APPENDIX F – POWER LEVELS

Power Levels

Consideration has been given to the lowest practicable power levels that will achieve the geophysical objectives of the survey. Although reducing the source output, does not, in theory, have a significant overall effect on the returned energy, it is the weaker reflection events and higher frequencies that get lost. This will potentially reduce the effectiveness of the survey. The attenuation plots below show that a low reflection coefficient signal will be lost in the noise and therefore not be observed if using a smaller source but the larger source will allow the low reflectivity to be recorded.

Figure F1: 99 Barm Source 11uBar noise. As is estimated reflection coefficients

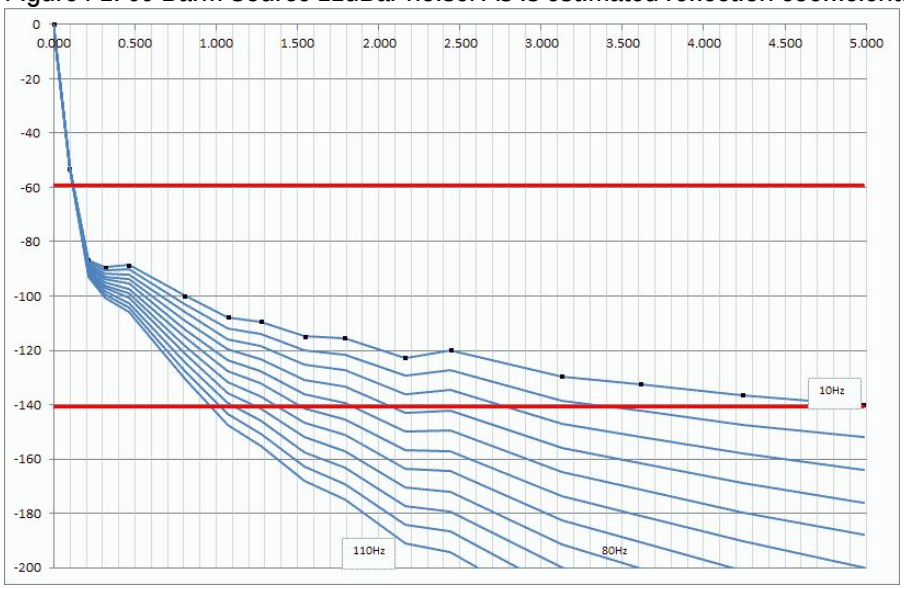


Figure F2: 55 Barm Source 11uBar noise. As is estimated reflection coefficients

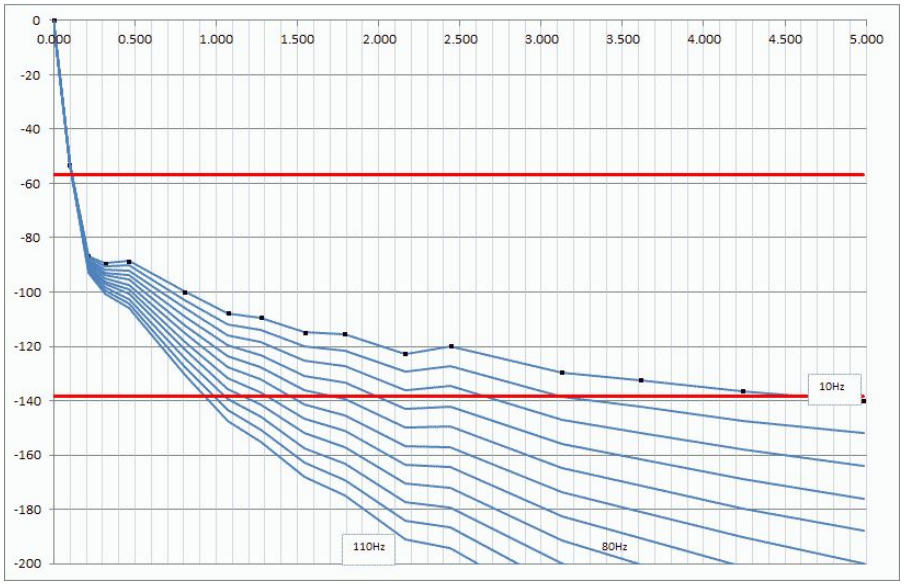


Figure F3: 99 Barm Source 11uBar noise. Small reflection coefficient

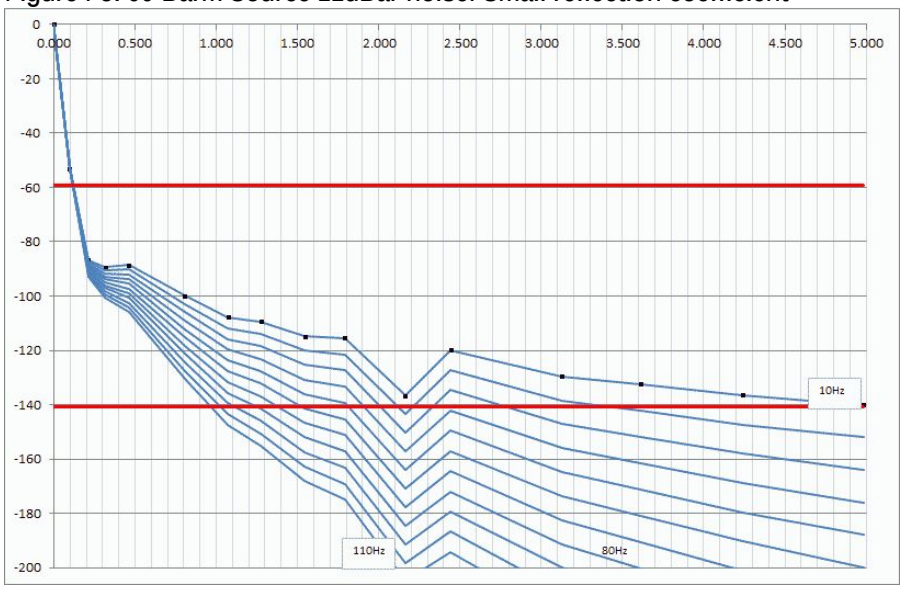
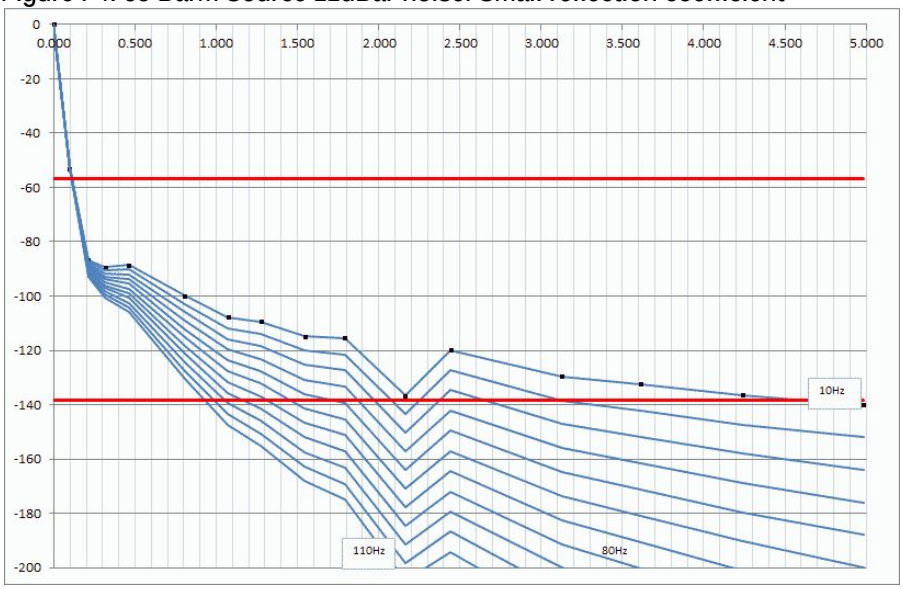


Figure F4: 55 Barm Source 11uBar noise. Small reflection coefficient



APPENDIX G – ENVIRONMENTAL MANAGEMENT PLAN

ACRONYMS AND UNITS

	%	Per hundred
	2D	Two dimensional
	3D	Three dimensional
B	BMP	Bureau of Minerals and Petroleum
C	CPT	Captain of survey vessel
	CR	Client representative
D	dB	Decibel
	DCE	Danish Centre for Environment and Energy
E	EEZ	Exclusive economic zone
	EIA	Environmental impact assessment
	EMA	Environmental mitigation assessment
	EMP	Environmental management plan
	EMS	Environmental management system
	ER	Emergency response
F	FLO	Fisheries Liaison Officer
	FMC	Fisheries Monitoring Centre
	FRC	Fast rescue craft
H	HSE	Health, safety and environment
G	GINR	Greenland Institute of Natural Resources
	GLFC	Greenland Fisheries Licence Control
	GV	Guard vessel
I	IMO	International Maritime Organisation
	ISO	International Standards Organisation
J	JNCC	Joint Nature Conservation Committee
K	km	Kilometre
	km^2	Square kilometre
	KNAPK	Greenland Hunting and Fishing Association
M	m	Metre
	MMSO	Marine mammal and seabird observer
N	nm	Nautical mile
O	OSCP	Oil spill contingeny plan
P	PAM	Passive acoustic monitoring
	PAR	PA Resources E&P Services Limited
	psi	Pound per square inch
S	SC	Survey crew
	SEIA	Strategic environmental impact assessment
	ShC	Ships' company
	SM	Survey manager
	SOPEP	Shipboard Oil Pollution Emergency Plan
U	µPa	Micro pascal (unit of pressure)

CONTENTS

1 INTRODUCTION

PA Resources E&P Services Ltd (PAR), on behalf of PA Resources AB, wishes to acquire 3D seismic data in the Ekholm survey area (600km^2) within its West Greenland Naternaq Licence (2008/17) Block 8. Block 8 is located on the Store Hellefiskebanke in the eastern Davis Strait. The survey area is 8.25km from the coast at its closest point and is 143km from the Greenland/Canada median line.

In accordance with Bureau of Minerals and Petroleum (BMP) guidelines, 'Guidelines for application, execution and reporting of offshore hydrocarbon exploration activities (excluding drilling) in Greenland' (BMP 2011), PAR submitted a Scoping Report (Document Reference PARUK-BMS-PROJ011-04, PAR 2012a) describing three potential survey areas. The BMP with support from the Danish Centre for Environment and Energy (DCE) and Greenland Institute of Natural Resources (GINR) have assessed the Scoping Report to determine whether the activity applied for will require an Environmental Impact Assessment (EIA) or an Environmental Mitigation Assessment (EMA). In a statement from the BMP dated 15th February 2012, it has been recommended that PAR prepare an EIA (PARUK-BMS-PROJ011-06-1).

Of the three survey areas considered in the Scoping Report, PAR consider Ekholm to be the most viable area for future development and therefore this area has been selected for the survey and is the only area considered in the EIA (PAR 2012b).

The Scoping Report identified all potential impacts that may result from the seismic survey and presented the mitigation measures that would be used to minimise the impact. The EIA identified whether any residual impacts would remain following consideration of the mitigation measures and project specific information and assessed those impacts.

The 'BMP Guidelines for application, execution and reporting of offshore hydrocarbon exploaration activities (excluding drilling) in Greenland' (BMP 2011) require that an EIA should include an Environmental Management Plan (EMP) describing measures to be taken in order to mitigate against impacts to the environment. This document therefore describes how the mitigation measures proposed in the Scoping Report (PAR 2012a) and the EIA (PAR 2012b) will be implemented.

