Chapter 9: Cumulative Impacts

The Sakhalin II Phase 2 Project is a large oil and gas development, but it is only one of a number of activities in the region that could have potential impacts on western gray whales. Potential impacts of the Sakhalin II Project need to be put into context with those other potential sources of impact. The various impacts could interact in various ways such as additive, synergistic, or balancing. The external impacts are largely outside of the control of SEIC. Nevertheless, an awareness of their relative importance and the way that they interact could influence the effectiveness of mitigation measures and prompt different design decisions. A partnership approach could be used to mitigate some cumulative impacts.

This section focuses only on known or expected future developments that have the capacity to significantly affect western gray whales in the future, in the areas of key concern for the Sakhalin II development.

The sources of concern are considered to be

- Sakhalin I oil and gas development;
- Sakhalin II oil and gas development, northeast Sakhalin Island;
- Sakhalin II oil and gas development, southern Sakhalin Island;
- other oil & gas activities;
- vessel traffic within and outside of the Sakhalin region;
- the fishing industry in the Sakhalin region;
- whaling; and
- oil spills (non routine).

9.1 Sources of Cumulative Impact

9.1.1 Sakhalin I Oil and Gas Development

SEIC is not party to the details of Sakhalin I's development plans, but it is known from information in the public domain that the consortium intends to develop three fields in its licence area:

- the Chayvo oil and gas field will be developed by a combination of fixed platform and drilling from shore;
- the Odoptu oil and gas field will be developed by drilling from shore; and
- the Arkutun Daginskoye field will be developed later, probably by fixed platform(s).

Oil and gas will be processed in an onshore processing plant. Sakhalin I has announced plans for an initial oil project with export via pipeline to the port of DeKastri on the Russian mainland, followed by a later gas pipeline project, possibly to Japan.

9.1.2 Sakhalin II Oil and Gas Development, Northeastern Sakhalin Island

The development of the Sakhalin II project began in 1994. It consists of two fields: the Piltun-Astokhskoye (P-A) oil field and the Lunskoye field. Sakhalin II is a two-phase project.

Phase I of the Sakhalin II project (PA-A) consists of the development and, since 1999, operation of the Vityaz production complex in the Piltun–Astokhskoye field. The Vityaz production complex comprises the PA-A platform (formerly the Molikpaq arctic caisson drilling rig) and the Okha Floating Storage and Offloading (FSO) vessel, the latter being moored to a Single Anchor Leg Mooring (SALM) buoy. Oil is transferred via a sub-sea pipeline to the FSO for offloading to tankers.

Drilling activities occur year-round from the PA-A platform (14 production wells have been drilled and an additional 13 pressure maintenance wells are planned), but oil production occurs only during a portion of the year, generally a 6- or 7-month period when ice cover is not prohibitive to navigation and SALM operation. During the ice-covered period, from approximately December through May, oil production ceases, the FSO is disconnected from the SALM and leaves the Okhotsk Sea, and all oil transfer operations are suspended.

Phase II of the Sakhalin II project consists of the following developments off northeastern Sakhalin Island:

- a second drilling & production platform on the Piltun-Astokhskoye field (PA-B);
- a drilling and minimal production facility on the Lunskoye field (LUN-A platform), including facilities for the oil rim production;
- an Onshore Processing Facility (OPF) that treats gas and liquid production from the LUN-A platform
- an oil pipeline system including booster stations that will gather oil produced from the PA-A (Molikpaq) and PA-B platforms and oil/condensate from the LUN-A platform for transportation to an oil export terminal at Prigorodnoye; and
- a gas pipeline system that will gather gas from the PA-A, PA-B and LUN-A platforms for transportation to a Liquefied Natural Gas (LNG) plant at Prigorodnoye.

Seismic exploration of the Lunskoye Licence Area is planned for 2003. A separate EIA for those activities is being prepared in 2002.

