It is not finalised how many wells will be drilled in each of the blocks and two scenarios are being considered; one with two wells drilled in the southern blocks (Lady Franklin and Atammik) and two in the north (Eqqua, Napariaq), and a second scenario with three wells in the southern blocks and only one in the north.

All the wells for the 2011 campaign are expected to be drilled with water based drilling fluids (referred to as drilling mud). Water based mud consists of approximately 75% water (freshwater, seawater or brine), with addition of inert weighting agents (barite and clays) and various chemical additives to provide properties required for safe and efficient drilling.

Most of the chemicals planned for use offshore are classified as 'green' (Pose Little Or No Risk – so called PLONOR substances). Substances classified as 'yellow' or 'red' (ie with specific ecotoxicological properties relating to toxicity, bioaccumulation and biodegradation) will only be used where essential for safety of drilling operations. Individual 'red' chemicals will also require a detailed justification for use before approval is sought from the Greenland authorities.

The drilling process uses drill bits of different sizes to drill a series of holes from the seabed to the planned well depth. The drilling fluids will be pumped down the drill string and out through the bit. Once each section of the hole has been drilled, the drill string will be lifted out and casing will be lowered into the hole and cemented into place. Although rock cuttings and drilling fluids from the top sections of any well are planned for discharge at the sea bottom, subsequent well sections will be drilled using a riser, which returns drilling fluids and cuttings to the drill unit. There the drilling fluids will be separated from cuttings and recycled, while cuttings will be discharged to sea via a caisson (discharge pipe) following treatment. Used drilling fluids will be discharged at sea at the end of the drilling campaign.

On average approximately 500 m^3 of cuttings are expected to be produced at each well location, including the proposed Napariaq well. Modelling has shown that the majority of cuttings will be deposited within several hundred metres of the well location, with bottom deposition greater than 1 mm covering a maximum area of 0.4 km^2 around the well head. Once each section of the hole has been drilled, the drill string will be retrieved and casing will be lowered into the hole and cemented into place.

At present, there is no firm plan to undertake well testing, however it remains a possibility if drilling results indicate the presence of hydrocarbons and has been included in this assessment. Testing is used to establish reservoir characteristics and, if required, will involve a controlled flow of hydrocarbons to the drill unit where they will be tested and flared. The exact volume of hydrocarbons which may be flared will not be known until the well is tested. Any flaring will require permitting by the Greenland authorities and will be monitored for signs of incomplete combustion. An oil recovery vessel with full dispersant capability will be on standby throughout the process.

Following completion, the wells will be plugged and abandoned or suspended. Each well will have an industry standard wellhead at the surface, with a protective cover to prevent damage to the wellhead due to snagging. On completion of the contracted operations, the MODUs and support vessels will demobilise from Greenlandic waters to the next port of call or area of operations.

PROJECT ALTERNATIVES AND FUTURE DEVELOPMENT

As well as the *No Development Option*, various alternatives exist for carrying out exploratory drilling. There is no feasible alternative to exploratory drilling if development of the field is to take place. Subsurface imaging cannot provide the physical data and level of assurance required for development to proceed.

The aim of the project is to use Best Environmental Practices (BEP) and apply Best Available Techniques (BAT) throughout as far as practical. There are also constraints on project alternatives which limit the available options and include:

- Safety requirements, including safety of the drill units and vessels, search and rescue capability and safety of the drilling operation;
- Environmental and climatic conditions, including limited operating window due to ice cover;
- The isolation of the area and lack of established infrastructure, including waste management and disposal facilities;
- The water depth and target drilling depth at the proposed well locations;
- The nature of the geology to be drilled through; and
- The available support facilities onshore and the time required to reach the drilling locations.

The term Best Available Techniques (BAT) takes account of both technological and commercial factors and alternatives must therefore be technologically and financially feasible.

Drilling Locations

Drilling locations are selected based on extensive geological surveys and subsurface modelling. The presence of hydrocarbon reserves is a complex mix of many factors all of which need to be examined in order to decide whether and where, to drill, including, but not limited to, the environmental conditions and safety requirements.