1.1 PROJECT OUTLINE

PAR may wish to acquire 600km^2 of 3D seismic data in the Ekholm survey area. This survey would be undertaken to gather more detailed data following the 2D seismic survey PAR conducted in Block 8 in 2010. At the time of writing PAR has yet to secure a suitable acquisition contractor to perform the proposed seismic programme and specific vessel details are not yet known; appropriate updates to the EMP will be made when this is confirmed. However, in line with the assumptions made in the Scoping Report this EIA has assumed that there will be one 3D seismic survey vessel, one guard/chase vessel and one fast

rescue craft (FRC). PAR will inform the relevant Greenlandic authorities as resources, contractors and schedules are confirmed. 3D seismic data will be acquired by sailing the seismic vessel along predetermined acquisition lines. The survey will be shot in a north - south orientation and provisionally consists of 102 sail lines, which are presented in Figure 1-2.

The main stages of the survey are as follows:

- Mobilisation of seismic survey vessel (with one guard vessel) to Block 8
- Deployment of the towed equipment (airgun arrays and hydrophone streamers).
- Data acquisition
- Retrieval of equipment and demobilisation from the area.

The source will consist of two 4,240 cubic inch sources (2,000psi) fired alternating at a 12.5m shot point interval. The sources will discharge through multiple airguns of varying sizes, towed behind the seismic vessel in arrays underwater. A seismic source of the size proposed, is expected to generate power up to 262dB re 1µPa@1m (peak to peak), in the frequency band of 0-220Hz.

Eight streamers containing hydrophones will be towed behind the seismic vessel under water and will receive and record the seismic data. It is anticipated the streamers will be 4,000m to 6,000m in length and will be towed at a depth of approximately 10m. The streamers will be armoured to minimise the potential for damage.

1.2 PROJECT SCHEDULE

The date that the operation will commence is yet to be confirmed however, this will be between June and early September 2012. Ekholm will require 380 hours (16 days) of prime acquisition with 95 hours (4 days) infill (25%). An additional 120 hours (5 days) (25%) has been included to accommodate poor weather preventing operations. In total the operational period is estimated to be 25 days. There will be three days prior to the operation for mobilisation and two days post-operations for demobilisation, bringing the total project period to 30 days.

1.3 ENVIRONMENTAL MANAGEMENT FRAMEWORK

PAR corporate policies and environmental management system (EMS) provide a fit for purpose framework to implement the mitigation measures proposed in the EIA. The EMS is certified to ISO-14001:2004 standards and provides adequate control and bridging arrangements for PAR to ensure that the contractors implement the mitigation measures.

This EMP has been developed to implement and monitor the mitigation measures. The structure of the reporting system outlined in Section 5.2 provides for key personnel to attend a daily survey management meeting and

to provide and maintain daily logs which then feed into weekly and monthly summary reports. These short summary reports (1-2 pages) enable any significant issues of relevance to the environmental management of the seismic survey operations to be flagged, addressed and reviewed to reduce the likelihood of them being repeated.

This approach will ensure that PAR, the regulator (BMP) and its advisory bodies (i.e., DCE and GINR) are satisfied that environmental risk is reduced to as low as reasonably practicable.

1.4 SCOPE & PURPOSE OF THE EMP

The purpose of the EMP is to provide a management framework through which the mitigation measures for the environmental impacts associated with the seismic survey, documented in the Scoping Report (PAR 2012a) and EIA, (PAR 2012b), are implemented. The implementation measures are designed to:

- Avoid environmental impacts or reduce them to a level as low as reasonably possible
- Comply with national and international legislation/conventions
- Minimise risks to the project programme and reputation

The EMP is therefore a key reference document for:

- **Seismic survey team** to implement mitigation measures required by the EIA.
- **PAR** to ensure that seismic survey contractor, client representative and other key personnel are undertaking the roles assigned to them for the protection of environment and other sea users.
- **BMP** to confirm if permit conditions and other statutory requirements described in the Scoping Report and EIA are being met.

Reference to the Scoping Report and EIA is made throughout the EMP, and although it is advised that this document is read in conjunction with the Scoping Report and EIA, all mitigation measures are included within this document. In order to gain a full understanding of HSE management for this project, it is advised that the EMP also be read in conjunction with the project specific Safety Plan, Emergency Response Plan, and Oil Spill Response & Contingency Plan.

The EMP clearly explains:

- **What** environmental mitigation and monitoring measures are to be implemented
- **When** these measures are to be implemented
- **Who** is responsible for implementation
- **How** compliance on implementation is to be reported

Any comments or additions, following BMP review and approval will be included before issue for use.

1.5 FOCUS OF EMP

The mitigation and monitoring measures detailed in this EMP are focussed on the main environmental risks associated with the seismic survey; i.e.

- Death, injury or significant disturbance as a result of subsea noise
- Marine pollution caused by diesel spillage
- Disturbance to local fisheries / hunting activities

1.6 STRUCTURE OF THE EMP

For convenience of the reader the following table summarises the structure and content of the EMP.

Table 1-1: Structure of EMP

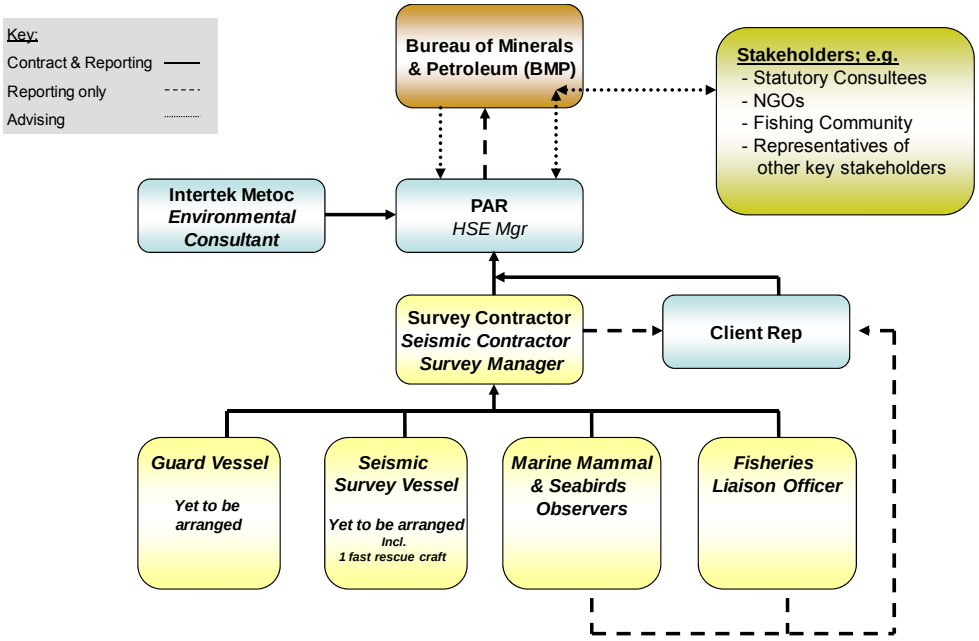
Section	Title	Content
1	Introduction	Brief project description and explanation of the purpose and context of the EMP.
2	Organisational Structure & Responsibilities	Explanation of the roles and responsibilities of parties involved in the implementation of the EMP.
3	Environmental Mitigation Measures	Details of environmental mitigation measures to be implemented by the project.
4	Environmental Monitoring	Reporting activities to monitor implementation of mitigation and effectiveness of measures
5	Communication & Documentation	Description of communication and reporting protocol for environmental management.
6	Outline of Emergency Response & Contingency Plan	Summary description of the plan and how it will be implemented. Clear cross references to the relevant section of the HSE Plan, where full details are provided.
7	Environmental Training	Description of environmental training structure; key responsibilities, content, resources, schedule.

2 ORGANISATIONAL STRUCTURE AND RESPONSIBILITIES

2.1 EMP ORGANOGRAM

The organogram below illustrates the key parties working on the project and their contractual/reporting roles and main interfaces as explained in this EMP.

Figure 2-1: Organogram for Environmental Management



2.2 RESPONSIBILITIES

Key responsibilities associated with the roles provided in Figure 2-1 are listed below. Reporting responsibilities for project personnel are in Table 5-1 and Appendix B provides their contact details.

PAR, HSE Manager

Key Role: Management of Seismic Survey compliant with national and international requirements.

PAR is ultimately responsible for implementing the EMP and complying with permit consent conditions stipulated by the BMP. The PAR HSE Manager will oversee that the project's activities are compliant with national and international HSE obligations. Responsibilities of the HSE Manager will also include ensuring that appropriate training material, associated with the EMP, is made available for all project personnel.

PAR will contract a Client Representative (CR) to be on-board supervising the works in progress (see below). Responsibility for environmental training is also likely to be delegated to the CR (see below).

Key Role: Stakeholder Liaison

PAR will ensure that all the relevant stakeholders are informed of the survey programme. This will be achieved through BMP, through direct information dissemination and consultation in association with BMP. Any media inquiry received either through BMP or directly will be routed to the PAR HSE Manager for a response from the company.

PAR, Client Representative (CR)

Key Role: Supervision of Survey Works on behalf of PAR

PAR will subcontract a CR to protect the interests of PAR on-board during the seismic survey and to ensure that the contractor complies with contractual and other obligations. The CR will report regularly to PAR and will have the authority to instruct the seismic and other subcontractors on site to halt or amend works if deemed necessary.

Seismic Contractor – to be confirmed

Key Role: Provision of services to complete survey works as contracted

The Contractor will have direct responsibility for implementing the measures detailed in the EMP as per the contractual obligations, in addition to the standard legal obligations under international treaties and conventions (e.g., MARPOL 73/78 etc). Headed up by the Survey Manager (SM), the Survey Team are responsible for the delivery of the seismic survey as per their contract obligations to PAR. The SM on-board will be the main point of contact with the wider contractor survey crew (SC).

The Contractor will engage subcontractors qualified to nationally/internationally recognised standards to provide the roles of

- Two Marine Mammal & Seabird Observers (MMSOs),

- Fisheries Liaison Officer (FLO) if required by BMP,
- Guard vessel

Key Role: Maintenance of Survey Vessel and health and safety of all on board compliant with national and international legislation.

The Ships Company: The Captain of the Survey Vessel (CPT) has ultimate responsibility for maintaining the smooth operation of the vessel and the safety of all persons onboard. The Captain will be the main point of contact regarding communications with the wider Ship's Company (ShC). The Captain works closely with the SM and the CR to support the efficient delivery of the project.

Marine Mammal and Seabird Observers (MMSOs)

Key Role: Implement Mitigation & Monitoring measures to protect marine mammals and seabirds according to recognised guidelines.

The Contractor will subcontract two MMSOs to work aboard the seismic vessel during the survey. Their role will be to ensure the mitigation measures to protect marine mammals and seabirds are implemented fully. The MMSO will liaise directly with the onboard Client Rep to advise of actions required, this may include a cessation of seismic testing in the event that they believe protected species of marine mammals or seabirds are at significant risk of death or injury.

At least two trained MMSOs will be on board in order to observe continuously when operating the airguns. The MMSO will be responsible for ensuring implementation of all activities necessary to comply with the requirements outlined in 'Guidelines to environmental impact assessment of seismic acitivites in Greenland waters' (DCE 2011) and 'Joint Nature Conservation Committee (JNCC) guidelines for minimising the risk of injury to marine mammals from seismic surveys' (JNCC 2010) (See Appendix A).

The MMSO will also record seabird abundance and distribution data to supplement background information for future SEIA and EIA during transit. Data will be collected to the standards required by DCE (DCE 2011) to ensure they are compatible with DCE databases.

Fisheries Liaison Officer (FLO)

Key Role: Provide point of liaison between PAR/Survey Vessel and the local/regional fishing community

In accordance with the BMP guidelines (BMP 2011) a Fisheries Liaison Officer will be onboard the seismic vessel, if required by BMP, to act as an advisory observer and communicator on matters relating to fishing. The Contractor will subcontract a FLO, known and respected by the regional fishing community and approved by the BMP (as per BMP 2011). To minimise disturbance to the local fishing community, the role of the FLO will be to ensure local fishermen are informed in advance, of the location and schedule of works and required safety distances to be maintained from the operating survey vessel. The FLO's responsibilities also include liaison with local vessels.