9.1.3 Sakhalin II Oil and Gas Development, Southern Sakhalin Island

Phase II of the Sakhalin II project will include the development of the following facilities at Aniva Bay:

- an Oil Export Terminal (OET) at Prigorodnoye with an offshore loading facility (Tanker Loading Unit –TLU);
- a pipeline between the OET and the TLU; and

- a phased two-train LNG plant at Prigorodnoye with LNG export facilities.

9.1.4 Other Oil and Gas Developments

There are currently seven defined prospective areas with delineated oil and gas fields along the northeast coast of Sakhalin Island. Only Sakhalin I and II have progressed beyond the exploration stage. Therefore, whereas further oil and gas exploration and development are expected in the other areas, such major developments are not defined at this stage and will not start for at least 5-10 years.

9.1.5 Vessel Traffic

Virtually all cargo arriving in Sakhalin Island arrives by sea. Ocean-going transportation in the area is expected to increase with the economic growth associated with oil and gas development. Increased vessel traffic may disturb or even displace western gray whales in the area.

9.1.6 Fishing Industry

Sakhalin Island is the third-largest producer of fish products in the Russian Far East. Total annual quotas include 1.4 million tons of fish and 345,000 tons of squid, shrimp, oysters, and other marine invertebrates. The fishing industry in the Sea of Okhotsk and on Sakhalin Island has grown significantly in the last four years, and growth is expected to continue.

Continued expansion of the fleet and the annual catch are expected to increase the pressure on marine resources and the natural environment. That is expected to be the dominant local influence on the sustainability of the environment in the Sea of Okhotsk, and also important on Sakhalin Island, because of the central role of salmon as a food source for many animals, in addition to its commercial importance.

9.1.7 Whaling

Whaling decimated the gray whale population in the western Pacific. The original population of western gray whales was estimated at 1,500-10,000 individuals; that has been reduced to approximately 100 animals. The critically-endangered western gray whale population is now completely protected from hunting, although an illegal take of a western gray whale is known to have occurred in Japan in recent years.

9.1.8 Non-Routine Oil Spills

Major oil spills are considered rare events and are not expected in the lifetime of the project. Operational records from other oil and gas developments indicate that the great majority of oil releases are small and result from operational spills, such as vehicle refuelling and maintenance of pumps. Total oil spilled from the Vityaz complex during Phase I since production began in 1999 was about 0.3 m^3. The SEIC design and operations philosophy is to aim for zero spills through environmental safeguarding and good practice.

Small releases of oil can be expected to have localised impacts, but limited long-term effects, because the Sakhalin II development crude is a “light” crude. Light crude has a

high percentage of volatile compounds, with a relatively high evaporation rate and high natural dispersion.

9.1.9 Marine environmental pressures outside of Sakhalin region

The western gray whale is a migratory species that spends part of the year migrating to and from its southern feeding and calving grounds, probably located in waters off south China. The migration route of western gray whales is probably through the China Sea and the Sea of Japan. Those two seas are among the world's busiest shipping regions. Marine pollution is also a recognised problem.

9.2 Impacts Contributing to Cumulative Impacts on Western Gray Whales

9.2.1 Sakhalin II Phase 1 Oil and Gas Development, Northeastern Sakhalin Island

Based on sampling at sites systematically monitored in the offshore marine environment, the prey of western gray whales or their primary feeding habitat near Piltun does not appear to have been affected by disturbances to the seabed around the PA-A platform or by discharges originating from the P-A license area. Results of extensive aerial and boat-based surveys between 1997-2002 indicate that western gray whales continue to aggregate and feed in the nearshore waters off the northeastern coast of Sakhalin Island.

9.2.2 Sakhalin II Phase 2 Oil and Gas Development, Northeastern Sakhalin Island

Impacts of the Sakhalin II Project on western gray whales off northeast Sakhalin Island are discussed in detail in Chapters 5 and 7.

9.2.3 Sakhalin II Phase 2 Oil and Gas Development, Southern Sakhalin Island

Because western gray whales are not known to occur in Aniva Bay, the only potential source of impact is increased vessel traffic on their migration route during Sakhalin II project construction and especially operations phases.

