# EXECUTIVE SUMMARY

## 1 INTRODUCTION

This Environmental Statement (ES) has been prepared by Environmental Resources Management (ERM) on behalf of Sakhalin Energy Investment Company Ltd (SEIC). The ES reports the findings of the Environmental Impact Assessment (EIA), details the environmental issues associated with SEIC's proposed Lunskoye seismic survey and proposes measures to mitigate and monitor possible impacts and potential receptors.

The purpose of the seismic survey is to provide additional geological information to aid in the development of the Lunskoye offshore oil and gas field, located off the northeast coast of Sakhalin Island, in the Russian Far East (see *Figure 1*). The field will be developed as part of the SEIC Sakhalin II Project.

There is currently no requirement under Russian Federation environmental legislation to carry out an EIA for offshore seismic surveys. However, SEIC's own environmental policy requires a full EIA to be carried out for all operations in potentially sensitive areas, or areas where there are potentially sensitive receptors.

The use of the waters off the east coast of Sakhalin Island as migration routes and feeding areas for protected species, including the Critically Endangered (1) western gray whale is a key environmental issue with regard to offshore developments in this area. LGL, a Canadian research and consulting firm that specialises in marine mammals, was commissioned to provide expert input to this ES regarding the assessment of impacts on the western gray whale and other species of marine mammals found within the region.

## 2 EIA OBJECTIVES

The Lunskoye seismic survey EIA has the following objectives:

- to describe the physical, biological and human components of the environment in the project area and to assess their sensitivities;
- to identify environmental risks associated with the proposed seismic survey;

(1) A species is Critically Endangered according to the 2002 IUCN *Red List of Threatened Species* when it is facing an extremely high risk of extinction in the wild, as defined by IUCN criteria (IUCN, 2002).

- to assess the character of environmental impacts;

- to develop appropriate mitigation measures, environmental monitoring plans and management procedures (to be undertaken by the contractor in association with SEIC) with the aim of reducing potential environmental impacts to 'as low as reasonably practicable' (ALARP) levels.

# 3 POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK

The Lunskoye seismic survey will be conducted in accordance with Russian Federation and international legislation and guidelines, industry best-practice guidelines and SEIC Health, Safety and Environment policy.

# 4 PROJECT DESCRIPTION

## 4.1 OVERVIEW

The proposed programme will acquire seismic data along survey lines running across the Lunskoye oil and gas field in an east-west direction (see *Figure 5*). The survey's objective is to undershoot an area of subsurface shallow gas sands in the central portion of the field(1) that has obscured data collection during previous surveys. Given the complex geology of the field, a 3D survey type has been selected by SEIC to obtain the quality of data required.

## 4.2 NEED FOR THE SURVEY

The maximum exploitation of gas reserves within the Lunskoye Field will require directional drilling from a gravity-based manned platform. The primary reasons for conducting the proposed seismic survey are:

- maximisation of drilling performance by mitigating drilling risks, and maximise reservoir performance by optimising the drilling programme;

- avoidance of shallow gas pockets during drilling;

- avoidance of shallow faulting during drilling;

- avoidance of reservoirs isolated by secondary faulting (which restricts the amount of resource that can be extracted);

(1) Undershooting is a technique for the acquisition of seismic data avoiding areas that are blocking seismic energy *eg* the shallow gas sands in the Lunskoye Field.

- identification of optimal locations of production wells within the field to reduce the number of wells required, minimising associated drilling impacts (*eg* the footprint), risks and costs;

- accurate appraisal of the extent, volume and nature of the available reserves, and the possible identification of previously undiscovered reservoirs;

- targeting suitable areas, away from faults and fault zones within the field for the re-injection of drill cuttings and produced water [(1)].

## 4.3 *SURVEY LOCATION*

The Lunskoye Field is situated 12 km offshore to the northeast of Sakhalin Island in water depths of 35-55 m. The field is approximately 25 km long and 8 km wide, with an area of some 200 km$^2$. The proposed seismic survey site covers an area of 327 km$^2$ (see *Figure 5*). This area incorporates the Lunskoye Field and turning circle requirements for the vessel and survey equipment. The survey area chosen is considered by SEIC to be the minimum area required for the collection of the required data.