During the survey, if required by the BMP, a government approved FLO will be onboard the survey vessel monitoring the fishing vessel activity and providing a continual point of contact between the survey vessel and the fishing vessels in

the area, ensuring that they continue to be well informed of activities and the requirement to remain clear of the survey route.

The FLO will liaise directly with the CR on board and work closely with the ship's company to maintain ready access to the ship's communications systems.

The FLO will also liaise with the SM and CPT to ensure the 3 day Look-Ahead and hourly ship location are transmitted to BMP and Fishing Association respectively (see Section 3 for details).

Guard Vessel (GV)

Key Role: preventing intrusion of other vessels into the vicinity of the survey transect while underway.

The guard vessel will be subcontracted by the survey contactor to protect the survey operations from intrusion by other vessels by maintaining the operational exclusion zone around the Survey Vessel. While underway, the guard vessel will work closely with the Survey Vessel's captain and the onboard FLO (if present).

Bureau of Minerals & Petroleum (BMP)

Key Role: Main Regulator of Oil & Gas Industry

As the key regulating authority, BMP also represents the main point of contact for statutory and non-statutory bodies concerning the scope and activities of the seismic survey, throughout the duration of the seismic survey and the dissemination of the survey results thereafter. BMP are also the authority responsible for the review and approval of the Scoping Report, EIA and this EMP. PAR will continue to liaise closely with BMP representatives, throughout the project lifespan to maintain awareness of any developments that arise (e.g., legislative changes, stakeholder concerns etc).

Key Role: Liaison with fisheries community.

The BMP are responsible for liaison with the fishing community, e.g., via on-going liaison with the Greenland Hunting and Fishing Association (KNAPK). The BMP will circulate to the fishing community the three day look-ahead plan produced on a daily basis by the seismic survey vessel. BMP will also liaise with PAR to facilitate the distribution of information leaflets etc. to the community outlining mitigation measures to be implemented during the survey operations.

3 ENVIRONMENTAL MITIGATION MEASURES

This section of the EMP provides the details and management of the mitigation measures to be implemented. To facilitate the users of the EMP, the information is presented in a series of topic specific tables showing:

- Key impacts
- Mitigation measures to be implemented for each impact
- Timeframe for implementation
- Person/party responsible for implementing the mitigation
- Person/party responsible for monitoring the implementation of each measure.

The Scoping Report and EIA list a greater number of impacts than presented in the mitigation measures tables below. This is because a particular suite of mitigation measure will cover multiple impacts, e.g., Marine Pollution Prevention & Control mitigation measures address impacts on fish populations, water quality, benthic environments etc. Table 3-1 presents a summary of the inter-relationship between the impacts/receptors documented in the Scoping Report and EIA and the mitigation measures detailed in the EMP.

The following receptor specific mitigation measures are provided;

- Marine Mammals (Table 3-2)
- Marine Pollution Prevention & Control (Table 3-3)
- Fishering & Hunting (Table 3-4)
- Seabirds (Table 3-5)
- Shipping & Navigation (Table 3-6)
- Air & Climate Quality (Table 3-7)
- Emergency Response (Table 3-8)

Table 3-1: Summary of how EMP Mitigation Measures address all receptors documented in the EIA.

Impacted Receptor *(As listed in Scoping Report)*	Relevant Suite of EMP Mitigation Measures						
	Marine Mammals	Marine Pollution Prevention & Control	Fishing & Hunting	Seabirds	Air & Climate Quality	Emergency Response	Shipping & Navigation
Air Quality & Climate					✓		
Water Quality		✓				✓	✓

Seabed Conditions		✓				✓	✓
Plankton		✓				✓	
Benthic Ecology		✓				✓	
Fish & Shellfish		✓				✓	
Seabirds		✓		✓		✓	
Marine Mammals	✓	✓				✓	
Protected Sites & Species	✓	✓		✓		✓	
Shipping & Navigation		✓	✓			✓	✓
Fishing & Hunting	✓	✓	✓	✓		✓	✓
Tourism	✓	✓				✓	
Other Sea Users		✓	✓			✓	✓

Tavle 3-2 to 3-8 include details of how the implementation of the mitigation measures will be monitored and reported. Section 4 outlines the approach to monitoring while Section 5 provides details of the nature of the respective reports mentioned.

3.1 MARINE MAMMALS

Table 3-2: Management of Mitigation Measures for the protection of Marine Mammals.

Impact	ID	Mitigation *(from Scoping Report and EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	Monitoring	
Protection of Marine Mammals						
Increased Collision Risk	2.1	Chase/guard vessels will be used to minimise the risk of collision between the seismic vessel and marine mammals.	During	SM	CR	CR Environmental Reports
Impact on marine mammals' (i.e., whales, dolphins & porpoises) through physical harm, interfere with ability to echolocate and communicate, cause displacement from the area.	3.1	For Marine Mammals and Seabird observation and reporting, the latest best practice guidelines from DCE (DCE 2011) and the UK Joint Nature Conservation Committee (JNCC) guidance will be followed (JNCC 2010).	During	SM/ MMSO	CR	MMSO Report CR Environmental Reports
	3.2	The airgun array will not be larger than needed for the specific survey as specified in the EIA	During	SM	CR	MMSO Report Survey Report CR Environmental Reports
	3.3	Methods to reduce unnecessary high frequency noise have been considered during the planning stages	Pre	PAR	PAR	EIA Report
	3.4	Methods to reduce airgun noise to increase directionality have been considered during the planning stages	Pre	PAR	PAR	EIA Report
	3.5	Scheduling of the survey has considered the presence and distribution of marine mammals	Pre	PAR	PAR	EIA Report
	3.6	Other planned surveys have been identified and the potentail cumulative impacts of these assessed in the EIA (Section 6)	Pre	PAR	PAR	EIA Report
	3.7	A mitigation gun will be used where appropriate. The mitigation gun is the smallest airgun, in terms of energy output and volume, in the existing array	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.8	An injury zone of 200m shall be applied. If marine mammals are observed within 200m during full power, the output shall be reduced to the mitigation gun until the mammal has left the zone.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.9	A safety zone of 500m from the airgun array shall be applied.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports

Impact	ID	Mitigation *(from Scoping Report and EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	Monitoring	
	3.10	Passive Acoustic Monitoring (PAM) of vocalising whales shall be deployed for monitoring purposes during start up at night or during periods when the sea state is above 3, especially in areas with bowhead whales	During	MMSO	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.11	A pre-shooting search will be conducted before commencement of any use of the airguns. As waters will be less than 200m deep this search shall last 30 minutes. If marine mammals are spotted within the 500m safety zone, the ramp-up procedure shall be delayed 20 minutes, from the time when the marine mammals have left the safety zone, or the ship has moved so as to place them outside the safety zone.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.12	During the survey the pre-shooting search for a new survey line will be initiated before the end of the previous survey-line, while the airguns are still firing.	During	MMSO	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.13	The array shall not be started with all guns firing at full power. Instead individual air-guns will be added to the firing pattern sequentially or, if this is not possible, the output of all airguns in the array will be slowly increased by manipulation of pressure (ramp-up or soft start procedures).	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.14	This ramp-up procedure will occur over a period of approximately 2.6 hours, and may occur whilst the survey ship is en route to the starting point of the transect line.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.15	Ramp-up will not be initiated if marine mammals are inside the array or within the safety zone (500m) of the array. If marine mammals are discovered within the safety zone during the ramp-up procedure, the airguns shall be reduced to the mitigation gun, and a new ramp-up procedure initiated when the mammals have left the safety zone – i.e. at least 20 minutes after the last sighting.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.16	If proper ramp-up cannot be performed for technical or other reasons, other measures will be taken to assure that no animals are within the safety zone at the start-up.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.17	If the array is shut down for any reason while on the transect line it may be re-initiated at full power if the silent break is not longer than 5 minutes. Otherwise a full ramp-up	During	SM	MMSO	MMSO Report Survey Report

Impact	ID	Mitigation *(from Scoping Report and EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	Monitoring	
		procedure will be followed.				CR Environmental Reports
	3.18	During line changes the array output will be reduced to the mitigation gun; if the transit time is longer than 20 minutes, a full ramp-up will be initiated prior to arrival at the next line. If the transit time is less than 20 minutes the array may be operated during transit. This will preferably be at reduced power output (mitigation gun).	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.19	Two MMSO will be posted on the source vessel and at least one will be continuously on the look-out, particularly for whales and seals during the pre-shooting search and when airguns are operating.	During	MMSO	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.20	Observation of marine mammals which have entered the safety zone during shooting may not lead to shutdown, but if marine mammals are observed within the 200m injury zone of the array, output will be reduced to the mitigation gun until the marine mammals are outside the 200m zone again.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports
	3.21	A log of all observations made by the two MMSOs will be kept on the ship and reported as part of the cruise report.	During	MMSO	CR	MMSO Report Cruise Report CR Environmental Reports
	3.22	Airguns will not be used outside the transect lines, except in ramp-up prior to arrive and on short transit lines and for strictly necessary testing purposes. Testing the array at full power will be initiated with a ramp-up procedure as described above.	During	SM	MMSO	MMSO Report Survey Report CR Environmental Reports

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

3.2 MARINE POLLUTION PREVENTION & CONTROL

Table 3-3: Management of Mitigation Measures for Marine Pollution Prevention & Control

Impact	ID	Mitigation *(from EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
Marine Pollution Prevention & Control						
Pollution from Ship-board waste discharges	6.1	All vessels will have and implement a written *"Vessel Waste Management Plan"* compliant with MARPOL 73/78 and its Annexs IV and Annex V.	Pre/During	CPT	SM	CR Environmental Reports
	6.2	Food wastes will only be discharged beyond 12NM from shore and no other materials will be disposed at sea, regardless of location.	During	CPT	PAR/CR	CR Environmental Reports
	6.3	Solid wastes will be compacted where possible and stored for appropriate disposal ashore.	During	CPT	PAR/CR	CR Environmental Reports
	6.4	Sewage wastes will be treated where possible.	During	CPT	SM	CR Environmental Reports
Accidental spill *(e.g., smothering, slicks etc)*	7.1	The operation will be scheduled between early summer and early autumn, this scheduling minimises the potential risk to seabirds which are highly dispersed but in low numbers during this period.	Pre	PAR	PAR	EIA Report
	7.2	At least two trained marine mammal and seabird observers (MMSO) will be on board and at least one posted when operating the airguns. They will also record seabird abundance and distribution data to supplement background information for future Strategic Environmental Impact Assessments (SEIA) and EIA during the survey and when sailing in transit. Data will be collected to the standards required by DCE (DCE 2011).	Pre / During	MMSO	CR	MMSO Report CR Environmental Reports
	7.3	Solid armoured streamers will be used, which are less likely to be damaged, punctured or leak than fluid filled streamers.	Pre	SM	CR	CR Environmental Reports
	7.4	Training, good housekeeping and storage and handling procedures.	Pre/During	CPT	SM	CR Environmental Reports
	7.5	Regular inspection of the equipment. Sumps and drains should catch accidental spill releases.	Pre/During	CPT	SM	CR Environmental Reports

Impact	ID	Mitigation *(from EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
	7.6	Offshore bunkering will not take place.	During	CPT	SM	CR Environmental Reports
	7.7	Management controls will be in place to eliminate spills within the port.	During	CPT	SM	CR Environmental Reports
	7.8	The use of appropriate classified Ice Class vessels for the survey and chase boat. PAR will ensure the survey vessel has multiple fuel tanks to minimise loss of containment.	Pre	PAR HSE Mgr	PAR HSE Mgr	PAR to confirm
	7.9	PAR will ensure all vessels have an approved shipboard oil pollution emergency plan (SOPEP) in place.	Pre/During	CPT	PAR	CR Environmental Reports
	7.10	An ice management plan will be written and implemented to minimise the risk of ship collisions with ice or spill interceptions with ice bergs. The plan will take into consideration the Danish Maritime Authority technical regulations number 169 of 4 March 20091 and Order 417 of 28 May 20092.	Pre/During	CPT	PAR	CR Environmental Reports
	7.11	PAR has committed to subscribe to the InfoTerra Pollution satellite monitoring service for 2012. In the event of a spill, Envisat satellite data will be used to identify oil slicks, each of which will be time and date stamped with probable sources of pollution and direction of travel.	Pre/During	CPT	PAR	CR Environmental Reports

PAR: PAR HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

[1] Technical regulation no. 169 of 4 March 2009 issued by the Danish Maritime Authority. Technical regulation on the use of ice searchlights during navigation in Greenland waters.

