

**NON-TECHNICAL SUMMARY  
FOR  
3D SEISMIC SURVEY  
SAQQAMIUT AND PROSPECTING AREA  
OFFSHORE SOUTH GREENLAND 2011**



Prepared for CAPRICORN GREENLAND EXPLORATION 1 LTD

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## INTRODUCTION

This document comprises the Non-Technical Summary of the Preliminary Environmental Impact Assessment for a 3D seismic survey and associated activities in Saqqamiut and Prospecting area in South Greenland. The purpose of this document is to briefly describe the project, present conclusions on preferred options and summarise potential impacts and appropriate mitigation measures.

## **PROJECT SUMMARY**

Capricorn Greenland Exploration 1 Limited (Capricorn) holds 'Hydrocarbon Exploration and Exploitation Licences' for Kingittoq, Saqqamiut, Salliit and Ummannarsuaq blocks and a 'Prospecting Licence' for the Prospecting Area adjacent to these blocks. The Licence and Prospecting Areas include the southeast of Davis Strait and northeast of Labrador Sea, and cover approximately 63,540 km<sup>2</sup> of continental shelf in water depth ranging from 50 to 3500 meters.

Since 2008 Capricorn has conducted a number of seismic surveys across the offshore south Greenland blocks. Based on the analyzed 2D data, it is now proposed to undertake a 3D seismic survey covering 1490 square kilometres in 1500 – 3100 meters water depth and 50 kilometres off the coast offshore South Greenland. The operations are expected to commence in June-August 2011 with MV Ramform Challenger vessel collecting data over 6-7 weeks.

The main objective of the proposed survey is to obtain 3D seismic profiles of the seabed geology in the Saqqamiut and Prospecting areas offshore South Greenland. Maps generated from the processed and interpreted seismic data will facilitate identification of areas where hydrocarbons could be trapped in oil or gas-filled geological structures.

The geophysical method commonly used in surveying is called 'seismic reflection'. The technique involves releasing pulses of acoustic energy along designated lines. The energy penetrates sub-surface rocks and is reflected back to the surface where it can be detected by acoustic transducers (hydrophones). Analysis of seismic reflections provides a profile of the underlying rock strata and identification of any configurations that are favourable to hydrocarbon accumulations. In some cases, it is possible to record anomalies that may correspond to actual hydrocarbon deposits.

In the marine environment seismic surveys are typically conducted using ship-borne air guns as the acoustic energy source. A streamer of hydrophones is towed behind the vessel, extending for several kilometres. A survey is usually based on a grid pattern of lines, along each of which are 'shot points', where the sound is released.

## PROJECT ALTERNATIVES

An important element of the EIA process is the consideration of alternatives to the proposed seismic programme in terms of operational, temporal and spatial parameters.

To date no method for surveying deep marine geology has been developed that is more accurate, time efficient, or has fewer environmental impacts than the use of a towed airgun array and hydrophones contained in a long streamer. Prior to the development of airguns, dynamite was used for seismic surveying, and this resulted in significant fish mortalities in the vicinity of the explosion, however the process was abandoned over 30 years ago by the industry.

The main survey parameters such as line position, line length, line spacing, shot point interval, and streamer length are determined in advance by geophysicists bearing in mind the objectives of the survey. Parameters such as airgun array and streamer tow depths may be adjusted at the start of the survey to optimize data quality. Gun types, array configurations, and streamer type are limited to what equipment is available on the vessel and therefore cannot be easily changed.

Specific timing of the program will depend on a variety of factors, including vessel availability, weather conditions, timing, and sensitivities associated with biological and socio-economic constraints. For example, mitigation options to minimize impacts can potentially include modification of the operations schedule within specific areas.

To minimise the potential impacts of 3D seismic operations the following alternatives were considered and adopted:

- Large survey spread to minimise time on location
- Use of latest streamer technology to maximise efficiency and time on location
- Source size considered to be the minimum required to provide sufficient resolution
- Use of solid streamers to avoid streamer kerosene leakage
- Minimising additional infill data through consideration of the impact of coverage on Fresnel zones

**DISCUSSION OF IMPACTS AND MITIGATION MEASURES**

The Environmental Impact Assessment prepared by RPS Energy assesses the potential impacts that may arise from the proposed 3D seismic survey on the local environment.

The main sensitivities and environmental constraints identified in the project area of influence include fish species, resident breeding and migrant seabirds, and marine mammals. Shipping, fishing and whaling are also likely to take place within or in proximity to the operational area.