## 4.4 *PROGRAMME ACTIVITIES AND SCHEDULE OF OPERATIONS*

The survey will be conducted by a specialised seismic survey vessel, which will arrive on site equipped to carry out the complete survey without the requirement to visit port. The vessel will tow two arrays of sound sources (airguns) at a nominal depth of 6 m below the sea surface. Hydrophones attached to between four and eight streamers, each 3,600 m long, will be towed behind the vessel at a nominal depth of 7 m. As the vessel proceeds at a speed of approximately 4.5 knots, each of the airgun arrays will fire approximately once every 20 seconds. Each array will be triggered alternately in a process known as 'flip-flop' mode, therefore an energy pulse will be emitted from the survey vessel once every 10 seconds during surveying operations. Reflected sound waves will be detected by the hydrophones, and onboard computers will record the acquired data.

(1) Oil and gas reservoirs have a natural water layer (called formation water) that due to its greater density lies underneath the hydrocarbons. Oil reservoirs frequently contain large volumes of water, while gas reservoirs tend to produce only small quantities. To achieve maximum oil recovery, additional water is usually injected into the reservoirs to help force the oil to the surface. Both formation and injected water are eventually produced along with the hydrocarbons, and, as an oil field becomes depleted, the amount of produced water increases as the reservoir fills with injected seawater. At the surface, produced water is separated from the hydrocarbons, treated to remove as much oil as possible, and then either discharged into the sea or injected back into the wells. In addition, some installations are able to inject produced water into other suitable geological formations (UK Offshore Operators' Association, 2002). Care needs to be taken when identifying suitable areas for the re-injection of produced waters as the disposal of pressurised waters can induce the activation of faults and fractures.

A support boat will be provided to assist the seismic survey vessel, to remove any obstacles (*eg* fishing equipment) and to guide other vessels away from the seismic vessel and survey equipment.

Seismic survey operations are scheduled to commence between July and August 2003. The duration of the survey is estimated to be 30 days, including 10 days contingency for down-time due to meteorological or technical problems [(1)]. Operations will be continuous during the survey period; 24 hours a day, seven days a week.

### 4.4.1 *The Pre-Seismic Site Survey*

In addition to the main seismic survey, SEIC is proposing to conduct a side scan sonar survey to yield information on the location, size and height of any sea floor features within the Lunskoye Field. This will allow the identification and mapping of features that may represent potential obstructions to the collection of seismic information during the main survey.

## 5 *ENVIRONMENTAL IMPACT ASSESSMENT*

This section includes a summary of the assessment of impacts that maybe associated with the proposed survey. Key issues have been identified through a combination of specific site and timing sensitivities, technical specifications, previous experience and international guidance such as the International Association of Geophysical Contractors *Environmental Manual for Worldwide Geophysical Operations* (IAGC, 2001) and Joint Nature Conservation Committee *Guidelines for Minimising Acoustic Disturbance to Marine Mammals from Seismic Surveys* (JNCC, 1998). It should be noted that issues not thought to be potentially applicable to the survey have been omitted from the assessment process.

### 5.1 *KEY ISSUES*

Considering the potential interactions of each project activity, or series of activities, on the Lunskoye Field's environment and potential receptors has identified the following key environmental issues:

- disturbance and noise effects from the survey operations on marine mammals;
- disturbance and noise effects from the survey operations on other marine biota;

(1) For example, equipment failure or adverse weather conditions.

- interference with other users of the area *eg* other vessel traffic and fishing activities;

- pollution risks from emissions, effluents and wastes;

- accidental spills, leaks and dropped objects.

## 5.2 *IMPACT ASSESSMENT METHODOLOGY*

The assessment of impacts requires consideration of the likelihood and magnitude of the environmental effect, its geographical scale and duration in relation to the sensitivity (1) of the key environmental receptors. For this assessment, four impact significance categories have been applied:

- *no impact (negligible);*
- *minor impact;*
- *moderate impact;*
- *major impact.*

Major impacts will result where an accepted limit or standard is exceeded or from significant environmental effects on receptors of high value or sensitivity *eg* endangered species. Lesser impacts will result from smaller impacts on receptors of lower value or sensitivity.