[2] Order number 417 of 28 May 2009 issued by the Danish Maritime Authority. Order on technical regulation on safety of navigation in Greenland territorial waters.

3.3 FISHING AND HUNTING

Table 3-4: Management of Mitigation Measures for minimising impacts on local fishing & hunting activities

Impact(s)	ID	Mitigation *(from Scoping Report)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
Fishing & Hunting *(i.e., licensed / regulated marine hunting)*						
	1.1	PAR will liaise with the KNAPK (Greenland Hunting and Fishing Association) and will organise local meetings for the fishing and whaling community if it is felt necessary.	Pre	PAR	PAR	PAR to confirm
	1.2	On a daily basis, provide a three day look-ahead plan to the BMP for circulation to fishermen.	During-Daily	SM	CR	CR Environmental Reports
	1.3	The seismic vessel will report hourly position data to the Greenland Fisheries Licence Control (GFLC) and Fisheries Monitoring Centre (FMC).	During-Hourly	CPT	SM	Ships Log
	1.4	Chase/guard vessels will be used to minimise the risk of collision between the seismic vessel and commercial fishing vessels & gear.	During	CPT	SM	Ship's Log
	1.5	An operational exclusion zone will be established around the seismic vessel when operating.	During	CPT	CR	Ship's Log CR Environmental Reports
	1.6	If required by BMP, Fisheries Liaison Officer (FLO) to keep contact between the survey vessel and fishing/hunting vessels ensuring they continue to be well informed of survey activities and the requirement to remain clear of the survey route.	During	FLO	CR	Ship's Log CR Environmental Reports
Pollution from Accidental Oil/Chemical Spills		See Marine Pollution Prevention & Control	During	CPT	CR	CR Environmental Reports

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

3.4 SEABIRDS

Table 3-5: Management of Mitigation Measures for minimising impacts on Seabird populations

Impact	ID	Mitigation *(from EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
Seabirds						
Disturbance of birds resting on the surface; Disturbance to birds feeding	4.1	Routine operations will not involve the use of helicopters	During	SM	CR	Survey Report Ships Log CR Environmental Reports
	4.2	At least two trained MMSO will be on board in order to observe continuously when operating the airguns. They will record seabird abundance and distribution data to supplement background information for future SEIA and EIA. Data will be collected to standards required by DCE (2011) to ensure it is compatible with DCE databases.	Pre / During	MMSO	CR	MMSO Report CR Environmental Reports
Smothering, physical contamination and toxic effects	4.3	See Marine Pollution Prevention & Control mitigation measures	*various*	CPT	CR	Survey Report CR Environmental Reports

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

3.5 SHIPPING & NAVIGATION

Table 3-6: Management of Mitigation Measures for minimising impacts on Shipping & Navigation.

Impact	ID	Mitigation *(from EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
Shipping & Navigation						
Increase Risk of Collisions, Obstruction to vessel navigation	8.1	Mariners will be notified of the presence and duration of the survey. The chase/guard vessel will be used to warn other sea users of the survey programme if they come within close proximity to the survey. An operational exclusion zone of 500m will be established around the seismic vessel when operating.	Pre/During	SM	CR	CR Environmental Reports
	8.2	The seismic vessel will adhere to the Danish Maritime Authority Order no. 417 on safety of navigation in Greenland territorial waters	During	CPT	CR	CR Environmental Reports
	8.3	The seismic vessel will comply with the Greenland vessel monitoring system and will report their position hourly to the Greenland Fisheries License Control (GFLC) Fisheries Monitoring Centre (FMC). If the vessel is equipped with an Inmarsat-C transceiver, a DNID will be downloaded and tested before arriving in the Greenland EEZ. Alternatively an ARGOS unit will be leased and installed in Nuuk	During	CPT	CR	CR Environmental Reports

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

3.6 AIR QUALITY & CLIMATE

Table 3-7: Management of Mitigation Measures for minimising impacts on Air & Climate Quality.

Impact	ID	Mitigation *(from EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
Air & Climate						
Loading of Greenhouse Gasses and degradation of air quality	9.1	PAR and any contractors will undertake practical steps to minimise atmospheric emissions. Including ensuring efficient operations by keeping all power generation equipment well maintained.	Pre/During	CPT	SM	CR Environmental Reports
	9.2	Vessels engaged and machinery used, will only use diesel and gasoil with a low sulphur content and monitor fuel consumption	Pre/During	CPT	SM	CR Environmental Reports

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

3.7 EMERGENCY RESPONSE

Table 3-8: Management of Mitigation Measures in the event of an Emergency Response.

Impact	ID	Mitigation *(from EIA)*	Timing (Pre, During, Post Survey)	Responsibility		Audit Plan/Evidence of Implementation
				Execution	*Monitoring*	
Emergency Response						
Potential smothering, physical contamination, and/or toxic effect from oil/chemical spill		See Marine Pollution Prevention & Control Measures.	Various	Various	PAR/CR	CR Environmental Reports
Potential Impact on Tourism from Visual Impact of Spill						
Sediment Contamination						
Scour around dropped objects	10.1	The position of any dropped objects will be noted and other sea-users informed as appropriate.	During	SM	CR	CR Environmental Reports
	10.2	The feasibility of removing large objects will be considered.	During	SM	CR	CR Environmental Reports

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	SC: Survey Crew	ShC: Ship's Company	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer	GV: Guard Vessel

4 ENVIRONMENTAL MONITORING

Environmental monitoring measures provide an on-going review of:

- Implementation of mitigation measures detailed in the EMP
- Effectiveness of the mitigation measures

The key elements of the Monitoring Measures detailed in this EMP are:

- **Recording:** The Reporting Schedule is summarised in Table 5-1. Monitoring comprises reviewing the daily logs to be kept by the respective parties and, in addition to feedback at the daily survey management meetings onboard, weekly and monthly progress reports.
- **Reviewing:** The daily logs are reviewed by the CR on at least a weekly basis, who then incorporates any key issues in the weekly/monthly progress reports to the PAR Project Manager / HSE Manager. It is the responsibility of the key parties (i.e. MMSO, SM, etc) to raise any issues of importance at the daily survey management meetings (See Section 5.2) and to keep an accurate daily log.
- **Improving:** where an issue has been identified regarding the implementation of the environmental mitigation measures (e.g., an obstruction to the efficiency of implementation), the CR should discuss with the relevant party to discuss what actions are necessary to resolve/improve the situation.

Any amendments to methodology of implementing environmental mitigation measures must:

- Not compromise compliance with national/international legislation/recognised guidelines
- Continue to fulfil the functionality of the mitigation measures outlined in this EMP
- Be clearly explained with supporting rationale
- Be signed-off by the expert party and the CR (e.g., the MMSO will sign-off on an amendment to the methodology used, authorised by the signature of the CR).

Table 4-1: Summary of Topic Specific MonitoringTable

Sector	Parameter Monitored	Monitored by	Quality Indicator
Marine Mammals	Minimum distance of Marine Mammals when shooting. Implementation of Guidelines for minimising the risk of injury to marine mammals from seismic survey (DCE 2011 and JNCC 2010). MMSO communication with CR/SM	MMSO	Appropriate timing of MMSO activity relative to seismic shooting. Proximity of marine mammals from active seismic array compliant with EIA assessment and DCE (2011) and JNCC Guidelines (2010) Efficiency of communications between MMSO and SM/CR.
Seabirds	Presence of protected species of seabirds.	MMSO	Avoidance of undue disturbance of populations of protected species of seabird
Marine Pollution	Separation, storage, disposal of onboard domestic wastes. Waste Log	CR	Appropriate separation, storage and disposal of waste products.
	Discharge of sewage (i.e., location, type) Sea-surface Disposal practices by crew ShC	CR	No plastics or floating materials are discharged at sea Food wastes will only be discharged beyond 12NM from shore and no other materials will be disposed at sea, regardless of location. Sewage wastes will be treated where possible.
Environmental Emergency Response	Appropriate shipboard equipment and trained response teams. Readily accessible safety related manuals; e.g., Oil Spill Contingency Plan, Safety Plan, Emergency Response Plan.	CR	Adequately certified equipment & response teams onboard OSCP/ER Manuals present on bridge & other key locations

5 COMMUNICATION AND DOCUMENTATION

This section outlines the communications and documentation required to implement the EMP effectively.

5.1 COMMUNICATIONS:

Communications protocols are covered in the PAR Emergency Response Manual (PARUK-BMS-OP012-11, 2012c) and in contractual agreements between PAR and the Contractor,

Effective communications play a key role in understanding the roles of different parties involved in the project.

- **Environmental Awareness:** All key project parties will be provided with focused training to provide an adequate level of knowledge about the potential environmental risks and how they will be mitigated during the course of the works. An outline of the Training Plan structure and content is provided in Section 7 (Environmental Training).

- **Notification to the Fishing Community:** Notification to fishing community is formally undertaken by BMP via their liaison with KNAPK. PAR will produce information leaflets outlining intended mitigation measures to be implemented during the survey operations. PAR will contract a FLO as described in Section 2.2 if required by BMP (Responsibilities).

- **Wider Stakeholder Communications:** It is understood that PAR will interface with most key stakeholders via the BMP. A notice to mariners will be issued as per the requirements of the IMO (International Convention for the Safety of Life at Sea, 1974). Records of communications with stakeholders will be carefully logged and reported at the Survey Management Meetings. The CR will collate these and provide a summary report of stakeholder communications in the final Client Rep Environmental Monitoring Report. As above, PAR will produce information leaflets outlining intended mitigation measures to be implemented during the survey operations.