9.2.4 Other Oil and Gas Developments

Because further oil and gas exploration and development off Sakhalin Island are not defined at this stage and will not start for at least 5-10 years, it is not possible to assess their potential impacts or their contribution to potential cumulative impacts.

9.2.5 Vessel Traffic

Impacts of marine traffic on marine mammals have been discussed in some detail in Section 5.3.4.6. In summary, western gray whales may show little reaction or slow, inconspicuous avoidance reactions to boats that are moving slowly on a steady course. If the vessel changes course and/or speed, the whales likely will swim rapidly away. Avoidance is strongest when the boat travels directly towards the whale. After mitigation, he potential impacts on behaviour of western gray whales of vessel traffic during the life of the project are likely to be low to medium magnitude, over a local to district geographic extent, and over a long duration, thus, *moderate*.

Western gray whales are susceptible to damage or mortality from collisions with vessels. Even the death of one individual is considered to be a major impact because of the small

population size. After the application of mitigation measures, the probability that any collision with an SEIC vessel would be fatal would be very low.

9.2.6 Fishing Industry

Potential impacts of the fishing industry on western gray whales could result from impacts of fishing on their prey, or impacts of fishing gear or activities on western gray whales themselves.

The use of bottom trawls could reduce the availability of the prey of western gray whales, either through mortality or disturbance of habitat. However, effects on western gray whales would be negligible because most, if not all, of their prey would not be taken in bottom trawls, and disturbance to the soft-bottom habitat would be transient.

Fishing vessels and fishing gear could have potential adverse effects on western gray whales through collisions, entanglement, and noise generation. Migrating eastern gray whales appear most susceptible to collisions compared to other whale species. Entanglement in fishing gear and subsequent drowning is possible, although that concern is largely related to the use of drift nets, which are not commonly used today.

Underwater noise may be associated with propellers, engines, and on-board equipment including winches, generators, pumps, and hydraulics on fishing vessels. The principal source of sound from a vessel is cavitation noise made by the propellers. In general, large ships are noisier than small ships. However, cavitation is a function of the speed of the propeller blades and can be very high, and hence noisy, for even small vessels that are dealing with high loads, such as a fishing boat pulling a large trawl.

Noise in the marine environment has the potential to interfere with a western gray whale's ability to communicate, although they do not communicate much while migrating or feeding. Avoidance of areas where noisy activities are occurring also has the potential to modify migration routes or displace western gray whales from feeding areas, in which case the condition and the well being of their population may be affected. Vessel noise is treated in greater detail in Sections 5.3.4.6.

9.2.7 Whaling

Because the western gray whale population is so small, any illegal harvesting is expected to have a significant impact.

9.2.8 Non-routine Oil Spills

There have been no major oil spills in the P-A License area since installation of the platform in 1998. One relatively minor oil spill (< 2 bbls) occurred in late September 1999. This spill was caused by the parting of the break-away coupling when a hawser connecting the FSO to the SALM failed. Most of the oil was recovered by the oil spill response vessel (OSRV) that was on stand-by when the spill occurred. To date, that has been the only notable spill of oil or fuel that has occurred in the P-A license area.

If an oil spill should occur, it would be expected to impact numerous resources in the area. There is little evidence of oil spills having serious impacts on whales.

Another potential impact of an oil spill is the activity and noise associated with spill clean-up operations. The presence of ships, helicopters, fixed-wing aircraft, and personnel during a period when western gray whales may be present could have negative impacts.

As discussed earlier, the western gray whale is a critically-endangered species, and would be a high-profile species susceptible to ship traffic and noise impacts associated with oil spill cleanup activities.

9.2.9 Marine Environmental Pressures Outside of Sakhalin Region

SEIC operations are not likely to have impacts on western gray whales once they leave their summer feeding grounds and migrate out of the area of increased vessel traffic, i.e. La Perouse Strait. However, impact may occur from other activities throughout the migration route and over-wintering grounds. It had previously been thought that the wintering grounds for the western gray whales were along the south coast of the Korean peninsula, but it is now believed that the wintering grounds are in the South China Sea, possibly along the coast of Guangdong province and around Hainan Island. The migration route of western gray whales between Sakhalin Island and the South China Sea is also unknown, but given the preference of gray whales for coastal waters, it probably involves a route along the east coast of Korea or west coast of Japan, and keeping close to shore through the East China Sea and into the South China Sea.

