Application for Incidental Harassment Authorization for the Non-Lethal Taking of Whales and Seals in Conjunction with Proposed 2008 Open Water Tophole Section Drilling and Geotechnical Programs in the Beaufort Sea, Alaska

Submitted to:

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ATTACHMENTS

Shell Offshore Inc. (SOI) used the following guidance to prepare its request for Incidental Harassment Authorization (IHA).

> 50 CFR 216.104 "Submission of Requests"
>
> (a) In order for the National Marine Fisheries Service (NMFS) to consider authorizing the taking by U.S. citizens of small numbers of marine mammals incidental to a specified activity (other than commercial fishing), or to make a finding that incidental take is unlikely to occur, a written request must be submitted to the Assistant Administrator. All requests must include the following information for their activity:

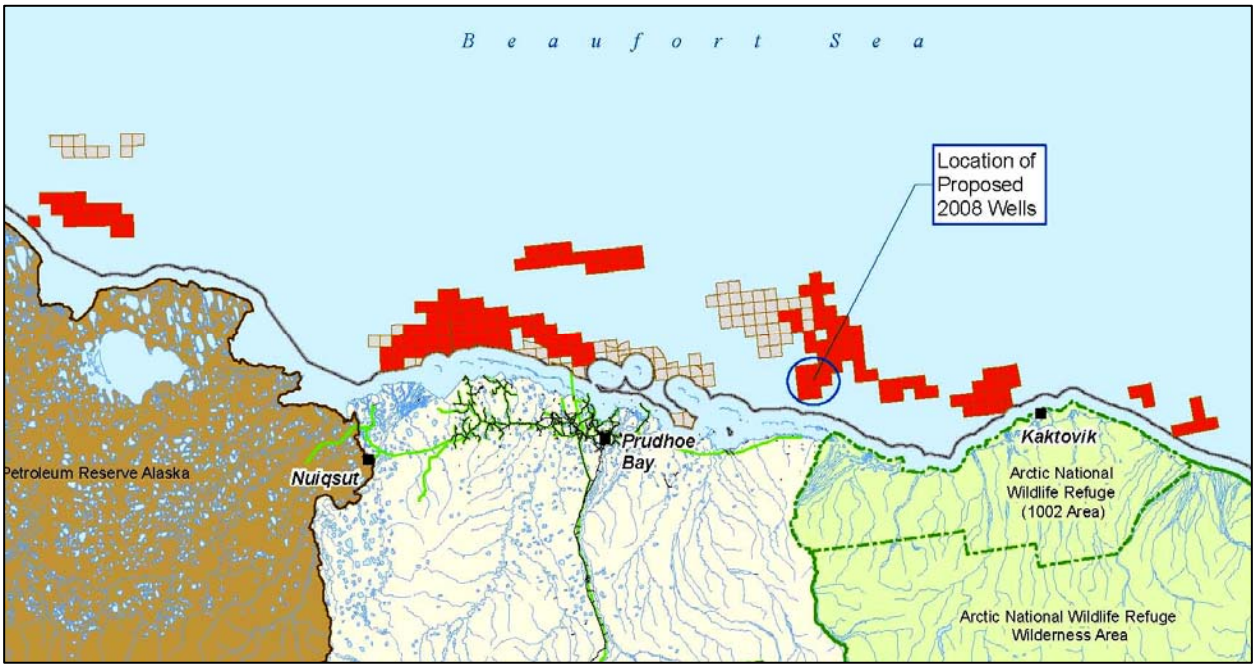
1. A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals:

Information required by 50 CFR§216.104 (a):

1.1 Open Water Exploration Drilling – Tophole Sections

SOI is proposing to utilize one drilling unit during the 2008 open water season to drill tophole sections for priority exploration targets on its U.S. Minerals Management Services (MMS) Outer Continental Shelf (OCS) leases in the Beaufort Sea acquired during MMS Lease Sale (LS) 195. SOI's highest priority exploratory targets for the 2008 season are encircled in Figure 1 and this is collectively known as Sivulliq. Sivulliq is located offshore of Pt. Thomson and Flaxman Island in Camden Bay.

