Chapter 3: Description of Operations

3.1 Introduction

This chapter gives a detailed technical description of all major offshore facilities and activities during the construction phase of the project. The descriptions include programme locations (Piltun-Astokhskoye Licence Area, Lunskoye Licence Area, Aniva Bay); principal operations activities (platforms, cables and pipelines, tanker-loading unit, vessels and aircraft); operations schedule; and sources of potential impacts (presence of structures, effluents, solid wastes, air emissions, discharges of drilling muds and cuttings, noise, and disturbance).

3.2 Project Locations

Programme locations are described in Chapter 2.

3.3 Principal Operation Activities

3.3.1 Platforms

3.3.1.1 PA-A

The PA-A or Molikpaq platform is located 17 km offshore and ~24 km southeast from the entrance of Piltun Bay. It is part of the Vityaz production complex, which also includes the Okha Floating Storage and Offloading (FSO) vessel, which is moored to a Single Anchor Leg Mooring (SALM) buoy. The PA-A platform is a fixed-type platform that is attached to a steel spacer that elevates the upper portion of the platform 14 m above sea level. The overall dimensions of the spacer are 110 m x 110 m. The platform includes a drilling rig with accommodation for 32 slots. The process module consists of three phase separation (oil, gas, and future produced water) and gas re-injection facilities.

The PA-A platform is an independent offshore structure designed to house a maximum of 133 people. It is equipped with cabins, a canteen, office premises, a recreation room, and a medical room. Manning is by 28 day-on 28 day-off rotations. Personnel are rotated continuously and transported to and from the platform by helicopter, except in bad weather, when flights are substituted by vessel transport.

The warehouse, tank, and bunker capacities are designed for storing 2000 m^3 of barite and cement, 350 m^3 of mud, 70 m^3 of water for preparing drilling mud, 5000 m^3 of fuel, and 500 m^3 of potable water. The dimensions of the deck are 73 m x 73 m with a helipad and fueling station located on it.

The platform has two operating zones:

- A drilling complex that incorporates a drilling unit, modules for preparing drilling mud and cement slurries, and auxiliary equipment;
- A production complex that incorporates the Process Module that includes the power generator, the flare unit, the oil and gas processing unit, the Motor Control Center, the Control Room, and utilities.

Wastewater drainage and treatment is split into three systems:

- Clean rain water is drained overboard;
- Domestic wastewater and sewage water are directed to the sewage treatment plant; and
- Process, deck, and drilling wastewater is directed to the oily water treatment system.

The process drainage system receives oily wastewater from the bilge pumps and washing of production areas, process equipment and floors of the drilling unit, the process module, and the utility facilities. Oily water is stored in a collecting tank and fed into the separator for oil removal. After oil separation, the wastewater is discharged.

There is currently no produced water from the Vityaz complex because of reservoir characteristics; that is, the flow from production wells is virtually all oil at this stage and any minor entrained water is shipped with tankers. As water production increases, the water will be re-injected.

Fourteen wells have been drilled from 1998-2000, as part of Phase 1. Included were 13 production wells and one gas injection well. Oil production started in July 1999. The new drilling programme (pressure maintenance project) calls for thirteen wells to be drilled – four producing, six water injection, and three gas-injection wells.

Oil is transferred via a subsea pipeline to the FSO for offloading to tankers. As there is no production storage facility at the platform, production is suspended during the winter season (December through May) when the FSO is demobilised because of ice conditions. At that time, the pipeline is flushed with water and left in its normal position on the sea floor, the SALM Buoy is lowered to the sea floor, and the FSO departs the Sea of Okhotsk. However, drilling activities continue on the PA-A platform during that time.

The FSO will be phased out once the PA-A platform is tied into the oil pipeline network, connecting it to PA-B; the decommissioning of the FSO is expected in 2005. The FSO will remain in 2006 as an operating vessel. At some time, it will leave the Piltun-Astokhskoye field and will be available for operation in other oil and gas fields, but not by SEIC.

3.3.1.2 PA-B

The planned PA-B platform will be located in the Piltun area of the Piltun-Astokhskoye field at 52°55’59”N and 143°29’5”E. It will be situated 20 km offshore, in a water depth of 30 m. Production is anticipated to commence in 2006.

The PA-B platform will be a drilling and oil production platform with accommodation facilities for the operating personnel. It is designed for operation throughout the year under specific ice conditions, extremely low ambient air temperatures, winds, wave conditions, and seismic impacts.

The PA-B platform has been designed to meet the following criteria:

- transportation operations and other aspects;
- production of 11,129 m^3 of crude oil per day (70,000 barrels per day);

- gas export rate of $2.6 \cdot 10^6$ Sm^3/d ($92 \cdot 10^6$ scf/d);
- production of 3,975 m^3/day of produced water;
- injection of 19,078 m^3/day of water; and
- transportation of oil and gas.

The maximum annual output will be 3.2-3.4 million t/year of crude oil and ~0.9 billion m^3 of associated gas.

The PA-B platform will be a four-legged, concrete GBS platform. The GBS measures 109.1 x 99.3 m, with a height of 15 m and with four cylindrical supports 22 and 24 m in diameter, which support the above-water part of the structure with its topsides. The southeast leg of the platform will be used as the well bay, the northeast leg will be used for pipeline risers, and the west legs will be used for seawater and firewater pumps, and for storage tanks and associated pumps. The well bay in the southeast leg will have 45 well slots designed for 20-30 production wells (including gas lift wells) and 15-22 water injection wells (including one spare slot).