Given the international importance of Critically Endangered and Endangered (2) species, a precautionary approach was adopted when defining impact assessment criteria so that all impacts on these species are considered to be either *moderate* or *major* (*ie* no impacts are defined as *minor*). In some cases the mitigation measures will effectively reduce the impacts to *minor* or even to *no impact (negligible)* levels, but the impact will still be defined as *moderate* or *major*. The impact assessment categories are defined within *Section 5.3.1*, below.

## 5.3 *MITIGATION*

Practical ways of avoiding or reducing potentially significant impacts of the proposed survey ('*mitigation measures*') have been incorporated into the execution plan of the works. For areas where there is uncertainty regarding the magnitude of predicted impacts, monitoring programmes have been agreed to allow adjustments to be made, where possible, on the way the survey is conducted and on the mitigation measures applied.

(1) For example the conservation status and the rarity of the species concerned.
(2) A species is Endangered according to the 2002 IUCN *Red List of Threatened Species* when it is considered to be facing a very high risk of extinction in the wild as defined by IUCN criteria (IUCN, 2002).

### 5.3.1 *Impact Assessment Categories*

*'No impact'* (otherwise referred to as *'negligible'*) is the term applied where activities do not have an impact or the impact is so small that it does not require further consideration in the assessment. No specific mitigation measures are required.

*'Minor'* impacts are considered to be of low or minor importance due to the scale, duration and degree of impact on environmental resources and no specific mitigation measures other than good practice operational procedures are required.

*'Moderate'* impacts are considered to be significant and require mitigation measures to be developed and applied to reduce the impact to ALARP levels.

*'Major'* impacts are significant and mitigation must be applied/or some other action (*eg* alternative technologies or scheduling) taken to reduce the impact to a *moderate*, *minor* or *no impact* level.

Identified potential impacts have been reassessed taking into account the agreed mitigation measures, including the safeguards built in to the vessels' standard operation procedures.

A summary of potential and residual impacts (taking agreed mitigation measures into account) can be viewed in *Table 1* at the end of this Executive Summary.

## 5.4 *DISTURBANCE AND NOISE EFFECTS ON MARINE MAMMALS*

The key environmental concerns and risks associated with the proposed seismic survey operations relate to physical interactions and disturbance effects, primarily regarding the acoustic impacts of the survey on marine biota and particularly concerning the Critically Endangered western gray whale.

### 5.4.1 *Hearing and Disturbance Impacts on Marine Mammals*

Marine mammals rely heavily on the use of underwater sounds to communicate and to gain information about their surroundings. Experiments also show that they hear and react to many man-made sounds, including sounds made during seismic exploration.

Assuming that ramp-up ('soft-start') mitigation methods are applied, physical effects (temporary threshold shift or TTS, permanent threshold shift or PTS, and non-auditory physiological effects) on baleen whales, toothed whales, and pinnipeds are likely to be *minor,* because of the known avoidance reactions of the species (1) (1).

(1) Further details of mitigation measures, including 'soft start' procedures, are provided within *Chapter 7* of the Main Statement.

*No impacts* relating to the disturbance of bowhead whales are predicted to occur as a result of the survey, as the species has only been observed in the region during February and March.

Fin and minke whales may be present in small numbers during the survey period, and impacts to them are likely to be *moderate*. The Endangered North Pacific right whale may also be present within the region. The species' status and significance has led to the prediction of potentially *moderate* impacts. The implementation of mitigation measures, including 'soft start' procedures and the ceasing of survey operations when whales are within the agreed safety radii (2), leads to the prediction of *moderate* impacts to North Pacific right whales and fin and minke whales.