The waters adjacent to and including the Project area are inhabited by a number of nationally and internationally protected species (IUCN and Greenland Red Lists). Most of the mammals and seabirds found within and close to the Project Area are listed on Annex IV of the EC Habitats Directive and Appendix II of the Bonn Convention (North and Baltic Sea populations). All cetaceans (whales and dolphins) are listed on Annex A of EU Council Regulation 338/97.

The environmental aspects of the seismic operations which have been assessed as resulting in potential impacts of medium to high importance and require mitigation include: underwater noise from survey equipment, physical presence of vessels and equipment, large fuel spills potentially resulting from vessel collision, and waste management. The significant impacts from the proposed operations may include pollution of the marine environment and disturbance of wildlife species (mainly cetaceans and pinnipeds).

These aspects, their potential impacts and proposed mitigation measures have been tabulated below:

**Summary of impacts on marine wildlife due to underwater noise**

Impact	Impact Assessment	Mitigation
Disturbance to marine mammals	<p>General avoidance behavioural effects within approximately 1.1 km from the source, including baleen whales which are likely to have feeding habitat in the survey area.</p> <p>Physical injury to cetaceans and pinnipeds may occur at distances of less than 100 m from the array, though this can be mitigated to reduce the likelihood of this occurring.</p> <p>No other marine mammals (polar bear, narwal, walrus) are expected to be present during the proposed survey.</p> <p><b>Medium Impact:</b> Potentially significant impacts on marine mammals, particularly baleen whales behaviour. Can be mitigated to lower significance to some extent.</p>	<p>Adhere to guidelines published by Greenland NERI (2010), using MMSOs and PAM to ensure mammals are absent from the immediate vicinity of the airgun array.</p> <p>Soft starts to minimise risk of injury and behavioural impacts.</p>
Disturbance to fish ecology	<p>Behavioural effects (including avoidance behaviour) within approx. 3 km from the airgun array. Auditory damage may be expected in the immediate vicinity of the array (~100 m from the airguns).</p> <p>Injury/damage to fish eggs and larvae may occur within a few metres of the source.</p> <p><b>Low Impact:</b> Insignificant short term behavioural impacts outside 3 km of array.</p>	<p>Soft start to minimise risk of physical injury to adult fish.</p> <p>No mitigation for injury to fish eggs/larvae</p>
Injury/mortality to benthic organisms.	<p>Survey area located within 1500 - 3100 meters depth therefore negligible impacts expected on benthic habitats.</p> <p><b>Low Impact:</b> Negligible</p>	
Impact on fishing and whaling	<p>Fishing within or close to the behavioural effects zone (approx. 3 km from source) may experience temporary changes in catch. Shrimp and scallop catches are concentrated within 60 km from the coast and are less likely to be affected. Whaling is a less frequent activity and a short term minke whale displacement should not have a significant impact.</p> <p><b>Low Impact:</b> Short term, localised displacement of target species from survey area</p>	<p>Fishing and whaling boats will be advised to move away from the survey area.</p>

## Summary of Impacts from Routine and Non-routine Operational Discharges

Impact	Impact Assessment	Mitigation
Marine pollution due to discharge of wastewater and sewage	Relatively small volumes discharged; High dilution factors. Short duration. Low-medium intensity. <b>Low Impact:</b> Adverse but not significant	Sewage should be treated before discharge in line with MARPOL 73/78 Regulations.
Marine pollution due to discharge of bilge water	Small volumes discharged; High dilution factors. Short duration. Low-medium intensity. <b>Low Impact:</b> Adverse but not significant	An oily water separator should be employed to ensure oil content in discharged bilge water does not exceed 15 ppm in accordance with MARPOL 73/78 Regulations.
Pollution due to discharge of food waste	Small volumes discharged; High dilution factors. Short duration. <b>Low Impact:</b> Adverse but not significant	Food should be macerated before disposal in accordance with MARPOL 73/78 Annex V requirements.
Marine pollution due to a large fuel spill	<b>High Impact</b> to marine environment: potentially significant impacts, but can be mitigated to lower significance. <b>Low Impact</b> to shoreline from MGO spills within the survey area. <b>High Impact</b> to shoreline from MGO spills near Narsaq port.	Maritime navigation and communications measures safeguard vessel from risk of collision or grounding. Strict refuelling procedures, to be carried out away from sensitive resources. Avoid refuelling at Narsaq Port.
Marine pollution due to small oil spills	Small volumes discharged; High dilution factors. Short duration. Low-medium intensity. <b>Low Impact:</b> Adverse but not significant	Use of chase boats to prevent interference with other sea users and physical obstructions (i.e. icebergs). Shipboard Oil Pollution Emergency Plans (SOPEP) onboard all vessels. Trained personnel in spill response.
Disturbance to seabed habitat due to loss of streamer.	Localised physical impact on seabed. Low probability and low intensity. <b>Low Impact:</b> Adverse but not significant	Routine monitoring of the streamer. Use of chase boats to prevent interference with other sea users and physical obstructions (i.e. icebergs).