A cuttings injection system will be used for the disposal of oil-based mud, oil contaminated solids, sands, and drilling cuttings. The system and well design provide for a possibility to inject drill cuttings into the well annulus when using oil-based muds. Water-based drilling cuttings generated in the first well and the conductor string for each subsequent well will be discharged overboard. When water-based mud is used to drill through shale it will form a gumbo, a hydrated shale with the consistency of heavily saturated clay. That material is of such a consistency that it may be difficult to inject. If overboard discharge is required, then an equal amount of the 30" conductors' cuttings will not be discharged. However, injection might be possible once the material has been fluidised.

In order to maintain the formation pressure and continuous oil production, it is necessary to inject water into the formation. The PA-B platform will be provided with appropriate equipment for preparation and injection of ~19,000 m^3 of water per day. Produced water will be injected into the formation along with an adequate amount of seawater to keep the balance. At the early stage of oil production, the volumes of produced water will not be sufficient, and primarily seawater will be injected.

The water injection system will comprise equipment for seawater filtration, deaeration, and injection. Filtering equipment will remove 96% of solid particles with a size of over 10 μm. The water will be deaerated to 50-ppb oxygen content maximum. The design of water injection wells will be similar to that of oil production wells. The produced water will be mixed with seawater and injected in the reservoir in order to maintain the reservoir pressure.

The platform will be able to accommodate 100 permanent and 40 temporary personnel. Two commuting crews working for 2 or 3 weeks on rotation will perform the operation of the platform. Helicopters and vessels will transport personnel, equipment, materials, and fuel.

3.3.1.3 LUN-A

The planned LUN-A platform will be a manned drilling platform with limited processing facilities. LUN-A will be the primary supplier of gas for the LNG plant. Condensate/oil and gas will be sent to the OPF for processing. Production from the LUN-A platform is anticipated to begin in late 2005 or early 2006.

The LUN-A platform has been designed to meet the following functions:

- production of about 7,949 m^3 of condensate per day, at the OPF outlet;
- production of at least 51.1 million m^3 of gas per day;
- production of approximately 2,544 m^3 of oil per day;
- production of 3,180 m^3/day of produced water; and
- transportation of gas and condensate/oil.

The maximum annual output will be ~19 billion m^3 of gas and ~2.9 million m^3 of condensate and oil.

The LUN-A platform will be four legged, with a GBS. The GBS measures 104.1 x 96 m, with a height of 15 m and with four cylindrical supports 24.5 m in diameter, which support the above-water part of the structure with its topsides. The southeast leg will be used as the well bay, while the northeast leg will be used for the pipeline risers. The west legs will be used for the non-flammable storage tanks, and seawater and firewater pumps. The well bay will have 27 well slots; the maximum number of producing wells at any one time will be 21.

A cuttings injection system will be used for the disposal of oil-based mud, oil contaminated solids, sands, and drilling cuttings. The system and well design provide for the possibility to inject drill cuttings into the well annulus when using oil-based muds. Water-based muds from the conductor string for each well and the first four wells will be discharged overboard. When water-based mud is used to drill through shale it will form a gumbo, a hydrated shale with the consistency of heavily saturated clay. That material is of such a consistency that it may be difficult to inject, unless fluidised. If it is not possible to inject, material will be discharged overboard; however, an equal amount of the 30" conductors' cuttings will not be discharged.

The separation system of gas and gas condensate will consist of two process lines, each designed to treat about 25.5 million Sm^3/day of non-dry gas and associated condensate, oil, and water. The condensate at the outlet from the separator will contain on average of up to 2% water.

After separation of produced water, condensate and gas will be transported to the onshore processing facilities via two 30” diameter pipelines for further processing at the OPF. Lean glycol (MEG) will be added to the condensate/oil and gas prior to transportation to the onshore facilities to prevent hydrate formation. A 4.5” diameter offshore pipeline will be used for recycling of regenerated ethylene glycol from the OPF to the LUN-A platform.

Produced water will be mixed with seawater and injected into formations to maintain the formation pressure. There will be two injection wells.

The platform will accommodate 90 permanent and 36 temporary personnel. The operation of the platform will be performed by two commuting crews working for 2 or 3 weeks on rotation. The personnel, equipment, materials and fuel will be transported by helicopters and vessels.

3.3.2 Cables and Pipelines

See Section 2.3.2 in Chapter 2 for details regarding cables and pipelines.

3.3.3 Floating Storage and Offloading Vessel

At present, the oil from PA-A flows via a subsea pipeline to the Single Anchor Leg Mooring (SALM) buoy at the FSO, and then to market tankers.

The FSO vessel Ohka stores the PA-A oil production for batch trans-shipment to market crude oil tankers. The FSO is ice-resistant and offloading is achievable in winter; however, offloading takes place only during the ice-free season to avoid the need for ice navigation by the market tankers. Average tanker traffic is one every seven days. The FSO will be phased out once the PA-A platform is tied into the oil pipeline network, connecting it to PA-B.

SEIC marine personnel board all tankers and remain on the crude oil tanker throughout the tanker's stay. They ensure the safe berthing of the tanker together with the connection of the mooring hawser and flexible loading hose, and carry out the necessary safety checks with the complex and the tanker prior to cargo transfer operations.