Drilling Units and Materials

The drilling units selected for this work are modern high specification rigs, specifically designed for work in harsh environments in the water depths of the drilling areas. These drilling units have been selected due to their

technical capability and their availability to conduct operations within the drilling weather window.

The mud system constituent options are selected on the basis of technical requirements, ecological toxicity and bio-degradation properties. Consequently, water based mud systems have been selected for the exploration wells (as opposed to more harmful oil based systems), as they contain low-toxicity ('green') and inert chemicals as described above.

Alternatives to disposal of used drilling fluids and cuttings to sea include transporting to shore for disposal or reinjection into geological formation. As reinjection is not technically justifiable at the exploration phase of drilling and transportation of cuttings for treatment and disposal onshore is typically only considered where oil based fluids are used for drilling due to associated environmental impacts, disposal of low toxicity water based muds and cuttings offshore has been selected as the best practicable environmental option (BPEO) for the 2011 drilling campaign, including the Napariaq well.

Support and Supply

Forward supply bases are required to provide material storage and resupply, for fuel, water and food and to provide a transfer point for personnel. Ports from Aasiaat in the North to Paamiut in the South were considered as potential forward supply bases. Selection of port facilities for the 2011 operations depends on water depths, berth length, ice conditions, availability of fuel and water, available laydown space and the distance from the operational areas. Based on these criteria, the ports of Nuuk (for Lady Franklin and Atammik blocks) and Aasiaat (for Eqqua and Napariaq) have been identified as meeting all the project criteria for a forward supply base. The use of each selected port will depend on the final selected well locations.

Future Development

Capricorn's 2011 operations are still at a very early stage of the exploration process. Any future field development scenarios will require substantial further work over several years and be subject to a proven commercial discovery. The likelihood of such commercial success is low. Feasibility studies undertaken to date indicate that the time from commercial discovery to production is likely to take from 9 to 15 years, based on similar projects. This period is likely to involve between 4 and 10 years of exploration and appraisal drilling, between 1 and 7 years for development of the field and then a producing life of between 10 and 30 years before the field is decommissioned.

Early studies have been undertaken into potential future development options; however as the nature of any potential discovery (gas or oil), its location, water depth and the available technology at the time of development are all unknown, the options identified as technically feasible are still highly speculative and include:

- an ice-tolerant, ship-shaped floating production, storage and offloading (FPSO) unit (for oil), or a floating liquefied natural gas (FLNG) unit (for gas), with an ice-breaking vessel in support and ice-breaking shuttle tankers to transport hydrocarbons to a market; or
- a subsea development with a pipeline along the seabed to transport hydrocarbons to a near-shore or on-shore processing plant, plus icebreaking shuttle tankers to transport hydrocarbons to a market

Each option has its own potential impacts and benefits and a summary is provided in the report; however due to the early stage of exploration and the many unknowns, further examination of the potential impacts and benefits of possible future development are not presented here.

ENVIRONMENTAL SETTING

To provide a baseline against which potential impacts can be assessed, the EIA provides a description of the conditions that will prevail in the absence of the Project. The baseline includes information on all receptors and resources identified as having the potential to be significantly affected by the proposed Project.

