuel consumption and atmospheric emissions.

Whichever method of installation is used, it is likely that at the beginning of the installation process, the end of the pipeline will be fixed to the seabed by means of an anchor or temporary pile; this anchors the line, and allows it to be put under tension as it is progressively laid down. The pipeline will then be laid away from this point, over the various prepared crossing locations, and will terminate at the "lay-down" position where the end of the pipeline would be lowered onto the seabed. Following lay-down, the pipeline is likely to be flooded with inhibited seawater. Positioning of the pipeline and the anchors of the lay-barge will be carefully monitored by use of GPS and post-lay surveyed and controlled by means of a ROV (Remotely Operated Vehicle).

There is no declared exclusion zone around the pipe-laying operations. However, the area will be continuously monitored from the pipelaying vessel to guard any operation that could result in snagging of anchors or demersal trawl gear, such as the anchorlines from the pipelaying vessel itself, pipeline crossings or the lay-down heads prior to final protection. The pipe-lay vessel will have a Fisheries Liaison Skipper on board and daily notifications will be issued as required by the conditions of the DTI pipeline works authorisation. The pipe-lay operations will be post-lay surveyed to ensure that the pipe and the rock dumps are laid in the correct location and that no free spans or other obstructions occur along the pipeline.

Bridging documents between Statoil, and the installation contractors operating the pipeline installation vessel, will describe the management structure and division of responsibilities that will prevail during the operations, the methodology for executing the work programme, and the emergency response procedures.

The main operations that would be undertaken during the pipeline construction phase are shown in Table 4-4.

Table 4-4: Proposed pipeline operations

Type of operation	Type of vessel/method
Surveying of route	Survey vessel
Method for laying the new gas export pipeline	S-lay (anchor lay-barge or DP)
Method for laying the 10" riser at the Statfjord B platform	Reel lay or S-lay
Hot tap tie-in operations at FLAGS	Diving vessel/installation vessel
Pipe tie-in operations at the Statfjord B platform, and installation of protective structures at FLAGS and the Statfjord B platform	Installation vessel/ crane vessel
Rock dumping	Rock dumping vessel

4.4.3.2 10" Riser

The 10" export riser will be installed by a reel barge and will be buried. The 10" gas export riser pipeline will be pulled into the existing 14" J-tube at the south-west corner of the Statfjord B platform. The J-tube entrance is located approximately 1.3m above the seabed and the riser will be pulled through the J-tube by a wire attached to a winch on the topside of the Statfjord platform. The 10" gas export riser will expand due to high temperature (design temperature 65°C) and will be rock-dumped with 0.3m to 0.5m of rock cover along the length of the riser, to provide stability and to protect the line from dropped objects and displacement by mobile fishing gear. An estimated 2,200 m^3 of rock-dump will be required.

4.4.4 Corrosion Protection

The corrosion protection system is designed in accordance with ISO 15589-2 for cathodic protection design. The design life for the corrosion protection system is 20 years.
Protection against corrosion will be provided by coatings and by proprietary sacrificial aluminium-zinc-indium alloy anodes placed in the form of bracelets around the pipe, with spacing intervals dependent upon the diameter of the pipeline. The concrete-coated 22" / 32" pipeline will have a 6mm asphalt enamel corrosion coating between the bare

steel pipe and the concrete. The anodes will be suitable for long term continuous service in seawater, saline mud or alternating seawater and saline mud environments. All the anodes will be 40mm thick and will be connected via welded steel continuity straps. In a 500m long section at each end of the pipeline, the unit mass of anodes will be twice that of the remaining length of the line. The total mass of anodes on the main pipeline will be approximately 12 tonnes.

A 3mm thick, 3-layer polypropylene corrosion coating will be used for the 10" riser. The anodes for the 10" riser will be placed outside the polypropylene coating. The total mass of anodes on the riser will be approximately 400 kg

4.4.5 Structures, Tie-Ins and Connecting Operations

The proposed gas export pipeline will connect the Statfjord B platform to FLAGS. Other main structures that will be installed subsea during the proposed SFLL pipeline programme are Pipeline End Manifolds (PLEMs) and Hot Tap Tee-pieces (HTT). Protective covers that are designed to deflect demersal trawling gear will cover these structures. Table 4-5 provides the location and dimensions of the PLEMs and HTTs to be used in the SFLL pipeline system.

Table 4-5: Location and dimensions of PLEMs and HTT

Dimension	Location	Easting	Northing
Pipeline End Manifold (PLEM) which will:			
	Connects the Statfjord B 10" gas export riser/pipeline and the new pipeline	437 036.67	6 786 022.99
	Connects the new pipeline and FLAGS Hot Tap Tee-piece	429 690.20	6 766 021.20
Hot Tap Tee-pieces (HTT), which will:			
36" x 16"	Connect the new pipeline to FLAGS	429 673.00	6 766 028.50
20" x 6	Connect the 20" intra-field pipeline to the new pipeline	437 753.44	6 784 572.82

4.4.5.1 Pipeline End Manifold (PLEM)

The two PLEMs provide the connections points for the tie-in spools from the new pipeline to the Statfjord B riser and the FLAGS pipeline respectively. Furthermore, the PLEM structures have been designed to carry out a number of functions like launching and receiving pigs in connection with pipeline de-watering, drying and product-filling.

The structures consist of two main units: a piping skid and a combined protection and foundation structure. The piping is mounted on a skid, so that the whole piping arrangement can be retrieved in the future. Due to limited lifting capacity on installation vessels, the two units can be installed separately. The foundation structure is integrated in the over-trawlable protection cover (15m x 15m x 5.5m) and the hatches in the protection cover can be opened for the removal or installation of the piping skid.

A non-return clapper safety valve is mounted in a retrievable vertical spool bridge, and protects the downstream systems in the event of an upstream system loss of containment. The retrieval and reinstallation of the valve in case of repair is a diver-less operation.

Using a standalone PLEM skid involves installing the structure near to the pipeline end and connecting the PLEM to the pipeline by a purpose-built spool. Several vessels will be required during the installation programme.

4.4.5.2 Hot Tap Tee-piece

The Hot Tap Tee piece will provide a connection point between the pipelines where no pre-installed tee or connection point is present. Figure 4-7 illustrates the piping and structural provisions for a Hot Tap Tee piece. The Hot Tap Tee pieces incorporate a protection cover that gives protection against dropped objects and trawling loads (Figure 4-8).

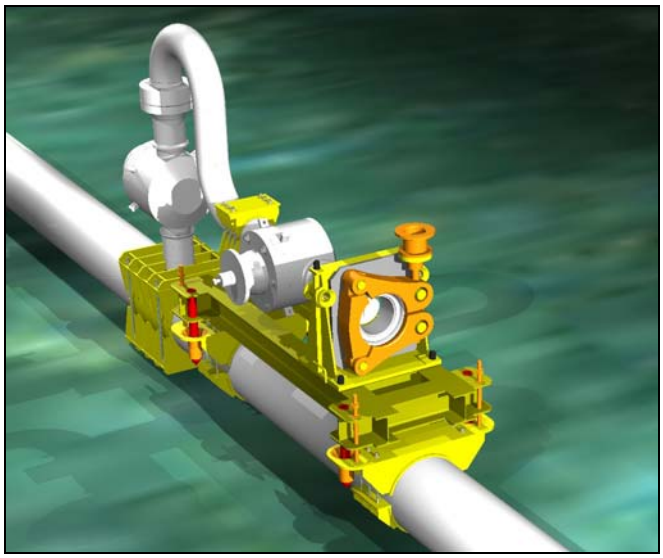

Figure 4-7: Piping and structural provisions of a Hot Tap Tee-piece

The hot tapping operation is usually performed with divers and diver-operated tools. The hot tapping operation and the installation of valves and piping are performed by divers, whereas the installation of the protection cover is a diver-less operation.

The diver-assisted hot tapping operation is proven technology, and regarded as a robust and safe installation method; a similar hot tapping operation was undertaken to connect the 16" Gullfaks loop pipeline to the 30" Gassled Area A pipeline to Kårstø in Norway. Hot tapping operations have been developed to minimise production shut-down and allow the production pipeline to remain pressurised.

For the manual welding operation, however, a hyperbaric chamber must be set up over the intervention point. Statoil are currently developing a diver-less method to perform the hot tap operation. If the method is technically proven by the time the hot tap operations on SFLL is scheduled, the new method will be implemented.

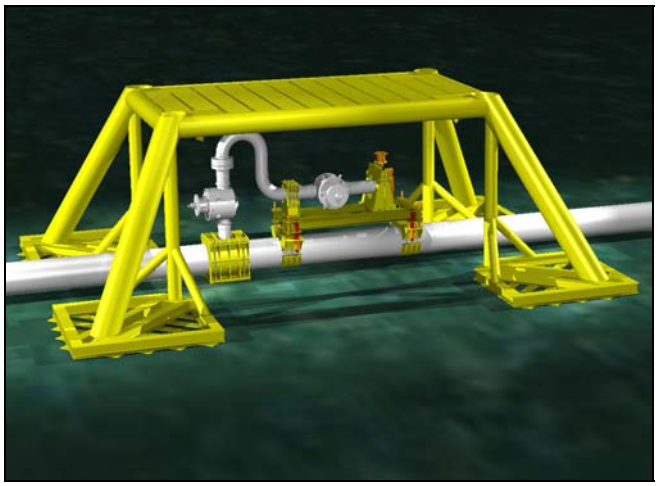

Figure 4-8: Hot Tap Tee Protection Cover

4.4.6 Leak Testing and Dewatering Operations

Flooding, gauging, and strength and integrity testing are routine stages of pipeline installation, performed using industry-standard techniques. These operations are necessary in order to:

- ensure that the internal dimensions of the installed pipeline conform to design;
- remove any small quantities of rust and mill-scale that may have remained on the internal walls of the pipeline after fabrication; and
- assure the integrity of the pipeline system by pressurizing the pipeline to a pressure high than the maximum operating pressure

During the process, it is necessary that the individual components of the pipeline system are flooded with seawater. During the flooding operation a gauging pig will be sent through the lines to check internal dimensions and remove internal debris (rust and mill scale), and integrity tests (hydrotests) will be carried out by pressurizing the the seawater within the pipelines to a predetermined test pressure which will be held for 24 hours. The PLEMS will have valves, pressure monitoring and control instrumentation and equipment for launching and receiving pigs. The Statfjord B platform will have the pumps and equipment for pressurizing and monitoring pressure in the pipeline system, and visual inspections of the tie-ins will be conducted by an ROV deployed from an installation vessel.

The pipeline system will be dewatered and dried before commissioning. During dewatering, seawater will be displaced by driving slugs of glycol through

the lines by means of a pig train (series of pigs). The dewatering train will itself be displaced by the use of hydrocarbon gas which will be introduced from Statfjord B, using the Gassled Area A pipeline as a constant pressure reservoir. The treated seawater line-fill and the glycol slugs will be discharged to the sea at the southern PLEM approximately 1,4 km south of the Brent A platform on the UK continental shelf.

During flooding, gauging, testing and dewatering operations, seawater will be used as the medium for filling the lines. As the seawater will be contained in the pipeline for more than one year, from August/September 2006 to October 2007, the seawater will need to be dosed with two types of proprietary chemical: an oxygen scavenger (e.g. sodium bisulphate at a concentration of <100 mg/l active ingredient) and a biocide (e.g. gluteraldehyde at <75 mg/l active ingredient). The use of these chemicals is necessary to:

- reduce the risk that pipeline corrosion will be initiated during a vulnerable period when the line is flooded with seawater; and
- protect downstream plant facilities from fouling by marine organisms that may grow inside the flooded pipeline.

In addition, the seawater to be used in leak testing of the tie-in connections of the Statfjord riser and tie-in spool, the inter-field tie-in spool and the FLAGS tie-in spool will be treated with a proprietary indicator dye (e.g. fluorescein at a concentration of 7.5 mg/l active ingredient) for visual indication of leaks.

Mono-ethylene (MEG) is to be used for de-watering in the main pipeline and the tie-in spools. There is an option to use tri-ethylene (TEG) for de-watering the SFLL spools and cross-overs at Brent, where there is the possibility of carry-over of residual quantities of the drying agent into the FLAGS pipeline. As there is a risk that MEG will not be compatible with the downstream processes at the Shell St Fergus Terminal, a more compatible dewatering chemical (TEG) may be required. The eco-toxicological properties of TEG are similar to MEG, differing mainly in solubility, TEG being less soluble in water. It should be noted that the overall volumes of de-watering chemical to be discharged from the SFLL spools and cross-overs at Brent (2-3m^3) are small in comparison to the main pipeline with an estimated volume of 100 m^3.

The quantities of chemicals to be used and discharged will be determined during the detailed design, and will be subject to a separate permit under the Offshore Chemical Regulations 2002 (Appendix 1). The Regulations require that operators use only approved chemicals, and support their permit application by providing detailed chemical information and environmental risk assessments for each chemical discharged.

As the testing regime remains to be finalized, provides generic information only, which reflects a best estimate of chemical usage and discharge. Proprietary versions of all of the generic chemicals in have been approved for use on the UK continental shelf. All of the planned discharges will be from point sources at or near the seabed, mainly at the PLEM at the FLAGS end of the pipeline, excluding the water from hydrotest depressurization (approx. 120 m^3) which will be discharged to the sea surface at Statfjord B. The discharges will be of variable duration, limited to approximately 12 hours. Section 7.5 provides information on the magnitude of the impacts that would arise as a result of these discharges.

Table 4-6 Proposed use and discharge of line-fill chemicals

Activity	Type of discharge	Location of discharge	Quantity (m^3)		Timing
			22"	32"	
Pipeline flood, clean and gauge	air	Subsea: Statfjord B or Brent	5,000	10,000	late summer
	treated seawater	Subsea: Statfjord B or Brent	200 + 200 contingency	400 + 400 contingency	late summer
System hydrotest	treated seawater	Sea surface: Statfjord B	60 + 60 contingency	120 + 120 contingency	late summer
Pipeline dewater and gas fill	treated seawater	Subsea: Brent	5,000	10,000	late summer
	glycol	Subsea: Brent	50 + 50 contingency	100 + 100 contingency	late summer
	hydrocarbon gas	Subsea: Brent	500 + 10,000 contingency	1000 + 20,000 contingency	late summer
Dewater Statfjord B riser and tie-in spool	treated seawater	Subsea: Statfjord B	50	100	late summer
	treated seawater with dye	Subsea: Statfjord B	10	20	late summer
	glycol	Subsea: Statfjord B	2	4	late summer
	nitrogen	Topside: Statfjord B	2,000	4,000	late summer
Dewater inter-field tie-in spool	treated seawater with dye	Subsea: Statfjord B	10	10	late summer
	glycol	Subsea: Statfjord B	10	10	late summer
Dewater FLAGS tie-in spool	treated seawater with dye	Subsea: Brent	6	6	late summer
	glycol	Subsea: Brent	3	3	late summer

Treated seawater:
oxygen scavenger, sodium bisulphite (<100mg/l active ingredient)
biocide, gluteraldehyde (<75mg/l active ingredient
Treated seawater with dye:
as per treated seawater with the addition of Fluoroscein (7.5mg/l active ingredient)
De-watering chemical:
Mono-ethylene glycol (MEG) (small quantities of tri-ethylene glycol(TEG) may be required at tie-in spools)

4.4.7 Emissions during Pipeline Installation

4.4.7.1 Sources of Emissions

The sources of atmospheric emissions that may arise during pipeline installation are given in Table 4-7.

Table 4-7: Sources of potential atmospheric emissions

Source of Emission	Type of Equipment	Gases Released
Combustion	Diesel engines Emergency generators Heaters	CO_2, CO, NO_x, N_2O, SO_2, CH_4, VOC
Refrigeration	Refrigeration units	HCFCs
Storage and Handling of dry chemicals	Bulk Storage Tanks Sack Room	Chemical dusts

Refrigerants would only be released if accidental leakage occurred from refrigeration units.

4.4.7.2 Vessel Emissions

The gaseous emissions from the vessel spread during pipeline installation operations can be evaluated on the basis of fuel consumption estimates, energy ratings and the duration of different phases of the operation. The estimated gaseous emissions are shown in Table 4-8.

Table 4-8: Estimated gaseous emissions from vessels during the installation of the pipeline and subsea structures

Activity	Duration	Fuel cons	Fuel cons	Emissions		
	Days	t/day	tonnes	CO_2	NO_x	SO_2
Mob/demob	10	8	80	253.60	4.72	0.96
Pipelay barge	14	15	210	665.70	12.39	2.52
Mob/demob	4	8	32	101.44	1.89	0.38
Reel lay vessel	10	15	150	475.50	8.85	1.80
Mob/demob	5	8	40	126.80	2.36	0.48
Survey vessel (all operations)	34	15	510	1,616.70	30.09	6.12
Mob/demob	10	22	220	697.40	12.98	2.64
MSV (PLEM)	42	18	756	2,396.52	44.60	9.07
Mob/demob	10	22	88	278.96	5.19	1.06
DSV (spool & tie-ins)	30	18	540	1,711.80	31.86	6.48
Mob/demob	10	10	100	317.00	5.90	1.20
Anchor handling vessel	14	5	70	221.90	4.13	0.84
Mob/demob	10	10	100	317.00	5.90	1.20
Anchor handling vessel/pipe hauling carrier	14	5	70	221.90	4.13	0.84
Mob/demob	10	10	100	317.00	5.90	1.20
Anchor handling vessel/pipe hauling carrier	14	5	70	221.90	4.13	0.84
Mob/demob	5	8	40	126.80	2.36	0.48
Rock-dumping vessel	40	15	600	1,902.00	35.40	7.20
Mob/demob	5	8	40	126.80	2.36	0.48
Guard vessel	87	4	348	1,902.00	35.40	7.20
ESTIMATED TOTAL EMISSIONS DURING INSTALLATION				13,998.72	260.54	52.99
TOTAL EMISSIONS FOR UKCS OFFSHORE EXPLORATION AND PRODUCTION ACTIVITIES (2001)				19,323,500	52,270	6,290
% OF TOTAL EMISSIONS DURING PIPELINE INSTALLATION COMPARED TO UKCS OFFSHORE EXPLORATION AND PRODUCTION ACTIVITIES (2001)				0.07%	0.50%	0.84%

Source: Institute of Petroleum, 2000; Learn IT Summary Reports 2001, 2002

4.4.7.3 Noise Emissions

In general terms, sound can be characterised with reference to two features, the frequency at which it is emitted (measured in hertz (Hz)) and its strength or intensity (measured in decibels (dB)). Noise levels in the marine environment are attenuated by distance (dispersion in three dimensions), and by absorption by the water. The degree of absorption is roughly in proportion to the square of the frequency.

During the programme to install the new pipeline, the main sources of sound in the marine environment will be the various vessels in the vessel "spread" offshore. The spread may include a DP or anchor operated pipelay vessel, a reel-barge, anchor-handling tugs, a survey vessel, a DSV and support vessels. The underwater noise level from a pipelay vessel or a supply/support vessel is typically within the range 150-180 dB close by the source.

The noise levels that might be received by marine mammals and fish in the water column adjacent to the operations can be calculated using formulae presented in Richardson *et al*., 1995, and Erbe and Farmer (2000).

A noise level above a threshold level of 120dB (which is regarded as significant in relation to the behaviour of marine mammals) would only be experienced within approximately 1km of the pipeline operations /11/.

4.5 The Operational Phase

4.5.1 Pipeline Maintenance

No further planned hydrostatic testing of the pipeline is scheduled during the operational phase. Annual inspections of the pipeline routes will be carried out. The design life of the system exceeds expected field life , therefore no maintenance is planned other than routine inspections such as checking for lack of cover, free spans and evidence of interaction with fishing. Any potential problems such as upheaval buckling and anchor snags will be avoided by correct design of subsea structures, and careful installation.

The pipeline will be designed to accommodate 'intelligent pigging', whereby a remote sensing 'pig' will be sent through the pipeline to undertake checks on pipeline integrity and condition.

4.5.2 Chemicals

There are no discharges of hydraulic fluids or other chemicals to sea involved with the operational phase of the new gas export pipeline Tampen Link.

4.6 Project Timetable

Major project milestones are shown in Table 4-9.

Table 4-9 Major project milestones

Aktivity/ Milestone	Date/period
Provisional Project Sanction	10th March 2004
Pipeline route survey	April 2004
Project Sanction	25th February 2005
Authority approcal PDO/PIO	1st. July 2005
Drilling	2006-2011
Pipeline installation window option 1	August-September. 2006
Pipeline installation window option 2	April 2007
Tie ins and pipeline commissioning	April-October.2007
Production start modification Phase 1	1st. October 2007
Production start modification Phase 2	1st. October 2009
Decommissioning, plugging and abandonment	2019-2025

4.7 Decommissioning

Following the completion of the SFLL project, production at the Statfjord Field is expected to continue until 2018. At least 2 years prior to cessation of production, a cessation plan detailing proposed methods for the decommissioning of seabed installations and pipelines will be prepared. Decommissioning of the facilities will be carried out in accordance with the requirements of relevant authorities in UK and Norway and international guidelines in force at the end of field life.

5 Description of Environmental Setting

5.1 Introduction

In order to assess the potential environmental impacts of the pipeline development associated with the Statfjord Late Life (SFLL) project, a description of the existing environment, and an assessment of the key sensitive components of the offshore environment (environmental sensitivities) is given below. This assessment is prepared with reference to existing scientific and technical publications. No new compilation of environmental data has been conducted for this project specifically.

The description covers the following items:

- General description of the physical, chemical and biological environment within the area of influence.
- Description of fishing activities and other user interests linked to the relevant sea area.
- Particular focus on the identification and discussion of the effects of the project activities on the environment and the surroundings, which can give rise to significant environmental impacts or conflicts with other user interests in the area.

The Department of Trade and Industry (DTI) has taken a policy decision that Strategic Environmental Assessments (SEAs) will be undertaken prior to future wide scale licensing of the UKCS for oil and gas exploration and production. To date since 2000, four SEAs have been prepared in the UKCS. The Strategic Environmental Assessment of the Mature Areas of the Offshore North Sea (SEA2) coincides with the proposed pipeline area, and where applicable has been used to provide a regional perspective.

5.2 Meteorology

The North Sea is situated in temperate latitudes with a climate that is strongly influenced by an inflow of oceanic water from the Atlantic Ocean, and by the large-scale westerly air circulation which frequently contains low pressure systems (OSPAR, 2000). The extent of this influence is variable over time, and the winter North Atlantic Oscillation (NAO) Index (a pressure gradient between Iceland and the Azores) governs the strength and persistence of westerly winds. The North Sea climate is characterised by large variations in wind direction and speed, significant cloud cover, and relatively high precipitation /42/.

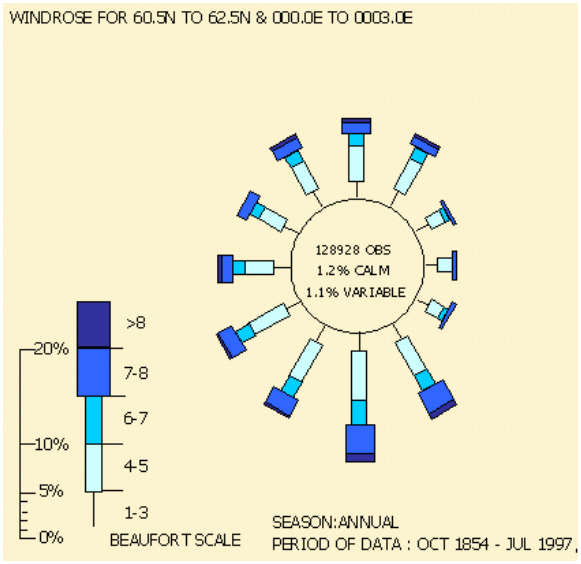

Figure 5-1: Annual windrose for the proposed pipeline development area

Figure 5-1 shows annual wind speed, frequency and direction in the area of the proposed pipeline. Winds in this region of the North Sea are most frequently from south to south-westerly directions (Meteorological Office, 2000). Winds greater than Force 7 (28m/s) occur most frequently during the winter months (September to March), and may occur from any direction. Wind speeds during the summer months (May to August) are generally much lower, with dominant wind speeds ranging between Force 4 and Force 6 (5 to 14m/s) /36/.

SENSITIVITY: The pipeline and operations to install it will have no implications for meteorology.

5.3 Oceanography

5.3.1 Seabed Topography

Seabed topography is important in relation to the circulation and vertical mixing of water masses. The rectangular basin of the North Sea is shallow (30-200m), with a shelving topography north to south and a deep trough (ca. 700m depth), the Norwegian Trench, on its northeast margin /40/

A survey of the seabed along the route of the proposed pipeline showed that it is virtually flat, with depth differences of only 7m between the northern (146m deep) and southern (139m deep) ends of the route (Figure 5-3). Slopes remained at less than 0.2° along the pipeline route /52/.

SENSITIVITY: The pipeline and operations to install it will have no implications for gross seabed topography.

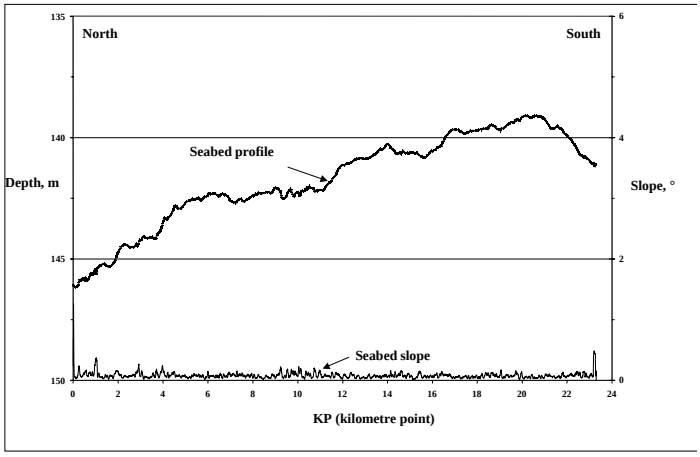

Figure 5-2: Seabed profile for the proposed pipeline route between Statfjord B and the tie-in south of Brent A

5.3.2 Sediment Characteristics

The characteristics of the local seabed sediments and the amount of regional sediment transport are important in determining the potential effects of pipeline installation on the area. The distribution of seabed sediments within this region of the North Sea results from a combination of hydrographic conditions, bathymetry and sediment supply.