Support vessels are used to assist the tanker link to the FSO. Support vessels at and approaching the Vityaz complex include:

- two multipurpose vessels with ice-breaking capabilities;
- oil Spill response stand by boat; and
- small line-handling launches to assist with berthing tankers and personnel transfer.

Facility support boats have fire fighting and spill response equipment on board.

3.3.4 Tanker-loading Unit

The TLU will be connected by subsea pipeline to the OET. The TLU will be designed to handle conventional crude oil tankers without specialised vessel loading equipment during the ice-free season. However, it is anticipated that during ice season, specialised tankers equipped for bow loading will be required. The terminal will be designed to allow the complete loading operations including mooring, loading and leaving the mooring within 24 hours. The TLU will be designed for tankers in the range of 40,000-150,000 DWT that will be able to carry cargoes of 300,000-1,000,000 bbls. Although the TLU is not designed for larger vessels, it could potentially accommodate those with draft and operating limits.

Tanker traffic from the TLU is linked to production rates. The average expected volume of tanker traffic is in the order of one tanker every four days. During loading operations, the TLU can be unmanned, however there will be visits to the TLU by personnel for routine and ad-hoc maintenance operations, typically one visit per month.

In the process of the TLU operation, the number of personnel will be dependent primarily on the size of crews of auxiliary vessels and it might reach 50 during periods of major repair and maintenance work.

3.3.5 Vessels and Aircraft

3.3.5.1 Vessel traffic

Vessels in the area will perform a number of tasks, including transport of personnel to and from the offshore platforms, as well as transport of equipment and supplies to the oil and gas fields. In addition, there will be tanker traffic in the PA field until 2006 and in Aniva Bay for the duration of the project.

Personnel transfers—If weather conditions preclude the use of a helicopter for transferring personnel to and from the platforms, such as during the open-water season, small vessels may transfer crews from the platforms to shore. Crew changes have been made by small vessels from the Molikpaq platform to the coastal port of Kaigon (several km south of Nogliki) when weather precluded helicopter flights. The number of such trips ranged from 10-25 per month and totalled about 100-120 trips per production season.

Auxiliary transport and supplies—Auxiliary vessels may be required for undersea inspections and maintenance operations, as well as for diving operations. Some vessels will be equipped as reserve vessels to be used in emergency situations at oil/gas fields. Their function, along with normal operation, will include oil spill response measures, work under ice conditions, rescue operations at sea, and evacuation of the personnel from the platforms.

Auxiliary vessels will be required at the LNG/OET site at Prigorodnoye and in the Piltun-Astokhskoye and Lunskoye fields. At the LNG/OET site, auxiliary vessels will be used as towboats for mooring LNG carriers and crude oil tankers. It is assumed that those boats will be also used for a number of other functions in addition to towing, including inspections and servicing of offshore facilities.

The vessels will be also equipped for emergency response operations, such as oil spill response and other emergencies at the OET. The vessels should be built in accordance with the adequate technical specifications for navigation under ice conditions in order to operate year-round in Aniva Bay, to be capable of accompanying LNG carriers and oil tankers in ice conditions, and to fulfil other missions under ice conditions at the oil terminal.

Small auxiliary vessels for the use at the offshore platforms will be built to special order, although it is possible that existing vessels will be used during the construction period and probably during the initial period of the new platform operation. Investigations will be carried out to optimise the location of the base for the vessels, but it is assumed at this stage that this base will be located close to the offshore oil and gas fields.

During operations, supply vessels will visit each platform approximately once every ten days. At Molikpaq, supply boats bring equipment and other materials and supplies from Kholmsk on the southwest side of Sakhalin Island. Trips by the supply vessels occur approximately every 10 days and total about 20 trips each production season.

Support vessels are used to assist the tanker link to the FSO. Support vessels at and approaching the Vityaz complex include

- two multipurpose vessels with ice-breaking capabilities;
- oil Spill response stand by boat; and
- small line-handling launches to assist with berthing tankers and personnel transfer.

The following auxiliary vessels will be associated with the mooring jetty near the LNG plant on Aniva Bay:

- one or two icebreakers for accompanying tankers in the Aniva Bay in winter. It is possible to use only one icebreaker if it is equipped with azimuthal navigation devices;
- two tugboats for assisting tankers in the process of mooring and loading operations; and
- small boats for assisting LNG tankers during mooring and for transportation of ice pilots from a vessel located in the Sea of Japan to the west of La Perouse Strait.

All auxiliary vessels will be equipped with appropriate fire fighting and oil spill response equipment. They will be inspected on a regular basis to verify their compliance with the general requirements.

3.3.5.2 Aircraft

Air transport will be used for the project for the following activities:

- passenger transport to Sakhalin Island via commercial and charter aircraft;
- flights from Yuzhno-Sakhalinsk to Nogliki (pending Nogliki upgrade);
- helicopter personnel transport to and from platforms;
- helicopter freight and passengers to various land locations on a rare *ad hoc* urgent basis;
- helicopter medi-vac from Nogliki base and other locations;
- helicopter support during offshore construction;
- helicopter or light aircraft pipeline inspection flights; and
- light aircraft whale surveys.