- **Onboard Survey Management Meetings:** A daily meeting shall be held at the same time each day, with key personnel on-board, to include (but not be limited to); the ship's Captain, Survey Manager, Senior Survey Engineer, CR, MMSO, FLO (if appropriate), Medic. The meeting will address issues arising over the previous 24hours and provide a briefing on potential issues and their management over the next 24hours. The daily agenda will include, inter-alia

  - EMP implementation
  - HSE
  - Report on Issues arising from last 24hours
  - Vessel Status

- Equipment status (including losses, breakdowns etc)

- **Minutes of Meetings:** See Section 5.2 for details

5.2 DOCUMENTATION

The findings of the environmental monitoring discussed in Section 4, together with daily and other meetings relating to the EMP implementation will be documented in the following reports:

Table 5-1: Summary of Reports to support EMP

ID	Title	Contents	By	To	CC
1.1	Client Rep Daily Log	Report of any communications with Stakeholders Daily Log of key observations. Key Issues to be raised at daily Survey Management Team Meeting.	CR	PAR	PAR to Confirm
1.2	Client Rep Weekly Report	1-2 Page summary of issues, responses, requirements, providing synthesis of conclusions from Weekly Reports received from FLO (if appropriate), MMSO, SM.	CR	PAR	CPT., PAR to Confirm
1.3	Client Rep Monthly Report	As for Weekly Report – providing end of month summary of key issues.	CR	PAR	CPT., PAR to Confirm
1.3	Final Client Rep Report – Environmental Monitoring	On completion of the survey, this document will report on the overall performance of environmental management during operations, lessons learnt and recommendations for future surveys. Will draw on final reports from MMSO & FLO (if appropriate)	CR	PAR	PAR to Confirm
2.1	MMSO Daily Log	Daily Log of key observations e.g., survey timings, species presence, proximity, density. Nature & context of any disturbance, injury or deaths observed, and response actions Key Issues to be raised at daily Survey Management Team Meeting.	MMSO	CR/SM	PAR to Confirm
2.2	MMSO Weekly Report	1-2 Page summary of issues, responses, requirements. Copy to be sent to CR.	MMSO	CR/SM	PAR to Confirm
2.3	Final MMSO Cruise Report	The MMSO will produce a Final Report of MMSO activities during survey operations. This will feed into the CR Env. Monitoring Report, and the Contractor Cruise Report.	MMSO	CR/SM	PAR to Confirm
3.1	FLO Daily Log (if appropriate)	Daily Log of key observations e.g., nature, location of interaction with other fishing vessels. Key Issues to be raised at daily Survey Management Team Meeting.	FLO	CR/SM	PAR to Confirm
3.2	FLO Weekly Report (if appropriate)	1-2 Page summary of issues, responses, requirements. Copy to be sent to CR	FLO	CR/SM	PAR to Confirm
3.3	Final FLO Cruise Report (if appropriate)	The FLO will produce a Final Report of FLO activities during survey operations. This will feed into the Client Rep Env. Monitoring Report, and the The Contractor Cruise Report.	FLO	CR/SM	PAR to Confirm
4.1	Survey Manager Daily Report	Key Issues to be raised at daily Survey Management Team Meeting. Daily (environmental) Log is not required. It is assumed that the SM will keep an overall Daily Log of activities including e.g., fuel type & Consumption, Mechanical Maintenance.	SM	CR	PAR to Confirm
4.2	Survey Manager Weekly Report	The 1-2 Page summary of issues, responses, requirements regarding environmental aspects of survey delivery.	SM	CR/PAR	CPT, PAR to Confirm
4.3	Survey Manager Final Cruise Report	A final deliverable from the Contractor to PAR covering all aspects of the survey operations, its findings and conclusions, including a report on environmental management performance the operations.	SM	PAR	PAR to Confirm

PAR: PA Resources HSE Manager	CR: Client Representative	SM: Survey Manager	CPT: Captain of Survey Vessel	FLO: Fisheries Liaison Officer	MMSO: Marine Mammal & Seabird Observer

- **Minutes of Meeting:** Formal minutes of meetings will be taken for all key meetings
  - Seismic Survey Kick-Off Meeting
  - Stakeholder Engagement Meetings
  - Environmental / HSE Project Management Meetings
  - Meetings Onboard; while onboard; comprehensive notes of the Survey Management Team meetings and any other meetings relating to the EMP Implementation will be taken by the CR or designate.

Other Technical Reports, including environmental references are:

- **Final Cruise Report:** The Contractor's Final Report of the seismic survey (including reference to MMSO / FLO reports).
- **Ships Log:** Detailed log of all ship's activities maintained according to international maritime legislation (including evidence of hourly position reports to the Greenland Fisheries Licence Control (GFLC) and Fisheries Monitoring Centre (FMC)).

6 OUTLINE OF ENVIRONMENTAL EMERGENCY RESPONSE AND CONTINGENCY PLAN

Environmental emergency response and contingency planning is predominantly concerned with diesel/chemical spill scenarios. The details (which are not repeated in this EMP) are provided in the following key plans to be provided by the seismic contractor (i.e., the Contractor)

- Project Emergency Response Plan
- Project Safety Plan
- Ship Oil Pollution Emergency Plan (SOPEP)

A copy of each of these documents will be maintained at all times on the respective ship's bridge. Further copies will be held by the SM and the CR. These documents will be aligned with PAR's Environmental Emergency Response Manual (Doc.Ref: PARUK - BMS - OP012 – 11), compliant with national and international legislative obligations. Appendix C provides "Notifications to Statutory Authorities in case of an Emergency in Greenland". This has been taken from the PAR's Emergency Response provisions for Greenland, which have been vetted by BMP. Appendix C should always be read in conjunction with the plans listed above.

7 ENVIRONMENTAL TRAINING

Environmental training will help to ensure that the requirements of the EMP are clearly understood and followed by all project personnel throughout the project period. The primary responsibility for providing training to all project personnel will be that of the CR.

The scope of the training will cover the requirements of the EIA with special emphasis on sensitising the project staff to environmental and social aspects of the project.

7.1 FORMS OF TRAINING

While certain training material will be generic in nature, it will be important that the training plan is designed to deliver an appropriate level of detail, focus and delivery timing for the trainees.

It is understood that there will be limited time available for training due to the importance of minimising any perceived delays to the ships operational timetable. Therefore any training needs to be designed to be concise and in a format that is both quickly and effectively assimilated, e.g.

- "**Tool-box" talks**: These short, focused presentations provide the key details required on a particular subject. Typically 30mins in duration, these will be delivered prior to the contractor survey vessels departure from port. Delivery of additional talks while at sea is unlikely to be required, though it should be considered as a means of briefing the crew should a particular issue arise.

- **Quick Reference Materials:**

  - **Posters:** Prepared in advance of deployment, to clearly illustrate a key topic, e.g., Marine Mammal Protection during Seismic Surveys. Laminated and displayed in readily visible locations on the ship, they will serve as a regular reminder of the key points of the associated Tool-Box Talk.

  - **Fact Sheets:** Prepared in advance of deployment, these sheets can provide a brief summary of the technical information on a particular topic, e.g., Role of Key Personnel, Marine Mammal Identification, Protected Species etc. Copies of the fact sheets should be laminated and accessible in key locations, e.g., the crew mess-room, the bridge etc.

- **Drills:** As addressed in Section 6 above, the HSE Plan will provide the details of the design and execution of environmentally related drills, predominantly relating to oil/chemical spills (see also Section 6.4).

7.2 TRAINING PLAN

Table 7-1 summarises the training requirements, when it should be delivered and by whom. The training will comprise three key stages.

- **Kick off Meeting;** A kick-off meeting will be organised before the start of the survey by the PAR HSE Manager. The key staff on the survey vessel will join via conference call. This meeting will aim to ensure that the personnel involved in the management and implementation of the survey are aware of:
  - Environmental risks identified through the Scoping Report and EIA
  - Location of the Scoping Report, EIA and EMP on the vessel (Hard copies or electronic)
  - Responsibilities of key personnel
  - Monitoring and reporting requirements for each role
  - Training requirements

This meeting/conference call will be attended by; *inter-alia*;

- PAR HSE Manager
- PAR Client Rep (CR)
- The Contractor Survey Manager (SM)
- Marine Mammal & Seabird Observer (MMSO) – if possible
- Fisheries Liaison Officer (FLO) - if appropriate

The Contractor will be made aware of the timing of the Training Plan to ensure sufficient time and facilities are incorporated to the deployment programme to both facilitate the delivery of the training on-board and avoid disruption to the vessel's programme.

- **Pre-deployment:** A series of tool-box talks will be delivered on-board, as outlined in Table 7-1 below, prior to the deployment of the ship to the survey area. Those responsible for delivering the pre-deployment briefings include the SM, CR and MMSO. Where required Intertek Metoc will provide the associated training materials (i.e., briefing scope, presentations, posters, fact-sheets).
- **On-board Quick-Reference materials:** As described in Section 7.1 focussed Posters and Fact-sheets will be prepared well in advance of deployment to support the on-board briefing and on-going environmental awareness of all on-board personnel.
- **Emergency Response Drills** with respect to oil/chemical spill contingency planning will be carried out at least once during the deployment, ideally during the first week at sea and after any crew changes to ensure all ship-board personnel are familiar with the protocol. This will be specified in the project Safety Plan.

Table 7-1:Schedule of Environmental Training PlanTable

ID	Training	Timing	Trainer	Trainees	Content	Frequency
1.1	General Environmental Management Briefing	Kick-off Meeting/ Conference Call	PAR/ Intertek Metoc	CR, SM, MMSO, FLO(if appropriate)	Summary of key environmental impacts and significance EMP Explained Other questions/clarifications required prior to survey	Before project
1.2		Pre-Survey (On-board)	CR	SC, FLO (if appropriate)		Before start of project activities
2.1	Marine Mammals & Seabirds	Pre-Survey	MMSO	SC, GV,	Explanation of Protected Status, Potential Impacts, Mitigation Measures MMSO role and methodology Legal Consequences of Death / Injury. Basic ID skills.	Once during project
2.2		During - Survey		SC	Update on Mitigation Performance	Daily
2.3					Revisions to Methodology Guidance	As Agreed with CR
3.1	Marine Pollution	Pre	CR	SM,SC, SHC,GV, MMSO, FLO(if appropriate)	MARPOL Requirements – Annex IV/V (Sewage/Garbage)	Once during project
3.2		During	CR	SC	Update on performance	Daily
4.1	Environmental Emergency Response	Pre	SM	SC,GV, MMSO, FLO(if appropriate)	Details of Response Drills for oil/chemical spills	Once during project
4.2		During			Updates as required	As required

8 REFERENCES

BMP (2011). BMP Guidelines for application, execution and reporting of offshore hydrocarbon exploration activities (excluding drilling) in Greenland. Bureau of Minerals and Petroleum Greenland Government.

DCE (2011). Guidelines to Environmental Impact Assessment of Seismic Activities in Greenland Waters. 3rd Revised Edition. Line A. Kyhn, David Boertmann, Jakob Tougaard, Kasper Johansen & Anders Mosbech Danish Centre for Environment and Energy. December 2011

JNCC (2010). JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys. August 2010. Joint Nature Conservation Committee, Aberdeen

PAR (2012a). Scope of Project Submission for West Greenland (Block 8) 3D Marine Acquisition. Document Reference PAR - BMS - PROJ011 – 04. PA Resources E&P Services Ltd, London

PAR (2012b). Environmental Impact Assessment for West Greenland Block 8 3D Marine Acquisition. PARUK-BMS-PROJ-011-06. PA Resources E&P Services Ltd, London.

PAR (2012c) Environmental Emergency Response Manual. PARUK - BMS - OP012 – 8. PA Resources E&P Services Ltd, London.

Appendix A : Guidelines for minimising the risk of injury to marine mammals from seismic survey (JNCC 2010)

JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys

August 2010

To find out more about seismic surveys visit http://www.jncc.gov.uk/page-1534
To learn more about JNCC visit http://www.jncc.gov.uk/page=1729

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JNCC guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys

August 2010

Introduction

The guidelines have been written for activities on the United Kingdom Continental Shelf (UKCS) and are aimed at reducing the risk of injury to negligible levels and can also potentially reduce the risk of disturbance from seismic surveys to marine mammals including seals, whales, dolphins and porpoises. Whilst there are no objections to these guidelines being used elsewhere JNCC would encourage all operators to determine if any special or local circumstances pertain, as we would not wish these guidelines to be used where a local management tool has already been adopted (for instance in the Gulf of Mexico OCS Region). In this context, JNCC notes that other protected fauna, for example turtles, will occur in waters where these guidelines may be used, and would suggest that, whilst the appropriate mitigation may require further investigation, the soft-start procedures for marine mammals would also be appropriate for marine turtles and basking sharks[i].

The guidelines require the use of trained Marine Mammal Observers (MMOs) whose role is to advise on the use of the guidelines and to conduct pre-shooting searches for marine mammals before commencement of any seismic activity. A further duty is to ensure that the JNCC reporting forms are completed for inclusion in the MMO report. In addition to the visual mitigation provided by MMOs, if seismic surveys are planned to start during hours of darkness or low visibility it is considered best practice to deploy Passive Acoustic Monitoring (PAM).