An ROV-based bathymetric survey (corridor width 200m) was carried out along the proposed 23.2km pipeline route from the PLEM close to Statfjord B to the tie-in south of Brent A /52/. The survey was carried out from the *"Seaway Petrel"* and performed utilising the ROV (Remotely Operated Vehicle) *SOLO2* equipped with survey sensors /52/.

Results of the survey indicated that fine to medium sand cover the area. This is inter-mixed with varying quantities of coarser material, generally in the size range of pebbles to cobbles, but boulders are also commonplace. Shell fragments are present in varying quantities. At the southern end of the proposed pipeline route irregularly distributed patches of coarser sediments (boulders on gravelly coarse sand) are more common than further north /52//.

Seismic sections showed that the sub-seabed geology of the area is characterized by stiff or very stiff clay /52/

Pockmarks, i.e. shallow, ovoid, sea-bed depressions or other major features on the seabed (e.g. ship wrecks) were not identified in the seabed survey of the pipeline route /52/.

SENSITIVITY: The pipeline will be installed to avoid the presence of boulders and will have no impact on the sediments other than the area directly covered by the subsea structures.

5.3.3 Water Masses

Several water mass classifications exist for the North Sea, based on temperature and salinity distributions or on residual current patterns or stratification /40/. The circulation and distribution of these water masses are important in supporting the biological productivity, and the transportation and concentration of plankton and fish larvae, as well as the distribution and circulation of potential contaminants.

Most of the inflows to the North Sea converge in the Skagerrak. The major flow consists of Atlantic water that follows the 200m depth contour to the north of the Shetland Islands, before passing southwards along the western edge of the Norwegian Trench. Some of this water may pass southwards into the northern North Sea close to the eastern border of the Shetland Islands. A smaller flow, the Fair Isle Current, follows the 100m depth contour, entering the North Sea between the Shetland and Orkney Islands. This flow is a mixture

of coastal and Atlantic water that crosses the northern North Sea along the 100m contour in a narrow band known as the Dooley Current, before entering the Skagerrak.

The Norwegian Coastal Current constitutes the only outflow from the North Sea, which balances the various inputs of water to the North Sea. Circulation in the North Sea is enhanced by south-westerly winds, thus circulation is normally stronger in winter than in summer.

SENSITIVITY: The pipeline and operations to install it will have no implications on the major flow of water in the North Sea.

5.3.4 Currents

Maximum surface tidal streams vary from 0.25 to 0.5m/s over most of the northern North Sea, and are in excess of 1.0m/s on the Orkney-Shetland Platform /34/. Information for the Brent facilities indicate that average tidal currents in this region range from 0.10m/s (neap tides) to 0.20 m/s (spring tides), with the major directional axis in a north-south direction.

SENSITIVITY: The pipeline and operations to install it will have no implications on northern North Sea currents.

5.3.5 Temperature and Salinity

Most areas of the North Sea are vertically well-mixed in the winter months. During spring, as solar heat input increases, a thermocline (a pronounced vertical temperature gradient) develops, which separates the upper and lower layers of the water column. Thermal expansion of the upper layers of water reduces its density, and self-stabilising stratification develops. The depth at which the thermocline forms is typically 50m in the northern North Sea. Seasonal surface cooling in autumn, as well as the increased number and severity of storms, promotes vertical mixing of the water column and subsequently destroys the thermocline.

Data from a study of the area suggests that minimum and maximum seabed temperatures are 3.5^{o}C and 11^{o}C, respectively /1/. In the open waters of the North Sea, seasonal changes in sea surface salinity are comparatively small /42/. Data for the area suggests that values range from 35 to 35.3ppt all depths /1/.

SENSITIVITY: The pipeline and operations to install it will have no implications on temperature or salinity values.

5.4 Biological Resources

The operations associated with pipeline installation may impact on the seabed and associated flora and fauna, including plankton, fish stocks, seabirds and mammals that occupy or migrate through the area associated with the development. An outline of susceptible flora and fauna, and their vulnerability to environmental conditions, is given below.

5.4.1 Plankton

The planktonic community is composed of a range of plants (phytoplankton) and animals (zooplankton) that drift freely on the ocean currents, and together form the basis of the marine food chain. Planktonic organisms, primarily copepods, constitute a major food resource for many commercial fish species, such as cod and herring /12/, and any changes in their populations are of considerable importance.

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. In the northern North Sea, the dinoflagellate genus *Ceratium* dominates the phytoplankton community. Plankton in the North Atlantic and North Sea has been monitored using the Continuous Plankton Recorder (CPR) over the last 70 years, and the results of this programme have shown an increase in dinoflagellates, with a gradual decrease in diatom species. The zooplankton communities of the northern and southern North Sea regions are broadly similar. The most abundant group is the copepods, and these are dominated by *Calanus* spp.

The larger zooplankton (or megaplankton) includes the euphausiids (krill), thaliacea (salps and doloids), siphonophores and medusae (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 /14/.

Changes in nutrient inputs affect the size structure of phytoplankton populations, which in turn affects the energy fluxes in the ecosystem and the subsequent transfer to species higher up the food chain /40/. Most phytoplankton species have short maximum doubling times, and when light and nutrient conditions are favourable, 'blooms' of these organisms can develop. In the North Sea, a 'bloom' of phytoplankton occurs every spring, often followed by a smaller 'bloom' in the autumn. Essentially, these spring and autumn 'blooms' are normal events. Under certain conditions, however, blooms can occur at other times of year. The concentrations of organisms in these 'blooms' can be very high, and may involve nuisance or noxious species. These 'Harmful Algal Blooms' (HAB) can have detrimental effects, such as deoxygenation, foam formation, fish and marine mammal mortality and a change to the ecosystem /15/.

It is sometimes difficult to differentiate anthropogenic impacts on the marine environment from the background 'noise' caused by hydro-climatic variations /15/; the effects of small-scale events such as petro-chemical spills, for example, are difficult to quantify.

SENSITIVITY: The planktonic community is potentially sensitive to chemical releases into the sea. The planktonic community in the vicinity of the proposed pipeline is typical of the area and has the capacity to recover quickly because there is a continual exchange of individuals with surrounding waters. Any impacts from offshore oil and gas operations are likely to be small in comparison with the natural variations.

5.4.2 Benthic Communities

Seabed sediments are utilised 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; the major influence for epifauna appears to be depth, whereas sediment characteristics are more important for infauna /8/. Other important factors include the influence of different water masses and the food supply to the benthos /9/. 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.

In terms of spatial coverage, the most comprehensive survey of the central North Sea was that of Eleftheriou and Basford /22/, who sampled 97 stations for infauna and identified four major groupings of stations. In offshore areas relevant to the pipeline activities, coarser, sandy sediments (sub-group 3) was characterised by *Thyasira* spp. and *Prionospio multibranchiata* and the polychaete *Spiophanes bombyx*.. Deeper, siltier parts (sub-group 4) was characterised by *Lumbrineris gracilis*, *Ceratocephale loveni* and *Eriopisa elongate*.

Much of the survey work in different parts of the North Sea has been carried out using different methods and techniques and, as a consequence, the results are not comparable. However, Eleftheriou and Basford's /22/ results were included in a synoptic survey of the North Sea conducted under the auspices of ICES in 1986, which used standard techniques and equipment. The infaunal results were published by Künitzer *et al.* /35/ including a classification analysis of all North Sea stations. This survey identified that species distributions and assemblages were influenced by temperature, sediment type and different water masses, and the food supply to the benthos. Kunitzer *et al.* /35/ classified the infauna of the deeper (>100m) northern North Sea into two groups according to sediment type, with the indicator species on finer sediments being the polychaetes *Minuspio cirrifera, Aricidea catherinae* and *Exogene verugera*, and the bivalve *Thyasira* spp., and on the coarser sediments the polychaetes *Ophelia borealis, Exogone hebes, Spiophanes bombyx* and *Polycirrus* spp.

Data from benthic surveys around the Brent facilities indicate that characteristic infaunal species associated with this region of the North Sea include the polychaete *Owenia fusiformis* (tube worm), *Thyasira* spp (bivalve mollusc) and *Myriochele* spp /60/.

The epifauna of the region associated with the proposed pipeline were characterised by the hermit crab *Pagurus bernharus*, the crustacean *Crangon allmani*, the purple heart urchin *Spatangus purpureus* and the mollusc *Colus gracilis*.

A regional environmental study of Region IV in the North Sea commissioned by Statoil and Norsk Hydro included a macrofaunal assessment of the Statfjord ABC field /4/. In general, there were large variations in the number of individuals (293-3955 individuals per station), taxa (35-110) and diversity (H' 2.1-5.8) over the Statfjord field. The closest sampling station to the Brent field is 1000m from the Statfjord B platform, in water depths of 143m. In 2002, the benthic community at this station was undisturbed, indicated by a Shannon-Wiener diversity index value of 5.6 (94 taxa, 355 individuals). This represents a community with a low dominance and a broad range of taxa from several major groups (polychaetes, echinoderms, crustaceans); taxa known to represent disturbed conditions are absent or occur in very small numbers. The numerically dominant species at this station included the polychaetes *Owenia fusiformis* (juvenile), *Ophiuroidea indet*. (juvenile), *Sphiophanes kroyeri, Pista bansei* and *Amythasides macroglossus.* Other numerous species included the echinoderm *Ophiuroidea indet*. (juvenile) and *Phoronis* sp. (phylum Phorondia).

Areas with slightly (0.72 km^2) and distinctly disturbed faunal groups (0.32 km^2) were identified at Statfjord ABC; these groups were dominated by the polychaetes *Chaetozone* sp. and *Cirratulus incertus,* and the bivalve *Thyasira sarsi*. Such species are known to increase in number with increasing contamination/organic enrichment in the sediment. Slightly disturbed stations had higher individual numbers of *Chaetozone* sp. and *C. incertus* than stations with undisturbed fauna, but taxa which are characteristic for undisturbed sediment were also well represented.

SENSITIVITY: Benthic infaunal communities are vulnerable to physical and chemical disturbances to the sediment. Such disturbances will occur as a result of the project implementation but are limited to a very small area.
The impact on benthic fauna from operations to install the pipeline are discussed further in **Section 7.**

5.4.3 Marine Mammals

Marine mammals include cetaceans such as whales, dolphins and porpoises, seals (pinnipeds) and otters, all of which are susceptible to disturbance and contamination from offshore oil and gas activities. Otters are not further discussed in this document as they will never be present inside the area of influence of the prosject.

About 16 of the 80 known species of cetacean (whales, dolphins and porpoises) are known to occur in UK waters /46/. These include the large baleen whales, notably fin, sei and minke whales, but also blue and humpback whales. The largest toothed whale, the sperm whale, also occurs around Britain, although only adult males have been seen /46/. Medium-sized whales are represented by the pilot and killer whales. Small species include Risso's dolphin, white-sided, white-beaked, common and striped dolphin, as well as the common porpoise and bottlenosed dolphin.

The abundance and availability of fish is of prime importance in determining the reproductive success or failure of marine mammals in the North Sea, as elsewhere. Population changes can be expected as a result of changes in the availability of principal forage fish /16/.

5.4.3.1 Cetacean Abundance and Distribution

The most common cetaceans in the North Sea are the harbour porpoise, bottlenose dolphin, white-beaked dolphin, Atlantic white-sided dolphin, killer whale and minke whale /16/. Harbour porpoise are the most commonly-recorded cetacean in this area; sightings occur throughout the year, but numbers are greatest in July /59/. Few other species of cetaceans have been sighted along the route of the proposed pipeline, but killer whale (low to very high numbers), minke whale (low numbers), white beaked dolphin (low to moderate numbers), white sided dolphin (low to high numbers) and Risso's dolphin (low numbers) have been sighted in adjacent quadrants /59/. As a result of the low numbers of cetaceans recorded in the vicinity, it is unlikely that operations to lay the pipeline would have a significant impact on local populations.

5.4.3.2 Pinniped Abundance and Distribution

Two species of seal are resident in UK waters, the common or harbour seal, and grey seal. Grey seals frequent the more exposed coasts, particularly around the Scottish islands and the Norwegian west coast, whereas common seals are typically found in

sheltered sea lochs and sandy estuaries. The Sea Mammal Research Unit /46/ estimated in 2000 that 120,000 grey seals populated British waters, just less than half of the world's population. The UK holds approximately 5% of the world population of common seals, and about 50% of the EC population /30/.

Approximately 40% of the world's population of grey seals breed at UK sites and the largest breeding colonies have been designated as candidate SACs. Studies have found that although grey seals forage widely, most feeding activity takes place within 50km of haul out sites. Common seal movements are strongly influenced by local food availability, with most movements considered 'local' compared with grey seals.

As a result of their foraging behaviour, and because of the distance of the proposed pipeline route from the nearest coastline, it is unlikely that either grey or common seals would be found in the area.

SENSITIVITY: 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 /16/. 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 /14/.
The impact of operations to install the pipeline on marine mammals is discussed further in **Section 7**.

5.4.4 Seabirds

Internationally important numbers of seabirds breed on the coastal margin of the North Sea, and rely on the offshore North Sea for their food supply and habitat. The offshore population of breeding seabirds has been estimated at 1.3 million pairs by Evans /25/, while Tasker *et al*. /54/ estimated the total breeding population to slightly more than 2 million pairs. Although some of these birds will range into Atlantic waters outside the breeding season, many are reliant on the North Sea at all seasons of the year.

The JNCC /31/ has derived an Offshore Vulnerability Index (OVI) to assess the vulnerability of bird species to surface pollution. In general, offshore areas contain peak numbers of seabirds following the breeding season and through winter; offshore populations are smaller in spring and early summer when birds forage closer to coastal breeding colonies. Seabird vulnerability in this area is rated as "low" to "moderate" throughout the year, and "high" in July, October and November (Figure 5-3) /31/. These vulnerabilities are related to the position of the proposed development area in relation to the Northern Isles (particularly Shetland), which are of significant importance for large numbers of birds during the breeding season. Many species returning to and departing from their breeding colonies in the Northern Isles during the year pass through this region. Vulnerability is highest in the post-breeding season (July), when many birds disperse out to sea from their coastal colonies and nearby waters. Seabirds feeding or resting on the sea surface are most vulnerable to water-borne pollution. Therefore, auks (e.g. guillemot, razorbill and puffin) are most vulnerable in the post-breeding season (July–August) when they become flightless during periods of moult, and thus spend large amounts of time on the water surface.

The fulmar is one of the species recorded in the highest numbers offshore throughout the UKCS, as well as being most widespread /59/, /32/, /14/. The fulmar is found throughout the year and is the most abundant species in this region of the North Sea; lower densities of other birds such as gannet, kittiwake and skuas are found in this area (Table 5-3). The aerial habits of fulmar and gulls, together with their large populations and widespread distribution, however, reduce their vulnerability to oil-related pollution.

Table 5-1: **Seabird species in the vicinity of the Statfjord and Brent Fields in the northern North Sea**

Seabird species
Guillemots and razorbills Variable densities throughout the year, highest numbers in July.
Fulmar Permanent presence of this species throughout the year in this area. Highest densities in this area occur from April to July and again in September, October and December.
Gannet Low to moderate densities mainly from March to August.
Great skua Widespread from May to September, but in low to moderate densities..
Kittiwakes Present in low to moderate densities throughout the year; higher densities in this area from January to April

Note: Seabird densities: low: 0.01-0.99 birds/km, moderate: 1.0-4.99 birds/km, high: 5.0-9.99 birds/km, very high: >10.0 birds/km (UKDMAP, 1998 /59/).
Source: Skov *et al.*, 1995 /45/; Stone *et al.*, 1995 /53/; UKDMAP, 1998 /59/; JNCC, 1999 /31/.

SENSITIVITY: 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 a large amount of time on the water surface. Seabird vulnerability to surface oil pollution in this area is rated as "low" to "moderate" throughout the year, and "high" in July, October and November.

The impact of the proposed pipeline on fishing is discussed further in **Section 7.**

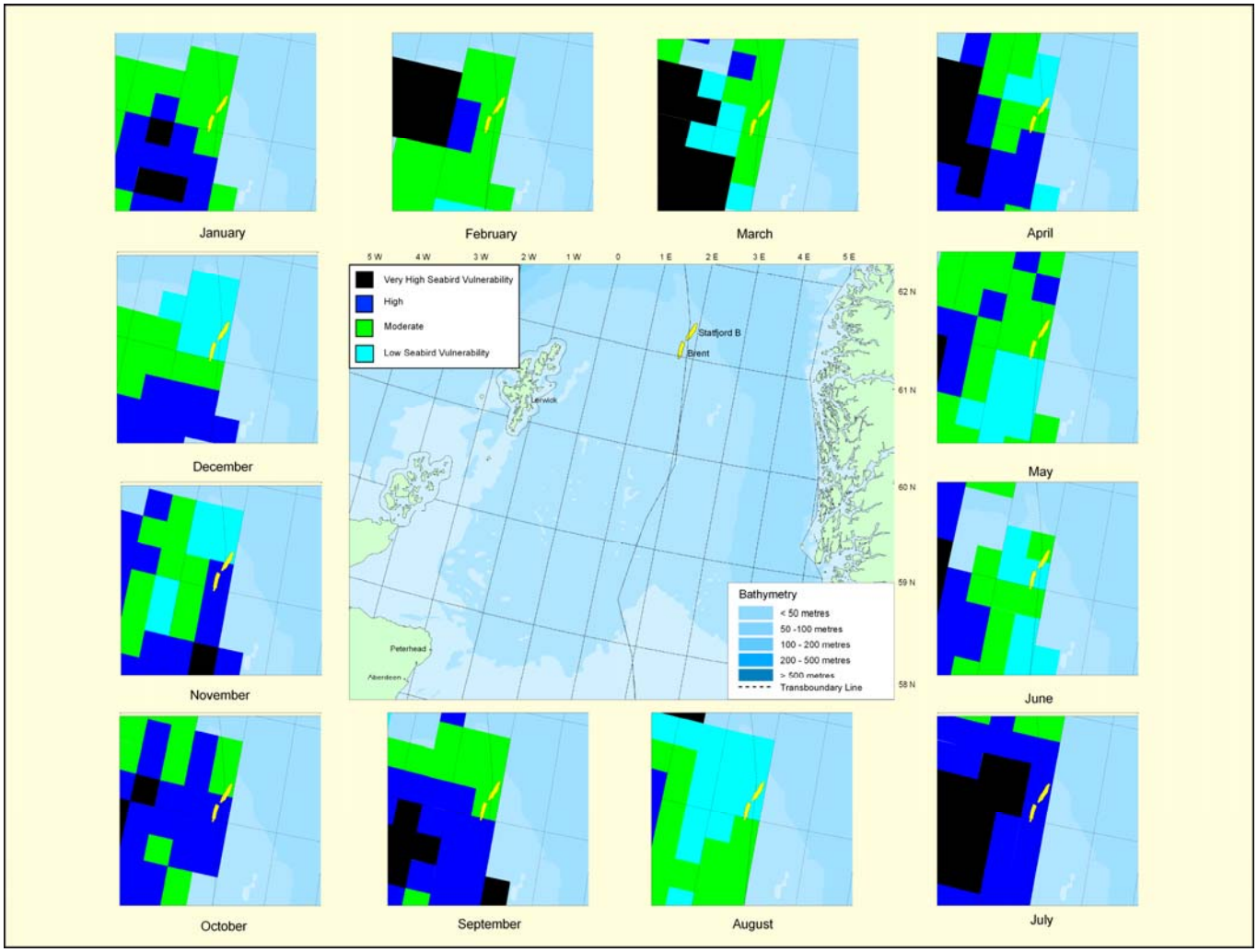

Figure 5-3: Seabird distribution in the vicinity of the Statfjord and Brent Fields in the northern North Sea

5.4.5 Fish Populations

A total of 224 species of fish have been recorded in the North Sea; most are common species typical of shelf seas, although deepwater species are found along the northern shelf edge and in the deepwater channel of the Norwegian Trench and the Skagerrak. It is estimated that fewer than 20 species constitute over 95% of the total fish biomass. North Sea fish can be broadly classified into pelagic species, those that live in mid-water, and demersal species, those that live on or close to the seabed. Shellfish species comprise demersal (bottom-dwelling) groups including molluscs, crustaceans such as shrimps, crabs, *Nephrops norvegicus* (Norway lobster), mussels and scallops.

Although the North Sea constitutes an important fishing ground, several key species have declined to critical levels. Cod stocks were confirmed to be on the verge of collapse in 2000, and other major fisheries for haddock and plaice are now are considered to be outside 'safe biological limits' and are reliant on single good breeding years and young fish /64/.

The spawning grounds of fish that release their eggs into the water column are widely distributed over the North Sea. Fish that lay their eggs on the sediment (e.g. herring and sandeels) use spawning grounds that are more localised /40/ and are, therefore, vulnerable to offshore activities. Ecologically sensitive fish (e.g. sandeels, herring and *Nephrops*) and those which live in intimate contact with the sediments (e.g. sandeels and most shellfish) are also vulnerable to potential seabed disturbance from the activities associated with pipeline installation.

Spawning and Nursery Areas

Spawning areas and nursery grounds are dynamic features of fish life history and are rarely fixed in one location from year to year /14/. The proposed route for the pipeline coincides with the spawning grounds for cod (January to April), haddock (February to May), saithe (January to April) and Norway pout (January to April) (Figure 5-4).

Cod spawn all over the North Sea, although the northern North Sea constitutes an important area for spawning activity. Cod are pelagic spawners, and distribute their larvae in the upper 30m of the water column. After 3-5 months the young move down to the bottom. Peak spawning for cod occurs in February and March. Haddock are generally regarded as benthic fish, but they can also be found in midwater. Peak spawning activity for haddock occurs between mid-March and early April /17/, with the main spawning area between the Shetland Islands and the Norwegian Deep, and south towards the Fladen Ground (Knijn *et al*., 1993). Haddock eggs and larvae are pelagic for the first seven months and remain within surface waters to a depth of 40m, after which they enter a bottom-dwelling (demersal) phase. The main spawning areas for saithe are east of the Shetland Islands and along the edge of the Norwegian Deep /17/ between January and April.

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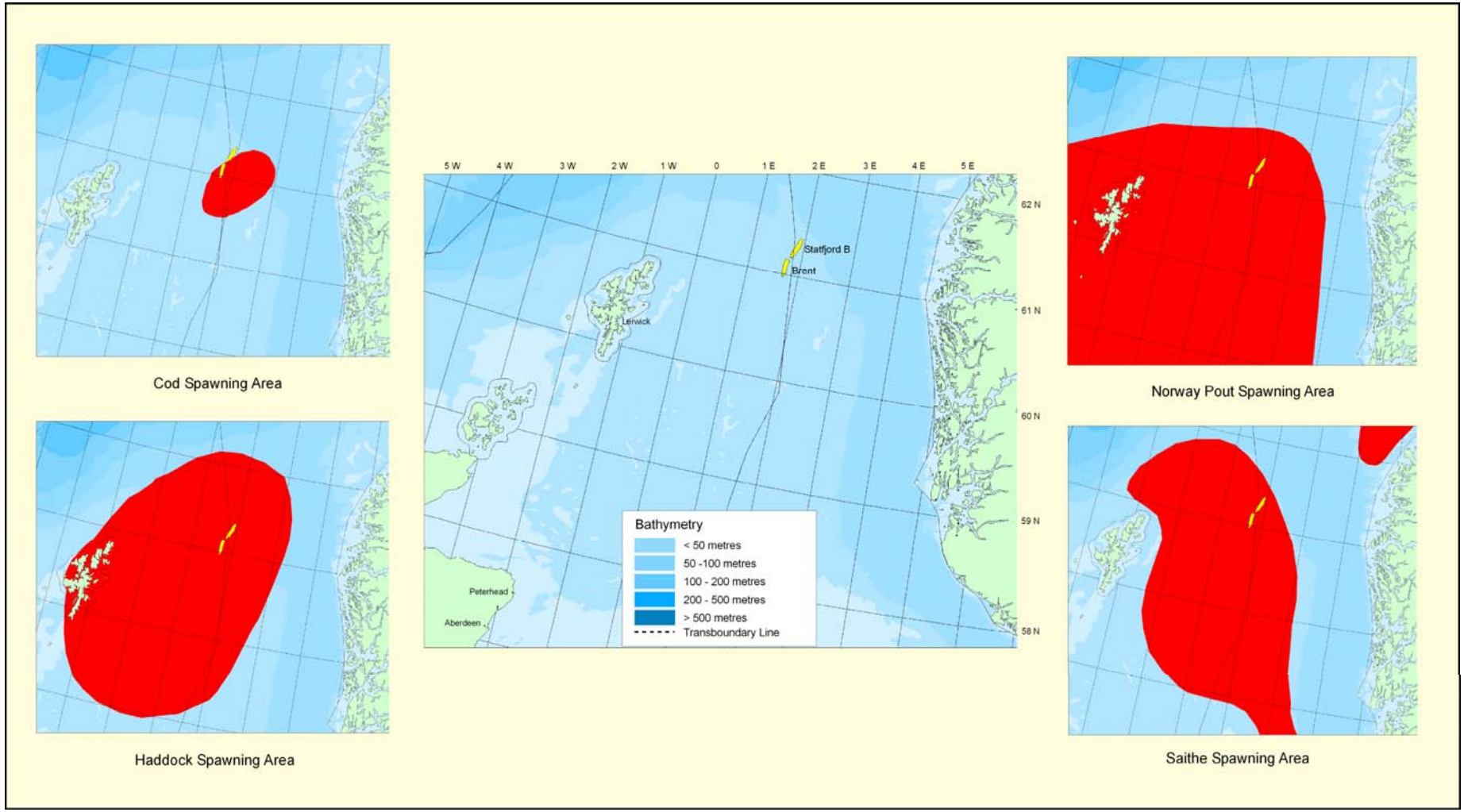


Figure 5-4: Fishing spawning sites in the vicinity of the Statfjord and Brent Fields in the northern North Sea

After a short pelagic phase, the young fish migrate into inshore and coastal nursery areas for 3 or 4 years before migrating to deeper water The Norway pout is a benthic predator with peak spawning occurring during February and March. They are not considered to have specific nursery grounds, but may remain close to spawning grounds in the northern North Sea. Norway pout are not suitable for human consumption due to their small size, but they are important in the fisheries for industrial production of fish meal and fish oil, and are also important as a source of prey for haddock, whiting, cod and hake /37/.