The following sites have or will have air transport facilities:

- Yuzhno-Sakhalinsk - International passenger and freight terminal and helicopter facilities;
- Nogliki - Regional passenger and freight terminal and SEIC helicopter base;
- All platforms – Helipads;
- OPF, BS-2, LNG/OET sites – Helipads/areas for potential regular use;
- Pipeline construction camps – Helipads for emergency use.

The most significant air traffic will be generated by helicopter personnel transport to and from the platforms. Helicopters will be used as the principle means of transporting personnel on and off the platforms. Currently, the PA-A platform is serviced by ~50 flights per month. Transport by support vessel is used when bad flying weather prohibits flying. Helicopters do not fly in fog, high winds, or atmospheric freezing conditions.

For three platforms, the expected flight volume is ~150 flights per month or five flights per day, seven days per week.

3.4 Operations Schedule

The PA-A platform has been in production since 1999. However, production at the platform is suspended during the winter season when the FSO is demobilised because of ice conditions. Year-round oil production from this platform is expected to commence in the 4th quarter of 2005, when the pipeline system is scheduled to be completed. Currently, the average tanker traffic is one every seven days from the FSO. The FSO will be phased out once the PA-A platform is tied into the oil pipeline network, connecting it to PA-B. Drilling at the LUN-A platform is scheduled to commence in the 4th quarter of 2005, whereas production at the new PA-B platform is expected to start in the 3rd quarter of 2006. Drilling will occur year-round at all three platforms. During operations, supply vessels will visit each platform approximately once every ten days.

The LNG plant will receive its first LNG cargo in November 2006. During periods of maximum LNG production, it is planned to load one vessel every two days; loading will take up to 16 hours.

Oil tanker traffic from the TLU is linked to production rates. The average expected volume of tanker traffic is in the order of one tanker every four days with mooring and loading taking 15–20 hours. During loading operations, the TLU can be unmanned, however there will be visits to the TLU by personnel for routine and ad-hoc maintenance operations, typically one visit per month.

Oil and gas activities associated with Sakhalin II are expected to terminate around 2045.

3.5 Sources of Potential Impacts

3.5.1 Presence of Structures

Various structures and facilities could affect the distribution, abundance, and behaviour of western gray whales in the project area. Offshore platforms will be installed at each of the PA-B and LUN-A sites. At the Vityaz Marine Terminal Complex in the PA field, a platform already exists (PA-A or Molikpaq), and an FSO and associated SALM system. The platforms will have integrated drilling and production capabilities.

Offshore pipelines will be installed and partially buried at a depth of 0.3 m, between the existing PA-B platform and PA-A, on a distance of 15.3 km from the PA-A platform to shore, 6 km from LUN-A to shore, and 1.5 km from the OET to the TLU in Aniva Bay. The majority of the sections will be buried.

3.5.2 Solid wastes

Solid wastes will be generated during offshore operations, on platforms, and on supply and auxiliary vessels. Solid wastes that may be generated and their Russian hazard class are:

Non-Hazardous	Packing materials Domestic and catering wastes
Low hazard	Incinerator ash Scrap ferrous and non-ferrous metals
Medium Hazard	Sewage sludge Paint and some chemical wastes
High Hazard	Waste oil Other chemical wastes

The PA-A platform has been operated since 1999. The annual amount of waste generation is about 700 t, including

- metals – 45% (mainly attributable to ongoing upgrade engineering works);
- food waste – 20%; and
- domestic solid waste - 11%.

Solid non-hazardous wastes are combusted in an incinerator on the platform. Metals and other non-combustible wastes (accumulators, mercury lamps) are hauled to onshore facilities.

Once in operation, PA-B and LUN-A will also be generating industrial and domestic solid wastes. Domestic solid waste will be separated, stored in containers, and regularly hauled to the onshore disposal sites. Industrial wastes are produced as a result of operation, maintenance, and repair of the drilling equipment. Industrial wastes will be collected, stored, and hauled to the onshore facilities for disposal according to their hazard class, in accordance with current regulations. Volume of waste generation for each facility will be comparable with volumes generating at platform PA-A.

3.5.3 Air Emissions

The primary sources of offshore air emissions from the project during the operation phase include

- flaring;
- venting and purging gases;
- combustion processes such as diesel engines;
- fugitive gases from loading operations and tankage; and
- losses from process equipment.

Other lesser but cumulatively significant emissions include those from sea and air transport. Offshore facilities are anticipated to produce about 35% of overall air emissions of the project.

3.5.4 Water discharges

Wastewater will be produced by the various transport and supply vessels, and the platforms. Wastewater from vessels will consist of components typical of all marine vessel operations, including engine cooling water and greywater. The significant planned water discharges from offshore platforms include

- clean rainwater;
- cooling water;
- greywater; and
- industrial wastewater.

3.5.5 Discharges of Drilling Muds and Cuttings

The PA-B platform will have 45 drilling windows, the PA-A has 32, and the LUN-A platform will have 27. Drilling muds are used for lubrication and are circulated within the well while drilling. They contain chemicals than can be hazardous to the surrounding marine environment. Drill cuttings are screened and removed from the mud and are often discharged into the marine environment near the well.

A cuttings injection system will be used for the disposal of oil-based mud, oil-contaminated solids, sands, and drilling cuttings. The system and well design provide for the possibility to inject drill cuttings into the well annulus when using oil-based muds. Water-based drilling cuttings generated in the first well and the conductor string for each subsequent well will be discharged overboard. When water-based mud is used to drill through shale, it will form a gumbo, a hydrated shale with the consistency of heavily saturated clay. That material is of such a consistency that it may be difficult to inject. If overboard discharge is required, then an equal amount of the 30" conductors' cuttings will not be discharged. However, injection might be possible once the material has been fluidised.