The 2010 version of the JNCC seismic guidelines reflects amendments (2007 and 2009 amendments) to the Conservation (Natural Habitats &c.) Regulations 1994 (Habitat Regulations, HR) for England and Wales[ii] and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (Offshore Marine Regulations, OMR**,** as amended in 2009 and 2010). Both regulations have revised the definition of deliberate disturbance of 'European Protected Species' (EPS), which now excludes

[i] Basking sharks are protected from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on the Wildlife and Countryside Act (1981), Schedule 5.
[ii] In 2010 a consolidated version of the regulations came into force: The Conservation of Habitats and Species Regulations 2010.

trivial disturbance from the offence. Both regulations now also include the offence of deliberate injury. European Protected Species include cetaceans and turtles.

It has been recognised that sound generated from seismic sources has the potential to cause injury and possibly also disturbance to marine mammals. Seismic surveys have therefore the potential to cause a deliberate injury offence as defined under regulations 41(1)(a) and 39(1)(a) and a deliberate disturbance offence as in 41(1)(b) and 39(1)(b) of the HR and OMR, respectively. The JNCC seismic guidelines reflect best practice for operators to follow during the planning, operational and reporting stages. **It is considered that compliance with the recommendations in these guidelines will reduce the risk of injury to EPS to negligible levels**.

Please note that the mitigation measures recommended in the existing guidelines are more relevant to the prevention of injury rather than disturbance as defined in regulations 41(2) and 39(1A), of the HR and OMR, respectively. The onus should be on the entity responsible for the activity to assess whether a disturbance offence is likely to occur. Guidance on how to carry out such risk assessment is provided in the JNCC, NE and CCW document 'The protection of marine European Protected Species from injury and disturbance'.

In relation to oil and gas seismic surveys in the UKCS, it is a requirement of the consent issued under regulation 4 of the Petroleum Activities (Conservation of Habitats) Regulations 2001 (& 2007 Amendments) by the Department for Energy Climate Change (DECC), that the JNCC Seismic Guidelines must be followed, and the elements of the guidelines that are relevant to a particular survey are incorporated into the legally-binding condition of consent. It should be noted that it is the responsibility of the company issued consent by DECC[iii], referred to in these guidelines as the 'applicant', to ensure that these guidelines are followed, and it is recommended that a copy of the JNCC guidelines are available onboard all vessels undertaking seismic activities in UK waters. Where relevant, when the survey is completed a MMO report must be submitted to the JNCC.

[iii] Department of Energy and Climate Change was formerly known as Department for Business and Regulatory Reform (BERR)

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Terminology

Marine European Protected Species: These are marine species in Annex IV(a) of the Habitats Directive that occur naturally in the waters of the United Kingdom. These consist of several species of cetaceans (whales, dolphins and porpoises), turtles, and the Atlantic Sturgeon.

Marine Mammal Observer (MMO): Individual responsible for conducting visual watches for marine mammals. For some seismic surveys it may be requested that observers are trained, dedicated and / or experienced. The MMO may also be a PAM operative if trained.

- **Trained MMO**: Has been on a JNCC recognised course
- **Dedicated MMO**: Trained observer whose role on board is to conduct visual watches for marine mammals (although it could double up as a PAM operative)
- **Experienced MMO**: Trained observer with 3 years of field experience observing for marine mammals, and practical experience of implementing the JNCC guidelines
- **PAM Operative**: Person experienced in the use of PAM software and hardware and marine mammal acoustics

Mitigation Zone: The area where a Marine Mammal Observer keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected).

Passive Acoustic Monitoring (PAM): Software system that utilises hydrophones to detect the vocalisations of marine mammals.

Seismic Survey: Any survey that uses airguns, including 2D/3D/4D and OBC (On-Bottom Cabling) surveys and any similar techniques that use airguns. Surveys using multibeam systems and sub-bottom profiling equipment such as boomers, pingers etc are not considered in these guidelines. However, the guidelines can be adapted and applied to the operation of such systems if considered appropriate.

Shot Point Interval (SPI): Interval between firing of the airgun or airguns.

Site Survey: Seismic survey of a limited area proposed for drilling, infrastructure emplacement etc (typically with source size of 180 cubic inches or less).

Soft-Start: Turning on the airguns at low power and gradually and systematically increasing the output until full power is achieved (usually over a period of 20 minutes). The appropriate soft-start method is dependant upon the type of seismic survey and is discussed in section 3.

United Kingdom Waters: Parts of the sea in or adjacent to the United Kingdom from the low water mark up to the limits of the United Kingdom Continental Shelf.

Vertical Seismic Profiling (VSP) or Borehole Seismic: Seismic survey undertaken ‘down hole’ in connection with well operations (typically with a source size of 500 cubic inches).

Section 1 – Assessing and minimising the risk of injury

1.1 The Planning Stage

When a seismic survey is being planned, the applicant should consider the following recommendations and best practice advice:

- Determine what marine mammal species are likely to be present in the survey area and assess if there are any seasonal considerations that need to be taken into account, for example periods of migration, breeding, calving or pupping. For UKCS activities the 'Atlas of cetacean distribution in north-west European waters' (Reid *et al*. 2003) is a useful starting point.
- Consult the latest relevant regulatory guidance notes; in the UK, DECC issues guidance notes for oil and gas seismic activities.
- As part of the environmental impact assessment, assess the likelihood of injuring or disturbing a European Protected Species. In the UK, it will be necessary to assess the likelihood of committing an offence as defined in the HR and in the OMR.
- Consult the JNCC, NE and CCW guidance on 'The protection of marine European Protected Species from injury and disturbance' to assist in the environmental impact assessment. To obtain a copy of the latest draft version of the guidance please contact JNCC.

The operator should whenever possible implement the following best practice measures:

- If marine mammals are likely to be in the area, only commence seismic activities during the hours of daylight when visual mitigation using Marine Mammal Observers (MMOs) is possible.
- Only commence seismic activities during the hours of darkness, or low visibility, or during periods when the sea state is not conducive to visual mitigation, if a Passive Acoustic Monitoring (PAM) system is in use to detect marine mammals likely to be in the area, noting the limitations of available PAM technology (seismic surveys that commence during periods of darkness, or low visibility, or during periods when the observation conditions are not conducive to visual mitigation, could pose a risk of committing an injury offence).
- Plan surveys so that the timing will reduce the likelihood of encounters with marine mammals. For example, this might be an important consideration in certain areas/times, e.g. during seal pupping periods near Special Areas of Conservation for common seals or grey seals.
- Provide trained MMOs to implement the JNCC guidelines.
- Use the lowest practicable power levels to achieve the geophysical objectives of the survey.
- Seek methods to reduce and/or baffle unnecessary high frequency noise produced by the airguns (this would also be relevant for other acoustic energy sources).

Section 2 - Marine Mammal Observers

2.1. Role of an MMO

The primary role of an MMO is to act as an observer for marine mammals and to recommend a delay in the commencement of seismic activity should any marine mammals be detected. In addition, a MMO should be able to advise the crew on the procedures set out in the JNCC guidelines and to provide advice to ensure that the survey programme is undertaken in accordance with the guidelines. Before the survey commences it is important to attend any pre-mobilisation meetings to discuss the working arrangements that will be in place, and to request a copy of the survey consent issued by DECC (if applicable). An MMO may also work closely with Passive Acoustic Monitoring operatives. As the MMO role in relation to the vessel and survey operations is purely advisory, it is important to be aware of the command hierarchy and communication channels that will be in place, and determine who the main MMO / PAM operative contacts should be.

In a typical vessel based seismic survey, the MMO / PAM operative may pass advice to the party chief and client's representative through the navigators or seismic observers, and it is important to establish what the working arrangements are, as this may vary from one survey to the other. The MMOs should consider themselves as part of the crew and respect the chain of command that is in place.

MMOs should make certain that their efforts are concentrated on the pre-shooting search before the soft-start. These guidelines cannot be interpreted to imply that MMOs should keep a watch during all daylight hours, but JNCC would encourage all MMOs to manage their time to ensure that they are available to carry out a watch to the best of their ability during the crucial time - the 30 minutes before commencement of the firing of the seismic source (or 60 minutes if surveying where deep diving marine mammals are likely to be present). Whilst JNCC appreciates the efforts of MMOs to collect data at other times, this should be managed to ensure that those observations are not detrimental to the ability to undertake a watch prior to a soft-start. Where two MMOs are onboard a seismic vessel, JNCC would encourage collaboration to ensure that cetacean monitoring is always undertaken during all daylight hours.

2.2. Training requirements for MMOs

A prerequisite for an MMO to be classified as a 'trained MMO' is that they must have received formal training on a JNCC recognised course. (Further information on MMO course providers is available at: http://www.jncc.gov.uk/page-4703)

2.3. MMO equipment and reporting forms

MMOs should be equipped with binoculars, a copy of the JNCC guidelines and the 'Marine Mammal Recording Form' which is an Excel spreadsheet and has embedded worksheets named: 'Cover Page', 'Operations', 'Effort' and 'Sightings'. A Word document named 'Deckforms' is also available, and MMOs may prefer to use this when observing before transferring the details to the Excel spreadsheets.

The ability to determine range is a key skill for MMOs to have, and a useful tool to perform this function is a range finding stick.

All MMO forms, including a guide to completing the forms, and instructions on how to make and use a range finding stick are available on the JNCC website.

2.4. Reporting requirements – the MMO report

A report, the 'MMO report', should be sent to the JNCC after the survey has been completed. It is the responsibility of the consent holder to ensure that the MMO report is sent to JNCC. Ideally the MMO report should be sent via e-mail to seismic@jncc.gov.uk, or it can be posted to the address on the front page of these guidelines. Reports should include completed JNCC marine mammal recording forms and contain details of the following:

- The seismic survey reference number provided to the applicant by DECC.
- Date and location of survey.
- Total number and volume of the airguns used.
- Nature of airgun array discharge frequency (in Hz), intensity (in dB re. 1µPa or bar metres) and firing interval (seconds), and / or details of any other acoustic energy used.
- Number and types of vessels involved in the survey.
- A record of all occasions when the airguns were used.
- A record of the watches made for marine mammals, including details of any sightings and the seismic activity during the watches.
- Details of any problems encountered during the seismic survey including instances of non-compliance with the JNCC guidelines.

If there are instances of non-compliance with the JNCC guidelines that constitute a breach of the survey consent conditions, JNCC will copy the report, and their comments on the potential breach to DECC. It is therefore essential that MMO reports are completed as soon as possible after the survey has been completed.

Section 3 – Guidance before and during seismic activity

All observations should be undertaken from the source vessel (where the airguns are being deployed from), unless alternative arrangements have been agreed with DECC. The MMO should be positioned on a high platform with a clear unobstructed view of the horizon, and communication channels between the MMO and the crew should be in place before commencement of the pre-shooting search (this may require portable VHF radios). The MMO should be aware of the timings of the proposed operations, so that there is adequate time to conduct the pre-shooting search. Figure 1 illustrates a typical seismic survey with decision making pathways in the event a marine mammal is detected.