Figure 1 – 2008 Open Water Exploration Drilling Program – Tophole Sections



The drilling unit to be used during 2008 is the floating, portable marine vessel, called the SOI "Kulluk". The Kulluk is 81 meters (m) (266 feet [ft]) in diameter with an 11.5 m (38 ft) draft when drilling. It is moored using 12 anchor cables, each connected to a 15 or 20-ton anchor.

The Kulluk will be accompanied by two ice management vessels or arctic class anchor handlers, and an estimated two support vessels. One of the arctic class supply vessels may make periodic re-supply trips from Tuktoyaktuk, Northwest Territories (NWT), Canada to the rig. The ice management vessels or arctic class anchor handlers which likely will be used are: M/Vs "Vladimir Ignatjuk" (VI) of the Murmansk Shipping Company fleet, and a vessel as yet to be contracted, but similar to the VI. If one or more of these specific vessels are not used, then similar vessel(s) will be substituted. The re-supply effort will be undertaken by the M/V "Jim Kilabuk" (Kilabuk) of the Northern Transportation Company Limited, and an additional multipurpose support vessel similar to the Kilabuk.

Other vessels in addition to the Kulluk, ice management/anchor handling vessels, and drilling support vessels may include the arctic-class barge called the "Endeavor" of Crowley (or similar vessel), plus an associated tug, and the Norseman II (or similar vessel), which will support the marine mammal monitoring and mitigation program in the Beaufort Sea during the 2008 open water season. Helicopter aircraft also will be used during the drilling season, helping with crew change support, provision re-supply and Search-and-Rescue operations. In addition, fixed-wing aircraft will be used for marine mammal surveillance over-flights. The aircraft operations will principally be based in Deadhorse.

SOI's Beaufort Sea open water exploration drilling program includes plans to excavate/drill only the tophole sections for three exploratory well locations. A tophole section typically includes excavation and completion of the mudline cellar (MLC) and drilling and setting of two or three deeper well sections. The MLC and the next two or three deeper well sections collectively extend to approximately 3,000 feet below the seafloor, and are referred to collectively as the "tophole" section, which is thousands of feet above any prospective liquid hydrocarbon-bearing strata. There is no measurable risk of encountering liquid hydrocarbons during the drilling of these topholes.

MLC completions are an essential component of drilling exploration wells in the Arctic Ocean where ice keel gouge might occur. The MLC is the upper most portion of an exploration well, so it is the first step of each well. The MLC is a large diameter excavation into which the blow-out preventer (BOP) and other sub-seabottom wellhead equipment are installed below the depth of possible ice scour. MLCs avoid damage to wellhead equipment possibly caused by the keel of an ice floe excavating into the sea bottom. At times during drilling, the floating drilling rig may need to disconnect from this sub-sea bottom equipment and move away, and this equipment remains to shut in the well. MLC excavations are typically 20 feet in diameter and 40 feet deep. Excavation of a MLC is done by a large diameter bit that is turned by hydraulic motors. SOI plans to excavate MLCs and complete tophole sections at Sivulliq during 2008. This is the area encircled in Figure 1 of this IHA application.

During the non-drilling season (approximately from November 2008 to July 2009), the Kulluk will be overwintered either near Hershel Island, Yukon Territory, Canada or in McKinley Bay, NWT, Canada. It may be attended at its overwinter location by one, or two ice management vessels.

Planned Mitigation

The Kulluk and all support vessels will operate in accordance with the provisions of a Plan of Cooperation (POC). The POC is developed to mitigate effects of SOI's proposed program(s) where activities would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses. SOI will consult with affected Beaufort and Chukchi Sea communities and marine mammal associations for the development of a POC. For this drilling program, SOI's POC with Chukchi Sea villages primarily will address the issue of transit of vessels, whereas the POC with Beaufort Sea villages will address vessel transit, drilling and associated activities. It is the intention of SOI to negotiate a Conflict Avoidance Agreement (CAA) with the Alaska Eskimo Whaling Commission (AEWC), and whaling captain's associations of affected