3.5.6 Noise and Disturbance During Operations

The main noise sources associated with operation activities of the Sakhalin II project are discussed below. Also, Table 2-4 in Chapter 2 lists some of the noise sources often associated with offshore oil/gas development projects.

3.5.6.1 Drilling

Each platform (SEIC Phase II) will be involved in the active drilling of wells. Noise will result from (1) platform equipment such as the drill rig, the rotation of the drill stem, and the movement of pipe associated with drilling; (2) the operation of generators, pumps, hydraulic equipment and other large machinery on the platform; and (3) high-pressure air releases, engines and winches. Underwater acoustics programmes conducted during 1999 and 2000 in the PA-A area and near Piltun Bay indicated that noise levels in those areas where western gray whales were present were generally less than 100 dB re 1 μPa rms

(Sobolevsky 2000, 2001). Generally, narrow-band sounds with frequencies below 1 kHz generated near Molikpaq were continuously detected in the western gray whale feeding area, whereas industrial noise with frequencies of above 1 kHz was not noticeable in the feeding area (Sobolevsky 2000, 2001).

Although drilling and production sounds will be relatively continuous, the noisiest events likely to occur at platform sites during drilling are the pulling-out-of-hole (POOH, or tripping) events during which the drill string is pulled from the hole, the bit changed, then the string is lowered back in the hole (usually done every 24-30 hours). Underwater noise levels produced during well drilling from a platform and by platform machinery have been found to be very low in the measurements from 11 production platforms reported by Gales (1982). However, Richardson et al. (1995) noted that those data did not allow source level estimates to be made. Gales' (1982) recordings of drilling platform noise off California were made in sea states of 3 or greater, and the received levels were so weak that they were nearly undetectable near the platforms. The greatest sound levels from drilling or drilling/production platforms may be at very low frequencies (~5 Hz). Received levels of those sounds were 119-127 dB at the near-field measurement locations. The highest frequency tone was at 1.2 kHz. Those near-field measurements are not directly comparable with results of other studies.

3.5.6.2 General Platform Operation

In addition to noise generated from drilling of wells, production machinery will create noise. There are very few data on noises associated with production activities (Richardson et al. 1995). The GBSs proposed for installation at PA-B and LUN-A will be made of concrete. Thus, conduction of production noise to the water will be poor, and it is anticipated that noise levels will be relatively low.

The deck of the platforms will be approximately 14 m above sea level. The drilling platform and most support equipment is on the deck in modular buildings. The noise levels produced by such rigs are comparable to those produced by semi-submersible drill rigs. Generally, noise levels produced by semi-submersible drill rigs are lower than those produced by drill-ships or other types of caisson rigs where some machinery is below the waterline (Richardson et al. 1995). Noise from a semi-submersible drilling rig working in 114-m water depth in the Bering Sea did not exceed ambient noise levels beyond a 1-km range (Greene 1986). Support vessels were also present at the time that those measurements were taken. In contrast, noise produced by working drill-ships did not decline to ambient levels until beyond 10 km from the source (Richardson et al. 1995).

3.5.6.3 Vessels and Aircraft

During operations, supply vessels will visit each platform approximately once every ten days. The vessels will have a number of roles including the transport of personnel, oil field equipment, and stores from the logistic base to the platforms, as well as subsea inspection and maintenance work.

In addition, there will be ongoing maintenance and survey vessels working in the area of the platforms on an *ad hoc* basis. There will also be substantial vessel traffic near the TLU in Aniva Bay. Tankers will frequent the TLU and will be accompanied by one or two icebreakers during winter. Two tugboats will assist tankers in the process of mooring and loading operations, and small boats will assist LNG tankers during mooring and for

transportation of ice pilots from a vessel located in the Sea of Japan to the west of the La Perouse Strait.

Oil tanker traffic will cease in the region of the Piltun-Astokhskoye field once the PA-A platform is tied into the oil pipeline network. The overall effect of adding two operating platforms and removing the offshore tankering operations is expected to change shipping activity from few, large vessels only in the open water season to more but smaller vessels along the east coast of Sakhalin Island. Vessel traffic will increase especially in Aniva Bay, as tanker-loading operations will be performed there at the TLU- and LNG-associated jetty. Noise from vessels is discussed in section 2.4.4.6 in Chapter 2.

Helicopters will introduce a source of low-frequency noise in the area. During operations, helicopters will be used as the principal means of transporting personnel on and off the platforms. The expected flight volume is ~150 flights per month or 5 flights per day, seven days per week. It is uncertain what type of helicopter will service the platforms.

Helicopters are noisy compared to fixed-wing aircraft. Noise source levels in the air for helicopters can be about 150 dB re 1 μPa (Richardson et al. 1995). When flying at an altitude of 150 m, the noise level on the surface of the water directly beneath the aircraft may reach 100–110 dB re 1 μPa rms (Richardson et al. 1995). However, sound does not transfer well between air and water. In the upper water column (3-18 m water depth), received noise levels depend on the altitude of the aircraft above the water; the higher the aircraft, the lower the received noise level (Richardson et al. 1995). Thus, potential effects are mainly related to disturbance of whales directly under the flight path of the helicopter.