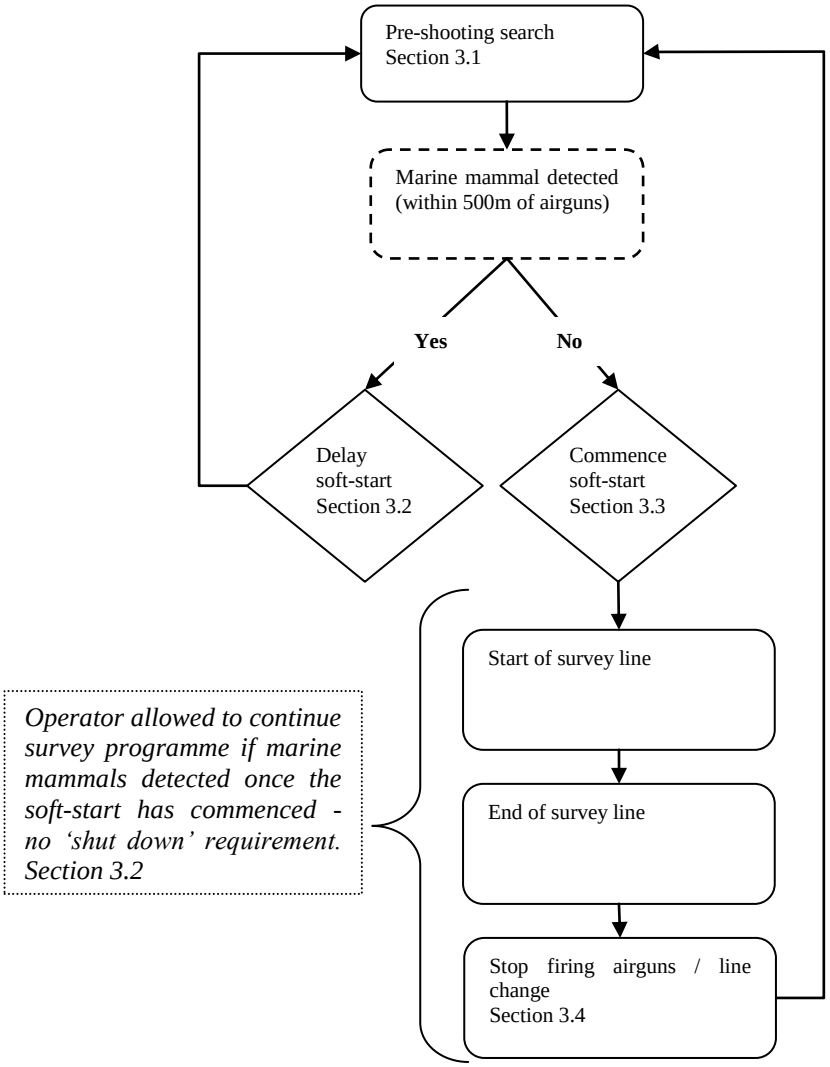

Figure 1. Flowchart illustrating the decision making pathway of a Marine Mammal Observer during a seismic survey.

3.1 Pre-shooting search

The pre-shooting search should normally be conducted over a period of 30 minutes before commencement of any use of the airguns. The MMO should make a visual assessment to determine if any marine mammals are within 500 metres of the centre of the airgun array.

In deep waters (>200m) the pre-shooting search should extend to 60 minutes as deep diving species (e.g. sperm whale and beaked whale) are known to dive for longer than 30 minutes. A longer search time in such areas is likely to lead to a greater detection and tracking of deep diving marine mammals.

To facilitate more effective timing of proposed operations when surveying in deeper waters, the searches for marine mammals can commence before the end of the survey line (whilst the airguns are still firing); this condition may be necessary for surveys which have relatively fast line turn times. If any marine mammals are

detected whilst the airguns are still firing, then no action is required other than for the MMO to monitor and track any marine mammals. The commencement of the soft-start for any subsequent survey lines should be delayed for at least 20 minutes if marine mammals are detected when the airguns have ceased firing.
If PAM is used in conjunction with visual monitoring the PAM operatives should ensure the system is deployed and being monitored for vocalisations during each designated pre-shooting period.

3.2 Delay if marine mammals are detected within the mitigation zone (500 metres)

If marine mammals are detected within 500 metres of the centre of the airgun array during the pre-shooting search, the soft-start of the seismic sources should be delayed until their passage, or the transit of the vessel, results in the marine mammals being more than 500 metres away from the source. In both cases, there should be a 20 minute delay from the time of the last sighting within 500 metres of the source to the commencement of the soft-start, in order to determine whether the animals have left the area. If PAM is used it is the responsibility of the PAM operatives to assess any acoustic detections and determine if there are likely to be marine mammals within 500 metres of the source. If the PAM operatives consider marine mammals are present within that range then the start of the operation should be delayed as outlined above.

If marine mammals are detected within 500 metres of the centre of the airgun array whilst the airguns are firing, either during the soft-start procedure or whilst at full power, there is no requirement to stop firing the airguns.

In situations where seal(s) are congregating around a drilling or production platform that is within the survey area, it is recommended that the soft-start should commence at a location at least 500 metres from the platform.

3.3 The soft-start

The soft-start is defined as the time that airguns commence shooting till the time that full operational power is obtained. Power should be built up slowly from a low energy start-up (e.g. starting with the smallest airgun in the array and gradually adding in others) over at least 20 minutes to give adequate time for marine mammals to leave the area. This build up of power should occur in uniform stages to provide a constant increase in output. There should be a soft-start every time the airguns are used, the only exceptions being for certain types of airgun testing (section 3.3.2), and the use of a ‘mini-airgun’ (single gun volume less than 10 cubic inches), these are used on site-surveys (section 3.3.1). The duration of the pre-shooting search (at least 30 minutes) and the soft-start procedure (at least 20 minutes) should be factored into the survey design.

General advice to follow for soft-starts:

- To minimise additional noise in the marine environment, a soft-start (from commencement of soft-start to commencement of the line) should not be significantly longer than 20 minutes (for example, soft-starts greater than 40

minutes are considered to be excessive, and an explanation should be provided within the MMO report).

- Where possible, soft-starts should be planned so that they commence within daylight hours.
- Once the soft-start has been performed and the airguns are at full power the survey line should start immediately. Operators should avoid unnecessary firing at full power before commencement of the line.
- If, for any reason, firing of the airguns has stopped and not restarted for at least 10 minutes, then a pre-shooting search and 20 minute soft-start should be carried out (the requirement for a pre-shooting search only applies if there was no MMO on duty and observing at this time, and if the break in firing occurred during the hours of daylight). After any unplanned break in firing for less than 10 minutes the MMO should make a visual assessment for marine mammals (not a pre-shooting search) within 500 metres of the centre of the airgun array. If a marine mammal is detected whilst the airguns are not firing the MMO should advise to delay commencement, as per the pre-shooting search, delay and soft start instructions above. If no marine mammals are present then they can advise to commence firing the airguns.
- When time-sharing, where two or more vessels are operating in adjacent areas and take turns to shoot to avoid causing seismic interference with each other, the soft-start and delay procedures for each vessel should be communicated to, and applied on, all the vessels involved in the surveying.

3.3.1 Soft-start requirements for site survey or Vertical Seismic Profiling (VSP)

Surveys should be planned so that, whenever possible, the soft-start procedures for site surveys and Vertical Seismic Profiles (VSP's) commence during daylight hours. Whilst it is appreciated that high resolution site surveys / VSP operations may produce lower acoustic output than 2D or 3D surveys it is still considered desirable to undertake a soft-start to allow for marine mammals to move away from the seismic source.

For ultra high resolution site surveys that only use a 'mini-airgun' (single airgun with a volume of less than 10 cubic inches) there is no requirement to perform a soft-start, however, a pre-shooting search should still be conducted before its use.

For site surveys and VSPs, a number of options are available to effect a soft-start.

- The standard method, where power is built up slowly from a low energy start-up (e.g. starting with the smallest airgun in the array and gradually adding in others) over at least 20 minutes to give adequate time for marine mammals to leave the vicinity.
- As the relationship between acoustic output and pressure of the air contained in the airgun is close to linear and most site surveys / VSP operations use only a small number of airguns and a soft-start can be achieved by slowly increasing the air pressure in 500 psi steps. From our understanding, the minimum air pressure which the airgun array can be set to will vary, as this is dependent on the make and model of the airgun being used. The time from initial airgun start up to full power should be at least 20 minutes.

- Over a minimum time period of 20 minutes the airguns should be fired at an increasing frequency (by decreasing the Shot Point Interval (SPI)) until the desired firing frequency is reached.

3.3.2 Soft-starts and airgun testing

Airgun tests may be required before a survey commences, or to test damaged or misfiring guns following repair, or to trial new arrays. Individual airguns, or the whole array may need testing, and the airguns may be tested at varying power levels. The following guidance is provided to clarify when a soft-start is required:

- If the intention is to test all airguns at full power then a 20 minute soft-start is required.
- If the intention is to test a single airgun on low power then a soft-start is not required.
- If the intention is to test a single airgun, or a number of guns on high power, the airgun or airguns should be fired at lower power first, and the power then increased to the level of the required test; this should be carried out over a time period proportional to the number of guns being tested and ideally not exceed 20 minutes in duration.

MMOs should maintain a watch as outlined in the pre-shooting search guidance (section 3.1) before any instances of gun testing.

3.4 Line Change

Seismic data is usually collected along predetermined survey lines. Line change is the term used to describe the activity of turning the vessel at the end of one line prior to commencement of the next line. Depending upon the type of seismic survey being undertaken, the time for a line change can vary. Line changes are not necessary for all types of seismic surveys, for example, in certain regional surveys where there is a significant distance between the lines, and for VSP operations.

The guidance relating to line change depends upon the airgun volume.

3.4.1 Seismic surveys with an airgun volume of 500 cubic inches or more

- If the line change time is expected to be greater than 20 minutes, airgun firing should be terminated at the end of the line and a full 20 minute soft-start undertaken before the next line. A pre-shooting search should also be undertaken during the scheduled line change, and the soft-start delayed if marine mammals are seen within 500 metres of the centre of the airgun array.

3.4.2 Seismic surveys with an airgun volume of 180 cubic inches or less (site surveys)

- If the line change time is expected to be greater than 40 minutes, airgun firing should be terminated at the end of the line and a full 20 minute soft-start undertaken before the next line. The pre-shooting search should also be

undertaken during the scheduled line change, and the soft-start delayed if marine mammals are seen within 500 metres of the centre of the airgun array.

- If the line change time is expected to be less than 40 minutes, airgun firing can continue during the turn, but the Shot Point Interval (SPI) should be increased (longer duration between shots). Ideally, the SPI should not exceed 5 minutes during the turn.

Depending upon the duration of the line turns and the nature of seismic survey it may be necessary to vary the soft-start procedures. If an applicant determines that an effective line change can not be achieved using the above methods please contact JNCC at the earliest possible opportunity to discuss the proposed alternative, and include the details of the agreed procedure and the consultation with the JNCC in the application for survey consent.

3.5 Undershoot operations

During an undershoot operation, one vessel is employed to tow the seismic source and a second vessel used to tow the hydrophone array, although the main vessel will still tow the hydrophone array. This procedure is used to facilitate shooting under platforms or other obstructions. The MMO may be too far away from the airguns to effectively monitor the mitigation zone, and it is therefore recommended to place the MMO on the source vessel. If this is not possible, for example for logistical reasons, or the health and safety implications of transferring personnel from one vessel to another, the application should explain that the recommended procedure cannot be followed in the application for the survey consent, or the application for a variation of that consent. Irrespective of the MMO location agreed with DECC, the pre-shooting search and soft-start procedures should still be followed prior to undertaking an undershoot operation.

Section 4 - Acoustic Monitoring

Visual observation is an ineffective mitigation tool during periods of darkness or poor visibility (such as fog), or during periods when the sea state is not conducive to visual mitigation, as it will not be possible to detect marine mammals in the vicinity of airgun sources. Under such conditions, PAM is considered to be the only currently available mitigation technique that can be used to detect marine mammals. Current PAM systems can be particularly helpful in detecting harbour porpoises within the 500 metre mitigation zone, although the systems have their limitations and can only be used to detect vocalising species of marine mammals.

PAM systems consist of hydrophones that are deployed into the water column, and the detected sounds are processed using specialised software. PAM operatives are needed to set up and deploy the equipment and to interpret the detected sounds.