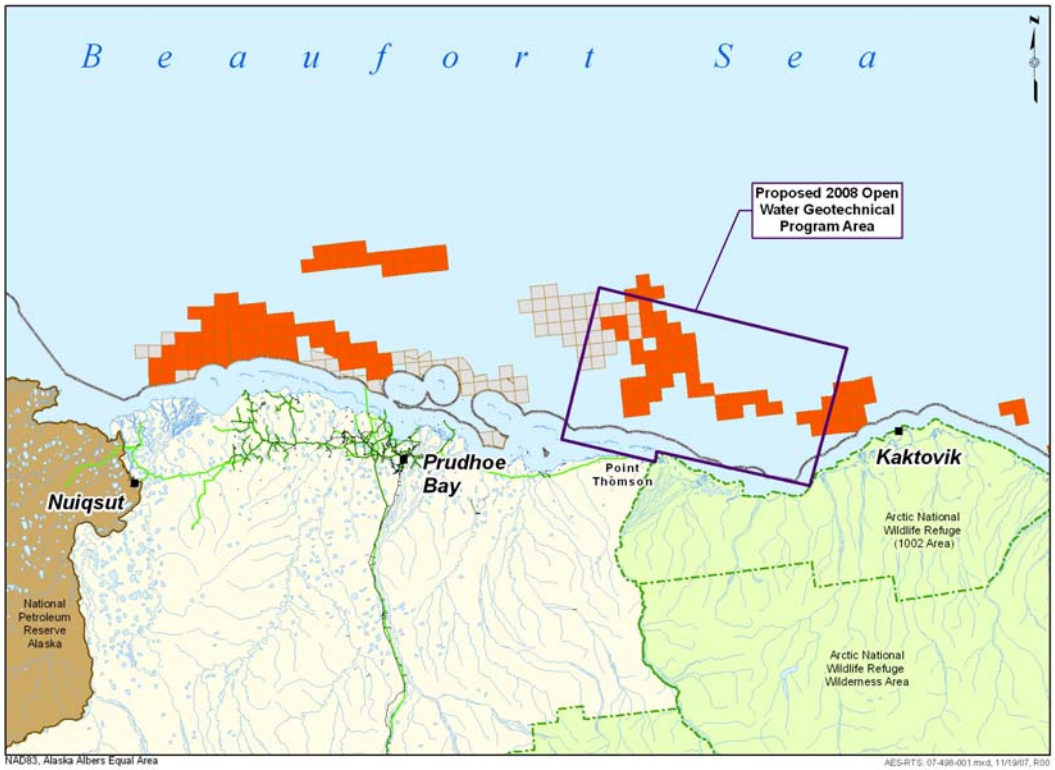
Beaufort and Chukchi Sea villages, as a component of the POC. If a CAA is negotiated with AEWC, then the provisions of the CAA will be included in the POC. In the absence of a final CAA, SOI is committed to the mitigation measures described in Section 12 (iii) of this IHA application and will instigate these measures which are intended to minimize any adverse effects on the availability of marine mammals for subsistence uses.

The POC will specify times and areas to avoid in order to minimize possible conflicts with traditional subsistence hunts by North Slope villages for transit and drilling operations. For its 2008 tophole drilling program, SOI will not operate the Kulluk and associated vessels in Camden Bay until after the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests are completed. Appropriate operational restrictions applicable for future open-water drilling activities (2009 and beyond) will be developed in consultation with affected communities; however, in future years, SOI specifically reserves the option to drill with one or more drilling rigs in the Beaufort Sea prior to and after the fall bowhead subsistence whale harvests of Kaktovik and Nuiqsut.

1.2 Open Water Geotechnical Program

Up to 20 boreholes, each up to 500 feet in depth, will be bored to obtain geotechnical data for feasibility analyses of shallow sub-sea sediments. The boreholes will be completed to depths well above any liquid hydrocarbon-bearing strata. Approximately three potential locations will be investigated at Sivulliq, as well as locations along a prospective pipeline access corridor through Mary Sachs Entrance to landfall in the vicinity of Point Thomson (Figure 2).

Figure 2 – Proposed 2008 Open Water Geotechnical Program Area



The open water geotechnical program will use borehole excavating equipment mounted on a marine vessel (geotechnical vessel) to advance boreholes through a moonpool located approximately at mid-ship of the geotechnical vessel. The geotechnical vessel also will have an electronic cone penetrometer (CPT) mounted on it. If used, the CPT unit will collect in-situ soil/sediment sub-sea samples to approximately 150 feet below the mudline. SOI will select the contractor to conduct this activity during February 2008. Afterwards, the name and specifications of the vessel should be known and SOI will then inform NMFS.