Nursery areas for mackerel, haddock, Norway pout and blue whiting occur within the proposed route of the pipeline Figure 5-5.

The proposed pipeline does not coincide with recognised spawning or nursery grounds for shellfish species such as *Nephrops*.

The consequences of oil and gas activities for fish populations are largely related to discharges to sea and the possibility of acute oil spill accidents from exploration and production operations. In addition impacts could arise from seismic survey activity and seabed interventions /14/.

SENSITIVITY: Juvenile fish, in particular ecologically sensitive demersal spawning species such as sandeels, herring and Nephrops, are vulnerable to any physical disturbance of their spawning and nursery grounds that may be caused by operations to install the pipeline. The proposed route for the pipeline 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. However, this region of the North Sea constitutes an important area for cod spawning activity.

The impact of operations to install the pipeline on fish spawning grounds are discussed further in **Section 7.**

5.4.6 Commercial Fisheries

The Fisheries Sensitivity Maps produced by the Fisheries Agencies and UKOOA /13/ include maps of the relative value of fishing resources in each ICES square to give an indication of overall commercial sensitivity. The north east Shetland Basin, which coincides with the proposed pipeline development, is of "moderate" commercial fishing value, in comparison to other areas of the North Sea /13/. According to FRS fisheries statistics /26/, the area is targeted for both pelagic and demersal species of fish, including mackerel, herring, haddock, cod, whiting and saithe.

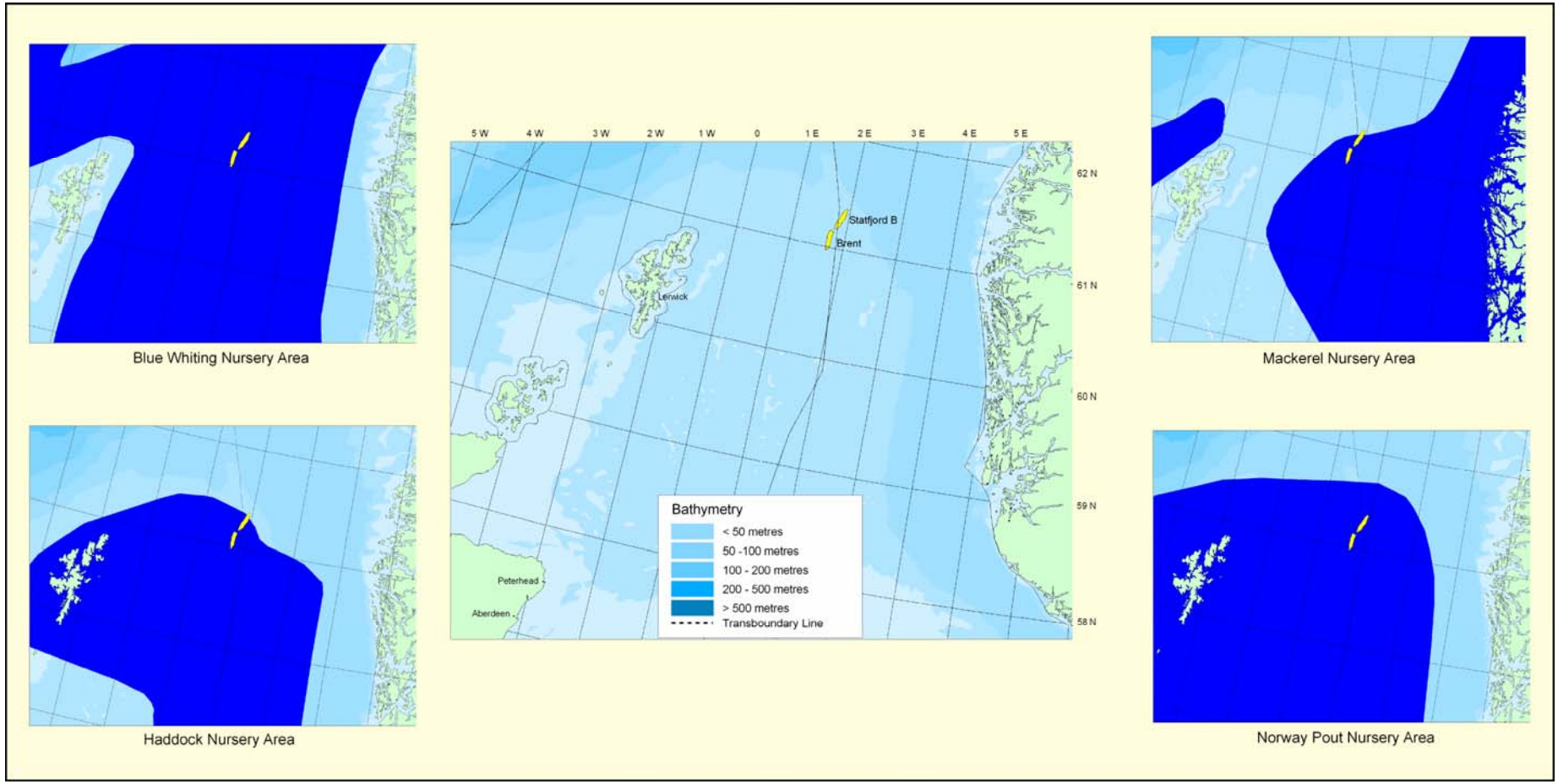


Figure 5-5: Fish nursery grounds in the vicinity of the Statfjord and Brent Fields in the northern North Sea

Figure 5-6 illustrates the total number of hours spent fishing (fishing effort) between 1999 and 2003 by UK vessels landing in Scotland from ICES rectangle 51F1 /26/. In the years 1999 to 2003, the total annual fishing efforts for UK-registered vessels landing in Scotland from ICES rectangle 51F1 were 2,806, 4,203, 3,458, 15,240 and 12,200 hours, respectively (Figure 5-6) /26/. In 2003, demersal trawling (twin/multiple rigged and pair) were the dominant fishing methods in ICES rectangle 51F1, followed by pelagic otter trawl and then seine net (Table 5-2).

Fishing occurs throughout the year in this area, but fishing effort tends to be lower in December and January than in other months. The overall UK fishing effort in this area is moderate in comparison to other ICES rectangles in the North Sea, where average annual fishing effort exceeds 20,000 hours /26/.

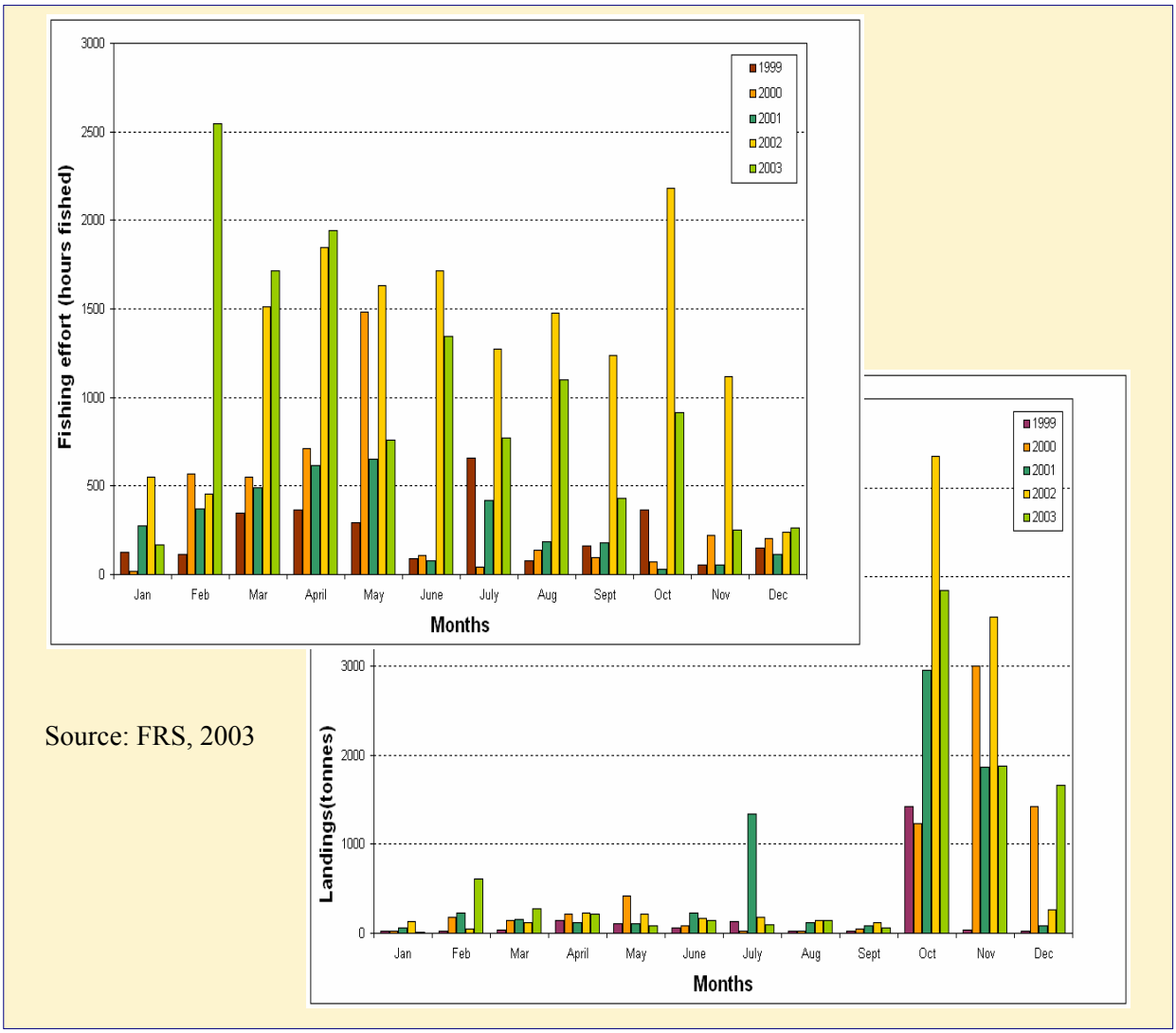
Table 5-2: Fishing methods in order of gears used in ICES rectangle 51F1

Fishing Gears	Hours fished in 2003
Pelagic otter trawl	1,008
Pelagic pair trawl	528
Demersal trawl (twin/multiple rigged)	4,800
Demersal pair trawl	4,168
Seine net	576
Pair seine	120

Source: FRS, 2003 /26/

The total annual landings to Scotland from ICES rectangle 51F1 by UK-registered vessels for the years 1999-2003 were 2,067, 6,807, 7,341, 10,519, and 9,005 tonnes, respectively (Figure 5-6). These data are for UK-registered vessels landing in Scotland only and do not account for any fishing effort or landings made from this rectangle by European vessels. These data may, therefore, provide an under-estimation of the actual fishing effort or fish landed from ICES rectangle 51F1 in this period. The pelagic species mackerel and herring dominated the total annual landings between 1999 and 2001; during this period, pelagic landings increased from 64% to 82% of the total annual landings. Between 2002 and 2003, mackerel dominated the total annual landings, representing 82% and 85%, respectively, of the total annual landings. Pelagic landings occurred predominantly between October and December, with occasional landings in May, June, July and September. There has been a corresponding decrease in demersal catches, which have declined from 36% of the total landings in 1999, to 15% in 2003. In recent years, peak demersal landings from ICES rectangle 51F1 have occurred between February and July; the main species landed were haddock, cod, whiting, saithe and ling. Shellfish landings within this area are generally not significant; between 1999 and 2002, they represented 1-10% of the total landings /26/.

Historically in Norwegian waters, the Tampen area (approximately 8,000 km^2) has been one of the most important areas for the Norwegian whitefish trawling in the North Sea /2/. The Statfjord field is located the western part of the Tampen area (statistical area 4274). The catch in this statistical area represented 13%, 9% and 8% respectively of total Norwegian whitefish catches the North Sea in the years 1997, 2000 and 2003 /2/. Fishing effort in this area is greatest in January and February, with lesser activity in the autumn /2/.



Source: FRS, 2003

5-6: Commercial fishing effort, and total landings, for ICES rectangle 51F1 for 1999-2003

SENSITIVITY: Commercial fisheries are sensitive to both natural changes in fish stocks and the high anthropogenic demand for fish, and several species are in an ecologically sensitive position.

The pipeline installation program will entail certain vessel traffic restriction in a small area for a short period of time. Although UK vessels fish in this area throughout the year, fishing effort is moderate in comparison to other areas of the North Sea. In Norwegian waters, trawling for whitefish in the Tampen area occurs mainly during the months of January and February. The area is targeted for both pelagic and demersal species of fish, including mackerel, herring, haddock, cod, whiting and saithe.
The impact of the proposed pipeline on fishing is discussed further in **Section 7.**

5.5 Offshore Conservation Areas

In 1992, the European Community (EC) adopted Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive"), and the EC Directive 79/409/EEC on the Conservation of Wild Birds (the "Birds Directive"), as a means of ensuring continuing biodiversity in European Member States. The Habitats Directive requires the establishment of a European network of conservation sites that will make a contribution to conserving the habitats and species identified in Annexes I and II of the Directive. In the UK, the EU Habitats Directive has been transposed into legislation by the Conservation (Natural Habitats &c) Regulations 1994 and applies to the UK onshore area and the inshore 12 nautical mile limit of its territorial waters. Recently, the range of application of the Directive has been extended to include UK offshore areas.

The UK Government, under guidance from the Joint Nature Conservation Committee (JNCC) and the Department of Environment, Food and Rural Affairs (DEFRA) has statutory jurisdiction under the EU Habitats Directive to propose offshore areas or species (based on the habitat types and species identified in Annexes I and II) to be designated as Special Areas of Conservation (SAC). Sites put forward for designation are known as candidate SACs (cSACs) and will be considered in the same way as if they had already been designated, with any activity likely to have a significant effect requiring an appropriate assessment.

Habitat types and species listed in Annex I and Annex II to the EU Habitats Directive, and relevant to the project area are shown in Table 5-3.

Table 5-3: Annex I habitats and Annex II species occurring in UK offshore waters

Annex I habitats considered for SAC selection in UK offshore waters
Sandbanks which are slightly covered by seawater all the time
Reefs (bedrock, biogenic and stony)
Bedrock reefs – made from continuous outcroppings of bedrock which may be of various topographical shape;
Stony reefs – these consist of aggregations of boulders and cobbles which may have some finer sediments in interstitial spaces; and
Biogenic reefs – formed by cold water corals (e.g. *Lophelia pertusa*) and *Sabellaria spinulosa*.
Submarine structures made by leaking gases
Submerged or partially submerged sea caves
Species listed in Annex II known to occur in UK offshore waters
Grey seal
Common seal
Bottlenose dolphin
Harbour porpoise

Source: JNCC, 2002 /32/.

5.5.1 Annex I Habitats

The main aggregations of "offshore sandbanks slightly covered by seawater all the time" occur in the southern North Sea around the north and north-east coast of Norfolk, in the outer Thames Estuary, and off the south-east coast of Kent, and off the north-east coast of the Isle of Man (JNCC, 2002). This habitat type is absent from the proposed location of the pipeline.

Pockmarks (shallow, ovoid, sea-bed depressions) containing carbonate structures (Methane-Derived Authigenic Carbonate (MDAC)) deposited by methane-oxidising bacteria from submarine structures, may fit within the definition of the Annex I habitat of "submarine structures made by leaking gases". Surveys and modelling studies have shown that the most readily pockmarked sediments are soft, silty muds /15/. Figure 5-7 illustrates the distribution of pockmarks in the UK North Sea. Pockmarks were not identified in the seabed survey of the pipeline route /52/.

Submerged or partially submerged sea caves are widely distributed in inshore waters, but no examples are currently known offshore (between 12 and 200 nautical miles from the coast) /33/ and, therefore, this habitat type is absent from the northern North Sea.

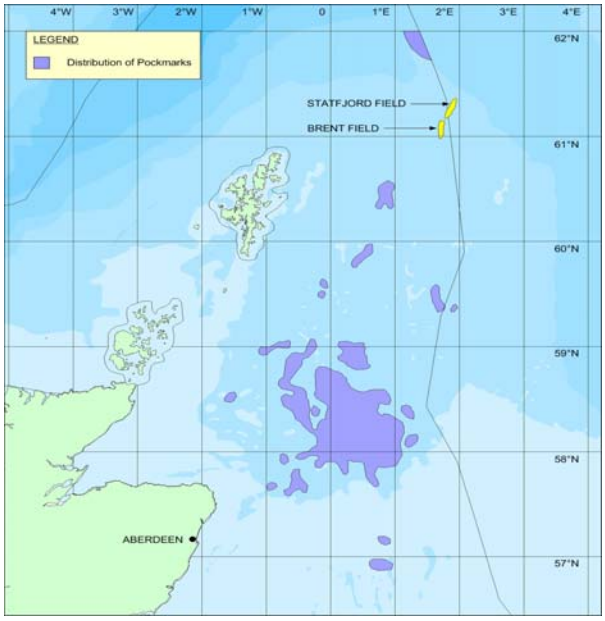


Figure 5-7: Distribution of pockmarks in the North Sea

(Source: DTI, 2001b /15/)

The reef-forming worm *Sabellaria spinulosa* is widespread in UK offshore waters, particularly in the North Sea, Irish Sea and English Channel. The full extent and location of the reefs formed by these organisms is, however, not known /32/. Based on available information, there are no known reefs (bedrock, stony or biogenic) in the vicinity of the proposed pipeline /18/

Potential bedrock and stony reef habitats (*Lophelia pertusa)* are much more common in western UK offshore waters and are virtually absent from UK offshore waters in the North Sea /14/, /18/. In the UK, *Lophelia pertusa* has been found frequently in small colonies from north of the Shetland Islands to the far west of Rockall, with the majority of the findings from Rockall westwards /63/. However, the true extent of reefs in the UK is unknown /30/. Several occurances of *Lophelia pertusa* are known in Norwegian coastal areas.

There is evidence of extensive colonisation of *L. pertusa* on the base of the flare structure on the Brent facilities /10/ and several colonies of *L. pertusa* growing on the major installations in the northern North Sea /11/. However, it may be argued that the presence of *L. pertusa* colonies on North Sea installations is an artefact resulting from the presence of man-made structures in the sea and that these opportunistic colonies are not of conservation value.

5.5.2 Annex II Species

The harbour porpoise is the only Annex II species known to occur in this region of the North Sea. This species occurs in this area throughout the year, but numbers are greatest in July /59/. Little information exists on the overall distribution and abundance of this species in UK waters. A UK survey covering 60-70% of relevant habitat in UK waters was undertaken as part of the SCANS project /28/. It estimated that the total population within the UK's Exclusive Economic Zone (EEZ), extending up to 200 nautical miles offshore, is approximately 150,000. The number of porpoises present in UK waters varies seasonally, however, and more animals are likely to pass through UK waters than are present at any one time /30/. The JNCC and other country agencies are currently analysing distribution data for harbour porpoise in UK waters to determine whether any suitable sites for SAC designation can be found /30/.

SENSITIVITY: Based on available information there are no known reef habitats of conservation value or any other Annex I habitats in the area of the proposed pipeline. The harbour porpoise is the only species defined under Annex II of the Habitats Directive that has been sighted in this area.
The prosject area is regarded as insignificant with respect to conservation measures following the implementation of the EU Habitats Directive, see also **Section 7.**

5.6 Other Sea Users

5.6.1 Shipping

Statoil has commissioned Anatec UK Ltd. to identify the shipping routes passing within a 10nm (~18.4km) radius around the proposed pipeline /6/.

Eleven shipping routes passing within 10 nm of the pipeline centre, and these routes are trafficked by an estimated 740 vessels per annum, which corresponds to an average of approximately 2 vessels per day (Table 5-4 and Figure 5-8).

Table 5-4: Shipping routes passing within 10nm of pipeline centre

Route No.	Description	CPA (nm)	Bearing (°)	Ships per year	% of Total
1	Nordfjord-Lerwick*	3.0	340	8	1%
2	Humber-Statfjord Term.*	3.3	94	32	4%
3	Gullfaks Term.-Milford Haven*	3.8	359	44	6%
4	Sognefjorden-Faroes*	4.1	3	136	18%
5	Moray Firth-N Norway/Russia	5.1	305	24	3%
6	Statfjord Term.-Hamburg*	5.2	79	188	25%
7	Aberdeen-Brent Shell*	5.2	202	130	18%
8	Brent-Lerwick Shell*	5.2	202	130	18%
9	Statfjord Term.-Milford Haven*	8.7	351	32	4%
10	Iceland-Sognefjorden*	9.6	187	8	1%
11	Sognefjorden-Statfjord Term.	9.8	22	8	1%
TOTAL				740	100%

* Where two or more routes share the same position, the description lists the subroute with the highest traffic.
Source: Anatec UK Ltd (2004) /6/

The majority of the vessels identified in the area are large tankers (61%) and offshore vessels (35%). The remaining traffic is made up of cargo vessels. The majority of the tanker vessels (68%) trafficking the area are large tanker, ≥ 40,000 dead weight tonnage (DWT).

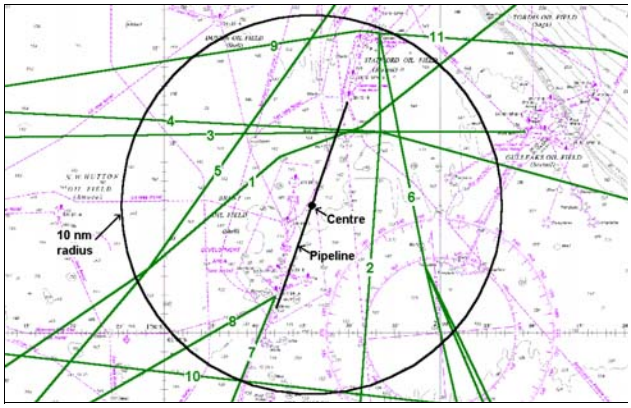


Figure 5-8: Shipping route positions within 10nm of pipeline centre

Source: Anatec UK Ltd (2004) /6/

To further illustrate the shipping movements in the area of the pipeline, a shipping density thematic map has been generated (Figure 5-9). The shipping densities vary along the pipeline route with several cells near the Northern part of the pipeline in the highest category due to tanker movements associated with the Gullfaks Field. Overall, the traffic levels in the area of the pipeline are low to moderate for the UKCS, with no 1 x 1 nm cell having an average shipping density greater than one vessel per day.

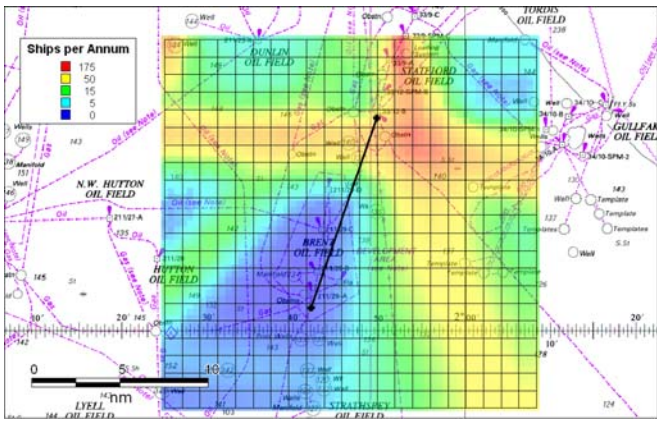


Figure 5-9: Shipping density plot of proposed pipeline route

Source: Anatec UK Ltd (2004) /6/

5.6.2 *Oil and Gas Activity*

The northern North Sea is an area of intensive oil and gas activity; numerous installations are present in the vicinity of the proposed development in both UK and Norwegian waters. In addition to Statfjord and Brent, other nearby fields in the UKCS include Hutton (Kerr-McGee), NW Hutton (BP Amoco), Dunlin/Dunlin SW (Shell), Ninian (Kerr-McGee) and Strathspey (Texaco) (DTI, 2001). In the Norwegian sector, the surrounding installations operated by Statoil ASA include Gullfaks, Snorre, Visund, Tordis, Gullveig, and Rimfaks. The nearest installation to the proposed pipeline is the Gullveig installation, which lies approximately 9km to the east.

5.6.3 *Ministry of Defence*

No routine military activities, e.g. submarine exercises, are known to occur in this area.

5.6.4 Wrecks-Cultural Heritage

There are two charted wrecks in this area which are marked on navigational maps; one lies 9km northeast of Brent B and the other lies 9km south of Brent A.

5.6.5 Submarine Cabels

There are no known submarine telecommunication or power cables in close proximity to the proposed pipeline route. Apart from the pipeline crossings detailed in **Section 4**, there are no other oil or gas pipelines in the vicinity of, or along, the proposed pipeline route.