4.1 Use of PAM as a mitigation tool

PAM can provide a useful supplement to visual observations undertaken by MMOs and JNCC may recommend that it is used as a mitigation tool when commenting on applications for survey consents. However, in many cases it is not as accurate as

visual observation for determining range, and this will mean that the mitigation zone will reflect the range accuracy of the system. For example, if the range accuracy of a system is estimated at +/-300 metres, animals detected and calculated to be within 500 metres from the source could, in reality, be 500 + 300 = 800 metres, but their detection would still lead to a delay in the soft-start. Although, at present it is not possible to express the range accuracy of most PAM systems in numerical terms, this example serves to illustrate that it is in the operator's best interests to use the most accurate system available, and for the PAM operative to factor in a realistic estimate of the range accuracy.

Some PAM systems do not have a reliable range determination facility or can only calculate the range for some species. In such cases, the detection of a confirmed cetacean vocalisation should still be used to initiate postponement of the soft-start if the PAM operator is able to make a judgement about the range of the animals from the airgun source, because of their experience gained in differentiating between distant and close vocalisations. In the absence of PAM systems capable of range determination, this expert judgement will constitute the basis for deciding whether an area is free from cetaceans prior to the soft-start.

In all cases where PAM is employed, a brief description of the system and an explanation of how the applicant intends to deploy PAM to greatest effect should be included in the application for survey consent.

In the last few years, software that processes and analyses cetacean sounds has been developed. An example of this is PAMGuard, an open source software that has been developed as part of the International Association of Oil and Gas Producers Joint Industry Project (JIP). JNCC recognises that PAMGuard is currently in a transition period between use as a research tool and widespread adoption as a monitoring technique. Moreover, JNCC recognises the need to balance proactive implementation of PAM with the need to further develop its capability, for example to include species recognition and baleen whale detection, and therefore encourages users of these systems to actively contribute to their development and refinement.

Section 5 – Requirements for MMOs and PAM

Any survey application or consultation received by JNCC will be considered on a case-by-case basis, and the mitigation measures advised to DECC will reflect the particulars of the survey and the importance of the survey area for marine mammals. The following paragraphs are provided as a guide to the advice applicants are likely to receive following submission of an application with JNCC.

For areas that are currently considered particularly important for marine mammals, for example in the UK this includes areas West of Scotland, the Moray Firth and Cardigan Bay, JNCC may recommend that:

- The MMOs should be experienced MMOs, and that PAM should be used.
- The PAM system should be used to supplement visual observations, or as the main mitigation tool if the seismic survey activity commences during periods of

darkness or poor visibility, or during periods when the sea state is not conducive to visual mitigation.

JNCC will advise that two marine mammal observers should be used when daylight hours exceed approximately 12 hours per day (between 1st April and 1st October north of 57^{O} latitude), or the survey is in an area considered particularly important for marine mammals.

When a non-dedicated MMO is recommended by JNCC (e.g. for VSPs and certain site-surveys), and the recommendation is incorporated into the conditions of the survey consent, a member of the rig's or vessels crew can perform the duties providing the crew member is a trained MMO.

When a dedicated MMO is recommended and this is a condition of the survey consent, the MMO should be employed solely for the purpose of monitoring the implementation of the guidelines and undertaking visual observations to detect marine mammals during periods of seismic activity.

When two dedicated MMOs are requested and this is a condition of the survey consent, both should be employed solely for the purposes of monitoring the implementation of the guidelines and undertaking visual observations, and the use of a crew member with other responsibilities as the second observer is not considered to be an adequate substitute for a dedicated MMO, or to be in compliance with the conditions of the survey consent.

Section 6 - Background Information

These guidelines were originally prepared by a Working Group convened by the Department of the Environment, and were developed from a draft prepared by the Sea Mammal Research Unit (SMRU). The guidelines have subsequently been reviewed three times by the Joint Nature Conservation Committee, following consultation with interested parties.

6.1. Existing protection to cetaceans

Section 9 of the Wildlife and Countryside Act 1981 (CRoW amended) prohibits the intentional or reckless killing, injuring or disturbance of any cetacean. The UK is also a signatory to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) and has applied its provisions in all UK waters. Amongst other actions required to conserve and manage populations of small cetaceans, ASCOBANS requires range states to "work towards...the prevention of ...disturbance, especially of an acoustic nature".

Reflecting the requirements of the Convention on the Conservation of European Wildlife and Habitats (the Bern Convention) and Article 12 of the EC Habitats and Species Directive (92/43/EEC), the UK has the following legislation in place:

- The Conservation of Habitats and Species Regulations 2010
- The Conservation (Natural Habitats, &c.) Regulations 1995 (Northern Ireland) (and 2009 amendments)

- The Conservation (Natural Habitats, &c.) Amendment (No. 2) Regulations 2008 (Scotland) (and 2009 amendments)
- The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (and 2007 amendments),
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (and 2009 and 2010 amendments) (beyond 12 nautical miles UKCS)

Section 7 – References and contacts

Further information on DECC's survey consent procedure can be found at: http://www.og.decc.gov.uk/.

A copy of these guidelines, the standard forms (electronic and hard copy) and further background information is available from the above address, or can be found on the JNCC website at: http://www.jncc.gov.uk/page-1534

Reid, J.B., Evans, P.G.H., & Northridge, S.P. (2003). *'*Atlas of cetacean distribution in north-west European waters*'* (Online). http://www.jncc.gov.uk/page-2713

If you have any comments or questions relating to these guidelines, or suggestions on how they may be improved, please email seismic@jncc.gov.uk

Appendix B Key Contacts - Environmental Management

Table B 1: Key Contacts relevant to EMP

ID	Name / Role	Contact	Email	Web
	PAR Contacts			
1.1	PAR HSE Manager	PA Resources UK Ltd 4th Floor, Waterfront, Winslow Road Hammersmith, London, W6 9SF United Kingdom Phone: (+44) 20 33 22 0140 Fax: (+44) 20 33 22 0101	jlucas@paresources.uk.com	www.paresources.se
	Vessel Contacts			
2.1	TBC	Bridge: Bridge: Tel PC: Tel IR:		
2.2	The Contractor - tbc	Office: tbc Mobile: tbc		
2.3	(Guard Vessel)TBC	TBC		
2.4	Fast Rescue Vessel (FRC) TBC	TBC		
	Key Survey Staff			
3.1	Survey Manager - tbc	The Contractor Phone: tbc Mobile : tbc	tbc	
3.2	Marine Mammal & Seabird Observer(s)	TBC		
3.3	PAR Client Rep	TBC		
3.4	Fisheries Liaison Officer	TBC		
	Other Contacts			
4.1	Greenland Fisheries License Control (GFLC)	Ministry of Fisheries, Hunting and Agriculture Imaneq 4, P.O Box 269, 3900 Nuuk, Greenland. Phone: (+299) 34 50 00 Fax: (+299) 64 63 60	gflk@nanoq.gl	
4.2	Fisheries Monitoring Centre (FMC)	Ministry of Fisheries, Hunting and Agriculture Imaneq 4, P.O Box 269, 3900 Nuuk, Greenland. Phone: (+299) 34 50 00 Fax: (+299) 32 47 04	apnn@nanoq.gl	
4.3	Greenland Hunting and Fishing Association (KNAPK)	Post Box 386, 3900 Nuuk, Greenland. Phone: (+299) 32 24 22	knapk@knapk.gl	http://www.knapk.gl
4.4	Bureau of Minerals & Petroleum (BMP)	P.O. Box 930, 3900 Nuuk, Greenland Phone: (+299) 34 68 00 (day time) Phone: (299) 48 25 99 (24hrs, offshore) Fax: (+299) 32 43 02	bmp@nanoq.gl	http://www.bmp.gl
4.5	Island Commander Greenland	3930 Kangilinnguit, Greenland Phone: (+299) 69 19 11	iscomgl@glk.gl	http://www.glk@glk.gl

		Fax:: (+299) 69 19 49		
4.6	Maritime Rescue Coordination Center (MRCC), Gronnedal	3930 Kangilinnguit, Greenland Phone: (+299) 69 19 12	mrcc@glk.gl	
4.7	Air Resue Coordination Center (ARCC), Sondrestrom	Phone: (+299) 84 12 01		
4.8	Police Head Office in Nuuk	Phone(+299) 32 14 48		
4.9	Royal Arctic Harbour Service	Phone: (+299) 34 92 01 (even weeks) (+299) 55 76 52 (odd weeks) (+299)55 82 48 (backup)		
4.10	Royal Arctic Spedition	Phone: (+299) 34 92 90 Fax: (+299) 34 92 89	rasnu@ral.gl	
4.11	Danish Maritime Safety Administration (Farvandsvæsenet)	Overgaden oven Vandet 62B, PO Box 1919, DK-1023 Copenhagen K Phone (+45) 32 68 95 00	frv@frv.dk	http://www.frv.dk
4.12	Danish Maritime Authority	Aqqusinersuaq 24 , PO Box 245, DK-3900 Nuuk, Greenland Phone: (+299) 32 54 44	nuuk@dma.dk	http://www.dma.dk

Appendix C Notifications to Statutory Authorities in case of an Emergency in Greenland

4. NOTIFICATIONS TO STATUTORY AUTHORITIES - GREENLAND

4.1. Safety Incident Notifications

Contact must be established with certain statutory bodies and supporting organisations immediately after an incident occurs.

The protocol for calling out emergency when at sea is to contact the “Island Commander Greenland” who will then notify the BMP and the appropriate emergency services.

When calling out emergency on-shore the protocol is to contact the Nuuk Police who will then notify the BMP.

The PARUK- contractor’s emergency response plan includes plans for co-ordination with the local police, the local hospitals, the Rescue Coordination Centre (RCC) at Kangerlussuaq (Søndre Strømfjord) and the Maritime Rescue Coordination Centre (MRCC) at Kangilinnguit (Grønnedal).

This document and the contractor’s emergency response planning includes actions to be taken, responsibilities of personnel, equipment to be used, procedures for reporting and list of organizations and persons to be contacted with their appropriate telephone numbers, email addresses and fax numbers (see Appendices).

4.2. Police

The nearest Greenland police station to operations on the west coast of Greenland is at Nuuk. Contact details provided in appendices.

4.3. Coastguard

Initially contact Island Commander Greenland (Gronlands Kommando) on tel + 299 691911 or Maritime Rescue Coordination Centre (MRCC) at Kangilinnguit on tel +299 691912 or DMA Danish Maritime Agency in Nuuk (tel +299 32 54 44). Relevant vessel call signs need to be provided to Island Commander Greenland so that he can make contact on VHF channel 16.

4.4. BMP

In the event of an incident the Rescue Coordination Centre (RCC) at Kangerlussuaq (Søndre Strømfjord) and \ or the Maritime Rescue Coordination Centre (MRCC) at Kangilinnguit (Grønnedal) will inform the BMP.

The BMP operate an emergency offshore telephone contact system 24hr per day - telephone contact (+299 48 25 99).

4.5. HSES

Reports of work accidents shall be handled and submitted in accordance with the instructions in the responsible company’s HSES-manual.

Reports and notifications of risks or violation to the safety or security of the installation or the personnel onboard shall be reported in compliance with the Authority Contact Matrix diagram above.

4.6. Oil or Chemical Spill Incident

Any oil or chemical discharges in Greenlandic waters regardless of amount or approval must be reported immediately to:

Greenland Island Commander

Followed as soon as possible to:

BMP
DEPA (Danish Environment Protection Authority)
Nuuk Police

It is necessary to report even minor oil spills as Greenlandic waters are closely monitored, and unreported oil spills are likely to initiate a prompt investigation requiring considerable resources.

For further details, refer to the appropriate field Oil Spill Contingency Plan.