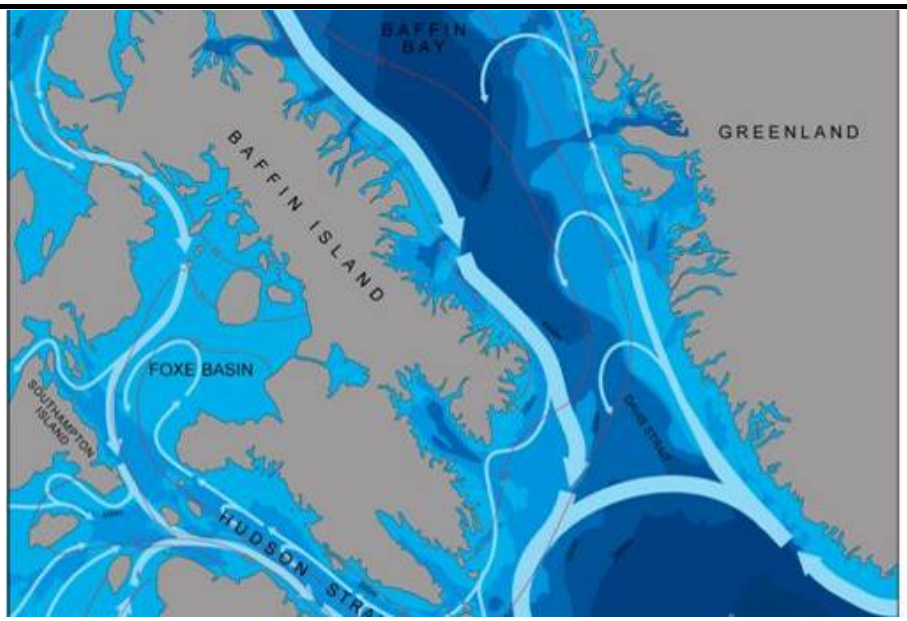
Baseline data has been acquired from existing sources including: government agencies; research and academic organisations; published literature; external stakeholders and the public; and previous offshore EIAs. Environmental and geophysical surveys have also been undertaken and studies have been carried out looking at ice conditions and oceanography.

Physical Environment

The Napariaq block is positioned over a relatively flat section of the continental slope, with water depths ranging approximately 200 m down to 600 m. To the south, the block roughly skirts the northern edge of the Uummannaq channel. This feature cuts across the continental slope and is approximately 60 km across. The two potential well locations fall within the central part of the survey area and are located in water depths of 288 and 296 m respectively. The seabed in this area is characterised by a generally non-depositional environment, with only a superficial veneer of silty sands overlying a hard over-consolidated glacial till. These tills have been heavily scoured by icebergs. The thin surface sediment layer is interpreted to represent modern postglacial deposits

The surface circulation in the sea off West Greenland is dominated by the relatively warm and salty northward West Greenland Current (WGC) and westward branches of this current (DMI, 2004) (see *Figure 3*).

Figure 3 *Regional Currents off West Greenland*



Source: Brian Petrie, Bedford Institute of Oceanography

Overall circulation in Baffin Bay demonstrates a northerly flow along the Greenland coast and southerly flow along the coast of Baffin Island. During the summer months the receding pack ice and melt water will cause the surface salinity to decrease. The warming effect of the sun will create a notable thermocline in the surface 40-50 metres and show a moderate increase in water temperature as high as 6 or 7 °C.

Ice conditions in the Davis Strait are predominantly controlled by the currents. However, the strength and direction of the surface winds also affect the local drift of sea ice, especially in southern waters. Nearly all ice drift in the western portion of Davis Strait is in a southerly direction (Jordan and Neu, 1981) but there is little net transport of sea ice on the Greenland side of the Davis Strait (Valeur *et al*., 1996). Typical drift velocities observed in southern Baffin Bay during winter and spring were 10 cm/s, increasing to 20-30 cm/s in Davis Strait. Velocities along the southern Baffin Island coast range from 10 to 15 cm/s.

Icebergs present within the Napariaq block are likely to come from glaciers to the east that have been transported by westward flowing branches of the main West Greenland Current. Many icebergs are deeply drafted but due to the bathymetry in the region large icebergs will not drift into shallow water regions. Measurements of iceberg drafts north of 62°N indicate that an upper limit of 230 m will only be exceeded very rarely, although no systematic 'maximum draft measurements' exist and the extremes remain unknown. The large icebergs originating in Baffin Bay are expected to have a maximum draft of about 250– 300 m.