White whales are known only to be present off Sakhalin's northeastern coast between May and June, so there will be *no impact* from a summer (July to September) seismic programme. Many of the species present in the region are known to prefer deeper, offshore waters and/or have only been reported to the south of the Lunskoye Field. These species include the Dall's porpoise, sperm whale, Baird's beaked whale, Cuvier's beaked whale, northern right whale dolphin, short-finned pilot whale, Pacific white-sided dolphin and the bottlenose dolphin. The survey is predicted to have *minor* to *no impact* on these species. The harbour porpoise is a coastal marine mammal that tends to stay within a few kilometres from shore, so *no impact* on harbour porpoises is predicted.

Odontocete species (3) that may be found near the seismic survey area, such as the common dolphin and the killer whale, may occur in large groups. The predicted acoustic impacts on these species are likely to be *moderate*. The agreed 'soft start' and safety radii mitigation measures will reduce impacts, but the survey is still predicted to have potentially moderate impacts on these species.

Effects of *No impact* to *minor* impact significance are predicted to occur to Steller sea lions and ribbon seals. This is due to the low numbers of individuals observed within the Lunskoye Field area between July and September when the survey will be underway.

The presence of a largha seal haul out site at Lunsky Bay, approximately 10 to 15 km due west of the survey area, and the distribution of the species along Sakhalin Island's entire east coast during the summer months has led to the prediction of *moderate* impacts occurring to the species. Mitigation measures will reduce these effects, but the potential impacts can still be considered to be of *moderate* significance. *Moderate* impacts are also predicted for ringed, bearded and northern fur seals.

(1) These reactions have been studied at the appropriate ranges necessary to determine the levels of damage that may be sustained.
(2) Radii within which significant impacts would be predicted to occur.
(3) Toothed whales.

Impacts to western gray whales are summarised in detail within the section below.

### 5.4.2 *Western Gray Whales*

The current western gray whale stock is estimated to be 100 to 250 individuals, with approximately 100 individuals summering along the northeast coast of the island. The stock is severely depleted due to environmental pressures such as historic whaling activities, and is consequently the subject of international concern.

Known feeding areas for western gray whales are some 50 to 200 km north of the Lunskoye area, however, the species probably migrates past the Lunskoye Field. Peak northward migration past the field probably occurs between May and June, and the peak for southward migration probably occurs during October and November. Limited surveys have been carried out in the Lunskoye Field and surrounding area, and a small number of whales have been sighted near the survey area during the months that the survey is planned. The area is not considered, however, to be an important feeding ground for western gray whales.

If western gray whales do feed within the field and some individuals were to incur a significant reduction in feeding opportunities for one month or more due to the survey operations, detrimental effects could result. Given the small population size of western gray whales, effects to individuals could have impacts at the population level, such as loss of reproductive potential, reduction in growth, and a reduction in the ability to survive winter conditions. Taking a precautionary approach, if such a situation were to occur, the potential acoustic impacts on feeding western gray whales could be predicted to be *major*. The implementation of mitigation measures including 'soft start' and the ceasing of survey operations when whales are within the agreed safety radii will reduce this potential impact to *moderate*.

If any migrating gray whales pass through mid-shelf waters where the Lunskoye seismic survey is to occur, they could be displaced from their usual migration route. Predicted acoustic impacts on migrating gray whales are therefore judged to be *moderate*.

### 5.4.3 *Potential Impacts of the Pre-Seismic Site Survey*

*No impacts* to baleen whales, including the western gray whale, are predicted from the side scan sonar survey as the sounds from side scan sonar are at frequencies far above the expected hearing range of these species. This is also true for the pinniped species that may be present during the survey period.

Odontocete species are considered to be the most sensitive of the cetacean species to high frequency sound. However, individuals that encounter the side scan sonar at close range are unlikely to be subjected to repeated pulses,

due to the equipment's narrow beam width and short, low energy pulses. *No impacts* are therefore predicted to occur.