SENSITIVITY: The relatively intense programme of vessel activity during pipeline installation could result in interference with other sea users, such as fishing vessels or supply vessels. This is an area of low to moderate shipping activity, with 11 shipping lanes known to occur in the area. Regular MOD activities have not been recorded in the area. No known submarine telecommunication or power cables occur in this area. The two known wrecks are marked on navigational maps.The impact of the proposed pipeline activities on other sea users is estimated as small, see also Section 6.

5.7 Summary of Environmental Sensitivities

Table 5-5 below provides a summary of the seasonal sensitivities for the proposed development area.

Table 5-5: Seasonal Environmental Sensitivities

KEY	
	Very high sensitivity
	High sensitivity
	Moderate sensitivity
	Low sensitivity
	Unsurveyed / No data available

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Likely Project Schedule : April 2006 to October 2007											
Plankton Plankton are vulnerable to oil and chemical discharges, but due to their wide distribution there is no direct threat to the viability of the populations. Indirect effects may exist for organisms further up the food chain. Main periods of bloom are in spring and summer. Any impacts from offshore oil and gas operations, including operations to install the pipeline, are likely to be small in comparison with natural variations.											
Benthic Fauna Benthic fauna are an important food resource for fish and shellfish, and are vulnerable to the disturbance of seabed sediments which is likely to occur during pipeline installation. However, no rare benthic species are known to occur in this area and the benthic communities in the development area are similar to those found throughout the surrounding area. Therefore, there is no direct threat to the viability of the local benthic community.											
Marine mammals Harbour porpoise are the most commonly recorded cetacean in this area; numbers are greatest in July. Few other species of cetaceans have been sighted along the route of the proposed pipeline, but killer whale, minke whale, white-beaked dolphin, white-sided dolphin and Risso's dolphin have been sighted in adjacent quadrants. Marine mammals are vulnerable to chemical discharges, acoustic disturbance from vessel operations, and injury from collisions with vessels. Marine mammals can easily avoid disturbed areas.											
Finfish Populations Fish are vulnerable to pollution, particularly during the egg, larval and juvenile stages of their lifecycle. The proposed pipeline is located in spawning grounds for cod, haddock, saithe and Norway pout. With the exception of cod, fish communities in this area are present throughout large areas of the North Sea, therefore there is no direct threat to the viability of the populations. However, this region of the North Sea constitutes an important area for cod spawning activity. The main schedule for the pipeline laying activities will not coincide with peak spawning (February and March) for this species.											
Fisheries The development area is of "moderate" commercial value; fishing occurs throughout the year, mainly in the autumn but effort is lower in December and January. The area is targeted for both pelagic and demersal species of fish. Although demersal trawling dominated fishing methods, pelagic species, such as mackerel and herring have dominated landings during recent years. From 1999 to 2003, pelagic landings occurred predominantly between October and December. The most important period for white-fish trawling on the Norwegian side is January-February.											
Seabird populations Seabird vulnerability to surface pollution have been described by the JNCC as "low" to "moderate" for most of the year, but is "high" in July, October and November. Vulnerabilities are related to the position of the proposed development area in relation to the Northern Isles (particularly Shetland) which are of significant importance for large numbers of birds during the breeding season. Important species in this area include fulmar gannet, kittiwake and skua.											
Conservation areas and species Based on generally available information and specific bathymetric survey data from the pipeline route there are no reef habitats or pockmark areas of conservation value or any other Annex I Habitats in the area of the proposed pipeline. Neither have any objects of cultural heritage importance been identified in the area of the proposed pipeline. The harbour porpoise is the only Annex II species known to occur in this region of the North Sea. The JNCC and other country agencies are currently analysing distribution data for harbour porpoise in UK waters to determine whether any suitable sites for SAC designation can be found. Currently no conservation designation.											

6 Risk Assessment

6.1 Method

6.1.1 Description of Method

The method used to undertake this Environmental Impact Assessment is based on an Environmental Risk Assessment (ERA) approach that has been widely applied internationally in the exploration and production industry, and in other industrial sectors. The methodology has been adapted from the approach to risk assessment and rating given in the British Standard BS 8800:1996 (BSI, 1996), the DTI Guidelines for Environmental Statements (DTI, 2003), and the methods used in numerous statutory ESs for UK offshore oil and gas projects. The study method is also in accordance with Norwegian EIA requirements

The ERA method assesses **risk** to the environment by examining the possible effects of activities on various receptors (e.g. benthic community, seabirds, commercial fishing) in the natural and socio-economic environment. The number and range of receptors examined is determined by the nature and scale of the activity being assessed.

The severity of each risk is determined by assessing two criteria, the **probability** of the occurrence of an event that could cause an impact and the **consequence** to the environment if the impact occurs. The ERA method therefore comprised three steps:

- The systematic identification of the environmental risks associated with each of the activities taking place during the SFLL pipeline project. This identification was made on the basis of the project description (**Section 4**), the description of the environment and its sensitivities (**Section 5**), and information obtained during meetings with Statoil. This identification took account of potential interactions between the development project and sensitive receptors.

- The classification of each of the environmental risks according to pre-defined probability and consequence criteria (Table 6-1 and Table 6-2). The assessment was based on the findings of detailed modelling where appropriate or available, knowledge from experience of similar events offshore, published information, and expert judgement. The risk assessment is based on 'residual risk', which takes account of the control and mitigation measures that reduce both probability and consequence during the pipeline project. The assessment of the consequence of each impact takes account of both the physical extent of the impact and its duration, and, where appropriate, also includes the effects of transboundary and cumulative impacts

- The assignment of an overall risk rating to each of the risks. Table 6-3 provides a matrix that shows how the combined levels of probability and consequence have been used to determine the risk rating. These fall into three negative categories, and one positive category. The four risk ratings are:

  Highly Significant Risks (Red zone in Table 6-3). This rating would typically signify an unacceptable level of risk. Highly significant risks would be managed by eliminating or avoiding the activity that gave rise to the risk, by further investigation or modelling studies to clarify uncertainties, or by the development of controls or mitigation measures to reduce the risk to tolerable or acceptable levels.

  Significant Risks (Amber zone in Table 6-3). These risks would generally be regarded as being at a tolerable level that is considered "As Low As Reasonably Practicable" (ALARP) (UKOOA, 1999). Typically the causes, controls/mitigation, and outcomes would be defined, and the risk would be judged to be tolerable because the benefits of carrying out the activity causing the risk would balance or outweigh apparent disadvantages. Within this risk category, however, there could be some scope for further investigation of causes and consequences or improvement of control and mitigation.

Not Significant Risks (Green zone in Table 6-3). These risks would be managed by standard controls/mitigation and would have a trivial effect.

Positive Effects (Blue zone in Table 6-3). These effects would be beneficial because they resulted in the avoidance of environmental harm, the enhancement of resource stewardship, or other socio-economic or environmental gain.

Table 6-1: Probability criteria for defining the likelihood of routine and non-routine activities or events.

Category	Description	Probability (unplanned events) or frequency (planned events)
Definite	Will definitely occur (e.g. during every planned emission or discharge). Applies to all planned events.	Probability: one occurrence per causal event. Frequency: continuous or intermittent occurrence whenever the causal event takes place.
Likely	Likely to occur during normal operation, given the controls/mitigation proposed.	Probability: one occurrence per 2 to 50 events. Frequency: daily to three-monthly.
Possible	Could occur infrequently during normal situations given the controls/mitigation proposed, or more readily during abnormal or emergency situations, e.g. minor spillages during fuel loading operations at sea.	Probability: one occurrence per >50 to 1,000 events. Frequency: >three-monthly to yearly.
Unlikely	Unlikely during normal operation given the controls/mitigation proposed, but may occasionally occur during abnormal or emergency situations, e.g. 'significant' (>1 tonne) overboard spill.	Probability: one occurrence per >1,000 to 10,000 events. Frequency: >yearly to 10-yearly.
Remote	Extremely unlikely given the controls/mitigation to be put in place, e.g. serious tier 3 spill event.	Probability: one occurrence per >10,000 events. Frequency: >10-yearly.

Table 6-2: Consequence criteria for defining the characteristics of environmental effects

Environmental Consequences	Social Consequences
SEVERE	
Degradation or loss of habitats or ecologically, commercially or culturally important species. Extent: At a regional, national or international scale. Duration: Low prospects of recovery to a representative state, within several decades in highly affected areas. Permanent, widespread impacts on resource quality and availability (i.e. of water, energy or raw material) to the long-term detriment of dependent businesses, communities, individuals, environment and socio-economic conditions. Permanent impact on status of internationally important or nationally protected sites or species, e.g. coastal regions of Shetland. Tier 3 spill or catastrophic emergency event, with consequences on a national or international scale.	Well-established and widely held areas of concern in society on a national or international scale, including possible perception of threats to the global environment, e.g. global warming, and wider issues of sustainability. Permanent, detrimental health impacts (any number of people) Permanent and widespread negative effects on human well-being (typically, but not necessarily, arising from nuisance). Permanent disruption to business, communities or individuals, with permanent consequential loss of revenue, assets or amenities. Requirement to dispose of controlled waste beyond national disposal capacity.
MAJOR	
Degradation or loss of habitats or ecologically, commercially or culturally important species over a wide area of seabed. Extent: Generally more than 1,000m from the source of the impact, or beyond the perimeter boundaries of onshore sites. Duration: Limited prospect of recovery to normal healthy conditions. Recovery to a representative state would generally be in the order of decades in highly affected areas. Substantial but ultimately reversible impacts on resource quality and availability (i.e. of water, energy, or raw material) to the detriment of dependent businesses, communities, individuals, environment and socio-economic conditions. Serious, long-term, but ultimately reversible, impact which would affect the status and/or management of internationally important or nationally protected sites or species e.g. coastal regions of Shetland. Tier 2 or 3 oil spill or major emergency event, with consequences on a local or regional scale.	Concern on a regional rather than local or global level involving multiple interest groups. Perception of threat to the regional environment and issues of regional sustainability. Reversible, detrimental health impacts (any number of people). Widespread and sustained negative effects on human well-being (typically on a scale of months to years; also typically, but not necessarily, arising from nuisance). Long term (typically on a scale of months to years) disruption to businesses, communities or individuals, with sustained consequential loss of revenue, assets or amenities. Requirements to dispose of controlled waste beyond 50% of the annual disposal capacity of the waste management region (e.g. county or regional level).
MODERATE	
Degradation or loss of habitats, or ecologically, commercially or culturally important species over a wide area of seabed. Extent: Generally within, but may extend beyond, 1,000m from the source of impact, or beyond the perimeter boundaries of onshore sites. Duration: This generally leads to short-term disruption with the potential for recovery to normal conditions within several years -typically less than a decade - but may extend beyond this period close to the impact source. Temporary (scale of weeks to months) impacts on resource quality or availability (i.e. of water, energy or raw material) causing nuisance to dependent communities, groups of people or affected individuals, but not to the detriment of the local environment or socio-economic conditions. Short-term, reversible impact on internationally important or nationally protected sites or species e.g. coastal regions of Shetland, which could not compromise the status or management of these sites or species. Uncontrolled tier 1 oil spill or small-scale emergency event	Concern at the community, rather than individual or single interest group, level. Perception of a threat to the community environment and issues of local sustainability. Local negative effects on human well-being (but not health), typically on a scale of weeks to several months (also typically, but not necessarily, arising from nuisance). Short-term (typically on a scale of days to weeks) disruption to businesses, communities or individuals, with short term consequential loss of revenue, assets or amenities. Requirement to dispose of controlled wastes at 10% to 50% of the disposal capacity of the waste management region (e.g. county or regional level).

Table 6-2 cont: Consequence criteria for defining the characteristics of environmental effects

Environmental Consequences	Social Consequences
MINOR	
Disruption to habitats, or ecologically, commercially or culturally important species over a localised area of seabed. Extent: Generally within, but may extend beyond, 500m from the impact source, or within the perimeter of an onshore site. Duration: Short-term disruption, with the potential for rapid recovery to a normal, representative state typically within months depending on the timing of the event in relation to the annual recruitment pattern. Localised and transient impact on resource quality or availability (i.e. of water, energy, raw material or labour) affecting the well-being of individuals. Highly transient, reversible impact on locally protected sites which could not affect or compromise the status or management of these sites. Contained and non-notifiable oil spill.	Concern at the level of individual people, individual businesses or single interest groups. Perception of a threat to the environment used by, and issues of sustainability relating to, individuals and single interest groups. Short-term (typically on a scale of hours to days) nuisance which causes inconvenience to individuals. Short-term disruption (typically on a scale of hours to days) to individual businesses rather than to communities, with transient consequential loss of revenue, assets and amenities. Requirement to dispose of controlled wastes at 1% to 10% of the disposal capacity of the waste management region (e.g. county or regional level).
NEGLIGIBLE	
Transient disruption to habitats, or ecologically, commercially or culturally important species. Extent: Within 500m of the source of the impact Duration: Potential for recovery to a normal, representative state, generally within hours to days. Negligibly small impacts on resource availability or quality which is not to the detriment of people, the environment, or socio-economic conditions. No impact on status of protected sites or species. No spills or emergency events.	No concern or perception of threats by people, communities or interest groups. Transient nuisance (scale of hours) which does not cause negative effects on human health, well-being, revenue sources, assets or amenities or social disruption. Requirement to dispose of controlled wastes at less than 1% of the disposal capacity of the waste management region (e.g. county or regional level).
POSITIVE	
Enhancement of habitats, or ecologically, commercially or culturally important species.	Enhancement of human prosperity, health, well-being or amenities. No requirement to dispose of controlled waste to land-fill.

6.1.2 Discussion of the Method

In this method, the probability and the consequence of each identified risk are assigned to one of a number of pre-defined qualitative categories. There are no universally adopted quantitative or qualitative definitions that can be applied to the two sets of criteria; different qualitative definitions may be used in different projects. The method used to set the definitions ensured that all the aspects of the project were encompassed.

In this ERA, every effort has been taken to use the best available data to assess potential impacts, and to apply the defined criteria uniformly and objectively. The ERA attempts to provide a transparent account of the judgements that have been made in the risk assessment. This transparency is provided by the tables (Table 6-4, Table 6-5 and Table 6-6) which show the values of probability and consequence for the each of the individual risks, and by clearly documenting the justifications for each of the assessments.

The ERA for each of the planned and unplanned events associated with the Tampen Link pipeline project should be viewed as a systematic scoping exercise, which allows all of the possible risks to be identified. Importantly, it differentiates between trivial risks, which can justifiably be excluded from more detailed investigation in the EIA, and those risks that are likely to have significant implications for the project because of the possible level of uncertainty, severity of residual impact, concerns of interested parties, or specific requirements for control and mitigation (see Table 6-7, Table 6-8 and Table 6-9).

The ERA is not the end-point of the investigation, but the initial part of the process of identifying likely significant risks and seeking to assess their true implications. The results are used as the starting

point for a more detailed assessment of the nature, scale, duration, and reversibility of the environmental and socio-economic impacts of each of the likely significant risks. These detailed assessments seek to put the risk into the context of the project and the receiving environment as accurately and as objectively as possible. **Sections 7 and 8** document these detailed assessments.

6.1.3 Final Classification of Results.

Assigning the risks to one of four categories allowed a wide range of potential risks to be screened, so that attention could be focussed on important "significant" risks.

Table 6-3 indicates how criteria for probability and consequence are combined to give the final risk classification.

Table 6-3: **Risk matrix**

Consequence	Probability				
	Remote	**Unlikely**	**Possible**	**Likely**	**Definite**
Severe	R.6	U.6	P.6	L.6	D.6
Major	R.5	U.5	P.5	L.5	D.5
Moderate	R.4	U.4	P.4	L.4	D.4
Minor	R.3	U.3	P.3	L.3	D.3
Negligible	R.2	U.2	P.2	L.2	D.2
Positive	R.1	U.1	P.1	L.1	D.1

Key	Highly Significant Zone	Significant Zone	Not Significant Zone	Positive Zone

6.2 Identification of significant Environmental Risks

Table 6-4 to Table 6-6 present the risk assessment matrices for the various activities associated with the Tampen Link pipeline project, based on the ERA process described in **Section 6.1**. The tables are listed by pipeline activity, with each table following a similar format (project events and risks against receptors). The codes shown in these tables (e.g. "L.3", "P.3") demonstrate how the evaluation was made during the risk assessment process, based on the combination of the two criteria, probability and consequence (Table 6-1 and Table 6-2).

For risks that were considered to be "not significant" or "positive", Table 6-7 to Table 6-9 provide a justification for the assessment made, and for excluding these risks from further investigation in the environmental assessment. The tables provide a brief description of the environmental risks, and summarise some of the standard or project-specific measures that could or would be taken to control or mitigate the identified risks. The majority of these measures would be standard practice for marine and offshore operations. Where possible, risks of a similar nature have been grouped to avoid repetition.

Table 6-4: Risk assessment of installation of pipelines, risers and subsea structures

	Physical and Chemical¨							Biological						Socio-Economic						
	Sediment structure / chemistry Chemistry/structure	Water Quality	Use of Resources	Use of disposal facilities	Air quality (local)	Trans-boundary issues	Cumulative impacts	Sediment biology (benthos)	Water Column (plankton)	Finfish and shellfish	Seabirds	Sea mammals	Integrity of conservation sites	Commercial fishing	Shipping	Military operations	Other users	Stakeholder concerns	OVERALL SIGNIFICANCE	JUSTIFICATION SECTION REFERENCE
INSTALLATION																				
Presence of vessels														D.4					D.4	7.1
Noise from pipelaying vessels										P.2		P.2							P.2	6.2
Power generation			L.2		L.2	L.2	L.2												L.2	6.2
Treated bilge discharge		L.2				L.2	L.2		L.2	L.2	L.2	L.2							L.2	6.2
Sewage discharge		L.2				L.2	L.2		L.2	L.2	L.2	L.2							L.2	6.2
Anchoring of pipelay vessel	L.2							L.4		L.2		L.2		P.3	L.2				L.4	7.2
Rock dumping	L.2		L.2					L.4		L.2		L.2		L.2	L.2				L.4	7.4
COMMISSIONING																				
Testing and commissioning of pipeline	L.2	L.3							L.3	L.3			L.2						L.3	7.5
ACCIDENTAL EVENTS																				
Pipeline rupture / failure leading to remedial engineering or escape of hydrotest chemicals	U.2	U.4							U.4	U.4			U.2						U.4	7.5/ 7.6
Snagging of fishing gear on PLEM, HTT or pipeline														U.4			U.2	U.4	U.4	7.4
Spills of Fuel (aviation and diesel)	U.3	U.4			U.3	U.3	U.3	U.3	U.4	U.3	U.3	U.3	U.3	U.3					U.4	7.6

Consequence of impact	Probability of impact				
	Remote	Unlikely	Possible	Likely	Definite
Severe	R.6	U.6	P.6	L.6	D.6
Major	R.5	U.5	P.5	L.5	D.5
Moderate	R.4	U.4	P.4	L.4	D.4
Minor	R.3	U.3	P.3	L.3	D.3
Negligible	R.2	U.2	P.2	L.2	D.2
Positive	R.1	U.1	P.1	L.1	D.1

Significance of identified risk		Number of risks
	Highly significant	0
	Significant	7
	Not significant	4
	Positive	0

Table 6-5: Risk assessment of production activities

	Physical and Chemical							Biological						Socio-Economic							
	Sediment structure / chemistry Chemistry/structure	Water Quality	Use of Resources	Use of disposal facilities	Air quality (local)	Trans-boundary issues	Cumulative impacts	Sediment biology (benthos)	Water Column (plankton)	Finfish and shellfish	Seabirds	Sea mammals	Integrity of conservation sites	Commercial fishing	Shipping	Military operations	Other users	Stakeholder concerns	OVERALL SIGNIFICANCE	JUSTIFICATION SECTION REFERENCE
PIPELINES AND UMBILICALS																				
Presence of pipelines, crossings and subsea structures	D.2							D.2						D.3				D.3	D.3	7.4
Emissions from anodes		L.2							L.2	L.2		L.2		L.2					L.2	6.2
ACCIDENTAL EVENTS																				
Snagging of fishing gear on PLEM, HTT or pipeline														U.4			U.2	U.4	U.4	7.4

Consequence of impact	Probability of impact				
	Remote	Unlikely	Possible	Likely	Definite
Severe	R.6	U.6	P.6	L.6	D.6
Major	R.5	U.5	P.5	L.5	D.5
Moderate	R.4	U.4	P.4	L.4	D.4
Minor	R.3	U.3	P.3	L.3	D.3
Negligible	R.2	U.2	P.2	L.2	D.2
Positive	R.1	U.1	P.1	L.1	D.1

Significance of identified risk		Number of risks
	Highly significant	0
	Significant	2
	Not significant	1
	Positive	0

Table 6-6: Risk assessment of decommissioning activities

	Physical And Chemical							Biological						Socio-Economic							
	Sediment structure / chemistry Chemistry/structure	Water Quality	Use of Resources	Use of disposal facilities	Air quality (local)	Trans-boundary issues	Cumulative impacts	Sediment biology (benthos)	Water Column (plankton)	Finfish and shellfish	Seabirds	Sea mammals	Integrity of conservation sites	Commercial fishing	Shipping	Military operations	Other users	Stakeholder concerns	OVERALL SIGNIFICANCE	JUSTIFICATION SECTION REFERENCE
VESSEL OPERATIONS																				
Physical presence if anchored	L.2							L.2		L.2				L.2	L.2	L.2	L.2		L.2	6.2
Power generation					L.2	L.2	L.2												L.2	6.2
Treated bilge discharge		L.2				L.2	L.2		L.2	L.2	L.2	L.2							L.2	6.2
Sewage discharge		L.2				L.2	L.2		L.2	L.2	L.2	L.2							L.2	6.2
PIPELINES																				
Removal of PLEMs, HTTs and other forms of subsea intervention	L.2	L.2		L.2				L.2	L.2	L.2				L.2					L.2	6.2
Presence of pipelines	L.2													L.4			L.2	L.4	L.4	7.4
ACCIDENTAL EVENTS																				
Operational diesel spill		U.3							U.3		U.4	U.3		U.4					U.4	7.6
Dropped objects	P.2							P.2						P.2					P.2	6.2

Consequence of impact	Probability of impact				
	Remote	Unlikely	Possible	Likely	Definite
Severe	R.6	U.6	P.6	L.6	D.6
Major	R.5	U.5	P.5	L.5	D.5
Moderate	R.4	U.4	P.4	L.4	D.4
Minor	R.3	U.3	P.3	L.3	D.3
Negligible	R.2	U.2	P.2	L.2	D.2
Positive	R.1	U.1	P.1	L.1	D.1

Significance of identified risk	Number of risks
Highly significant	0
Significant	2
Not significant	6
Positive	0

Table 6-7: Justification for excluding the causes of risks assessed to be *Not significant* or *Positive* from further investigation in the environmental assessment for the installation of pipelines, risers and subsea structures

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT OR RISK	PROPOSED CONTROL AND MITIGATION	JUSTIFICATION
		INSTALLATION	
Noise from pipelaying vessel	Noise emitted from the activities associated with the proposed pipeline operations could potentially disturb marine mammals (seals, whales, dolphins and other cetaceans). Many marine mammals exhibit an overt behavioural reaction at a received noise level of 120dB for continuous noise. Noise levels in excess of 120dB may be tolerated for a period of time, but the likelihood of behavioural response increases. Prolonged sound could result in marine mammals moving away from preferred areas.	The equipment used during the proposed activities will be well maintained and this will help to keep the noise from operating machinery as low as possible, and thus minimise potential disturbance to marine mammals.	Using formulae from Richardson *et al*.(1995) and Erbe and Farmer (2000), the predicted threshold distance from a noise source for a received level of 120dB (potential threshold for overt behavioural response by marine mammals) is within approximately 1km of pipeline operations. Data indicate a low density of marine mammals along the pipeline route. For the pipeline operations the impact is expected to be low because of the relatively small area that would be exposed to noise above the threshold level, and the low number of marine mammals anticipated in the area.
Power generation on vessels	Deterioration in air quality around exhaust outlets. Contribution to global processes such as global warming and acid rain deposition (cumulative and trans-boundary impacts).	Atmospheric emissions from vessels are inevitable but would be managed through use of well-maintained equipment, and burning low-sulphur diesel fuel in line with the requirements of MARPOL.	Short-term deterioration of local air quality within a few metres of the point of emission. Rapid dispersion and dilution of the emissions in exposed conditions offshore. The route of the pipeline is remote from other significant sources of atmospheric pollution, and so there would be no risk of cumulative effects. Overall very small scale contributor to global warming and to trans-boundary effects such as acid rain. No sensitive receptors in the area.

Table 6-7 continued: Justification for excluding the causes of risks assessed to be *Not significant* or *Positive* from further investigation in the environmental assessment for the installation of pipelines, risers and subsea structures

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT OR RISK	PROPOSED CONTROL AND MITIGATION	JUSTIFICATION
		INSTALLATION	
Discharges of treated bilge from vessels	Deterioration in seawater quality around the discharge point and the potential for oil slick formation.	Compliance with MARPOL which requires: • Oil-water separation and filtration equipment, monitoring and discharge to ensure oil concentration is below 15 ppm. • Retention of the bulk oil fraction after separation for recycling or incineration onshore. • UK or International Pollution Prevention Certificate for vessel drainage systems. • Vessel audits to ensure compliance.	The permitted intermittent discharge of low concentrations of hydrocarbons would be dispersed and broken down rapidly in the offshore environment. A slick should not form at the permitted concentration.
Sewage discharged from vessels	Localised increase BOD (Biological Oxygen Demand) around the point of discharge (caused by bacterial degradation of the sewage). Input of organic nutrients results in localised increase in productivity in fish, plankton and micro-organisms.	Sewage treated prior to disposal at sea or contained and shipped to shore. Vessel audits to ensure compliance.	Relatively few people involved in vessel operations. Therefore, BOD and organic input from sewage will be low. Sewage would be readily dispersed in currents offshore and broken down.