Biological Environment

Zooplankton

Zooplankton are the food-chain link between phytoplankton and higher organisms in the pelagic ecosystem. Western Greenland is dominated by holoplankton (GINR, 2003) with the most important being crustaceans, which constitute 86% of the zooplankton biomass (GINR, 2003).

Invertebrates

Benthic communities are an important ecosystem component in these waters. Communities provide a food source for marine mammals, birds, fish and other invertebrates and in some cases serve as the basis for fisheries for species such as scallops and shrimp. Surface seabed communities associated predominantly with hard and soft sediments were recorded. Small mobile species such as brittlestars were common but tracks indicating the presence of large mobile species such as predatory snails were not present.

More static species were recorded through the presence of burrows, siphons and worm casts throughout the site. Most species indicated a range of sizes suggesting a healthy breeding population and a stable environment. No protected habitats were identified and species diversity was recorded as being typical for this environment and water depth.

Fish

The total number of fish species known to occur in the Greenland Exclusive Economic Zone is 269, of which 79 occur in north west Greenland waters (Møller *et al*., 2010). The offshore fish fauna in the vicinity of the Napariaq block is dominated by demersal (bottom-dwelling) fish including cod and wolffish species (Mosbech *et al*., 2000).

Seabirds

Many seabird species, including 14 breeding species, can be found along the coast and offshore in the vicinity of the Napariaq block. These species include:

- seabirds breeding during the summer months; kittiwake, and Atlantic puffin;
- seaducks assembling to moult in summer; and
- other species occurring only as migrant visitors during spring and autumn (Mosbech *et al*., 2000).

Marine Mammals

There are 21 species of marine mammal that regularly occur in the waters and along the coast of western Greenland in the vicinity of the block: 14 species of whale, 5 species of seal, walrus and polar bear (NERI, 2004).

Protected Areas and Threatened Species

There is one species of fish that occurs in western Greenland in the vicinity of the licence block that appears as 'Vulnerable' on the IUCN Red List; Thorny skate.

Of the bird species present within the area, only Ivory Gull is on the IUCN Red List, listed as Near Threatened. However, Greenland's Red List places a number of these species in a higher category; Common Eider, thick-billed murre, kittiwake, White-tailed Eagle and Ivory Gull are listed as Vulnerable; Arctic tern, Atlantic Puffin and Harlequin Ducks are listed as Near Threatened.

Some of western Greenland's marine mammals appear on the IUCN Red List, Greenland's Red List and in the CITES Appendices, including Narwhal and Beluga whale.

Greenland has 11 sites in the Ramsar list of Wetlands of International Importance (Ramsar sites). Of these 'Qinnguata Marraa-Kuussuaq' is located 141 km from the licence area and covers a total area of 6,480 ha. This site was designated because it is an important moulting area for king eiders (*Somateria spectabilis*). In addition BirdLife International has designated a number of Important Bird Areas (IBAs) in western Greenland, some of which lie along the coast within the vicinity of the licence area.

IMPACT ASSESSMENT

Methodology

This EIA has been undertaken following a systematic process that predicts and evaluates the probable impacts of the Project on aspects of the physical and biological environments. Throughout the EIA process methods for practical and affordable mitigation are identified, agreed with the Project proponent and integrated into Project design.

Screening and Scoping has been underway throughout Project planning and has involved consultation with the Greenland Government and key stakeholders, review of legislation and international standards and examination of previous studies.

The assessment describes what will happen by predicting and quantifying as far as possible the magnitude of impacts. Magnitude also includes any uncertainty about the occurrence or scale of the impact. The next step in the assessment process is to explain what the magnitude of an impact means in terms of its importance to people and the environment. This is referred to as Evaluation of Significance. The magnitude of the potential impact and the sensitivity of the receiving resource or receptor are looked at in combination to evaluate whether an impact is significant and if so its degree of significance.

The process as defined by the legislation and Greenlandic Government has been followed. More detailed information appears in Annex B of the EIA.