## 5.5 DISTURBANCE AND NOISE EFFECTS ON OTHER MARINE BIOTA

### 5.5.1 *Marine Invertebrates and Fish*

Available literature concerning the potential impacts to marine biota, other than marine mammals, from acoustic impacts and associated pressure effects indicates that direct impacts to species are predicted to occur only when they are within a few metres of the airguns. The majority of species are likely to be driven away by the approaching sound source, the 'soft start' procedure and the movement of the vessel, and will therefore not be within range of the airguns to sustain injury. Any injuries and fatalities that do occur are considered to be *minor* in the context of local species populations.

Disturbance impacts to fish species are considered to be transient and *minor*. *No impact* on spawning fish is predicted, as no major spawning areas have been identified within the vicinity of the Lunskoye Field.

### 5.5.2 *Marine and Coastal Birds*

The main bird populations observed in northeastern Sakhalin Island inhabit the coastal areas, however, none of the species observed have showed tendencies to hunt or habitat areas in the vicinity of the Lunskoye Field and the proposed survey operations, preferring instead to stay closer to the shore. The migration routes for all species are also coastal, being confined to land or the nearshore environment. *No impact* is therefore predicted.

Noise and disturbance impacts on fish are discussed in the section above. Predatory bird species are unlikely to hunt as far offshore as the Lunskoye Field, and the survey vessel will not enter coastal waters within 4 to 5 km of the shore due to water depth restrictions. *No impacts* to predatory birds are therefore predicted to occur.

## 5.6 OTHER USERS OF THE MARINE ENVIRONMENT

The proposed seismic survey has the potential to interfere with other users of the area and the local onshore social environment. A summary of the assessment of impacts to these users is presented in the sections below.

### 5.6.1 *Commercial Fishing Practices and Equipment*

The seismic survey has the potential to cause interference with fishing activities and damage to any fishing equipment (*eg* nets, lines, fixed gear) that may be present in the Lunskoye Field. Damage to fishing equipment is a concern from both a safety perspective (*ie* potential risk to personnel on the fishing vessel and the survey vessel) and in terms of adverse reactions /

complaints and subsequent compensation claims from fishermen whose equipment has been damaged (*ie* loss of equipment and temporary loss of earnings / livelihood). Damage to the streamers from fishing gear is also a concern (see *Section 5.8*).

Planned and recommended control and mitigation measures, such as the notification of local communities and other relevant parties and the checks for fishing equipment within the survey area, (to be conducted by the support vessel), will maintain potential conflicts between the survey operations and the local fishing industry to within acceptable levels. *Minor* impacts on fishermen are therefore predicted.

The transient nature of the survey operations, the perceived small-scale nature of fishing activity in the area and the small area of coverage in relation to the available fishing grounds within the region lead to a prediction that impacts to fish catches will be *minor*. Impacts on shellfisheries are also considered to be *minor*.

### 5.6.2 *Hunting of Marine Mammals*

Hunting of marine mammals close to the Lunskoye Field exists only in the form of sea ice seal hunting by indigenous groups during the winter season. It is predicted, therefore, that there will be *no impact* on sea mammal hunting from a summer seismic survey.

### 5.6.3 *Local Social Environment and Economy*

The seismic vessel will arrive in the Lunskoye Field fully fuelled and supplied to conduct the survey without having to visit port on Sakhalin Island. Contact with local communities is therefore very unlikely, except in the event of an accident or emergency.

There are no records of any diving or marine-based tourist or recreational activities in the vicinity of the Lunskoye Field. As a precautionary measure, warnings of the proposed activities will be issued (Notice to Mariners) and a vigilant watch will be maintained throughout the survey programme.

It is predicted that there will be *no impact* on local communities, the local economy, recreational activities, tourism or amenity from the proposed survey.

### 5.6.4 *Vessel Navigation*

Vessel traffic in the survey area is considered to be at a low level, consisting of local freight traffic, local fishing boats and occasional oil field supply vessels. Encounters with these vessels have been identified as a potential hazard, but the risk of conflict will be minimised by the use of navigational equipment and operational procedures onboard the vessel.

On the basis that all planned and recommended control measures are adhered to, it is considered that potential conflicts between the survey operations and local vessel traffic can be maintained to within acceptable levels. *Minor* impacts are therefore predicted.