Shallow sub-sea bottom sampling for geotechnical analyses at the Sivulliq Prospect and along the access corridor will use a seabed frame to either push a sample tube or a cone penetration test into the seafloor. Other bottom sediment sampling proposed includes piston coring to a maximum depth of 10 feet sub-sea bottom, and box coring to a maximum depth of 1-foot sub-sea bottom.

2. The dates and duration of such activity and the specific geographic region where it will occur:

Anticipated Duration of this Permit

SOI anticipates that the IHA issued by NMFS for the proposed 2008 Beaufort Sea tophole section drilling and open water geotechnical program will be valid for one year from the date of issuance.

2.1 Open Water Exploration Drilling – Tophole Sections

SOI's priority drilling prospects for the 2008 open water season occur at Sivulliq (Figure 1), located in Camden Bay of the Beaufort Sea. As planned, it is anticipated that the Kulluk will excavate and drill tophole sections for three exploratory wells during the 2008 open water season. For its 2008 tophole section drilling program, SOI will not operate the Kulluk and associated vessels in Camden Bay until after the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests are completed. Anticipated demobilization of the Kulluk from the Alaskan Beaufort Sea will be in November 2008. In total, it is anticipated by SOI that the tophole section drilling program will require approximately 60 days, excluding weather or other operational delays, beginning with mobilization from the Tuktoyaktuk Buoy and ending with return of the Kulluk to the Canadian Beaufort Sea near Tuktoyaktuk. SOI assumes approximately 50 of the 60 days of this program will include drilling, while the remaining days include rig mobilization, rig moves between locations, and rig demobilization.

SOI's base plan is for two ice management vessels, the VI and one other similar vessel, to accompany the Kulluk from its overwintering location (near Hershel Island or in McKinley Bay) to Sivulliq. An ice management vessel of similar capabilities to the VI, may travel north through the Chukchi Sea and east through the Beaufort Sea after July 1, 2008, before arriving in Canadian waters to assist in the Kulluk mobilization. In November 2008, SOI expects to demobilize the Kulluk. One or two ice management vessels, along with various support vessels such as the MV Jim Kilabuk, will accompany the Kulluk as it travels east to the Canadian Beaufort Sea (McKinley Bay or Hershel Island). One or more of these ice management vessels may remain with the Kulluk during the winter season if the rig overwinters at Herschel Island. SOI's base plan for exit from the Beaufort Sea for ice management vessels which are not overwintered with the Kulluk is to exit via the west. Subject to ice conditions alternate exit routes may be considered.

2.2 Open Water Geotechnical Program

The open water geotechnical program is expected to begin in July 2008. Including operational delays, it is anticipated that geotechnical borings, CPT sampling, piston and box coring sampling may be

completed in approximately 50 days of work. SOI plans to complete the geotechnical program prior to the fall bowhead whale subsistence harvests of the communities of Kaktovik and Nuiqsut. SOI will not operate the geotechnical program in Camden Bay during the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests. If SOI is unable to complete the planned geotechnical program before the onset of fall whaling for Kaktovik and Nuiqsut, SOI would return to Sivulliq, and/or prospective pipeline corridor after the conclusion of the harvest to complete the program.

The proposed geotechnical borehole locations include Sivulliq and the Pt. Thomson to Sivulliq prospective pipeline access corridor through Mary Sachs Entrance (Figure 2). The locations of each boring will be determined in the field, based on local subsea terrain and results of analysis of geotechnical soil samples and CPT testing.

3. Species and numbers of marine mammals in area:

The species and numbers of marine mammals likely to be found within this portion of the Beaufort Sea are listed in Table 4-1.

A total of three cetacean species (bowhead, gray, and beluga whale), and three species of pinnipeds (ringed, spotted, and bearded seal) are known to occur in or near the proposed tophole section drilling and open water geotechnical program (geotechnical program) areas. Other extralimital species that occasionally occur in very small numbers in this portion of the Alaskan Beaufort Sea include the harbor porpoise, and narwhal. Because of the rarity of these mammals in this area, they are not expected to be exposed to or affected by any activities associated with the tophole section drilling, or the geotechnical program. Given the rarity of the harbor porpoise or narwhal in this area stock discussions of these other cetaceans (Section 4) are not included in this IHA application, but density and exposure estimates for these two other cetacean species are included (Section 6).