This region is among the most heavily developed in the world, with extensive industrial development along the coast in Japan, Korea, Taiwan, and China. Major cities, including Hong Kong, Macao, and Kaohsiung, are the hubs for significant vessel traffic, including tankers and fishing fleets. Many of those areas also have global reputations for air-borne and water-borne pollution. As noted above, illegal whaling may still be occurring and could impact some individuals from the western gray whale population

9.3 Cumulative Impacts on Western Gray Whales

9.3.1 Oil Spills

Other oil developments on the Sakhalin Shelf may be expected to add to the cumulative risk of an oil spill associated with the Sakhalin II development. Spills from other industrial developments (including onshore developments) and vessels (both oil-related and non-oil related) can also be expected to add to the cumulative impact of oil spills in the region.

A large oil spill would be expected to impact numerous resources in the area, including marine mammals. As noted above, whales are not particularly susceptible to oil spills. A large spill in one of their main feeding areas could have indirect effects on western gray whales through effects on their benthic prey.

To date, the record in the region has been good. Since SEIC operations began in 1998, there has been only one notable spill, and that was less than 2 bbls in 1999 associated with production operations. Determination of the future likelihood of an oil spill is clearly dependent on evaluating the effectiveness of safety protocols and procedures designed to prevent spills from occurring, and preventing them from reaching the environment in the event that they do occur.

The frequency and amount of oil spilled can be mitigated by regular maintenance and inspections, frequent training, and regular spill drills. The vast majority of spills that occur in industrial complexes are small: 84.1%of crude spills and 92.2% of product spills on the North Slope of Alaska from 1977-1997 were less than 2 barrels (84 gallons). Small releases can be expected to have localised long-term cumulative effects on western gray whales. Any such impacts will continue to be monitored in the future as part of the ongoing offshore environmental monitoring survey programme.

9.3.2 Noise

Because underwater noise propagates for long distances, the potential zone of influence around a particular vessel or other source of noise can be many tens of kilometers in radius. The zones include the area within which the underwater noise is audible to the western gray whale, the areas within which behavioural responses or auditory masking may occur, and the (theoretical) zones within which there could be hearing loss and physical damage. The various sources of underwater noise in the Sakhalin region include the development/production areas (both offshore and onshore), shipping routes, helicopter flight paths, and fishing grounds.

Because of the distance between the Piltun-Astokhskoye and the Lunskoye licence areas (~100 km), and especially between the Lunskoye Licence Area and Aniva Bay, it is unlikely that there will be overlap between the different areas' zones of influence. Western gray whales that migrate past the areas may be affected by each in turn, but there is no reason to believe that the cumulative effect would be greater than the predicted effects of the individual developments. Overall, most of the range of the eastern gray whale is used by vessels and is subject to noise and disturbance by other human activities, and the population has recovered from over harvesting. That would indicate little or no overall impacts of disturbance at the population level. Similarly, several years of seismic projects, installation and operation of an offshore drilling platform, regular aircraft and shipping traffic, and close approaches to the feeding whales by researchers in small boats have not displaced feeding western gray whales summering on the northeast Sakhalin Shelf.

9.3.3 Mitigation Measures for Cumulative Impacts

The effective mitigation of cumulative impacts must involve all parties involved in activities on the Sakhalin Shelf and in those areas through which the western gray whale migrates and over-winters. SEIC and ENL are committed to mitigating impacts on marine mammals, and it is recommended that similar mitigation measures be adopted by the fishing industry and commercial shipping. Little is known about the western gray whale's over-wintering areas, and at this time, mitigation of unknown cumulative impacts outside of the Sakhalin Region is not possible. SEIC and ENL support the idea of a satellite telemetry study to determine where the western gray whales go after they leave the waters off northeastern Sakhalin Island.