Table 6-8: **Justification for excluding the causes of risks assessed to be *Not Significant* or *Positive* from further investigation in the EA for production activities**

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT OR RISK	PROPOSED CONTROL AND MITIGATION	JUSTIFICATION
PIPELINES AND UMBILICALS			
Emissions from anodes	Release of contaminants into the water column and onto the seabed.	Anodes are required to protect the pipelines from corrosion, which could lead to pipeline failure and release of hydrocarbons. No specific mitigation proposed.	Concentrations of metals released are very low and would not cause toxic effects on organisms. Rapid dispersion and dilution in strong offshore currents.
ACCIDENTAL EVENTS			
Dropped objects	The creation of artificial substrata to be colonised by marine organisms. Possible obstruction to fishing.	Accurate accounting for all and pipeline sections (which have individual test certificates and records) and major items of equipment. Adherence to lifting and handling procedures. Use of certified equipment for lifting. Requirement to retrieve major items of debris from the seabed before leaving the site.	Pipe sections and major items would be recovered from the seabed. Loss of individual hand-tools and other minor items of equipment would not constitute a threat to species, habitats or fishing.

Table 6-9: Justification for excluding the causes of risks assessed to be *Not Significant* or *Positive* from further investigation in the EA for <u>decommissioning activities</u>

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT OR RISK	PROPOSED CONTROL AND MITIGATION	JUSTIFICATION
VESSEL OPERATIONS			
Physical presence if anchored	Refer to corresponding topic in Table 6-7		
Power generation	Refer to corresponding topic in Table 6-7		
Bilge discharge	Refer to corresponding topic in Table 6-7		
Sewage discharge	Refer to corresponding topic in Table 6-7		
PIPELINES			
Removal of PLEMs, HTTs and other forms of subsea intervention	Temporary disturbance of seabed and benthos	Although disturbance will occur as a result of the removal of the structures, the seabed will be returned to its previous state.	Area of seabed disturbance is minimal and would be re-colonised.
ACCIDENTAL EVENTS			
Dropped objects	Refer to corresponding topic in Table 6-8		

7 Evaluation of significant Environmental Risks

This section provides a detailed evaluation of each of the environmental risks that were assessed to be "significant" (**Section 6**). The evaluation is structured to provide evidence of:

- The magnitude and duration of transient and residual environmental impacts and risks (i.e. those that remain after mitigation).
- The consequences for sensitive receptors.
- The consequences for protected habitats and species, including designated or proposed conservation sites.
- The contribution to cumulative, transboundary and global processes.
- Resolution of the issues and concerns of stakeholders.
- The adequacy and effectiveness of the proposed risk-reduction measures.

The following aspects of the proposed pipeline installation associated with the SFLL project were assessed in **Section 6** as having "significant" risks:

- Physical Presence of Vessels (**Section 7.1**)
- Anchoring of vessels during pipeline Installation (**Section 7.2**).
- Pipeline installation (**Section 7.3**).
- Physical presence of the pipeline and subsea structures (**Section 7.4**).
- Use and discharge of pipeline chemicals (**Section 7.5**).
- Accidental spills of diesel (**Section 7.6**).

7.1 Physical Presence of Vessels

7.1.1 Magnitude and Duration

Installation the proposed SFLL pipeline may result in some interference with commercial fishing, shipping or military operations in the area. At this stage, there is the option to install the proposed SFLL pipeline using an anchor laybarge or a DP vessel (**Section 4.4.3.1**). If an anchor laybarge is to be used temporary restrictions or access to shipping and fishing during the installation operations will be limited to a radius of 2,000m centred on the laybarge (the area occupied by the length of the anchor wires and the associated pennants); this gives a total area of approximately 12.6km^2. If a DP vessel is to be used, restrictions or access to shipping and fishing will be limited to a radius 500m centred on the vessel and pipeline; this gives a total area of approximately 0.8km^2. Access restrictions along the proposed pipeline route are expected to last 2-3 months.

7.1.2 Impact on Sensitive Receptors

The presence of the pipelay vessels (laybarge and support vessels) will restrict other traffic in the area (fishing and shipping). Such restrictions will be confined to a relatively localised area (0.8km^2 to 12.6km^2) and will occur over a limited period (2-3 months). This would not significantly affect navigation or access to fishing grounds. Fishing effort in the area is moderate for the North Sea and the pipeline will be installed outside the most important fishing periods (**Section 5.4.6**). Shipping in the area is low to moderate (**Section 5.6.1**).

7.1.3 Impact on Proposed or Designated Conservation Sites

There are no proposed or designated conservation sites in the vicinity of the proposed operations. No habitats listed in Annex I of the EU Habitats Directive were identified during the seabed survey of the pipeline route (**Section 5.5.1**).

7.1.4 Trans-boundary, Cumulative and Global Impacts

The proposed pipeline lies within UK and Norwegian waters, and there will be no impacts in any other region of the North Sea. Approximately 7.7 km of the 23.2 km pipeline will be laid within Norwegian waters. The impact assessment is equally valid on both sides of the UK/Norwegian boarderline

7.1.5 Stakeholder Concerns

No specific concerns have been expressed by stakeholders regarding the vessel presence during the SFLL project pipelaying activities.

7.1.6 Adequacy of Proposed Mitigation Measures

The planned mitigation measures that Statoil would take to minimise the impact of the presence of vessels during the proposed activities are detailed in Table 7-1. The proposed mitigation measures represent standard industry practice and are judged to be sufficient.

Table 7-1: Potential sources of impact and planned mitigation measures for the presence of pipelay vessels.

Potential source of impact	Planned mitigation measure
Physical presence of pipelay vessels	Statoil will notify the Hydrographic Offices in both the UK and Norway, which will issue Notices to Mariners to advise fishing and shipping traffic of the potential hazards to navigation that are associated with the project. The operational area will be monitored with respect to vessel traffic during pipeline installation. The pipelaying vessel will have necessary communicational equipment to alert shipping and fishing vessels of potential navigational hazards.

7.2 Anchoring of Vessels during Pipelaying Activities

7.2.1 Magnitude and Duration

The pipe-lay contractor will be selected during 2005 and the contractor will be required to prepare a detailed method statement for the installation of the pipeline. At this stage, there is the option to install the pipeline using a conventional anchored lay barge or a DP vessel (**Section 4.4.3.1**).

An anchored lay barge would be positioned on the seabed by 10 to 14 anchors in a pre-determined 'anchor pattern' (Figure 7-1). In such a system, the anchors are attached to the lay-barge with a chain and cable combination; for each anchor line approximately 300m of chain would be in contact with the seabed, providing additional holding power. The anchors will be deployed and retrieved several times during the course of the pipelaying operation. The number of anchors to be used and their deployment pattern will be determined when the lay-barge to be used has been selected.

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 form and potentially become long-term obstructions when mobile fishing gear is used on the seabed. Geological surveys in the development area indicate that surface sediments are composed of fine to medium sand, and the sub-surface sediments (at depths of 0.1m to >10m) along the majority of the proposed pipeline route (KP 6 to KP 19.10) comprise stiff clay. It is possible, therefore, that persistent anchor mounds may be created along the proposed pipeline route. The potential area of impact would be highly localised, and all the sites so disturbed would be confined within approximately 1 to 2km on either side of the pipeline corridor.

A post-installation survey will be undertaken to identify any potentially significant seabed hazards.

If it cannot be ruled out that the anchor mounds represent a hazard, Statoil will ensure that any significant mounds formed during the pipelaying activities are flattened using suitable methods.

7.2.2 Impact on Sensitive Receptors

With persistent anchor mounds the main issue is potential for intermittent impacts to fishing gear. 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 disturbed material. This disturbance, however, will be small in comparison to the seabed disturbances already created by the fish trawling activities occurring within the area. In all cases, however, the disturbed sediments would be clean, and recolonisation from adjacent undisturbed communities would begin very quickly after the disturbance ceased. The area of seabed that could be physically disturbed by such operations would be very small in relation to the adjacent areas of comparable seabed along the pipeline route.

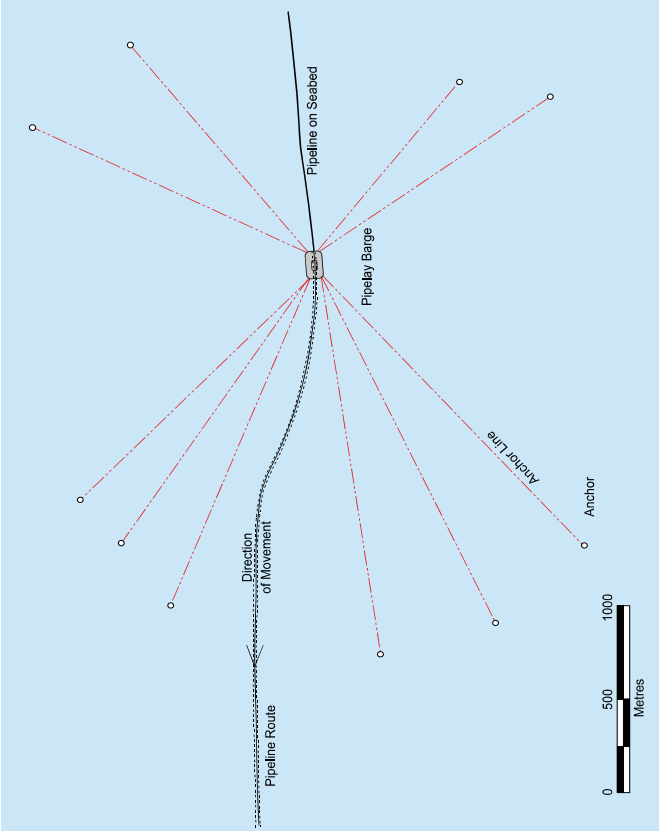


Figure 7-1: Typical anchor pattern for pipelay barge

7.2.3 Impact on Proposed or Designated Conservation Sites

There are no proposed or designated conservation sites in the vicinity of the proposed operations. No habitats listed in Annex I of the EU Habitats Directive were identified during the seabed survey of the pipeline route (**Section 5.5.1**).

7.2.4 Trans-boundary, Cumulative and Global Impacts

Anchor mounds are small and localised, and would not, therefore, contribute to trans-boundary or global impacts.

7.2.5 Stakeholder Concerns

No specific concerns have been expressed by stakeholders regarding the effects of anchoring during the SFLL project pipelaying activities.

7.2.6 Adequacy of Proposed Mitigation Measures

The planned mitigation measures that Statoil would take to minimise the impact of anchoring the pipelay barge during the proposed activities are detailed in Table 7-2. The proposed mitigation measures represent standard industry practice and are judged to be sufficient.

Table 7-2: Potential sources of impact and planned mitigation measures for anchoring of vessels.

Potential source of impact	Planned mitigation measure
Anchoring the pipelay vessel	Statoil will plan the exact location of the anchors and will use a ROV (post-lay) to ensure that they were placed correctly on the seabed. Although it is unlikely that persistent anchor mounds will form, Statoil will undertake a survey of the pipeline route immediately after the pipeline has been laid to identify any seabed discontinuities. If it can not be ruled out that the anchor mounds represent a problem, Statoil will ensure that any significant mounds formed during the pipelaying activities are flattened using suitable methods.

7.3 Pipeline installation

7.3.1 Magnitude and Duration

The 23.2 km, 22” or 32” new gas export pipeline will be placed on the seabed, in either a straight line, conventional lay formation or a snake-lay formation (**Section 4.4.3.1**).

During this pipelaying activity there will be disturbance to the seabed sediments, and benthic organisms living on or within the sediments, along the length of the pipeline route. It is estimated that the total area of the seabed that would be affected by the direct placing of the pipeline, rock dumps and protective structures is approximately 0.015 – 0.025 km^2 depending on pipeline dimension and installation method (snake-lay increases the length of the pipeline by 0.1 km). The spatial extent of the impact will therefore be confined to a relatively small area compared to the available habitat area in this part of the North Sea.

Three or four pipeline crossings (**Section 4.4.2**) will be constructed to support the proposed pipeline and protect the existing pipeline. At each crossing, the pipeline will be surrounded and covered by a gently

sloping protective "skirt" of rock. The graded, crushed rock will range in diameter from 3.2cm to 12.5cm. The existing pipeline that is being bridged will remain "live" during the construction of these crossings.

Regardless of the diameter of pipeline that is laid, rock dumping will be required at various locations along the line and at the pipeline crossings. If the pipeline is laid conventionally ("straight lay"), approximately 27,000m^3 of intermittent rock-dump would be required to stabilise the pipeline in the 22'' alternative (88,000 m^3 in the 32'' alternative), whereas the "snake-lay" arrangement of long sweeping curves would require approximately 7,000m^3 (22'') or 8,000m^3 (32'') of intermittent rock-dump to provide additional stability. The total amount of rock-dump required over four crossings would be approximately 6,000m^3 for both alternative dimensions.

7.3.2 Impact on Sensitive Receptors

Laying the pipeline and creating the rock-dumps will disturb the seabed sediments, and benthic organisms living in or on these sediments, in the relatively small area of seabed directly below the pipeline and rock dumps. The total area covered by these structures will, however, be small in relation to the area of undisturbed benthic habitat adjacent to the line, 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 will have a small surface area.

A very small number of demersal and pelagic fish might be temporarily disturbed by the pipelaying operations, and, if large amounts of seabed sediment were re-suspended into the water column, it is possible that small areas of spawning ground could become degraded for a time. After the pipe has been installed, however, it is anticipated that a variety of fish species would be found along its entire length, making use of the shelter provided by this new structure on the seabed.

7.3.3 Impact on Proposed or Designated Conservation Sites

There are no proposed or designated conservation sites in the vicinity of the proposed operations. No habitats listed in Annex I of the EU Habitats Directive were identified during the seabed survey of the pipeline route (**Section 5.5.1**).

7.3.4 Trans-boundary, Cumulative and Global Impacts

There are several existing pipelines in this area (**Section 4.4.2**). Since all of them were installed several years ago, the seabed will have recovered from any previous trenching operations, and therefore the installation of the new pipeline will not lead to any cumulative impacts.

7.3.5 Stakeholder Concerns

The SFF expressed a preference for trenching and burying the pipeline, rather than laying the pipeline directly onto the seabed. Statoil have looked into the option of trenching the pipeline, however, the coarse sand / shale seabed overlying stiff clay in the proposed area would easily result in problems with upheaval buckling of the pipeline and possible occurrences of free spans along the pipeline. The problems arising from the unevenness of the trench will require the pipeline to be rock dumped along its entire length **(Section 4.4.3.1).**

7.3.6 Adequacy of Proposed Mitigation Measures

The planned mitigation measures to be taken by Statoil to minimise the impact of installing the pipeline are detailed in Table 7-3. The mitigation measures represent standard industry practice and are judged to be sufficient.

Table 7-3: **Potential sources of impact and planned mitigation measures for pipeline installation**

Potential source of impact	Planned mitigation measure
Pipelaying	The pipeline route has been surveyed in order to determine the detailed bathymetry and seabed conditions, and so identify the optimum pipeline route. This survey includes side scan sonar, echo soundings, core samples and visual inspections by ROV. Carefull control will be carried out to ensure that the pipe is laid in exactly the correct location and according to specifications.
Rock dumping	The rock-dumping operations will be monitored and controlled, to ensure that all of the required rock-dumps are created in the correct locations and according to the planned specifications. The location and profile of rock dumps will be made available to fishermen and fishing interests. The characteristics and profiles of the rock dumps will be designed so that the risk of snagging to fishing gear is minimised

7.4 Physical Presence of the Pipeline and Sub sea Structures

7.4.1 Magnitude and Duration

Untrenched offshore pipelines lying on the seabed surface have the potential to interact with fishing gear and anchors. The presence of the new gas export pipeline, the pipeline crossings and the subsea structures with protective covers and rock dumps (HTTs and PLEMs) may therefore result in some interference with commercial fishing or shipping operations in the area.

7.4.2 Impact on Sensitive Receptors

The proposed pipeline is located in an area of moderate commercial value for fish species caught by both UK and Norwegian fishermen, and the main fishing gears used in the area are demersal / bottom trawling methods (**Section 5.4.6**), which also have the greatest potential to interact with subsea pipelines.

Fishing with passive gears, such as nets and lines, can also be impacted during pipeline installation /29/. After a pipeline has been laid, it is unlikely to represent any hazard to passive fishing gears. For this reason, the following section focuses on the interaction of active, rather than passive, fishing gear and the pipeline. It examines the following:

- Interaction with the pipeline itself;
- Interaction with rockdumps; and
- Interaction with HTT and PLEMs.

Interaction with the pipeline:

The Tampen Link pipeline will be designed to withstand interactions with fishing gear, and to present a profile that will, in so far as practicable, minimise the risk of impedance of mobile fishing gear which traverses the pipeline. The pipeline is regarded as being over-trawlable.

In areas where fishing with bottom trawl gear is likely, the industrial practice in the North Sea has been to protect all pipelines with diameters less than 16" from trawl interaction by burying or rock dumping the entire length /56/.

Studies undertaken in Norway concluded that pipelines laid directly onto the seabed and exposed to interaction with fishing gear, needed a protective coating, usually of concrete /62/. Research on the interaction between trawling and pipelines in the North Sea has shown that small diameter pipelines (16-20'') are more likely to cause snagging and possible loss of gear than large diameter pipelines /44/. Available evidence indicates that the interaction between large diameter pipelines and fishing gear is rare. The Tampen Link pipeline will be concrete coated, and will fall within the category of a 'large diameter pipeline' in both the 22" and 32" alternative.

Fishing in the vicinity of pipelines incurs the risk of hooking the trawl gear on the pipelines. Hooking is an accidental load condition on the pipeline, where the gear becomes attached to the pipeline and brings the fishing vessel to a halt /57/. Although hooking is rare, it is the most serious type of interaction, because it can result in damage to the fishing gear, displacement of or damage to the pipeline, and in extreme cases damage to the fishing vessel. Pipeline hooking is:

- limited to otterboard trawls rather than beam trawls;
- associated with larger diameter pipelines (>16");
- linked to fishing practices and, in particular vessels fishing along the pipeline rather than across it.

During 1988, a Norwegian project on "Trawling over Pipelines", which included pipelines ranging between 28" and 30", proved that, if trawls are to pass over pipelines without being damaged, the route and the alignment of the pipeline are important (Fiskeridirektorat, 1988). Tests showed there were no problems as long as the fishing gear passed the pipeline at an angle of 45° or more. Passing the pipeline at an angle of <45° makes it difficult for the gear to surmount the pipeline. The operational problems will increase with decreasing angle /29/. The route of the pipeline will be shown on Admiralty Charts, from which fishermen can judge the location of their gear and direction of the tow relative to the pipeline. There is no evidence that the trawling direction has any bearing on the volume of the catches in this particular area. In addition, Scottish vessels operating in the proposed area often (34% of fishing effort; **Section 5.4.6**) conduct pair trawling (two vessels towing a common bottom trawl). These vessels are not equipped with trawl doors that may hook onto the pipeline /2/.

Interaction with rockdump:

The proposed pipeline will be rock dumped along sections of the route to provided support and stability. Pipelines protected on the surface by rock dumping can present a hazard to towed fishing gears. While trawling over a rock dump section of a pipeline, graded rock can be dragged off a rock dump by bottom fishing gear and spread over the seabed. In addition the rock can:

- cause wear and tear on the net;
- damage the pump when the fish are unloaded; and
- crush or damage the fish when caught.

During 1997, the Norwegian Institute of Marine Research conducted an over-trawling experiment to assess the risk of rock dumped pipelines to bottom trawling fishing gears /47/. The trial concluded that lighter fishing gear with weighted ground line was not suitable for crossing rock dumped pipelines. However, fishermen trawling the trial area for whitefish (heavier gear), have towed their gear without reported difficulty /47/.

In addition, over-trawling tests were conducted over areas of rock dump along Statoil's 20" Sleipner condensate pipeline, an area extensively fished by light prawn trawlers. These 1998 trials indicated that over-trawling could be harmless even for light equipment if the trawl gear was rigged as for ordinary demersal fish trawling.

During 2002, meetings were held with fishermen regarding Norsk Hydro's Ormen Lange pipeline in the Norwegian sector of the northern North Sea. The fishermen confirmed that they trawled over pipeline rock dumps without operational problems or fishing gear damage, due mainly to their heavy net trawl gear and rock protective netting /6/. In relation to the Tampen Link pipeline, the use of heavier equipment by whitefish trawlers is predominant, and the rock placement will be well graded (**Section 4.4.3**), which enables rocks to pass through the mesh if they enter the fishing net, but also providing adequate pipeline protection. No significant operational problems for demersal trawling due to rock dumping along the new pipeline are therefore forseen.

Interaction with HTT and PLEMs:

These subsea structures will be located within protective tubular steel frames, which are designed to have a fishing friendly profile with sloping sides designed to deflect trawls. No significant operational problems for demersal trawling are foreseen from the presence of the protective covers on the seabed.

In summary, Statoil's detailed design of the concrete-coated pipeline, the graded and profiled rockdump, and the fishing-friendly protective covers on the HTT and PLEM, will address the concerns raised during the consultation exercise about the need to minimise the potential impact to the fishing industry. Mariners will be notified of the precise location, dimensions and heights of all seabed structures; the locations of all subsea structures will be recorded on Admiralty charts.

There is no known military activity in the vicinity of the proposed development.

7.4.3 Impact on Proposed or Designated Conservation Sites

There are no proposed or designated conservation sites in the vicinity of the proposed operations. No habitats listed in Annex I of the EU Habitats Directive were identified during the seabed survey of the pipeline route (**Section 5.5.1**).

7.4.4 *Trans-boundary, Cumulative and Global Impacts*

The proposed pipeline, crossings and subsea structures lie within UK and Norwegian waters. The impact assessment is equally valid on both sides of the UK/Norwegian boarderline

7.4.5 *Stakeholder Concerns*

DEFRA expressed concern that there may be potential interaction between fishermen and subsea structures in the proposed pipeline area. Potential fisheries interaction has been carefully addressed in the design of the subsea facilities. DEFRA also requested that the relevant fishing interest bodies are fully informed of the proposed work programme. In addition to information contained in this document, Statoil will continue to communicate with relevant bodies during the project, as required.

The MOD asked to be informed of the precise pipeline location, the date on which operations would begin, and details of the final design and planned installation programme. Statoil will notify all mariners of the pipeline installation work programme and the precise location, dimensions and heights of all seabed structures.

7.4.6 *Adequacy of Proposed Mitigation Measures*

The mitigation measures that Statoil plan to enact to minimise the main risks of fishing interactions with the subsea structures are detailed in Table 7-4. The proposed mitigation measures represent standard industry practice and are judged to be sufficient.

Table 7-4: Planned mitigation measures for the presence of the pipeline, crossings and structures

Potential source of impact	Planned mitigation measure
Loss of access to fishing grounds	The area covered by the new structures would represent a tiny fraction of the available seabed. A post-lay survey of the seabed will be conducted to verify that the structures are installed according to plan, and are over-trawlable. Mariners will be notified of the precise location, dimensions and heights of all seabed structures. All subsea structures, including pipelines, will be recorded on Admiralty charts.
Potential impedance to navigation and military exercises	No military activities have been found in the area.
Damage or loss of fishing or vessel caused by gear entanglement on the pipeline	The design of the pipeline, informed by the comments received during the consultation exercise, would minimise potential impacts to the fishing industry. The HTT and PLEM, and their protective structures, will be designed so that they do not impede fishing activities. The characteristics and profiles of the planned areas of rock dump will be designed to minimise the risk of snagging to fishing gear.

7.5 Pipeline Chemicals

7.5.1 *Magnitude and Duration*

Flooding, gauging, and strength and integrity testing are a routine part of pipeline installation, during which permitted discharges of chemicals to the marine environment will take place (**Section 4.4.6**).

The discharges will take place in UK waters (with some minor exceptions). The quantities of chemicals to be used and discharged will be determined during the detailed design, and will be subject to a PON 15C and a permit under the Offshore Chemical Regulations 2002.

The pipeline will be flooded with seawater containing an oxygen scavenger (sodium bisulphate) and a bioside (glutaraldehyde). As the chemicals vendor has still not been contracted, Table 4-6 (**Section 4.4.6**) provides generic information which reflects a best estimate of chemical usage and discharge.

In line with the PON 15C protocol, a PEC/PNEC calculation was carried out to predict the

environmental risks associated with the discharge of the treated linefill. A "worst case" approach has been taken in the calculations. PEC/PNEC represents the ratio of Predicted Environmental Concentration to Predicted No Effect Concentration. The calculated PEC/PNEC value represent the Risk Quotient (RQ) which provides a numerical index by which to assess whether or not the environmental risks associated with a particular chemical discharge would be deemed to be 'significant' or 'not significant'. Risks are generally assessed to be significant where RQ has a value that is greater than 1. An RQ was calculated for a scenario that represents the bulk discharge of the pipeline's contents at the end of gauging. In addition to the bulk discharge, there would be smaller separate discharges from the cross-over spools and the tie-in spools. These lesser events were not assessed because they would be likely to have highly localised effects (i.e. short-term deterioration in water quality in the immediate vicinity of the discharge point).

A RQ was calculated for a worst case scenario which would arise during a bulk discharge of glutaraldehyde biocide in pipeline linefill (by far the most toxic component in the linefill). The assessment was based on the discharge of a representative example of a proprietary gluteraldehyde-based biocide for linefill treatment: it is a CEFAS registered product which cannot be named for commercial reasons.

PNEC for the bioside glutaraldehyde is 0.047 mg/l (data taken from CEFAS template).

To calculate a PEC value, it was assumed that the entire volume of treated seawater in the pipeline would be discharged in a batch, and its contents would mix into a homogenous concentration in the water column within a 500m radius centred on the end of pipe.