Of the potentially affected species listed above, only the bowhead whale is listed as “Endangered” under the Endangered Species Act (ESA). Other ESA-listed species, which are known to occur in the adjacent Bering Sea include Steller sea lion, sperm whale, humpback whale, fin whale, blue whale, and northern right whale; however, these species are considered to be extralimital in the Chukchi and Beaufort Seas. Due to the very remote chance of interaction or potential impact, these species are not discussed further under this IHA application.

In an effort to reduce redundancy, the required information about these species and abundance estimations (to the extent known) of these species is included in Section 4 below.

4. Status, distribution and seasonal distribution of affected species or stocks of marine mammals:

The following six species of cetaceans and seals can be expected to occur in the region of the proposed tophole section drilling activity and geotechnical program: bowhead, gray and beluga whales, and ringed, spotted and bearded seals. These six species are the species for which general regulations governing potential incidental takes of small numbers of marine mammals are sought. As noted above, harbor porpoise and narwhal are rare in this area and these species are not discussed further under Section 4. The geographic boundaries and distribution, primary habitats, and population trends and risks are discussed under theses six species: bowhead, gray and beluga whales, and ringed, spotted and bearded seals.

Three species of marine mammals—the Pacific walrus, sea otter, and polar bear—are managed by the U.S. Fish and Wildlife Service (USFWS) and are not discussed further in this IHA application to NMFS.

TABLE 4-1
Species That May Be Encountered During Activities

A list of species that may be encountered during activities within the Beaufort Sea, including their habitats, conservation status, and estimated abundance numbers.

Species (Stock)	Habitat	Beaufort Sea Stock and/or ESA Status [1]	Estimated Abundance [2]
Cetaceans			
bowhead whale (*Balaena mysticetus*) (Western Arctic stock)	Pack ice and coastal	ESA listed as Endangered, listed as depleted under MMPA, and classified as a strategic stock	10,545
gray whale (*Eschrichtius robustus*) (eastern north Pacific)	Coastal, lagoons	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	18,813
beluga whale (*Delphinapterus leucas*) (Beaufort Sea/eastern Chukchi Sea)	Offshore, coastal, ice edges	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	39,258/3,710
Pinnipeds			
ringed seal (*Phoca hispida*) (Alaska)	Landfast and pack ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Up to 3.6 million; Currently, no reliable abundance estimate is available for the Beaufort Sea, however, combined with surveys from the Chukchi Sea, approximately 249,000 are estimated.
spotted seal (*Phoca largha*)	Pack ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Several thousand and several tens of thousands. An estimate with correction using 1992 data =59,214 seals but is preliminary at best.
bearded seal (*Erignathus barbatus*)	Pack ice	Not listed under ESA, not listed as depleted under MMPA, and not classified as a strategic stock	Currently, no reliable abundance estimate is available for this stock. Early estimates of the Bering-Chukchi Seas ranged from 250,000 to 300,000.

1. ESA = Endangered Species Act. Stocks listed as depleted under the MMPA (Marine Mammal Protection Act) is described as any stock that falls below its optimum sustainable population (OSP) must be classified as "depleted," 16 U.S.C. § 1362(1)(A). The numeric threshold for OSP has been interpreted by NMFS and USFWS as being above 0.6 K (i.e. greater than 60 percent of K, or carrying capacity). In other words, a stock that dropped in numbers to below 60 percent of K would qualify as "depleted" under the MMPA. The term "strategic stock" is defined as a marine mammal stock: (A) for which the level of direct human-caused mortality exceeds the Potential Biological Removal level; (B) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA of 1973 . . . within the foreseeable future; or (C) which is listed as a threatened species or endangered species under the ESA of 1973 . . ., or is designated as depleted under [the MMPA].
2. See text under individual species for population estimate sources.

Bowhead Whale (*Balaena mysticetus*)

The Western Arctic stock (discussed below) is distributed in seasonally ice-covered waters of the Arctic and near-arctic, generally between 60 and 75 degrees N latitudes in the western Arctic Basin (Moore and Reeves 1993). Currently, five bowhead whale stocks are recognized by the International Whaling Commission (IWC 1992). Small stocks occur in the Canadian Arctic and West Greenland (Baffin Bay, Davis Strait, and Hudson Bay), the Okhotsk Sea (eastern Russia), and the Northeast Atlantic from Spitzbergen westward to eastern Greenland (Zeh et al. 1993). The largest population is the Western Arctic stock, also know as the Bering, Chukchi, and Beaufort Sea stock (Rugh et al. 2003), and is the focus of this IHA.