### 5.6.5 *Submarine Infrastructure and Offshore Oil and Gas Production Facilities*

There are currently no offshore oil and gas production facilities, pipelines or submarine infrastructure (*eg* cables) within the seismic survey area. *No impacts* on existing infrastructure due to collision or disturbance are therefore predicted to occur.

### 5.6.6 *Damage to Maritime Archaeology and Wrecks*

No features of archaeological or cultural heritage importance have been identified in the vicinity of the Lunskoye Field, and no significant disturbance to sea floor sediments is predicted. In addition, the pre-seismic site survey (side scan sonar survey) would be expected to identify any potential features that may be present. If any features were identified, best practice guidance (such as the introduction of exclusion zones) would be adhered to in order to prevent any damage from occurring to the archaeological feature or wreck. *No impacts* to any currently undiscovered features of importance are therefore likely to occur as a result of survey activities.

### 5.6.7 *Military Use*

There is no known military interest or activity in the Lunskoye Field and therefore *no impacts* are predicted.

## 5.7 *POLLUTION IMPACTS FROM EMISSIONS, EFFLUENTS AND WASTES*

A summary of the impacts associated with effluent discharges, atmospheric emissions and the generation of solid and scheduled wastes from vessels engaged in survey activities are provided below.

### 5.7.1 *Effluent Discharges and Water Intakes*

Drainage from cable handling areas, bilges *etc* may be contaminated with hydrocarbons, however, providing compliance with MARPOL [(1)], *no impacts* on water quality and marine biota are predicted to result from controlled discharges.

Heated engine cooling water will rapidly lose its heat on discharge into the marine environment and its release is therefore predicted to have *no impact*.

(1) *The International Convention for the Protection of Pollution from Ships (MARPOL), 73/78.*

Natural dispersion by wave action, current flow and the assimilative capacity of the water column is likely to ensure that a *minor* impact results from discharges of treated sanitary effluent.

The installation of a coarse filtration system on seawater intake equipment will prevent the entrainment of fish species. Smaller fish species or free-floating planktonic organisms will be entrained, damaged or killed, however, this small-scale, localised and short-term impact is considered to be *minor*.

### 5.7.2 *Air Quality*

Emissions from the vessel propulsion and power generation systems, together with intermittent releases from the onboard solid waste incinerator will result in slight increases in downwind pollutant concentrations. Given the short-term nature of the survey operations, impacts from the survey on local air quality are predicted to be transient and *minor*.

Total emissions of acidic gases and greenhouse gases from the survey will be low, and their contribution towards total Russian emissions are considered to be *minor*. No release of ozone depleting substances is expected to be associated with the survey operations.

### 5.7.3 *Solid and Scheduled Wastes*

Scheduled wastes generated onboard the survey vessels will be disposed of at the appropriate facility when the vessel returns to port. Providing the handling, management and disposal of these wastes is conducted in accordance with appropriate legislative requirements and guidelines, and the vessels' standard operating procedures, *no impacts* are predicted from the generation of wastes.

## 5.8 *ACCIDENTAL SPILLS, LEAKS & DROPPED OBJECTS*

There are a large number of potential interactions and accidental / unplanned events that may result in the release of hydrocarbons, contaminants or materials to the marine environment. The sections below provide a summary of the investigation into the possible incidents that may result in the release of harmful substances to the marine environment and the potential impacts that may result.

### 5.8.1 *The Impact of Small Releases of Harmful Substances*

The discharge of harmful substances into the marine environment due to minor accidents (1) will have an impact on water quality and marine biota. The impact will depend on the type of pollutant released (*eg* its chemistry and volatility), the volume and location of the spill and the prevailing weather and

(1) For example, damage to kerosene filled streamers, failure of spill containment systems, separation of fuel hoses during bunkering operations or discharges of bilge water prior to treatment.

tidal conditions. Heavier pollutants such as bunker fuel would be expected to form a visible sheen on the surface of the sea, and would persist for longer time periods than the more volatile hydrocarbons such as kerosene. The impacts of accidentally releasing small quantities of harmful substances to the marine environment have been assessed as being *minor.*

Marine mammals can be affected by oil directly either through skin contact, absorption, ingestion, or indirectly by ingesting contaminated prey. Most marine mammals are not particularly susceptible to the effects of oil, and oil fouling of the external surface does not appear to have any adverse thermoregulatory effects. Small hydrocarbon spills would therefore be predicted to have *minor* impacts to marine mammals and the wider marine environment.