The following properties of the discharge were assumed in the calculation:

- Volume of pipeline = 10,888 m^3 (based on the 32" diameter pipeline)
- Dose of glutaraldehyde = 75 mg/l
- Mass of glutaraldehyde to be discharged = 75 mg/l * 10,888,000 litres = 817 kg
- Volume of water column = 500 m * 500 m * 139m (water depth) * Pi = 1091703444.7 m^3

On the basis of these assumptions, PEC/PNEC is calculated as:

- PEC = 817 kg / 1.1E9 m^3 = 7.5E-6 kg/m^3
- PNEC of 0.047 mg/l
- PEC:PNEC (RQ) = 7.5E-3 / 0.047 = 0.159

For the worst case discharge of glutaraldehyde in treated linefill from the Tampen Link pipeline, the RQ is less than 1, indicating an insignificant environmental risk from this discharge.

7.5.2 Impact on Sensitive Receptors

There would be a localised impact immediately around the discharge point. 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

With regard to the impacts on plankton and small nekton (organisms that swim in the water column), these organisms are widely distributed in the water masses that flow over large areas of the North Sea. Consequently, a short-term discharge of treated linefill could not threaten the viability of these species.

7.5.3 Impact on Proposed or Designated Conservation Sites

There are no proposed or designated conservation sites in the vicinity of the proposed operations. No habitats listed in Annex I of the EU Habitats Directive were identified during the seabed survey of the pipeline route (**Section 5.5.1**).

7.5.4 Trans-boundary, Cumulative and Global Impacts

On the basis of the risk assessment, it is highly unlikely that there would be significant cumulative, transboundary or global impacts.

The biocide, glutaraldehyde, is hydrophilic and partitions mainly into the aqueous compartment, rather than into lipid compartments (e.g. in tissue) and organic sediment /38/. Glutaraldehyde biodegrades rapidly in aerobic and anaerobic aquatic environments at low concentrations (below 10 mg/l, which is ~1500 times higher than the concentration stated in **Section 7.5.1**) and will not bioaccumulate.

Hydrolysis is slow, but glutaraldehyde undergoes aerial oxidation in solution.

Of the remaining chemicals, both the oxygen scavenger, sodium bisulphite, and the dewatering agent, monoethylene glycol, are on the list of substances/preparations that are used and discharged offshore which OSPAR considers to be PLONOR (i.e. 'Pose Little Or No Risk to the environment, under OSPAR Annex 11, Ref 2002-7). Both chemicals partition into the aqueous environment and both are readily biodegradable. Fluorescein, the leak detection dye, is relatively non-toxic, but has low biodegradability. It has a sub-warning, which means that users are encouraged to substitute preparations containing fluorescein, where there are technical alternatives available. Currently, there are no alternatives on the market. Nevertheless, if appropriate alternatives become available prior to the application for the chemical permit, then these will be evaluated by Statoil and substituted.

Mono-ethylene glycol (MEG) is to be used for de-watering in the main pipeline and the tie-in spools. There is an option to use tri-ethylene glycol (TEG) for de-watering the Tampen Link spools and cross-overs at Brent, where there is the possibility of carry-over of residual quantities of the drying agent into the FLAGS pipeline, see section 4.4.6 for further details. The eco-toxicological properties of TEG are similar to MEG, differing mainly in solubility, TEG being less soluble in water. It should be noted that the overall volumes to be discharged from the spools and cross-overs at Brent (2-3 m^3) are small in comparison to the discharges relating to the main pipeline (appr. 100 m^3).

7.5.5 Stakeholder Concerns

The Norwegian Institute of Marine Research (Havforskningsinstituttet – HI) wishes to be consulted regarding the best time slot for the planned discharges.

No specific concerns have been expressed by UK stakeholders regarding the effects of pipeline chemicals during the SFLL project pipelaying activities.

The discharges will take place in October 2007, outside the most sensitive periods for biological resources in the area.

7.5.6 Adequacy of Proposed Mitigation Measures

Table 7-5 details the planned mitigation measures to be taken by Statoil during the proposed development activities to minimise the main environmental risks associated with pipeline chemicals. The proposed mitigation measures represent standard industry practice and are judged to be sufficient.

Table 7-5: Discharges of pipeline chemicals and planned mitigation measures

Potential source of impact	Planned mitigation measure
Toxicity of chemicals in linefill	A permit for the use and discharge of linefill chemicals will be obtained in compliance with the Offshore Chemicals Regulations 2002. The permit application will be accompanied with a PON 15C which requires that only approved chemicals will be selected and risk assessments be carried out for chemical discharges. Pipeline flooding, gauging, testing, dewatering and drying operations will be designed and carried out by experienced, specialist contractors, who will be supervised by Statoil. There will be a strict requirement for contractors to adhere to the conditions of the chemical permit. Discharges will be made from designated points, will be controlled by means of the appropriate equipment (pumps, valves and instrumentation) and procedures, and will be carried out according to specification. The spill contingency provision will include response requirements for chemical spillage.

7.6 Accidental Diesel Spills

7.6.1 Magnitude and Duration

The Tampen link pipeline to FLAGS will carry gas so there is no likelihood of a crude oil spill from the pipeline itself. Consequently accidental spills could only arise from vessels working on marine operations, such as the laybarge or other types of ship. Potential sources of oil spills from the project's vessels include:

- Upsets in the treatment system for bilge water.
- Loss of containment in a storage tank (e.g. of lube oils, fuel oil, or chemicals).
- Damage to a fuel bunker caused by a collision, grounding or fire.

Diesel is a non-persistent oil that rapidly evaporates from the surface of the sea. In the unlikely event of

an accidental spill of diesel fuel from a vessel, a diesel slick would form on the sea surface. The slick would disperse and degrade rapidly as a result of wave, current, microbial and photolytic action.

To assess the potential impacts of an accidental spill from a vessel, a worst-case oil spill scenario (1,000m^3 of diesel caused by a major loss of fuel containment during a serious collision involving the laybarge) was modelled using Det Norske Veritas (DNV's) OILTRAJ model. OILTRAJ models the displacement of and mass balance of oil particles released from a fixed position. The results of the model simulations are presented as probability of pollution, drift times to different positions, mass balance as a function of time and remaining oil mass. The 1,000m^3 volume of diesel is considered to be a typical storage capacity for a pipelay vessel, although the operating capacity is usually much lower than this.

Stochastic modelling was undertaken for a release of 1,000m^3 diesel over an one hour period at 61° 8' 19.36"N, 01° 50' 01.04"E (approximately 1.4km south of the Brent A) in all seasons (600 simulations). The modelled diesel spill simulates dispersion without intervention over a 30 days period (Figure 7-2).

The stochastic modelling indicated that there is a <5% probability that the hydrocarbons would travel beyond an area of 2,700km^2. Under most of the 600 simulations, the diesel drifts in a south-easterly direction and remains on the surface up to 50km away from the spill site. After release, the 1,000m^3 diesel will rapidly evaporate or will be mixed into the water column by natural dispersion. The model predicted that less than 100 tonnes of diesel would be present on the surface, at a distance of 10 to 25 km from the source of the spill (Figure 7-3).

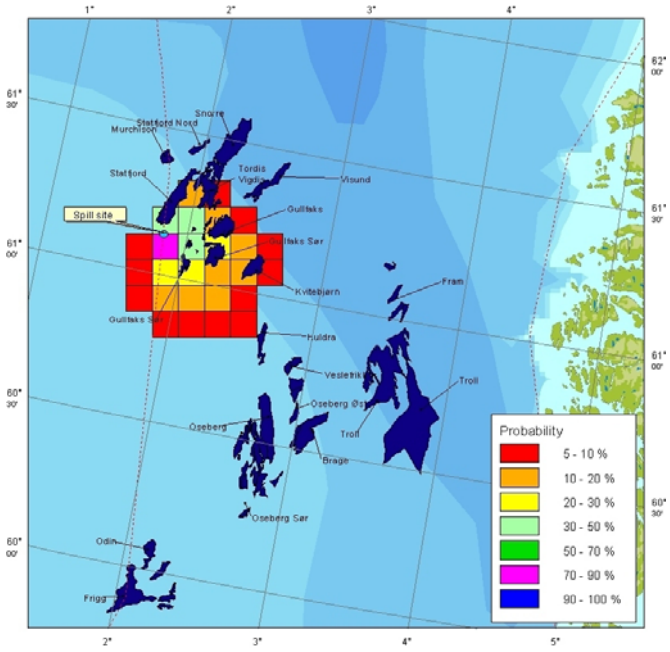


Figure 7-2: Stochastic modelling of hydrocarbons in the 10 km by 10km grid cells

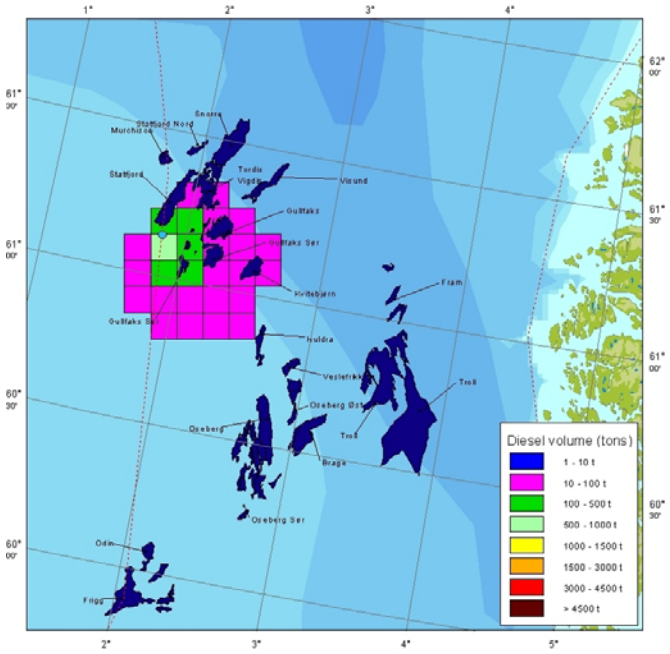


Figure 7-3: Stochastic modelling for the average diesel mass (in tonnes) in the 10 km by 10km grid cells

Prognostic modelling of the 1,000m^3 diesel spill forecasts the lifetime of the diesel on the sea surface (Figure 7-4). The model predicted under wind conditions ranging from 1 to 6 m/s (wind type) that the lifetime on the sea surface of the spilt hydrocarbons would be around 10 days, and that at any given point in time only a small sea surface area (<6km^2) would be affected by diesel.

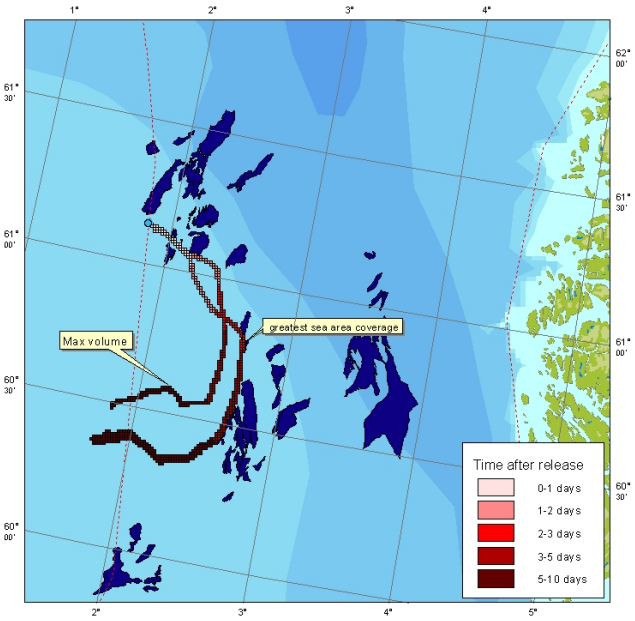


Figure 7-4: Prognostic modelling (single simulation) of the diesel spill

7.6.2 Impact on Sensitive Receptors

The potential risk to birds from diesel pollution arises as a result of damage to feathers which reduces mobility, buoyancy, insulation and waterproofing. Birds may also ingest the hydrocarbons, which are toxic, and may face starvation if their food sources are depleted as a result of the spill. The species most at risk from oil pollution are those that spend large amounts of their time on the water, such as guillemots, razorbills and puffins. The Joint Nature Conservation Committee (JNCC) Seabirds at Sea Team (SAST) have developed an index to assess the vulnerability of birds to the threat of oil pollution (JNCC 1999). The offshore vulnerability index is based upon four factors (Williams *et al.*, 1994):

- the amount of time spent on the water
- total biogeographic population
- reliance on the marine environment, and;
- potential rates of recovery

Seabird vulnerability in the area of the proposed pipeline is high in July, October and November (**Section 5.4.4**). In the other months, vulnerability is moderate to low.

There are generally very few cetaceans in the area of the pipeline so it is unlikely that the viability of any specific species would be impacted in the event of a diesel spill.

The eggs and juveniles of fish are most vulnerable to surface oil spills, because the adult fish are generally highly mobile and thus able to move away from polluted areas. Fish species with pelagic eggs and larvae spawn over wide areas of the North Sea, and the viability of the species would not be impacted in the unlikely event of a diesel spill.

Sensitive coastal sites would not be at risk from a diesel spill; modelling has shown that no beaching of diesel would occur (Figures 9-2 to 9-4).

7.6.3 Impact on Proposed or Designated Conservation Sites

There are no proposed or designated conservation sites in the vicinity of the proposed operations. No habitats listed in Annex I of the EU Habitats Directive were identified during the seabed survey of the pipeline route (**Section 5.5.1**).

7.6.4 Trans-boundary, Cumulative and Global Impacts

Should a major diesel spill occur during the pipeline activities, OILTRAJ modelling predicted that diesel could spread over a 2,700km^2 area, which if this were to happen, would impinge predominantly upon the Norwegian Sector of the North Sea.

There would be no global or cumulative impacts as a result of a diesel spill.

7.6.5 Stakeholder Concerns

No specific concerns have been expressed by stakeholders regarding the effects of an accidental spill of diesel during the SFLL project pipelaying activities.

7.6.6 Adequacy of Proposed Mitigation Measures

The mitigation measures that Statoil plan to take during the proposed development activities to minimise the main risks of hydrocarbon spills are detailed in Table 7-6. The proposed mitigation measures represent standard industry practice and are judged to be sufficient.

Table 7-6: Sources of oil spills and planned mitigation measures

Potential source of impact	Planned mitigation measure
Diesel	Statoil will put in place the following mitigation measures to reduce the risk of oil spills from the pipelaying vessels: All vessels will comply with IMO / MARPOL codes for the prevention of oil pollution and all vessels will have onboard Shipboard Oil Pollution Emergency Plans (SOPEPs). As far as possible, Statoil will use vessels which have experience of operating in the northern North Sea and are familiar with the weather and operating conditions in the area. Before mobilisation all vessels will be audited. This will ensure that the detailed list of spill prevention procedures which will be stipulated in the contract are in place.
Loss of pipelay vessel inventory (collision with another vessel)	To ensure that the risk of collision is minimised, Statoil will have the following mitigation measures in place: The ocean area in the vicinity of the pipelaying vessel will be continuosly monitored for approaching vessels on crossing route with the pipelaying operation Approaching vessels will be alerted. The pipelay vessel will be fitted with all necessary navigational and communication equipment. All relevant maritime authorities and fishing organisations will be notified of the proposed pipelaying activities.
All spills	As stated above, and as required under international legislation (MARPOL 73/92 Amended), the laybarge and other qualifying vessels will have in place Shipboard Oil Pollution Emergency Plans (SOPEPs). The plans will detail the actions to be taken in the event of a loss of shipboard containment. Vessels will have sufficient equipment to enable them to respond, contain on board and clean up minor pollution events. In the unlikely event that a large release occurred from vessel, there is the capacity to engage specialist spill response organisations, who can provide advice, support and an on-scene response, if required. These third party specialists would be brought in under the provisions that vessel operators have with their insurers. Statoil also have in place agreements with third party specialists.

8 Socio-economic and Employment effects

This chapter describes the effects on the economy and employment of the new gas export solution for Statfjord Late Life. The first section describes the major capital expenditure relating to the new gas export solution. The second section describes the employment effects. Calculation of the solution's profitability in socio-economic terms is not included in this chapter because the gas export solution is part of Statfjord Late Life, and the oil, gas and NGL income relates to this project and not specifically to the gas export solution. Calculation of the solution's profitability in socio-economic terms is instead included in Section 9 – Socio-economic effects and employment in the EIA/ES for the Statfjord Late Life project /48/.

All figures are based on a 22" Tampen Link pipeline between Statfjord and FLAGS, but comments are included on the changes in these figures that would result from a Tampen Link with a dimension of 32".

8.1 Capital Expenditure for the SFLL Gas Export Solution

The gas export solution will be constructed during the period 2005-2007. Data for capital expenditure is displayed in Table 8-1 below.

The Tampen Link pipeline will entail a total capex of more than NOK 1.5 billion (2004 NOK). These figures may be altered due to updating of the cost estimates.

Table 8-1: Capital expenditure 2005 – 2007 (million 2004 NOK)

	Gas export solution
Tampen Link Pipeline *)	955
Gas export and gas import facilities Statfjord B	597
Total	**1 552**

*) Alternatively a 32" Tampen Link will increase the capital expenditure by approximately NOK 126 million (2004 NOK)

Expenditure relating to operation of the pipeline is not included, but will amount to approximately NOK 10 million per year (2004 NOK). Decommissioning of the gas export/ gas import facilities is included in the figures for decommissioning of the Statfjord platforms. Decommissioning of the Tampen Link will be described in and approved on the basis of a separate decommissioning plan.

8.2 Delivery of Goods and Services and Employment

Construction and installation of the gas export pipeline will provide opportunities for private companies to deliver goods and services during the period 2005 – 2007. An estimate of the economic impact distributed over the construction and installation period is displayed in the diagram below.

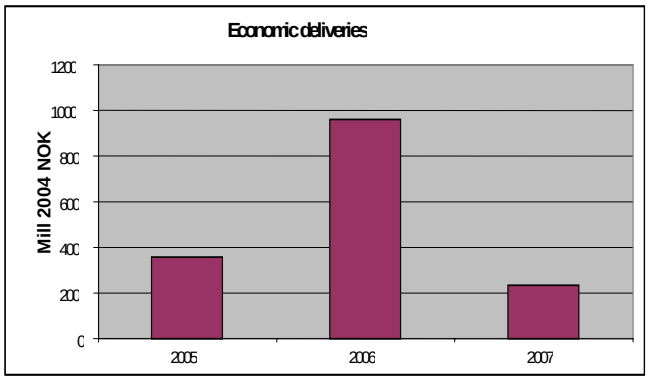


Figure 8-1: Deliveries of goods and services to the SFLL gas export solution 2005 – 2007

The development of the gas export solution will involve tasks such as:

- engineering in 2005 and 2006 for the pipeline, hot taps etc.
- procurement and fabrication in 2005-2007
- installation in 2005-2007, including pipe-laying, riser installation, seabed intervention, pipeline tie-ins and RFO
- fabrication, transportation and installation of gas export/gas import facilities topside SFB.

The estimated employment effects generated by the capital expenditure relating to the construction of Tampen Link and pertaining equipment on the SFB topside are based on a simplified calculation model. The model is based on empirical data from the construction of roads and results in 1.7-2.3 man-years for each NOK million invested. Due to the capital-intensiveness of projects in the petroleum industry and the generally high wage levels, the

model has been adjusted accordingly, to 1.2-1.8 man-years for each NOK million invested. In addition, approximately 0.3 man-years will be created as a result of increased consumption. The empirical model does not break down the employment by industry.

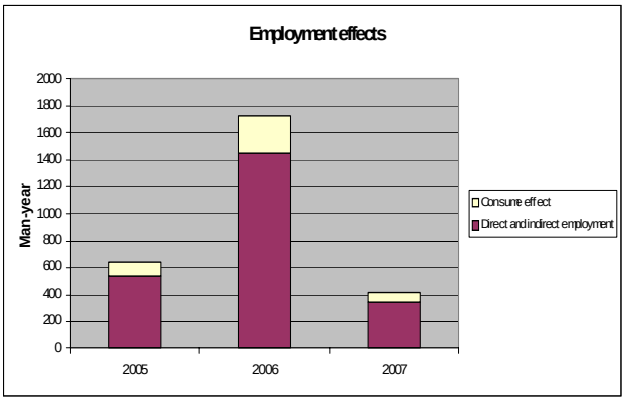


Figure 8-2: Employment effect of the SFLL gas export solution 2005 – 2007 (man-years)

Figure 8-2 shows the employment effects distributed over the construction and installation period. The gas export solution (22" Tampen Link) will have a total employment effect for the three years in the range of 2,300-3,200 man-years. The employment effect will increase by approximately 200 man-years if a dimension of 32" is chosen for the Tampen Link.

9 Environmental Management

This section assesses the proposed mechanisms for implementing the measures to reduce significant environmental impacts and risks. The assessment focuses on the framework and systems for assuring and monitoring environmental performance, and managing the interface between the operator and contractors during the construction and operational phases of the project

9.1 Company Policy

Statoil has an Environmental Policy which supports the goals of zero harm to the environment and sustainable development. Statoil's environmental policy is set by the company's senior management and applies to all the company's activities worldwide and to the whole workforce. Statoil's Environmental Policy is summarized as follows:

- We will act according to the precautionary principle
- We will minimise impact on the environment, whilst continuing to address health, safety and economic issues
- We will comply with applicable legislations and regulations

- We will continuously improve our energy efficiency, products and environmental performance
- We will set specific targets and improvement measures based on relevant knowledge of the area affected, and by applying risk analyses to assess environmental health effects
- We will consult and cooperate with relevant stakeholders and strive for solutions acceptable to all affected parties
- We will make our policy available to the public, openly report our performance and use a competent and independent body to verify our reported data
- We will seek to make the best possible utilization and use of natural resources
- We will contribute to the reduction of Green House Gases (GHG) by reducing relevant emissions from our activities and by participating in emission trading and utilising project based mechanisms
- We will prepare for a carbon constrained energy market and engage in the development of non-fossil energy sources and carriers

9.2 Policy Implementation and Environmental Management Systems

The commitments of the environmental policy are enacted by mechanisms that Statoil puts in place to effectively implement, measure, control and improve the activities and processes that are carried out by the company and its contractors. These activities and processes form an integral part of the business, commercial planning and decision-making processes at Statoil. Statoil's requirements for managing activities and processes are described in the document *HSE management in Statoil.*

This document specifies standards for management, the organisation, expertise, risk management and emergency response, as well as technical requirements for health and the working environment, the natural environment, safety, emergency response and security. HSE is a line management responsibility in Statoil. Managers have a particular duty to ensure that goals are met, but all employees in the company share a personal responsibility for this. Statoil requires that all entities have established and documented appropriate systems, which ensure that HSE requirements are met.

Such a system will apply to the Tampen Link pipeline project, and this Environmental Statement being a planning and decision making document within that system.

9.3 Project Specific Environmental Management

All of the mitigation measures and controls identified in the Environmental Statement have been summarised in Table 9-1 and Table 9-2. The Project Team has committed to implement these measures, but for some of which the details may have to be finalised. These measures will be incorporated into the Environmental Management Plan (EMP), which will be implemented prior to the start of construction. The EMP will be a key part of the system for implementing Statoil's company policies

and commitments made within the ES during the construction of the Tampen Link pipeline.

The main objectives of the EMP will be:

- Ensure compliance with legislation, Codes of Practice and Regulations;
- Ensure compliance with any conditions set by the authorities, or other consent granting bodies;
- Ensure compliance with Statoil group's environmental policy; and
- Ensure implementation of the mitigation measures identified in the EIA process.

In addition, it will address the following:

- Contingencies for unforeseen events;
- Roles for Statfjord Late Life staff and Contractor staff;
- Briefing of personnel on matters such as environmental awareness;
- Monitoring, watching briefs and audit of construction works; and
- Restoration, after-care and post-completion inspections.