Summary of Impacts

Overview

For the purpose of this impact assessment the impacts have been divided into:

- *planned events*: physical disturbance, emissions, discharges and wastes;
- *unplanned events*: unintentional releases, emergencies, accidents; and
- *cumulative impacts*: interactions with other relevant activities.

The main receptors that can be potentially impacted and are assessed as part of this EIA are offshore marine populations for planned project activities and offshore and coastal populations for potential accidental events. Impacts to species (eg fish or marine mammals) are therefore assessed within this EIA, however impacts to human populations including those associated with the exploitation of natural resources by humans (eg hunting and fishing) are covered in the Social Impact Assessment (SIA) which should be consulted in conjunction with this EIA.

The proposed exploration activity has the potential for sources of noise and atmospheric emissions, as well as physical disturbance and a variety of discharges and wastes. Those sources identified in the assessment are typical of drilling activities in waters around the world. There are no unusual or unique emissions, discharges or other potential sources of environmental impact. A detailed study of the potential impacts, sensitivity of receptors, mitigation measures and any residual impact has been carried out and is included within the EIA report.

A summary of the evaluation of significance of each impact (with mitigation taken into consideration) is provided in *Table 2*, with an overview of the main areas of impact and the related mitigation measures provided in *Table 3*. A more detailed description of those impacts that are considered to be of significance is then provided in the following text.

Table 2 *Significance Evaluation Assessment Results*

Environmental Impact	Major	Moderate	Minor	Not Significant
Planned Events				
Noise				
Marine mammals		Mid and low frequency cetaceans		High frequency cetaceans and pinnipeds
Polar bears				
Walrus				
Fish			Hearing specialists	
Seabirds - offshore				
Seabirds - colonies		Thick-billed murre and eider only		
Cumulative noise impact				
Presence and Movement of Vessels				
Marine mammals				Seals that haul out
Seabirds				
Presence and Movement of Helicopters				
Seabirds - colonies				
Seabirds – non-colony breeding				
Seabirds - seaduck				
Lights and flaring				
Seabirds				
Air Emissions				
Air quality				
Air quality - flaring				
Grey Water, Sewage and Kitchen Waste Discharge				
Water column quality				
Drainage and Bilge Water Discharge				
Water column quality				
Ballast Water Discharge				
Water column quality				
Drilling Muds Discharge				
Water column quality				
Combined Water Column Discharges				
Marine mammals				
Fish				
Benthic communities				
Cement				
Seabed				
Drill Cuttings				
Seabed				
Benthic communities				
Unplanned Events				
Small Diesel Spill				
Water column quality			Potentially	
Large Oil Spill (Note: very low probability of occurrence				
Animals on the ice	Potentially			
Swimming seals and cetaceans		Potentially		
Pelagic animals eg auks	Potentially			
The coastal environment		Potentially		
Chemical Spill				
Seabed			Potentially	
Benthic communities			Potentially	