At angles greater than 13° from vertical, most sounds are reflected away from the sea surface. Thus, noise from aircraft is audible mainly within a 13° cone under the aircraft. The area of potential audibility increases with increasing depth, but the sound also attenuates with increasing water depth. Thus, a Bell 214ST helicopter was audible to a hydrophone at a 3-m depth for 38 s, but only for 11 s at a depth of 8-m (Richardson et al. 1995). Some airborne sounds will enter the water column at angles greater than 13° from the vertical when seas are rough.

3.5.7 Oil Spills

As part of its commitment to sustainable development, SEIC has instituted measures to ensure that the likelihood and impact of an oil spill are kept to a minimum. The essence of SEIC's approach to oil spill prevention and response is three-tiered:

- prevention of any spills in the first instance through the robust design of production facilities and continuous monitoring for oil spills, adhering to international high standards and best practice;
- efficient and effective contingency planning in the event of a spill, which has been tried and tested by trained personnel with a clear chain of command and appropriate resources on hand to tackle any spill size; and
- minimisation of the volume and impact of any oil spill on the natural and human environment. In the unlikely event of a large spill, SEIC is also

committed to remediating the damage as well as providing compensation where appropriate and required by Russian Federation law.

Several design key features have a controlling role in limiting the volume of any spill to the environment, specifically:

- down-hole safety devices in wells;
- double hull tankers;
- emergency shutdown valves in wells and pipelines;
- secondary containment in plant sites; and
- rapid detection and intervention enabled by process control systems and process safeguarding systems.

In compliance with Russian federal laws and resolutions and Sakhalin Island decrees, and guided by international best practice and lessons learned from the implementation of Phase I, SEIC has developed Oil Spill Response (OSR) Plans for each of the facilities, or assets, that it proposes to operate under Phase II of the project: PA-B; LUN-A; OPF; OET; TLU and the offshore and onshore pipeline transfer system.

In addition, SEIC has also prepared a Corporate OSR Masterplan (COSRP) (SEIC 2002). Whereas the individual OSR Plans for each facility are intended to provide specific and detailed information relevant to each facility, the purpose of the COSRP is to provide a coherent framework in which to link each of these individual plans together. The COSRP is intended for use by those engaged in OSR and sets out the general principles and approaches employed by SEIC in OSR, together with project-wide information, company procedures, guidelines, and recommended practices for OSR. Importantly, the COSRP integrates the OSR strategy with the plans and strategies of other sectors associated with Phase II, particularly waste management, health and safety plans, environmental management, and general emergency response procedures.

3.5.7.1 General SEIC Philosophy on OSR

SEIC has established a general philosophy that sets the scene for its approach to OSR. The essential elements of this philosophy are as follows:

- Priorities in response to any oil spill event are protection of life and safety, the minimisation of potential effects in areas of special value, and the protection of social and economic assets. The safety of operations and oil spill response personnel and the public takes precedence over all emergency response and cleanup efforts;
- Assurance that spill prevention and response equipment is properly operated and maintained by competent, trained personnel; a guiding principal of the SEIC Health, Safety & Environmental Management System (HSEMS);
- Use of best local and international resources and best practices developed in world-wide operations to manage the development safely and efficiently;
- Compliance with relevant national regulations and international agreements and conventions as well as shareholder companies' standards and prudent oil industry practices;

- Emergency response procedures for each facility to enable personnel to respond efficiently to any emergency situation that may develop. They are compatible with SEIC's overall emergency response organisation procedures;
- Consensus between government agencies and the public with regard to the identification of areas of special value that would be subject to priority protection;
- Timely and accurate Communications in the event of an oil spill;
- A maintenance plan is in place, taking into consideration equipment and maintenance needs. The maintenance and inspection programme ensures that the facilities are cost-effectively maintained and that production and safety requirements are met;
- An environmental assessment and monitoring programme is implemented in the event of a major spill incident to identify and quantify any actual damage that might have occurred;
- All incidents that result in serious safety, health, or environmental consequences are investigated. The primary intent of the investigation is to learn from the incident and help prevent similar incidents;
- This COSRP and capabilities for the Sakhalin II Project operations areas are periodically reviewed and updated as appropriate.

3.5.7.2 Overview of SEIC's OSR Strategy

SEIC's OSR strategy is based upon the protection of vulnerable areas and resources, defined by their location, boundaries, and degree of vulnerability. SEIC has adopted a tiered approach to response planning. That approach enables SEIC planners and government regulators to evaluate the response capability for various scenarios during assessment, training, and exercises. The core elements of SEIC's OSR strategies are based on the following principles:

- The primary response objective following an oil spill is to minimise the affected area. The first response actions attempt to control the spill source in order to keep the amount of oil that is released into the environment at a minimum;
- If control of the source of the oil spill is not safe, practical, or successful, the next objective of the response operation is to attempt to contain the free oil, either on the water surface or on land, in order to minimise the spreading of oil;
- During this phase of the response, any areas of special value or other vulnerable resources that are at risk are identified and the feasibility and practicality of protection strategies are evaluated. Protection priorities would be selected based on input from local, regional, and federal government agencies, and environmental experts, considering operational feasibility and the potential for success;
- Oiled areas will be cleaned up in a manner that is consistent with the concept of Net Environmental Benefit to ensure that the effects of the spill are not increased by the response activities and actions;

- SEIC will seek full and direct co-operation between Federal and Oblast agencies at all levels of a response. SEIC recognises the resources that are available from outside the company, both in the region and beyond, and integrates those resources in the planning process.