Table 9-1: Significant environmental impacts and planned mitigation measures

Potential source of impact	Potential impact or risk to the environment	Planned mitigation measures
Physical presence of pipelay vessels	• Temporary restrictions to sea access during the construction period (0.8km^2 to 12.6km^2) in an area of moderate levels of fishing effort and shipping traffic in the UKCS and NCS.	• The pipelaying will be advertised through Notice to Mariners in the UK and Norway • The operational area will be monitored during pipelaying to alert shipping and fishing vessels on approach to the area • Activities and restrictions will only last for 2-3 months.
Anchoring of vessels during pipeline installation.	• Anchor mounds can form on clay seabed, and potentially become long-term, localised obstructions that could interact with fishing gear.	• Exact location of the anchors will be planned • An post-lay ROV (Remotely Operated Vehicle) inspection will be conducted to ensure anchors were placed on the seabed correctly • A survey of the pipeline route will be undertaken on completion of the activities to identify any seabed discontinuities • Statoil will ensure any significant mounds formed will be flattened using suitable methods.
Pipeline installation	• Installation will disturb the seabed sediments, and the benthic organisms living in or on the sediments, in a small area of seabed beneath the pipeline and rock dumps • The pipeline and rock dumps will create a new area of habitat for benthic organisms that live on hard surfaces, and provide additional habitat for crevice-dwelling fish • Potential impedance to commercial fishing (see also **Physical presence of pipelines**)	• A pipeline route survey has been conducted and has been used to plan the optimum pipeline route • A survey vessel will be on station during installation to ensure that the pipeline is laid in the correct location • Rock-dumping will be supervised by use of sonar, and will be post-dump surveyed by an ROV to ensure that material is placed accurately and in the correct location • Pipeline Works Authorisation (PWA) application will be made • Location and profile of rock dumps will be made available to fishermen and fishing interests • Characteristics and profiles of the rock dumps will be designed to minimise the risk of interference with fishing activity.
Physical presence of the pipeline and subsea structures	• Impedance to military exercises is not envisaged as the project area is not utilised for these purposes • Loss of access to fishing grounds will be insignificant as all subsea structures can be trawled over by demersal trawling gear • Marginal risk of damage or loss of fishing gear or vessel caused by gear entanglement on the pipeline, subsea structures or rock dumps.	• No mitigation planned • Mariners will be notified of the location, dimensions and heights of all seabed structures • Locations of all subsea structures, including pipelines, will be recorded on Admiralty charts • The pipeline, the HTT and PLEM and their protective structures, and the rock dumps will be designed to be over-trawlable and do not impede fishing activities • The seabed will be surveyed after the gas export pipeline has been laid and any significant obstructions will be levelled

Table 9-1 continued: Significant environmental impacts and planned mitigation measures

Potential source of impact	Potential impact	Planned mitigation measures
Pipeline chemicals	• Toxicity of chemicals in linefill. Dilution modelling results indicate there would only be a minor localised impact immediately around the discharge point at the PLEM 1.4 km south of Brent A.	• Further dilution modelling for the discharge of chemicals with the linefill water will be conducted in compliance with the **Offshore Chemicals Regulations 2002** • The permit application will be accompanied with a PON 15C which requires that only approved chemicals to be selected and risk assessments be carried out for the chemical discharges. Any conditions set by the authorities will be complied with • Pipeline flooding, gauging, testing, dewatering and drying operations will be designed and carried out by experienced, specialist contractors, whose performance will monitored by Statoil. • There will be a strict requirement for contractors to adhere to the conditions of the chemical permit • Discharges will be made from designated points, will be controlled by means of the appropriate equipment and procedures, and will be carried out according to specification • The spill contingency provisions will include response requirements for chemical spillage.
Accidental spill of diesel	• Diesel would disperse rapidly. No residual impacts would be expected on the local environment	Statoil will put in place a number of mitigation measures to reduce the risk of oil spills from the pipelaying vessels: • The pipelaying vessel will monitor the exclusion zone around the pipelaying vessel • The pipelay vessel will be equipped with all necessary navigation and communication equipment • All the relevant maritime authorities, and representative fishing organisations, will be notified of the proposed pipelaying activities • As required under MARPOL 73/92 Amended, the laybarge and other qualifying vessels will have in place Shipboard Oil Pollution Emergency Plans (SOPEPs) • The plans will detail the actions to be taken in the event of a loss of shipboard containment • Vessels will have sufficient equipment to enable them to respond, contain on board and clean up minor pollution events • In the unlikely event that a large release occurred, there is the capacity to engage specialist spill response organisations, who can provide an on-scene response, if required. These third party specialists would be brought in under the provisions that vessel operators have with their insurers • Statoil also have in place agreements with third party specialists

Table 9-2: Non-significant environmental impacts and planned mitigation measures

Potential source of impact	Potential impact or risk to the environment	Planned mitigation measures
Noise from vessels during pipelaying activities	• Noise could potentially disturb low densities of marine mammals in the area	• Noise will be minimised through well maintained equipment
Power generation on vessels during pipelaying and decommissioning activities	• Short-term, localised air quality deterioration around exhaust outlets.	• Emissions will be managed through the use of well maintained equipment • Compliance with IMO/MARPOL requirements
Discharge of treated bilge from vessels during pipelaying and decommissioning activities	• Localised deterioration in seawater quality around discharge point • Potential for minor oil slick formation, but local environmental conditions will rapidly disperse any hydrocarbon discharges	• Bilge treated prior to discharge. • Compliance with IMO/MARPOL requirements • Vessel audits
Sewage discharged from vessels during pipelaying and decommissioning activities	• Localised increase in biological oxygen demand around point of discharge • Increase in fish and plankton productivity • Offshore currents will readily disperse sewage	• Sewage treated prior to disposal or contained and shipped to shore • Compliance with IMO/MARPOL requirements • Vessel audits
Emissions from anodes during production activities	• Release of contaminants (metal ions) into water column and seabed • Concentrations of metal ions on the anodes are very low and would not cause toxic effects • Rapid dispersion and dilution in the offshore area.	• No particular mitigation planned
Dropped objects during production and decommissioning activities	• Possible obstruction to fishing • Creation of artificial substrata to be colonised by organisms.	• Adherence to procedures and use of certified equipment • Retrieval of major items of debris on seabed
Removal of PLEMs, HTTs and other forms of subsea intervention	• Temporary disturbance to seabed and benthos.	• Post operational seabed surveys to be conducted if judged necessary.

10 Conclusions

The environmental assessment undertaken for the Tampen Link gas export pipeline has established that sufficient information has been optained on both the environment and the proposed pipeline operations to evaluate the potential environmental consequences of the development.

The proposed pipeline chemicals will be subject to a separate permit under the **Offshore Chemical Regulations 2002**. The regulations require that operators use only approved chemicals, and support their permit application by providing detailed chemical information and environmental risk assessments for each chemical discharged. Statoil will comply in full with these regulations.

The potential environmental impacts of the project can be summed up as follows:

- The Tampen Link project will have an impact in a small area in the middle of the North Sea. In the area in question, both environmental resources and fishing activities are relatively evenly distributed over a large area. The area directly affected by the pipeline project is very small. Accordingly, the potential for coming into conflict with environmental or fishery interests is limited.

- The project activity with the greatest impact on the surroundings, will be the actual installation of the new pipeline. This phase will be transient and of short duration.

- The area of influence of the pipeline part of the Statfjord late life project does not include any habitats listed in Annex I to the **EU Habitat Directive**.

- Seabirds in the area in the middle of the North Sea may be particularly vulnerable to surface oil pollution in July and October/November. Statoil has established procedures to ensure that all necessary measures to prevent accidental spills will be implemented.

- Fishing activities in the area are limited. The most common fishing method is bottom trawling.
  It is considered that any conflicts with fishery interests in the operating phase of the Tampen Link pipeline will be minimal, since all subsea installations are designed to be over-trawlable. During the actual installation of the pipeline, certain traffic restrictions in the area must be expected, due to the presence of a pipelaying vessels, possibly with deployed anchor chains. Notification and monitoring procedures will be established, so that any conflict with the fishery interests and other shipping can be avoided as far as possible.

- For these reasons, there is little probability that the project will have any significant impacts on the environment or the fisheries.

No project activity would result in impacts or risks that were of such a magnitude or consequence that the project could not be undertaken. The following routine project activities would, however, result in impacts that were assessed to be significant, either because there would be a requirement for environmental safeguards or concerns were expressed during the consultation process:

- The presence of pipelay vessels

- The anchoring of vessels during pipeline installation.

- The various operations to install the pipeline.

- The physical presence of the pipeline and subsea structures on the seabed.

- The planned or accidental discharge of chwemicals from the pipeline during commissioning.

- The accidental spillage or release of diesel fuel from a vessel during installation operations.

Although there will be some environmental impact as a result of the installation and presence of the proposed pipeline, none the above project activities would result in serious impact or risks that would prevent the project from going ahead. Mitigation to avoid or reduce these environmental consequences is in line with industry best practice, and Statoil will

ensure that the mitigation measure will be implemented. In addition, Statoil has made, or intends to make, the necessary provisions to comply with all other legislative and company policy requirements during the implementation of the development.

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Appendix A The EIA process in Norway and the United Kingdom

A.1 The Process in relation to the Norwegian Authorities

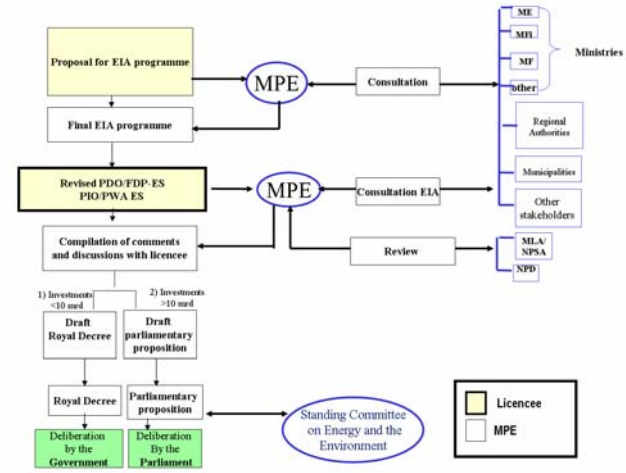

Figure A-1: The EIA process in Norway

The EIA process formally starts with a discussion of the framework for the process with the Norwegian Ministry of Petroleum and Energy (MPE) as the regulatory authority. A draft assessment programme is then sent to the MPE for consideration (Figure A-1).

The Ministry decides which are the relevant consultation bodies, distributes the programme and obtains statements from these. When the consultation round has been completed, the MPE submits the comments on the assessment programme to the developer and, when the developer's views on these comments have been received, adopts the final assessment programme for the environmental impact assessment.

On the basis of the assessment programme adopted, the developer will prepare an environmental impact assessment as part of the PDO (Plan for Development and Operation) and/or PIO (Plan for Installation and Operation).

The MPE distributes the environmental impact assessment to the same consultation bodies that were consulted on the draft assessment programme, and obtains statements from these. Statements on the PDO and/or PIO are also obtained from the Norwegian Ministry of Labour and Government Administration through the Petroleum Safety Authority (working environment and safety) and the Norwegian Petroleum Directorate (resource factors).

The statements from the EIA consultations are then submitted to the developer for comment. The ministry will be in charge of the further consideration of the EIA and the consultation statements received, and will ultimately decide whether the assessment obligation has been met. The EIA will be dealt with by Royal Decree or by the Storting.

On account of its investment budget of more than NOK 10 billion, Statfjord late life will require approval by the Storting. MPE will therefore make a recommendation in the form of a Proposition to the Storting which will be considered by the Storting's committees before it is submitted to the Storting for final approval. The Proposition to the Storting summarises the project in its entirety, including its impacts and any preconditions and measures on which approval is based.

A.2 The Process in relation to the UK Authorities

A simplified presentation of the UK EIA process is shown in Figure A-2.

The Department of Trade and Industry (DTI) is made aware of the project and may be asked to decide on an application for dispensation from the requirement to prepare an Environmental Statement in the form of a "Petroleum Operation Notice (PON) 15".

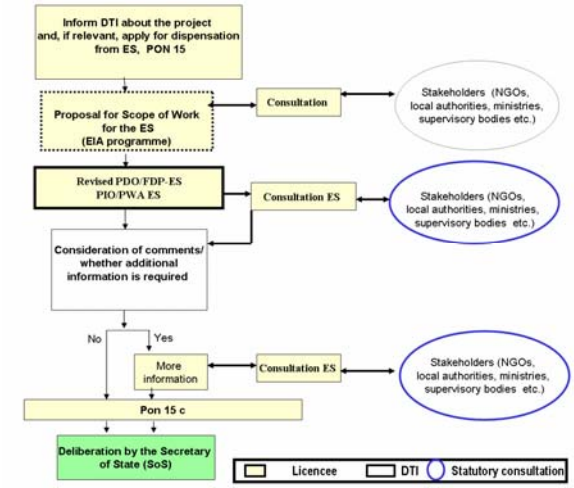

Figure A-2: The EIA process in the UK

If an Environmental Statement is required, the DTI recommends that the general public, fisheries organisations, environmental authorities and other relevant authorities and stakeholders be consulted before the ES is prepared. The licensee is responsible for this communication, and the DTI is consulted on an equal basis with other consultation bodies. Furthermore, there are as mentioned no documentation format requirements for this preliminary consultation (e.g. letter of information, EIA programme etc.).

PON 16 for "Submission of an Environmental Statement in support of an Application for Consent" is submitted together with the ES. PON 16 may alternatively be submitted together with any approved dispensation from preparing an ES.

The licensee must send an ES for consultation for a minimum of 28 days and, as part of the consultation, the general public must be informed in at least two national newspapers. Unlike in Norway, the licensee is responsible for the consultation process, but the comments are sent to the DTI for compilation. The DTI may decide to send comments from the consultation round to the licensee for elaboration and comment.

The DTI will determine whether the assessment obligation has been met or whether further information is required on the basis of the ES and any consultation statements that the DTI receives. If further documentation is required, the licensee must procure it and send it for consultation to the same consultation bodies that received the ES. The DTI will normally need eight weeks to process the ES.

In addition to the ES, the licensee must submit an application for the approval of any chemicals that are to be discharged (PON 15). A full risk assessment is required as basis for such an application. For Statfjord late life, it will be necessary to submit a PON 15c in connection with the activities of laying and starting up the gas export pipeline Tampen Link. The PON 15c does not require public consultation, but in this case (the new Tampen Link gas export pipeline) JNCC and FRS will be consulted about the application. The DTI will normally require 28 days to process the application.

The development is subject to approval by the Secretary of State (SoS). The SoS will only approve the development if the information provided in the ES and any additional information is found to be satisfactory, and it has been documented that the development will not have any significant environmental impact. If the environmental impact is considered to be significant, consent may be granted on the condition that certain mitigating measures are implemented. Whether consent is granted is based on a balanced evaluation of beneficial and adverse impacts on the environment and socio-economic benefit. This consent is a precondition for approval of the field development and pipeline. The decision can be appealed within six weeks.

Appendix B Approval of the EIA program

The program was approved by MPE 13 October 2004 and is presented below in B1.1 and B1.2.

B.1 Content of the EIA

The plan is to carry out a field-specific environmental impact assessment which will make use of the assessment work carried out in the Regional Impact Assessment for the North Sea. This means that no new studies will be carried out for assessment items already covered. References to the Regional Impact Assessment will be used instead. The items this concerns are described in the following.

Based on this EIA-programme, the environmental impact assessment will include a discussion of the assessed development alternatives and transport solutions and state the grounds for the selection of the development solution. This means that an account will be given of the selection made in respect of technical feasibility, safety, project economics and environmental impact, including the impact on fisheries and other industry. The socio-economic impacts of alternative developments and gas transport solutions will also be described.

The EIA will provide a supplementary description of the development and transport solution selected and assess its impacts on the environment and the economy. Mitigating measures on the basis of the company's zero harm philosophy and the authorities' environmental policy and regulations will be documented in further detail.

An account will also be given of the licences, approvals or consents to be applied for in accordance with the existing legislation and the plans for abandonment and emergency response.

Consultation statements received on the assessment programme will be commented on with a possible reference to where in the assessment the various items are discussed.

B.2 Topics to be assessed

B.2.1 Overview of vulnerable Natural Resources

The Regional Impact Assessment for the North Sea (Sub-report 3) contains a description of natural resources and their utilisation. The Regional Impact Assessment is generally regarded as being adequate for the EIA for Statfjord late life. However, the information will be updated where more recent data is available. Information relevant to describe potential impacts of the gas export pipeline on the UK territory will also be collected if necessary, such as information about habitats, benthos, sea birds, sea mammals and fisheries, including spawning and nursery areas.

B.2.2 Emissions to Air

The development will involve emissions to air associated with:

- Drilling
- Marine operations
- Well operations
- Production/processing
- Storage, loading and transport of gas/oil

The EIA will update the calculations for energy requirements and emissions to air for the parameters CO_2, NO_X, CH_4 and nmVOC. The EIA will highlight the authorities' environmental policy and regulations and how the measures assessed are based on these.

Statfjord late life is a modification project for a field that has been producing for 25 years. There will therefore also be a detailed description of emissions, the measures implemented in a historical perspective and the factors that limit the selection of measures in the late life project.

The emissions associated with the development will be compared with emissions from:

- Tampen/North Sea
- Total emissions from the Norwegian continental shelf
- National emissions
- Emissions from Statfjord in a historical perspective

The environmental impacts of emissions to air will be assessed on the basis of the Regional Impact Assessment for the North Sea.

B.2.3 Discharges to Sea

Discharges to sea in Statfjord late life could occur from:

- The use of well chemicals for well operations
- The use of chemicals when preparing pipelines
- Discharges of produced water, including chemicals used in the process
- Other discharges includet ballastwater

The EIA will highlight the companies' and authorities' environmental policies and how it is planned to implement them in this project. Both planned and assessed mitigating measures will be described.

The quantities of various components that are discharged to sea as a consequence of the development will, where possible, be related to discharges from:

- Tampen/North Sea
- Norwegian continental shelf
- Discharges from Statfjord in a historical perspective

Where possible, the discharges will be quantified with and without mitigating measures.

Drilling and Well Operations
Oily cuttings and drilling fluid will be injected. There will be no drilling in the top sections and there will therefore be no discharges of water-based drilling fluid and cuttings. There will only be minor discharges of well chemicals to sea.

An overview will be provided of the chemicals that are to be used in connection with drilling and completion of wells, special challenges associated with late-life drilling and any discharges and effects of well chemicals.

Preparation of Pipelines
Discharges of chemicals in connection with preparation of the export pipeline will be described. This includes chemicals that will be used to prevent corrosion and fouling and any dyes used for pressure testing and leakage detection. Any local effects and the times of discharges will be described. Measures to limit any effects will also be documented.

Produced Water
Produced water volumes, quantities of substances/dissolved components in the water and contributions to environmental risk from produced water will be described in the EIA. The content of radioactive components in produced water and the formation of low-level radioactive waste will also be elucidated.

Discharges of produced water and mitigating measures (assessed and planned) will be described for all the platforms. Measures implemented for handling produced water will also be described, as well as the factors that limit the selection of late-life measures.

The EIF method and environmental risk will be used to describe the impacts of produced water. In this connection, the EIF calculations will be updated in accordance with new water profiles, an updated late-life chemicals programme and any other changed conditions. The EIF method will be described in further detail and there will be an interpretation of the EIF figures produced with regard to acute toxic effects and chronic effects, including the risk of bioaccumulation and the degradability of the substances.

The results from monitoring and from research programmes, including PROOF (2002-2008), which discuss the long-term effects of discharges to sea from petroleum activities, will be used where possible. The environmental risk analysis, commissioned by OLF (the Norwegian Oil Industry Association) and to be carried out by the Norwegian Institute of Marine Research and Rogaland Research Aquatic Environment in 2004, to describe the real environmental risk to fish posed by alkyl phenols, will also be used as a basis where results are available. Furthermore, results from the sampling of produced water with regard to radioactive components will be used.

The possible impact of produced water will also be assessed on the basis of the resources and species present in the area and their prevalence and movements. The PEC/PNEC ratio versus the available resources will be presented on a map. In order to evaluate the representativeness of the data on which the EIF calculations are based, an evaluation of the presence of species in relation to the species on which the PNEC values used in the calculation of the EIF will also be carried out.

Other regular Discharges
Other discharges such as drainage water, sanitary waste water, cooling water, displacement water, ballast water on ships, discharges from pipelines in connection with operation and discharges of oily sand are not expected to have any appreciable impacts. The discharges and the implemented and planned mitigating measures will, however, be described.

Among other things, importance will be attached to describing the discharges of oily sand, the environmental risk these discharges are deemed to represent, and the contribution to total risk in relation to regular discharges.

B.2.4 Accidental Discharges

The EIA will assess the probability of acute discharges associated with the drilling and production phases, oil drift and the extent of any damage. The degradation properties of the oil and any changes in the existing oil spill response plans since the Regional Impact Assessment for the North Sea was approved will also be described.

The assessment will be based on the material underlying the Regional Impact Assessment for the North Sea, existing environmental risk analyses for Statfjord and new environmental risk calculations that will be made in connection with Statfjord late life.

The risk associated with transport of oil (shuttle tankers and tankers) will also be assessed. For a description of environmental damage after a possible acute discharge of oil, reference will be made to the Regional Impact Assessment (Sub-reports 4 and 7).

The following items are regarded as largely covered by the Regional Impact Assessment but will be supplemented where necessary by updated information:

- Description of environmental damage after an acute oil discharge (Sub-report 4, chapter 6)
- Description of existing oil protection emergency plans in the area (Sub report 4, chapter 7)
- Aquaculture in the area of influence of oil spills (Item Assessment Report 7, chapter 9)

B.2.5 Impacts of Pipelines and Area occupation

The environmental impact assessment will, in addition to discharges associated with the pipeline, describe:

- Pipelines and pipeline routes
- Laying period
- Requirements for protection of pipelines including rock/gravel dumping
- Activities and impacts in connection with laying and operation
- Any measures to reduce the impacts.

The development alternative selected is expected to have insignificant impacts for fisheries, any habitats/benthos worthy of protection and cultural heritage.

The Regional Impact Assessment for the North Sea and the provisional EIA (issued in relation to selection of development alternative) will be used as the basis for a description of the impacts of area occupation and pipelines, in particular with regard to fisheries.

Descriptions of fish resources on the Norwegian side will be updated and fisheries statistics, including spawning and nursery areas, will be obtained from the area of influence on the UK side. Any impact on habitats or species worthy of protection, particularly with respect to the EC Habitat Directive e.g. pockmarks, will also be elucidated. Subsea photos/video will as far as possible be used for documentation.

It will also be established whether the presence and laying of the pipeline will have other impacts that need to be addressed in the EIA.

Where protection of the pipelines is required, the extent of rock dumping will be assessed. A

description of the type of laying vessel will also be provided where information is available.

A final assessment of these factors cannot be made until after the route has been surveyed. The route survey will be carried out as part of the pre-engineering, but the route will not be finally decided until the detailed project engineering.

However, the EIA will discuss the impacts of possible scenarios for the extent of rock dumping and type of laying vessel.

In connection with connection to FLAGS, old heaps of oily cuttings downstream of Brent A will be surveyed to avoid them when laying the pipeline. Other mitigating measures will also be described.

B.2.6 Socio-economic Impacts

The impact assessment will be based on experience from previous developments, updated investment profiles, income forecasts and other conditions, and calculate and analyse:

- Expected supplies of goods and services in the development and production phases
- Manpower requirements and employment effects of the development and production phases
- Socio-economic profitability of the selected development alternative and gas transport solution.

Employment effects and the potential for supplies of goods and services are based on what can be expected on the basis of previous experience. All contracts associated with specific projects will be awarded in accordance EU's competition rules and on the basis of technical and commercial assessments.

Furthermore, the EIA will give an illustration and justification of the factors to which importance was attached when selecting the gas transport solution.

Effects on production in other fields following pressure reduction at Statfjord will also be assessed in further detail.

B.2.7 Environmental Monitoring and Research

The environmental impact assessment will contain a detailed description of the regional and local environmental monitoring currently taking place and will assess its results. The Regional Impact Assessment will be used as the basis together with the results from recent years' survey expeditions. The results available will be compiled and, where possible, presented on a map.

The EIA will also assess the extent to which it is necessary to carry out specific studies and monitoring as a result of the development in the light of the impacts of the development and the existing guidelines for monitoring.

The research in progress to describe the effects of petroleum activities and the results of this research will, where relevant to Statfjord late life, be commented on.

Appendix C Non-Technical summary – Enrionmental Statement for the Statfjord late life (Field Modifications)

C.1 Description of the Project and the EIA Process

The Statfjord field is an existing oil field consisting of three platforms: Statfjord A, B and C. Statfjord Late Life (SFLL) is a project that entails shifting from oil production to gas production by relieving the pressure in the reservoir. SFLL makes it possible to prolong the production at Statfjord in relation to the current drainage strategy (the Statfjord reference alternative), thereby exploiting a larger share of the total gas and oil resources at the Statfjord field. The recovery factor will now be 68 and 74 per cent for oil and gas, respectively; high figures in both a national and international context.

The realisation of Statfjord late life will provide significant value creation for society. However, the project is only marginally profitable to the owners, and is critical in time due to the extensive modification of the platforms.

Since 2001, the Statfjord late life project has identified and assessed various development alternatives in order to increase exploitation of the Statfjord field. Over 50 alternatives were originally considered. A study to select the three most promising development alternatives was concluded in June 2003. These alternatives were compared with each other and with the current drainage strategy. The project recommended re-construction and modifications to existing platforms (removal of bottlenecks) for development of the Statfjord field for late life production. This recommendation was made on the basis of an overall assessment of technical, financial, operational, environmental and resource-related factors.

SFLL is based on a change of drainage strategy in order to increase the recovery factor at the field. By changing from pressure maintenance (current strategy) to pressure relief (late life), the reservoir pressure will gradually be reduced. Gas will be released from the remaining oil and collect in the gas layer of the reservoir for production. Gas will no longer be reinjected into the reservoir, but exported via the new gas export pipeline, the Tampen Link, which links Statfjord to the existing infrastructure on the UK side of the North Sea (FLAGS). Statfjord A, B and C will be modified to handle the changed operational conditions following the implementation of late life production, and to ensure compliance with all regulatory requirements relating to the field's prolonged life, including those on health, safety and the environment

The Statfjord Treaty of 1979 regulates the exploitation of petroleum from the Statfjord field, the requirements for documentation, and the approval of plans and agreements for the field by the public authorities. According to the "*Agreement between the Government of the Kingdom of Norway and the Government of the United Kingdom of Great Britain and Northern Ireland on the Exploitation of the Statfjord Reservoirs and the Transport of Petroleum from these Reservoirs*" (the "Statfjord Treaty"), cf. Proposition to the Storting (the Norwegian Parliament) no. 15, 1980-81, a field development plan will have to be prepared with subsequent approval by the public authorities of both countries.

In consultation with the public authorities of both countries, a decision was made to prepare a joint plan for the planned alterations and modifications at the Statfjord field, which would meet both countries' guidelines for approval documents: the, Plan for Development and Operation (PDO) in Norway and the Field Development Plan in the UK.

In connection with Statfjord late life, a new gas export pipeline, the Tampen Link, is planned for the transport of gas from the Statfjord field. The installation of a new gas export pipeline from Statfjord to FLAGS is regulated by the framework agreement of 1998 between Norway and the United Kingdom (the "1998 Agreement"). This framework agreement also requires processing and approval by the public authorities of both countries. In consultation with the public authorities of both countries, a decision was made to prepare a joint plan for the Tampen Link, which would meet both countries' guidelines of for approval documents: the Plan for Installation and Operation (PIO) in Norway and the Pipeline Work Authorisation (PWA) in the UK.