Table 3 Summary of Main Impact Areas, Operations and Mitigation Measures

Potential Impact	Source of Impact / Area of Operations	Mitigation Measures
Noise and disturbance	Underwater noise from drilling, vessel movement and positioning of the MODUs. Physical presence of MODUs and vessels. Airborne noise from onboard plant and machinery. Helicopter and aircraft movements.	• Regular maintenance programme for plant and machinery. • Any use of a seismic source will follow mitigation measures as defines in NERI's Guidelines to Environmental Impact Assessment of Seismic Activities in Greenland Waters, 2010, to minimise disturbance to marine mammals. • Helicopter flight paths will be planned taking into account sensitive coastal areas and periods to minimise disturbance. • Helicopter travel will take place at a minimum height of 300 metres over the coastal zone, and will avoid areas identified as important for birds. • The sudden change of speed or direction of vessel movement in the vicinity of marine mammals and seabird colonies shall be avoided
Light	Lights on MODUs and vessels Flaring	• Potential effects on migratory birds are minimised by shielding external lights on MODUs and vessels to the extent possible. • Flaring duration will be minimised and timing will be planned to avoid flaring in darkness to the extent possible
Emissions to air	Combustion plant and machinery on the MODUs, vessels and aircraft. Emissions to air from potential well test flaring.	• Regular maintenance programme for plant and machinery. • Use of arctic grade low sulphur fuel to reduce emissions. • At present there is no plan to undertake well testing. Approval from Greenland authorities will be sought prior to well testing and high efficiency flares will be used during the well testing.
Discharges to water	Discharges of 'domestic' drainage and sewage from the MODUs and vessels. Discharge of organic food waste offshore. Discharge of cuttings during drilling and release of drilling mud at the end of drilling. Bilges and drainage water.	• Sewage, grey water and kitchen waste will be treated, handled and discharged according to MARPOL standards. • Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water). • Only water based muds will be used for drilling. • All chemicals will be registered according to agreed standards and their selection will be made on the basis of the least environmentally harmful available alternative. • Cuttings will be treated to remove mud prior to discharge. • Cuttings contaminated by hydrocarbons from the geological formation will be separated at the drilling unit. • If on board treatment cannot reduce oil on cuttings to a level agreed with the Greenland authorities, they will be contained and transported for treatment or disposal at a suitable onshore facility.

Potential Impact	Source of Impact / Area of Operations	Mitigation Measures
Waste	Routine drilling operations. Vessels and onshore support operations.	• All solid wastes will be transferred to a registered waste management contractor for disposal at appropriate licensed facilities onshore. No waste materials, other than cuttings and food waste, will be discharged to sea. • All wastes will be managed and disposed of according to the Waste Management Plan, the relevant legislation and international good practice. • Waste oil from any unplanned event will be managed in accordance with the Oil Spill Contingency Plan.
Oil spills and unplanned events.	A major unplanned event such as a blow-out. Vessel collision. Spills from storage failure and refuelling incidents.	• Two rigs are being used in order to provide contingency capability for rapid drilling of a relief well. • Oil spill modelling has been carried out and a detailed Oil Spill Contingency Plan developed and implemented. • Oil spill contingency measures in a transboundary context have been discussed with the Greenland and Canadian authorities based on modelling results. • In the case of a well control incident, the well will be closed in at the Blow-Out Preventer (BOP). • Operating procedures and proactive inspection are in place for fuel and material transfers and onboard storage of hazardous materials. • Equipment standards will be maintained and preventative maintenance of critical fuel handling and storage components will be undertaken. • An ice management plan will be adopted to help minimise the risk of collision with icebergs. • Navigational risks will be mitigated by requirements for vessels built and equipped to international standards eg IMO and SOLAS. • Refuelling operations will be conducted in calm weather conditions and closely monitored.

The mitigation measures outlined in the EIA and the accompanying Management Plans are the result of extensive industry experience with offshore exploration drilling. Mitigation measures have been identified to apply Best Environmental Practices and use the Best Available Techniques, taking into account technical and financial feasibility.

Planned Events

Noise

Underwater noise can impact marine fauna and airborne noise can impact seabirds. The potential sources of underwater noise during drilling are the operation of the two dynamically positioned drill units; the operation of support vessels and ice management vessels; and, Vertical Seismic Profiling (VSP) at each well using a seismic source. Should VSP be required (ie in the

event of a discovery), a separate application will be made in accordance with the requirements of the Greenland authorities.

Taking the mitigation measures which are inherent in the Project design into account, the overall impact of Project generated noise on mid and low frequency cetaceans is assessed as being of *moderate significance*. Impacts to certain fish species are anticipated which may cause small behavioural changes. Overall, the impact of underwater noise generated by the Project on fish is predicted to be of *minor significance*.

Seabird colonies in the vicinity of the shore base may be impacted by low flying helicopters during crew transfers out to the MODUs. Aerial acoustic impacts from supply vessels and helicopters to seabird colonies are considered to be of *minor* to *moderate significance* depending on the species.