## Summary of Impacts due to Air Emissions

Impact	Impact Assessment	Mitigation
Reduction of air quality due to emissions of CO, NO <sub>x</sub> , N <sub>2</sub> O, SO <sub>x</sub> , VOC and particulates.	Emissions will be quickly dispersed. Localised, short-term, low intensity effect. <b>Low Impact:</b> Adverse but not significant.	Engines, generators and compressors should be well maintained to maximise their efficiency. Use of low sulphur fuel (<1.5%)
Increase in global warming due to emissions of greenhouse gases (CO <sub>2</sub> and CH <sub>4</sub> ).	Low intensity but cumulative effect. <b>Medium Impact:</b> potentially significant impacts, but cannot be mitigated to lower significance.	None

Summary of Impacts form Produced Solid Waste

Impact	Impact Assessment	Mitigation
Marine Pollution due to waste mismanagement.	Loss of waste offshore may lead to physical and toxic adverse effects of low-high intensity; short to long term persistence but low probability. <b>Medium Impact:</b> potentially significant impacts, but can be mitigated to lower significance.	Vessels are required by MARPOL 73/78 Annex V regulations to have a garbage management plan and a garbage record book where garbage volumes, types and disposal routes are recorded.  Designated segregation and containment of waste.
Pollution due to discharge of food waste.	Small volumes discharged; High dilution factors. Short duration. <b>Low Impact:</b> Adverse but not significant	Food should be macerated before disposal in accordance with MARPOL 73/78 Annex V requirements.
Visual impact, contamination of soil & groundwater due to onshore disposal	Localised short-term to permanent effect. <b>Medium Impact:</b> potentially significant impacts, but can be mitigated to lower significance.	Ensure waste handling facilities are authorised and properly managed; arrange for shipment and disposal by specialised and registered waste contractors.

Summary of Impacts due to Physical Presence

Impact	Impact Assessment	Mitigation
Delays to shipping	Some short term and localised impact to freight or ferry traffic is possible. <b>Low Impact:</b> Adverse but not significant	Consultation and notification. Regular communications with vessels and the port. Use of chase boats to warn small vessels.
Disruption to fishing and whaling	Short-term direct effect, low to medium probability, low intensity within a limited (local) scope <b>Low Impact:</b> Adverse but not significant	Consultation and notification. Regular communications with fisheries and the port. Use of chase boats to warn small fishing vessels. Fishing activities (including nets) must be removed from survey lines.
Aesthetic/visual impacts	<b>No Impact</b>	None

As with any project, environmental performance and risk management is largely dependant on responsible and experienced operators. Capricorn’s priority will be the implementation of comprehensive pollution prevention programmes to effectively protect Greenland’s environment and to minimise the above identified impacts to lower and acceptable significance levels. Capricorn will ensure that the seismic survey contractor (PGS) employs best environmental practices, such as effective waste and effluent management, strict refuelling procedures, adherence to NERI Guidelines for Minimising Acoustic Disturbance to Marine Mammals from Seismic Surveys, employment of qualified Marine Mammal and Seabird Observers, staff awareness of environmental issues and training in pollution prevention procedures and emergency response. Chase boat(s) will be used to ensure the exclusion zone around the seismic vessel is maintained and to prevent interference with other sea users and physical obstructions (i.e. icebergs).



To this end, mitigation measures and an environmental protection plan have been developed which are designed to facilitate the final planning, implementation, and follow-up activities associated with the proposed operations. Capricorn monitors contractor's performance and measures their practices through active programmes that are reviewed at regular intervals. This helps to ensure that operations are carried out with the lowest possible to the environment risk in an environmentally acceptable manner and that the residual impacts from the proposed activities are of lower significance following the implementation of preventative and mitigation measures.

## UNCERTAINTIES

The offshore environment of South Greenland is still relatively unstudied, despite the ongoing research by organisations such as NERI, the Danish Meteorological Institute (DMI) and the Greenland Institute of Natural Resources (GINR). Where uncertainties have been identified, which may significantly influence the assessment of impacts, the precautionary principle has been applied.