SEIC's response to an oil spill will vary depending upon the size of the spill, and will be structured according to a tiered approach that enables a flexible build up of resources at regional, national, and international levels, as required. The level of response is very much dependent on the size of the spill, its behaviour and dynamics, and the prevailing climatic and hydro-meteorological conditions at the time.

A tiered approach has been adopted to facilitate the rapid and orderly expansion of emergency response by each project facility, should that become necessary during a declared emergency. A tiered approach enables a spill response to be managed in the most efficient and effective manner. The tiers defined below are standard industry terms used to describe the extent of a spill event and of the subsequent response. The definitions conform to the Sakhalin Oblast Governor's Decree #193 – "*Temporary Regulation on prevention of and response to emergency spills of oil and petroleum products in the Sakhalin Oblast territory*" – developed in accordance with the RF Government Resolution #613 – "*On immediate measures to prevent and responding to emergency spills of oil and petroleum products*" – and the International Petroleum Industry Environmental Conservation Association's (IPIECA's) description of a tiered response system. The definition of each tier is as follows.

1st tier of response: The first tier relates to an onshore emergency of on-site significance only and to a minor spill in marine areas (as defined in Regulations #613 and #193). Tier 1 spills occur at or near a facility and have minor potential environmental effects or little potential to escalate. Immediate on-site response capability (equipment and manpower resources) is adequate to respond to Tier 1 spills. Tier 1 response organisations are established at each of the designated areas of operations and operate under the guidance of a Facility OSR Plan. Each Facility OSR Plan includes scenarios with detailed counter-measure tactics for possible oil spills within that specified region. In the event that the facility resources are insufficient to handle the size or type of spill, professional emergency response teams (services) and OSR contractors become involved in response operations on a contract basis. An oil spill relating to the first response tier can be upgraded to the next tier by a Site Controller (facility manager), the SEIC Emergency OSR Co-ordinator, and/or bodies of local government if such a response level is warranted.

2nd tier of response: The second tier relates to an onshore emergency of local, territorial, or regional significance, to an emergency of territorial and regional significance on a water body (lake or river), and to a moderate-size marine spill (as defined in Regulations #613 and #193). Tier 2 spills can occur at or in the vicinity of a facility and have the potential for moderate to major effects. A Tier 2 response comprises the cascading of additional SEIC resources, regional response resources available from Mutual Aid or partner entities (other in-region oil companies), commercial organisations with proper licenses, or special response teams, to augment the existing Tier 1 resources on-scene. In addition, personnel and equipment of the Sakhalin Territorial Subsystem of RSCS, Far-Eastern Regional Subsystem of RSCS, and regional divisions of Russian State Marine Rescue Service may be mobilised. A Tier 2 response can involve one or more Facility OSR Plans and this COSRP.

3d tier of response: The third tier relates to an emergency of federal significance onshore, in a water body (lake or river), and to major marine spills (as defined in Regulations #613 and #193). Tier 3 spills occur near or at a facility and have a potentially significant environmental impact. In addition to the Tier 1 and Tier 2 resources, a Tier 3 operation uses compatible major response equipment that can be brought to the scene rapidly from other locations, including RSCS, reserves of the special equipment terminal of the RF Ministry of Emergencies, Russian State Marine Rescue Service, and, if necessary, world-wide co-operative stockpiles. The stockpiles include Oil Spill Response Ltd. (OSRL) and the East Asia Response Ltd. (EARL), as well as other resources of foreign companies upon approval of the authorised bodies of the Government of the Russian Federation. A Tier 3 response can involve one or more Facility OSR Plans and this COSRP.

Oil spill response organisations, such as those provided through Mutual Aid agreements, augment SEIC resources available for spill response, as needed. The OSR organisations stockpile equipment and have trained responders to maintain, mobilise, deploy, and use their resources on a spill. Contracts or other terms of agreement are to be established with OSR organisations to ensure an appropriate level of support for possible Tier 1, Tier 2, and Tier 3 spill incidents. SEIC management takes appropriate steps, such as audits, to ensure that the resources identified as available through the OSR organisations are in the inventory and operational.

3.5.7.3 Response Resources

SEIC maintains response capabilities to effectively handle Tier 1 spills. Those resources are staged primarily at the Nogliki SEIC and ENL Camp, the shore base near the TLU site in Aniva Bay, and offshore aboard the Multipurpose Support Vessel (MSV). Cascading of resources from those locations comprises the first strategy towards meeting Tier 2 response needs. If required, the SEIC resources may be augmented by mobilising resources from within the region, coordinated by the Committee for Emergency Situations of the Sakhalin Oblast. Other resources may derive from SakBASU and/or Mutual Aid agreements with other oil companies. A Tier 3 response would use a combination of the above and resources provided by worldwide oil spill cleanup contractors, and resources available within the Russian Federation, the US Coast Guard, and Japan if necessary.

On-water Marine Response Resources

In order to achieve a primary response objective, that is to control at or near the source, the immediate first response is to deploy the response equipment that is on the standby vessel full-time at the offshore facility. For submarine pipeline spills, equipment would be deployed from the standby vessels and/or from the shore-based response centers adjacent to PA, LUN, and the TLU.