Disturbance
There are three potential sources of disturbance which may affect receptors as a result of the planned activities; from the presence and movement of vessels, helicopter flights and from lights and flaring.

Impacts from the drill units and support vessels are predicted to be of *minor significance* to marine mammals. Most seabirds are extremely mobile and are very unlikely to be disturbed by slow moving vessels. Some flocks of flightless seabirds are likely to be encountered by the support vessels during the second half of the drilling campaign, however they will be able to avoid the vessels and the potential impact is predicted to be of *minor significance*.

There is a possibility that the lights and flaring associated with the Project will attract seabirds in the area, resulting in increased risk of collision during poor weather conditions. Given the short hours or darkness over the summer and the likely low numbers of birds passing through the block over this period, the potential impact of increased bird collisions as a result of vessel lighting and flaring is considered to be of *minor significance*.

Discharges to Sea
During the drilling period various types of waste and discharge will be produced, each requiring appropriate handling and disposal. Waste and discharges to the marine environment could locally affect water quality and may have secondary impacts on marine ecology. Discharges will include: grey water (eg showers, sinks); black water (sewage); organic kitchen waste; drainage, bilge and ballast water; and drilling muds and cuttings.

Grey water is not required to be treated under MARPOL (international maritime agreement) and will be discharged to sea without treatment. Black water (sewage) will be treated on board in a certificated IMO compliant sewage treatment facility to MARPOL requirements and discharged offshore. Only small volumes of grey and treated black waters will be produced as a result of offshore operations and will disperse and dilute quickly due to ocean currents.

Galley wastes will be macerated before discharge. Organic waste discharged from galleys will introduce nutrients and organic material to the water column, which may cause a local increase in Biochemical Oxygen Demand (BOD) thus reducing oxygen availability in the water.

The sensitivity of the water column has been categorised as low. The overall impact of grey and black water discharges and organic kitchen waste discharge is assessed as being of *minor significance*. The overall impact to fish caused by localised changes in the water column is of *minor significance*.

Drainage and bilge water will be potentially contaminated with oils and lubricants from machinery space. Oil content in waters allowed for discharge is controlled under MARPOL Annex 1 and any discharges must be routed via equipment capable of reducing the oil in water concentration to 15 ppm or below. The overall impact of drainage and bilge water discharge is assessed as being of *minor significance*.

The impacts of water based muds and cuttings discharges are primarily physical (with potential secondary effects to seabed fauna) as they will form a footprint on the seabed. All associated liquid discharges will also affect the salinity and potentially the temperature of the local area. However, due to the use of water-based muds and low-toxicity chemicals, coupled with the water depth and currents, the local changes are expected to be of *minor significance* and will not impact the marine environment.

Seabed Impacts
Top-hole cuttings and treated drill cuttings released to the seabed will form a footprint on the seabed around the wellhead. The effects of this deposition on the seabed may involve changes to the benthic communities over a small area for a short period of time. Sediment chemistry and particle size would be changed for a longer period. The Project will use water-based drilling muds (considered Best Environmental Practice) that have a low toxicity and will not bio-accumulate. The overall impact from drill cuttings to the seabed and associated benthic communities is assessed to be of *minor significance*.

Unplanned Events

Oil Spill Risk Assessment
Oil spill modelling was undertaken to inform the assessment as detailed in *Section 6.3.2* with full details provided in *Annex G* of the EIA. Full details of the procedures in place to respond to oil spills during the drilling campaign are contained within Capricorn's Oil Spill Contingency Plan.

Key factors in reducing the likelihood and severity of such spills are:

- dual-rig drilling strategy
- equipment standards;
- operational control, procedures and training;
- planning of critical activities;

- navigational risk control; and
- meteorological risk control.

In the event of a worst case spill scenario resulting in a high volume release over a long term there could be impacts adversely affecting local populations on a number of sensitive receptors, specifically pinnipeds (seals and walruses), polar bears, seabirds, seaducks and species inhabiting sheltered coastal habitats. In general impacts will be of greater magnitude if the oil spill reaches the ice margin or coincides with breeding. Cetaceans are more vulnerable to oil entrained within pack ice than on the open water. Ice contaminated with oil can remain affected for more than one season and is difficult to clean, consequent impact will therefore be longer term. Further details of potential oil spill impacts are included in *Annex G*.