The EIA/ES documentation for Statfjord late life and the Tampen Link will also be prepared jointly and will meet both the UK and Norwegian assessment requirements and guidelines. This EIA will deal with the field modifications in Statfjord late life. The EIA/ES for the Tampen Link is available as a separate document /48/. A summary of this EIA/ES is included in appendix D.

C.2 Natural Resources and Environmental Conditions in the Area of Influence

The North Sea is one of the world's most biologically productive ocean areas, and it is of great commercial importance. High production of plankton results in rich marine life. The North Sea in general is an important area for many species, including species that are vulnerable to acute oil pollution. Commercially important species of fish are present in the North Sea.

No stable productive eddies or frontal systems which would cause organisms to accumulate in specific areas, form in the North Sea. Fish eggs and larvae are therefore relatively homogenously distributed over a large area. The transportation of fish eggs and larvae is dependent on the predominant current directions, which are largely influenced by water from the Atlantic entering the North Sea from the west and north, and the Norwegian Coastal Current flowing northward.

Due to the lack of distinct eddies/fronts large aggregations of seabirds at specific fronts will not normally occur in the North Sea, as they do, for example, in the Norwegian and Barents Seas. However, seabird aggregation can be observed in the North Sea as well.

The analysis area also covers the southern parts of the Norwegian Sea. Here, Atlantic water and the Norwegian Coastal Current both flow northward. The Norwegian Coastal Current forms eddies in the shallower waters along the Norwegian coast, and plays an important role in the transportation of eggs and larvae in this area.

The Norwegian Coastal Current with its low salinity forms more or less clearly demarcated fronts against the water from the Atlantic Ocean in the west, which has a higher salinity and nutrient content. This means that the biological production is particularly high in these frontal areas.

As the number of daylight hours increases in April and May, primary production increases, providing the basis for the growth of fish fry and seabirds. The most intense frontal processes occur where several currents converge, i.e. around the Frøya Bank, Halten Bank and Sklinna Bank. In addition, nutrient-rich Atlantic water from greater depths will rise and mix with the surface water in these areas (up-welling). These areas in the Norwegian Sea are located on the margins of the area of influence of the Statfjord late life project.

The following biological resources in the influence area are deemed to be the most sensitive:

- Seabirds in the open sea, particularly the pelagic divers such as common guillemot, puffin, razorbill and little auk
- Sensitive life stages of fish, i.e. the egg and larval stages
- Sensitive coastal habitats.

As regards discharges of produced water, the most sensitive life stages of fish, i.e. the egg and larvae stages, are the most important.

C.3 Planned Emissions to Air

C.3.1 Planned Mitigating Measures

A number of emission-reducing measures have been assessed during several phases of the planning of the SFLL project, on the basis of the potential for emission reduction, environmental cost efficiency and the framework conditions of the environmental authorities with respect to international agreements and the EU's IPPC directive (Integrated Pollution Prevention Control).

Statfjord will implement flare gas recovery at SFB before SFLL.

The Statfjord late life project is marginal in financial terms, and has a tight implementation plan. Over and above the CO_2 and NO_x reductions that will result directly from late-life production as compared with current production, the project has not recommended further measures for reducing emissions to air. An imposed requirement for low

NO_x turbines would have very low environmental cost efficiency and, due to the increased costs, would make it impossible to realise Statfjord late life within a profitable framework.

C.3.2 Emission Reduction

Statfjord's emissions to air are considerable in a national context, and a number of emission-reducing measures have been implemented at Statfjord during the period 1999-2003. SFLL will lead to significant reductions in emissions to air, primarily due to the cessation of seawater and gas injection. The development of emissions during SLFF has been calculated based on already implemented measures and planned measures.

The emissions from drilling and well activities in connection with power generation are included in the emissions from production. Flaring will not take place in connection with drilling and well operations.

The average annual emissions of CO_2 and NO_x will be 49 and 42 per cent lower, respectively, than in 2001.

Table C-1 summarises some main figures pertaining to emissions to air during SFLL, and Table C-2 shows emissions during SFLL compared with the emissions reported in 2001.

Table C-1: Emissions to air during SFLL compared with emissions reported at the field in 2001

Parameter	2001	SFLL		
		Peak year	Average per year	Accumulated 2008 - 2018
CO_2 (million tonnes)	1.54	1.02	0.78	8.59
NO_X (1,000 tonnes)	6.2	4.7	3.6	39.6
CH_4 (1,000 tonnes)	1.2	0.8	0.5	5.1
Nm VOC (1,000 tonnes)	70.9	12.4	5.2	57.7
CO_2 per o.e. kg/scm	41	160	99	
NO_X per o.e. kg/scm	0.17	0.73	0.45	

Table C-2: Reduction in annual emissions during SFLL compared with emissions at the field in 2001

Parameter	Reduction (%) Peak year during SFLL compared with 2001	Reduction (%) Peak year during SFLL compared with 2001
CO_2	32 %	49 %
NO_X	23 %	42 %
CH_4	34 %	60 %
Nm VOC	83 %	93 %

C.3.3 Environmental Impacts

The annual emissions from the Tampen area during 2008-2018, i.e. the production period for SFLL, will be lower than the emissions estimated for the peak year 2000, which was the basis for the impact assessments in the Regional Impact Assessment for the North Sea (RIA).

The Tampen area's environmental impacts in the form of acidification, eutrophication and the formation of tropospheric ozone will be considerably lower during 2008-2018 than that described in the North Sea RIA. The largest proportion of the emissions will be transported towards the Norwegian coast, and crossboundary impacts in the UK will be marginal.

C.4 Planned Discharges to Sea and to the Utsira Formation during Drilling and Well Operations

C.4.1 Discharges in connection with Drilling

Drilling will chiefly consist of sidetrack drilling in existing wells, and top-hole drilling will not normally take place.Drilling in the deeper sections will be carried out will oil-based drilling fluid. Oily cuttings will be injected into the Utsira formation together with residues of completion, gravel packing and cementing chemicals. At present approx. 66 per cent of the oil-based mud is reused, and this will be continued in late life. A total of approx. 35,000 tonnes of cuttings and oil-based drilling fluids will be injected into the Utsira formation over a period of six years.

Drilling and drilling operations will gradually become more difficult after 2007, due to pressure relief in the reservoir. Pressure relief means that the density of the drilling fluid will have to be reduced. If the density becomes too low, the above-lying shale sections could collapse as a result of low hydrostatic pressure in the well. Chemicals can be added to the drilling fluid to compensate for this.

The consumption of chemicals used to compensate for the low hydrostatic pressure in the wells will therefore increase during SFLL, but this consumption has not been estimated.

C.4.2 Discharges in connection with Well Operations

At present, cementing and completion chemicals are used in connection with well completion and cleaning. This will also be the case during SFLL. Like the drill cuttings, these chemicals are for the most part returned to collection tanks on the platform and injected into the Utsira formation, or sent ashore for recycling.

During well clean-ups, the platform's test separator will be used, and residues from the cementing and completion chemicals together with oily water from the wells will be treated in the platform's cleaning plant.

The annual discharges of cementing and completion chemicals during late life will correspond to that previously reported for Statfjord. These chemicals are classified as "green" and "yellow" and pose little risk to aquatic organisms.

During production, scale inhibitors and scale dissolvers will be used to handle scale problems in the wells. The chemicals are injected into the wells and, together with the scale, they follow the production flow back to the platforms. They are then discharged together with the produced water.

Discharges of scale dissolvers and scale inhibitors are expected to increase during late life due the potential for increased scale formation in the wells. These chemicals are classified as "yellow".

The drainage water from the platform's drillfloor will be collected and injected into the Utsira formation.

C.4.3 Impacts of Discharges to Sea from Drilling and Well Operations

The chemicals used during drilling and well operations pose little risk to the environment, and the environmental impacts of discharges from today's production are marginal. Impacts during late life are also expected to be small, even though the discharges will increase.

Statoil is actively seeking substitution with more environmentally friendly chemicals, and this work will also continue in late life. A more detailed overview of chemicals to be used during drilling and well operations in late life: consumption, discharges to sea, proportions designated for recovery and injection into the Utsira formation, including any mitigating measures, will be prepared as a basis for the application for a discharge permit. A more detailed overview of the scope of well cleaning, discharges and any mitigating measures, will also be provided

C.5 Planned Discharges to Sea of Produced Water

C.5.1 Planned Mitigating Measures

Several mitigating measures relating to discharges of produced water have been implemented at Statfjord. Further measures have been adopted for implementation, among other things to comply with the company's "zero mindset" and the environmental authorities' framework conditions for produced water, including the OSPAR regulations and the target of zero harmful discharges of produced water.

Mitigating measures for Statfjord operations and SFLL have been selected on the basis of available technology, the Statfjord field's limitations/ framework conditions, environmental impacts and assessment of environmental cost efficiency.

The zero discharges report for Statfjord (2003) was based on the following measures:

1) Substitution of red chemicals (corrosion inhibitors)
2) Reducing the consumption of chemicals through optimising dosing
3) Optimising existing hydrocyclones
4) Implementation of the new CTour cleaning technology
5) Reinjection of produced water at SFC for pressure support (PWRI).

Statoil has recommended that PWRI be stopped at Statfjord, primarily because continued operation will increase H_2S production and the consumption of H_2S scavenger.

The SFLL project will be based on the use CTour cleaning technology, which will be upgraded to:

- facilitate low-pressure production
- treat satellite water at SFC
- include cooling measures to increase the amounts of condensate at SFB and SFC.

In addition, SFLL will continue the efforts to optimise the CTour technology and work towards further substitution of corrosion inhibitors as part of the project's continuous improvement work.

The injection of H_2S scavenger in a separate well has been assessed. This solution has very low environmental cost-efficiency at SFA and relatively low cost efficiency at SFB and SFC. The project does not recommend that H_2S scavenger be injected at SFA or, for the time being, at SFB and SFC. The measure will be further assessed for SFB and SFC.

The injection of produced water into the Utsira formation is the only real alternative to CTour, technically speaking.

The environmental cost-efficiency of the solution is very low compared with CTour, and it would also lead to an increase in emissions to air. An official order for the injection of produced water into the Utsira formation would make it financially unviable and would preclude the realisation of Statfjord late life.

CTour cleaning Technology

The Statfjord licence has been the driving force behind the qualification of the CTour cleaning technology to reduce the environmental risk associated with produced water. Compared with other technology, it is particularly effective for the removal of dissolved natural components, and it is very efficient for the cleaning of those natural components in produced water to which the greatest environmental uncertainty attached (C4+ phenols and PAH compounds). CTour has also demonstrated that it is capable of handling peak loads and variations in oil concentration very effectively, and it is therefore expected that the discharge concentrations will be kept at an even and low level. CTour removes 30 per cent of the active components in the corrosion inhibitors used at Statfjord. The BTEX content (Benzene, Toulene, Ethylbenzene, Exylene) in the discharge water will increase as a result of CTour. The technology is efficient in relation to the composition of the water at Statfjord.

C.5.2 Reductions in Discharges

Based on the current drainage strategy and forecasts for produced water, water production at Statfjord will peak in 2006 at approx. 150,000 m^3/d. Statfjord C will account for half of this amount. The annual discharges of produced water in SFLL will not increase in relation to the Statfjord reference

alternative, but the period of production will be prolonged.

Discharges of certain natural components in produced water have already been considerably reduced at Statfjord as a consequence of measures already implemented, and most of the natural components will be further reduced by the implementation of CTour. In Statfjord late life, discharges of natural components will peak in 2011, when the discharge laods will typically have increased by 10-20 per cent in relation to the year with the lowest discharge loads in the Statfjord reference alternative (2006).

The reduction in discharges of natural components in late life will be considerable compared with the current levels (2003).

Total hydrocarbons at the field have been reduced considerably since the year 2000 and the current forecasts indicate further reductions. The OSPAR target of 15 per cent reduction by 2006 is a national target, but Statfjord will contribute its share. Discharges of total hydrocarbons will be reduced by approx. 40 per cent in the period 2000-2006, even if the BTEX level will increase as a result of the implementation of CTour.

The dispersed oil concentration in the produced water is much lower than the OSPAR requirement of 30 mg/l by 2006, and the field has shown a very positive trend. The dispersed oil concentration will be further reduced through the implementation of CTour, and is typically expected to be in the range of 6-9.5 mg/l in SFLL. Compared with Statfjord in the year 2000, discharges of dispersed oil in SFLL will have been more than halved.

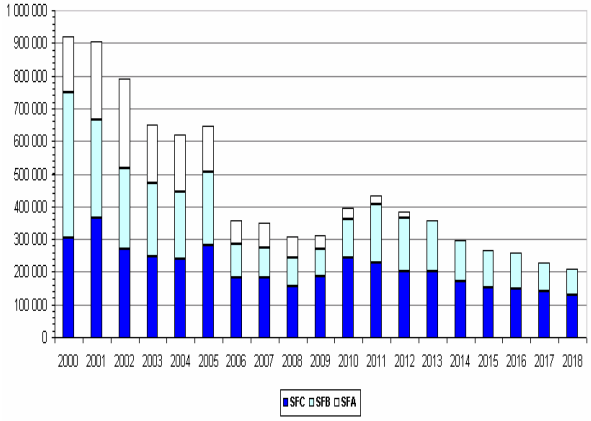

Figure C-1: Reported and forecast discharges of dispersed oil at the Statfjord field (kg/year)

Discharges of C0-C3 phenols will increase with the water volumes, and will not be reduced as a result of the implementation of CTour. Discharges of C4-C5 and C6+ phenols, on the other hand, will be reduced by 23 and 45 per cent, respectively, in 2006 compared with the current levels. By 2011 late life discharges of C4-C5 will have been reduced by approx. 20 percent and C6+ phenols by 30 per cent compared with the current levels. Late life discharges of C0-C3 and C4-C5 phenols will remain at the same level as in the lowest year in the SF reference alternative, but discharges of C6+ will increase by 25 per cent compared with 2006.

Discharges of naphthalenes, 2-3 ring PAH and 4+ ring PAH will be halved compared with the current discharges (2003) when CTour is implemented. Discharges will increase somewhat in SFLL compared with the reference alternative, but will still be approx. 45 per cent lower in the peak year (2011) than they are at present (2003).

C.5.3 Environmental Impacts

Statfjord's Discharges compared with other Fields

Of the total discharges of produced water that have a bearing on the water quality in the Tampen area, an estimated 75 per cent originate from installations in the UK sector, while approx. 25 per cent can be attributed to installations on the Norwegian side (based on figures from the North Sea RIA, 1999). Statfjord accounts for approx. half of the total Norwegian discharges.

Environmental Risk and dispersion of Natural Components

There is a considerable decrease in environmental risk (expressed as the Environmental Impact Factor - EIF) compared with 2003 both as regards the SF reference alternative and SFLL. The EIF will be reduced by 85 per cent during the period 2003-2011 and by 45 per cent during the period 2004-2011.

The risk level at the field will remain relatively stable and low during the period 2006-2012, and will vary in the range of 1000-800 EIF. The risk level will then decrease towards the end of the field's life in step with the reduction in water volumes.

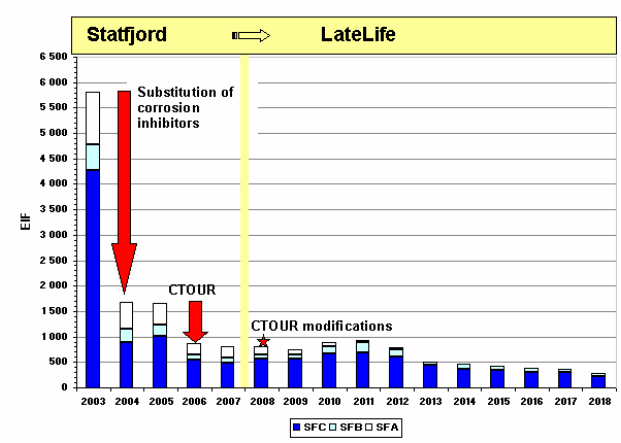

Figure C-2: Development of EIF at Statfjord before and after Statfjord late life

The most significantdecrease in the environmental risk can be attributed to the substitution of corrosion inhibitors. The substitution of corrosion inhibitors during the period 2003-2004 will reduce the environmental risk by approx. 70 per cent. Corrosion inhibitors at SFA were mostly substituted in 2002 and the effects of substitution are therefore even greater than shown.

The use of production chemicals is limited to those that are easily degradable and do not involve any risk of bioaccumulation.

There will also be a marked decrease in environmental risk as a result of the implementation of the CTour cleaning technology in 2005. The technology will be fully effective from 2006. The positive development in terms of environmental risk will be maintained through capacity expansion and modifications to the CTour cleaning technology in SFLL.

The areas with PEC/PNEC >1 will be significantly reduced in SFLL compared with 2003. The areas with PEC/PNEC >1 are relatively limited, and will not increase as a result of overlapping fields of concentration between SFA, SFB and SFC.
The dispersion maps for 2-3 ring PAH, dispersed oil and C4-C5 phenols show that in 2003 concentrations of PEC/PNEC>1 for these substances were present in a very limited area only. In SFLL, only a small area around SFC will have PEC/PNEC>1.

Overlapping Concentration Fields

Even if the discharges from the various installations in the Tampen area could potentially become mixed and create overlapping concentration fields, the calculations show that the concentration levels in the overlapping areas will be low, and that such overlapping will not increase the environmental risk.

The discharges of produced water will primarily be dispersed on the Norwegian side of the continental shelf, and the risk of transboundary impacts is low.

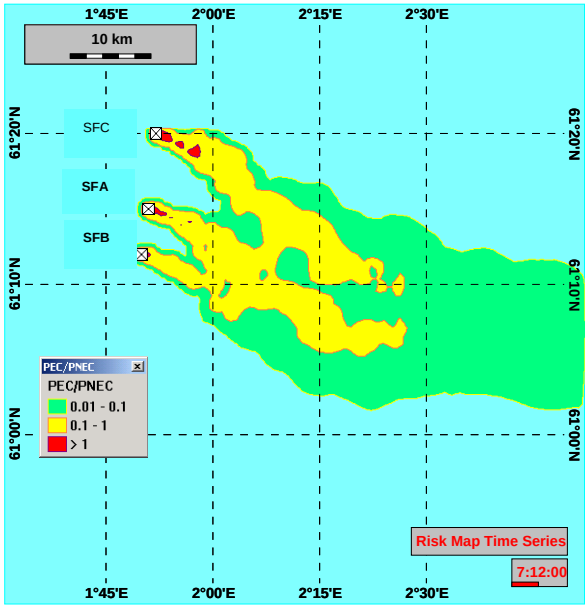

Figure C-3: Environmental risk map, calculated for a 30-day period.

Natural Resources

In principle, all natural resources in the area could potentially become exposed to discharges of produced water from the installations at Statfjord, but on the basis of existing knowledge it is primarily fish at different stages of development that are deemed to be vulnerable. In the Tampen area, most of the important species of fish are present, such as herring, cod, saithe, haddock, plaice, Norwegian pout, sandeel and mackerel. Marine mammals and seabirds are present in the area during migration and foraging periods, but are not regarded as vulnerable to ordinary discharges of produced water.

Monitoring and Research Data

Components of produced water that adhere to particles and sediments could potentially affect benthic organisms. In the Tampen area, however, the benthic fauna has been monitored for more than 20 years, and it has not been possible to find any relationship between observed effects and discharges of produced water.

Results from monitoring of the water column and research into the impacts of natural components in produced water show weak indications of biological effects in the organisms studied, but the possible significance of these indications in the long term is uncertain.

Discharges of C_4+ alkylphenols will be significantly reduced as a result of cleaning with CTour. On this basis and based on the research data, there is reason to believe that, in Statfjord late life, the risk of endocrine effects on fish will be significantly reduced and that there is no risk of any impacts of significance to the fish populations.

Additionally, at the concentrations calculated for the Statfjord area, there considered to be negligible probability that fish populations will be affected by PAH. Considering that the PAH compounds will be reduced by approx. 50 per cent in relation to current levels, it is clear that the risk of damaging effects will be reduced further in Statfjord late life.

C.6 Planned Discharges of Produced Sand

Section 59 of the Activities Regulation requires that there is less than one per cent by weight of oil adhesion to discharged sand. At Statfjord, this means that a sand cleaning plant must be installed on each platform. The Statfjord licence has appealed against this requirement to the Ministry of the Environment and has been granted dispensation until 31 December 2006.

No environmental impacts of discharging oily sand have been proven.
However, short-term effects of dispersed oil in being discharged together with the sand cannot be ruled out, but it is not probable that there will be any measurable effects considering the duration and dispersion of the discharges.

Statoil's view is that the environmental benefit of sand cleaning as a measure to meet the authorities' requirement for less than one per cent by volume of oil adhesion to sand is small, and that the environmental benefit in relation to the cost (226 million) is very small.

Sand cyclones will reduce the discharges of dispersed oil, but the cleaning process will have little environmental effect. In order to eliminate any uncertainties relating to local effects of dispersed oil in the discharge jet, the project is of the opinion that alternative measures to sand cleaning are more relevant.

The project therefore recommends an alternative strategy for handling the environmental issues relating to discharges of sand. All the measures included have in common that they will not meet the authorities' requirements for less than one per cent by volume of oil adhesion to sand, but the project believes that they will give at least the same environmental benefit as cleaning plants for sand, and at a far lower cost.

The alternative strategy involves the following measures:

- Installation of sand control equipment in most wells
- Monitoring of sand production
- Improving the measurement program for discharges of dispersed oil and oil adhering to sand
- Optimisation of the jetting process
- Assessing the use of pre-jetting in combination with automatic jetting and the installation of sand detectors.

C.7 Environmental Risk and Contingency planning

Relevant accident scenarios in SFLL include:

- Oil spills during transfer of oil from loading buoy to shuttle tanker
- Shipping accident
- Oil leakages from intrafield pipelines
- Storage tank failure
- Uncontrolled blowout.

The majority of these events involve limited oil spills only, or have a very low probability of occurrence.

An uncontrolled blowout from a platform has been identified as design incident. An uncontrolled blowout could entail discharges of large quantities of oil and potentially harm the natural environment.

The blowout scenario has the following specifications:

- Probability of occurrence: $8.9x10^{-4}$
- blowout rate: 1,820 m^3/day
- maximum duration: 90 days

The overall environmental risk associated with a blowout is a function of the probability of occurrence and the estimated environmental harm. The probability of a blowout from the Statfjord field is very low. The very low probability of a blowout combined with the probability of vulnerable biological resources being present in the area hit by the oil, leads us to conclude that the overall environmental risk relating to the SFLL project is very low or insignificant.

Hypothetically, if a blowout occurred, the most exposed resources would be fish eggs and larvae, seabirds in the open sea and sensitive coastal habitats along the Norwegian coast. The probability of sensitive coastal habitats being exposed is, however, very low. Sensitive habitats along the coast of Shetland are even less exposed.

The impacts on vulnerable resources in the water column (i.e. fish eggs and larvae) are considered to be small. This is because there is little overlapping between spawning grounds for fish and the areas in which the total hydrocarbons concentrations exceed the PNEC (Predicted No Effect Concentration) for these resources.

The potential harm to seabird populations caused by a blowout is categorised as “minor” or “moderate”, i.e. it will take less than 3 years to restore the population. The probability of experiencing this level of damage is, however, very low.

These assessments do not take account of the effects of emergency response measures. In the event of an accidental oil spill, the impacts would be further reduced by oil spill response measures. Local oil spill response scheme has been established for the Tampen area, and this would also cover SFLL.

C.8 Waste Handling

Statfjord late life will generate increased amounts of waste during the development phase compared with current operations. No special waste problems are expected, however, as a result of Statfjord late life given the mitigating measures that will be implemented. During the production period, and to a large extent also during the development phase, it will be possible to adapt waste handling for SFLL to the existing arrangements for transport and receipt at the Statfjord field.

To ensure adequate handling of waste in the development phase in line with applicable requirements and guidelines, contractors will be required to document an HSE/ internal control system that includes waste management.

C.9 Socio-economic Effects and Employment

The socio-economic profitability and employment effects of the reference alternative and SFLL have been estimated.

Capital expenditure (capex) and operating expenditure (opex) for the reference alternative amount to approximately NOK 5.5 billion (2004 NOK) and NOK 11 billion (2004 NOK) respectively. Comparable figures for the SFLL case are approximately NOK 16 billion and NOK 26 billion (accumulated over the period 2005-2018)). Investments in the SFLL alternative will be made throughout the period 2004-2018, i.e. some before and some after the development period (2005-2011). Expenditure in connection with decommissioning is estimated to be in the range NOK 11 billion for both alternatives.

The socio-economic profitability, net present value of prospective income and expenditure at a discount rate of seven per cent before tax is estimated to be approximately NOK 12 billion for the reference alternative and approximately NOK 22 billion for Statfjord Late Life.

The calcualtion of employment effects includes direct, indirect and consumption effects.

The total employment effect of the reference alternative is estimated to be 36,000 man-years, of which approximately 20,500 during the development period and 15,500 during the decommissioning phase.

The SFLL case will generate a total employment effect of 79,300 man-years for the period 2005 –

2026, of which approximately 44,300 will be generated during the development phase (2005 – 2011), 19,500 during the production phase and 15,500 during the decommissioning phase. The employment effect of the new gas export pipeline comes in addition to this.

C.10 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 establishment of mechanisms and systems for efficient implementation, measurement, control and improvement of all the activities and processes carried out by the company and its suppliers.

This system will also apply to SFLL, and this environmental impact assessment will serve as a planning and decision-support document within the framework of this system. The environmental impact assessment identifies mitigating measures and possible improvements that will be assessed in the further planning work. These measures will be followed up by the project on a running basis in the development and production phase.

The project will also try to identify new mitigating measures. This is part of the project's ordinary work relating to health, safety and the environment (HSE), and is in accordance with Statoil's own guidelines for further development of the project