The dedicated oil spill response equipment is staged on and deployed from a Multipurpose Support Vessel (MSV) that will be on site adjacent to the production facilities, the TLU, and the submarine pipeline operations at all times. In the case of the TLU, the equipment will be deployed from one or more of the dedicated harbour tugs. Dedicated Vessel of Opportunity Skimming System (VOSS) equipment also would be staged on the OSRVs or MSVs, the tugs, or on the offshore production platforms for use on a Vessel of Opportunity.

If the spilled oil cannot be completely mechanically contained and recovered at or near the source and it is being transported towards the coastal zone, then the Tier 1 equipment would be used also to achieve the second objective, that is, to contain and recover the oil on the water. In addition, if the oil threatens any of the lagoon inlets that have been identified as Areas of Special Value, then permission would be requested to use approved chemical treating agents (dispersants) to protect those highly sensitive areas SEIC recognizes that such a decision would involve a trade-off, and the request would be presented in the form of a Net Environmental Benefits Analysis. If approved, dispersants would be used in accordance with the regulatory requirements. A second option to protect environmentally sensitive areas threatened by oil is controlled burning at sea. That strategy also would be considered if, at the outset, mechanical recovery and chemical dispersion are not considered likely to succeed, and if oil spill and metocean conditions were considered appropriate. The decision to undertake *in-situ* controlled burning would need to be made within a few hours of the spill occurring, otherwise its effectiveness would be compromised. Any two or all three of these strategies could be employed to combat a spill used concurrently.

If the threat to the coastal zone is considered to be beyond the capability of the Tier 1 resources stationed in the local area, then a Tier 2 response would be initiated that would involve the deployment of resources from nearby Tier 1 facilities and/or from Korsakov. A Tier 2 response could involve the use of non-SEIC equipment available on Sakhalin Island. A summary of the capability of the planned Tier 2 response resources that will be available full-time is provided in Table 3-1 below. The table also includes non-SEIC containment and recovery equipment that would be available from Korsakov to support a response in the Aniva Bay area (TLU) or the northeast production area.

TABLE 3-1. Summary of planned offshore Tier 1 and 2 oil spill response capability.

	Tier 1			Tier 2		
	Open Water Skimming Capacity (m^3/hour)	Offshore Storage Capacity (m^3)	Dispersant Capability (t)	Open Water Skimming Capacity (m^3/hour)	Offshore Storage Capacity (m^3)	Dispersant Capability (t)
PA	330	min. 500	850	410	min. 500	850
LUN	80	min. 500	850	410	min. 500	850
TLU	350	min. 500	500	1,568*	Unlimited*	500

In the event of a Tier 3 response, additional equipment would be acquired from sources in Russia and abroad. Oil spill response organizations (OSROs), such as those provided through Mutual Aid programmes and oil spill cooperatives, will augment SEIC resources available for spill response, as needed. The OSROs maintain stockpiles of equipment and have trained personnel to maintain, mobilize, deploy, and use their resources. Contracts or other terms of agreement have been established with OSROs to ensure an appropriate level of support for possible Tier 3 spill incidents. In particular, SEIC has a contract in place with the OSRO Global Alliance (OSRL and EARL) that provides a rapid Tier-3 response capability from its bases in Singapore and the United Kingdom.

Coastal Zone and Shoreline Protection Response Resources

If spilled oil is moving towards the coastal zone, and if it appears that the offshore response actions would not be capable of completely containing and recovering, chemically dispersing, or burning the oil on the water surface before it reaches the coastal zone, then a nearshore sensitive zone protection strategy and an inlet protection strategy would be implemented immediately to prevent oil from entering those areas. A priority would be placed on those inlets or other locations, such as seal haulouts, identified as "Areas of Special Value" (ASVs) in the OSRP (SEIC 2002). "Rare sea mammal species population areas" are included in the list of ASVs, but western gray whale feeding areas are not explicitly identified.

The shoreline protection equipment at Nogliki and Korsakov has been specifically designed to contain and recover oil in or near the inlets that form the link between the lagoons and the open ocean. Also, the response systems have been designed so that the resources can be deployed rapidly by road, fast response boats, or helicopter. The systems from Nogliki and Korsakov could be mobilized by air within 24 hours if additional coastal protection resources are required for a Tier 2 level response.

A total of three protection systems would be staged at Nogliki, to be shared between the PA and the LUN facilities, so that sensitive nearshore areas and up to three inlets could be protected simultaneously. Two protection systems exist at the present time and are comprised of ten skimmers with a rated recovery capacity of 141 $m^3 \cdot h^{-1}$ and ~6,000 m of boom. The acquisition of a recommended third system would increase the capability up to a rated recovery capacity of 171 $m^3 \cdot h^-1$ and ~9,000 m of boom. Presently no protection systems are located near the western gray whale feeding area adjacent to Piltun Bay, but systems could be moved from Nogliki to Piltun in the event of a spill in that area.

One inlet protection system would be staged at Korsakov. The planned inlet protection system would include three skimmers with a rated recovery capacity of 43 $m^3 \cdot h^{-1}$ and ~3,000 m of boom.

In the event of a Tier 3 response, additional equipment would be acquired from sources in Russia and abroad. SEIC has a contract in place with the Global Alliance (OSRL and EARL) that provides a rapid Tier 3 response capability from its bases in Singapore and the United Kingdom.