Although mitigation measures make a medium or large spill highly unlikely the impact of an oil spill on pelagic animals, particularly birds, is assessed to be *potentially major*, particularly for those animals found on the ice during July-November. Impacts to the coast and swimming seals and cetaceans are assessed to be *potentially moderate*. However, the probability of this occurring is very low.

The most likely scenario of a spill affecting the water surface would be a small diesel spill during refuelling which would cause localised impacts on water quality for a short period of time (eg 2 to 3 days by which time the fuel will have mostly evaporated). A small diesel spill during refuelling is assessed to be of *potentially minor significance*.

Chemical Spills

The MODUs and supply vessels will hold a variety of chemicals. The quantities held on each vessel will be small and all chemicals used will be selected based on the least environmentally harmful available alternative and will be pre-notified to the Greenland authorities for review. The likelihood of a large chemical spill is very low. A small spill of primarily non-toxic chemicals is more likely and is assessed to be of *potentially minor significance*.

Potential Cumulative Impacts

The drilling of the Napariaq well is part of a wider drilling campaign being conducted offshore west Greenland by *Capricorn* in 2011, planned to include a total of 4 wells drilled across some or all of the following blocks: Eqqua, Napariaq , Lady Franklin and Atammik. As *Capricorn* has two MODUs available for the 2011 campaign, it is highly likely that drilling operations will be taking place in two separate blocks simultaneously. It has not yet been decided in which order the wells will be drilled; however there is the potential for cumulative impacts to occur as a result of other *Capricorn* operations. There are no other activities in the area unconnected with this Project which are known and have the potential to contribute to cumulative impacts, other than minor vessel traffic or fishing operations which are not considered significant given the likely numbers and the proposed drilling locations.

Any species impacted by noise will have a large area into which they may temporarily relocate during the short term disturbance, and other sources of noise generated by the Project will be sufficiently distant so as to not impact on displaced individuals. Therefore *no significant cumulative impacts* are predicted to occur.

Disturbance as a result of vessel activity, lights and flaring will be highly localised around the well site area and the route to the relevant supply base. Since the well sites are located significant distances apart, *no significant cumulative impacts* are predicted to occur. Mitigation measures will be implemented to minimise potential environmental impacts from helicopter flight patterns, ensuring that *no significant cumulative impacts* occur.

Any impacts to air quality and/or water quality will be highly localised and pollutants will naturally disperse to background levels within a short distance of the emission source. Since the well sites are located significant distances apart, there will be *no significant cumulative impacts* on local air or water quality.

Impacts to the seabed resulting from the deposition of drill cuttings will be highly localised and cover a very small area of seabed in the context of the wider block. Although this impact will be repeated at each well site, the area of seabed affected by the entire drilling campaign will still be very small, and therefore *no significant cumulative impacts* are predicted.

Summary

In summary, the potential impacts from the Project are well understood and mitigation measures have been built into the project design to address those potentially significant impacts to levels considered Best Environmental Practice (eg use of water based mud) or to be the Best Available Technique (eg use of dynamically positioned drill units). The potential impacts associated with a major spill are addressed through both preventative measures (subsurface knowledge, technology and materials, relief well capability, operating procedures and controls) and response measures (modelling, equipment and materials, contingency planning and training), however the significance of a large oil spill remains potentially of *major significance*, although the probability of occurrence is extremely low and multiple preventative barriers are in place.

Following mitigation there are no identified impacts from routine operations assessed as being of major significance and only a few species which may be subject to moderate impacts due to underwater noise. All other impacts are assessed as being of minor significance or as not significant. An emergency situation leading to a large oil spill is therefore the only impact which may be assessed as being of potentially *major significance*.

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