### 5.8.2 *The Impact of Large Releases of Harmful Substances*

The effects of larger releases of pollutants such as bunker fuel, diesel or kerosene as a result of the grounding of vessels, collisions or other major accidents will depend on the quantity released, the location of the release and the prevailing weather/oceanographic conditions. As reported in *Section 5.8.1* of this summary, most marine mammals are not very susceptible to deleterious effects of oil, however, weak or highly stressed individuals may be vulnerable to significant oiling. The potential impacts on marine biota and coastal environment could be *moderate* with injury to weak or stressed marine mammals and injury and mortality to local populations of marine invertebrates and fish being possible.

Major accidents are unlikely given the standard operating procedures of the survey and support vessels (including warning and navigation systems) and the identification of potential grounding or snagging obstructions by the pre-seismic side-scan sonar survey. In addition, the seismic survey vessel and support vessel will have oil and fuel spill response/ contingency plans and spill kits on board in accordance with MARPOL regulations. In the event of an oil or chemical spill from one of the vessels, a response effort will be initiated immediately to contain and clean-up the spill and to prevent it from spreading. Given the small likelihood of major accidents occurring, and the quantity of oil and chemicals stored on the seismic vessels, the residual impacts are considered to be minor (1).

### 5.8.3 *Loss of Equipment*

The loss of small items such as depth control units (one metre long plastic 'birds') and lead weight strips used to control buoyancy in solid streamers (if used (2)) is likely. These objects are, however, unlikely to present a fouling hazard and therefore losses of this nature are predicted to have *no impact.*

(1) See *Chapter 5* of the Main Statement for an explanation of how the likelihood of extreme accidental events have been evaluated within this ES.
(2) Whether liquid (kerosene) or solid filled streamers will be used for the Lunskoye seismic survey will not be determined until the conclusion of the seismic contractor tendering phase.

Any large items of survey equipment lost overboard could have the potential to create an obstruction and may act as a future source of pollution within the marine environment (*eg* the loss of streamers due to vessel collision and the subsequent release of kerosene). In the event that equipment is lost, a detailed incident reporting system will be followed, recording the location of the lost equipment and warning other vessels operating in the area. The items will also be retrieved wherever it is considered practicable and safe to do so. These operational controls and mitigation measures together with the small risk of such a loss occurring have led to the prediction of *minor* impacts.

## 6 *ENVIRONMENTAL MANAGEMENT*

An outline Environmental Management Plan (EMP) has been developed which highlights the environmental conditions and constraints pertinent to the proposed Lunskoye seismic survey. The plan sets out specific environmental protection measures consistent with Russian Federation and international regulations and guidelines, industry guidelines and SEIC policy. The seismic survey contractor will be required to adopt the measures set out in the EMP, which can be referred to in *Chapter 8* of the Main Statement.

## 7 *CONCLUDING STATEMENT*

The potential environmental impacts of the proposed 2003 Lunskoye seismic survey have been assessed through a process of Environmental Impact Assessment and have been reported in this Environmental Statement. It is concluded that providing the proposed mitigation measures are developed, incorporated into the survey EMP and monitored to reduce impacts then there will be no *major* environmental impacts, and all *moderate* impacts will be reduced to 'as low as reasonably practicable' (ALARP) levels. For *minor* impacts, specific mitigation is not required, however, many of these impacts are controlled by standard vessel operating procedures, best practice and legal compliance measures.

*Table 1 Summary of Potential and Residual Impacts (Taking Agreed Mitigation Measures into Account)*

| Issue | Key Impacts | Potential Impact | Residual Impact |
|---|---|---|---|
| **Noise and Disturbance Effects on Marine Biota** | | | |
| The effects of noise and physical presence of survey vessels on marine mammals | • TTS, PTS, and non-auditory physiological effects on all cetaceans and pinnipeds | Moderate | Minor |
| | • Disturbance and short-range avoidance movements in bowhead and white whales, and ribbon seals | No Impact | No Impact |
| | • Disturbance and short-range avoidance movements in fin and minke whales | Moderate | Moderate |
| | • Disturbance and short-range avoidance movements in common dolphins, killer whales and largha, ringed, bearded and Northern fur seal | Moderate | Moderate |
| | • Disturbance and short-range avoidance movements in the Endangered North Pacific right whale | Moderate | Moderate |
| | • Disturbance and short-range avoidance movements and temporary displacement from usual migration route of western gray whales if migrating past Lunskoye | Moderate | Moderate |
| | • Disturbance and short-range movements and reduced feeding opportunities, possible loss of reproductive potential, reduced growth, and reduced ability to survive winter for the Critically Endangered western gray whales if feeding near the survey area (1) | Moderate / Major | Moderate |
| | • Injury or fatality to marine mammals (including the Critically Endangered western gray whales), from collisions with vessels and deployed equipment | Major | Moderate |
| The effects of physical presence of survey vessels and seismic sound sources on other marine biota | • Injury and fatality from underwater airgun noise | Minor | Minor |
| | • Spawning disturbance or damage to eggs | No Impact | No Impact |
| | • Behavioural disturbance *eg* dispersal of fish shoals | Minor | Minor |
| | • Disturbance to shellfisheries | Minor | Minor |
| | • Noise and disturbance impacts to birds (including secondary impacts due to the disturbance of prey species) | No Impact | No Impact |

(1)On the basis of present data there are no western gray whales feeding in the Lunskoye area, which would make impacts at most *moderate*. However, if new data would show that whales are feeding, the potential impact would be *major*, to be reduced to *moderate* after mitigation.

| | | | |
|---|---|---|---|
| **Impacts on Other Users of the Area** | | | |
| Vessel and equipment interaction with other users of area | • Potential for collision or other accident with other vessels, equipment and concomitant injury, loss of life, vessel damage, loss of property/cargo | Moderate | Minor |
| | • Temporary interference with commercial fishing activities / damage to fishing equipment | Minor | Minor |
| | • Interference with any military use of the area | No Impact | No Impact |
| | • Direct damage to identified or unidentified wreck or non-wreck sites | No Impact | No Impact |
| | • Hunting of marine mammals and birds | No Impact | No Impact |
| | • Impacts on the local social environment and economy | No Impact | No Impact |
| | • Impacts on cables and other manmade submarine infrastructure | No Impact | No Impact |
| **Pollution Impacts from Effluents, Emissions and Wastes** | | | |
| Effluent discharges | • Impacts on water quality and marine biota from cooling water and surface drainage discharges (*eg* sea spray and rainwater) | No Impact | No Impact |
| | • Impacts on water quality and marine biota from controlled drainage and sanitary waste water discharges | Minor | Minor |
| | • Impacts on marine biota from water intakes | Minor | Minor |
| Air emissions from survey vessels | • Reduction in local air quality | Minor | Minor |
| | • Contribution to regional and global atmospheric pollution phenomena *eg* acidic deposition, ozone layer depletion and the greenhouse effect | Minor | Minor |
| Solid and scheduled waste | • Impacts on marine organisms from waste management and disposal practices | Moderate | No Impact |

| **Accidental Spills, Leaks and Dropped Objects** | | | |
|---|---|---|---|
| Spills, leaks and dropped objects | • Small release of harmful substances (*eg* wastes, oil, fuel oil) resulting in a decrease in water quality and injury to marine organisms | Minor | Minor |
| | • Loss of small objects and cargo | No Impact | No Impact |
| | • Large release of harmful substances (*eg* wastes, oil, fuel oil), and large scale objects and cargo resulting in a decrease in water quality, injury to marine organisms and obstruction to other vessels | Moderate | Minor |