In Alaskan waters, the majority of bowhead whales winter in the central and northwestern Bering Sea (November to March), migrate through the Chukchi Sea in the spring (March through June) following offshore ice leads around the coast of Alaska, and summer in the Canadian Beaufort Sea (mid-May through September) (Braham et al. 1980; Moore and Reeves 1993).

Bowheads tend to migrate west in deeper water (farther offshore) during years with higher-than average ice coverage than in years with less ice (Moore 2000). During fall migration, most bowheads migrate west in water ranging from 15 to 200 m deep (Miller et al. 2002 *in* Richardson and Thomson 2002); some individuals enter shallower water, particularly in light ice years, but very few whales are ever seen shoreward of the barrier islands.

Bowhead whales typically reach the Barrow area during their westward migration from the feeding grounds in the Canadian Beaufort Sea in mid-September to late-October. Although, over the years, local residents report having seen a small number of bowhead whales feeding off Barrow or in the pack-ice off Barrow during the summer, indicating that this area may be an important feeding area. Autumn bowhead whaling near Barrow normally begins in mid-September, but may begin as early as August if whales are observed and ice conditions are favorable (USDOI/BLM 2005). Whaling can continue into October, depending on the quota and conditions.

The pre-exploitation population of bowhead whales in the Bering, Chukchi, and Beaufort Seas is estimated to be 10,400 to 23,000 individual whales, and was reduced by commercial whaling to perhaps 3,000 individuals (Woodby and Botkin 1993). Up to the early 1990s, the population size was believed to be increasing at a rate of about 3.2 percent per year (Zeh et al. 1996; Angliss and Lodge 2002) despite annual subsistence harvests of 14 to 74 bowheads from 1973 to 1997 (Suydam et al. 1995) and 42, 35, 49, 37, and 35 in 1999 through 2003, respectively (Suydam and George 2004). This is consistent with an annual population growth rate of 3.4 percent (95 percent CL 1.7-5 percent) from 1978 to 2001 reported by George et al. (2004) who estimated the population in 2001 at approximately 10,470 animals. Based on the most recent abundance estimates using 2001 data, approximately 10,545 bowhead whales make up the Western Arctic stock, with a minimum estimate [coefficient of variation [CV](N) = 0.128] of 9,472 whales (Angliss and Outlaw 2005).

The inclusion of the abundance estimate for 2001 results in a rate of increase of 3.5 percent (confidence intervals [CI] = 2.2 to 4.9 percent) (Brandon and Wade 2004 *cited in* Angliss and Outlaw 2005). Calf counts in 2001 was the highest recorded at 121 individuals, and lends building evidence of a growing population.

This bowhead population is currently listed as Endangered under the ESA and is classified as a strategic stock by NMFS (Angliss and Outlaw 2005).

Gray Whale (*Eschrichtius robustus*)

Gray whales originally inhabited both the North Atlantic and North Pacific oceans. The Atlantic populations are believed to have become extinct by the early 1700s, while a relic population survives in the western North Pacific. The eastern North Pacific or California gray whale population has recovered significantly from commercial whaling, and now numbers about 18,813 individuals, and this stock is the focus for this IHA (Angliss and Outlaw 2005).

The eastern North Pacific population of the gray whale ranges from the Bering, Chukchi, and Beaufort Seas (in summer) to the Gulf of California (in winter) (Rice 1998). Gray whales have also been documented foraging during summer in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and California (Rice and Wolman 1971; Berzin 1984; Darling 1984; Quan 2000; Calambokidis et al. 2002). Most of the eastern North Pacific population migrates annually from Alaska waters to Baja California in Mexico, more than 8,000 kilometers (km) (5,000 miles [mi]) roundtrip. From late-May to early-October, the majority of the population concentrates in the northern and western Bering Sea and the Chukchi Sea.

Gray whales are found primarily in shallow water, and usually remain closer to shore than any other large cetacean. Gray whales are considered common in the nearshore waters of the eastern Chukchi Sea, and occasionally are seen east of Point Barrow in late-spring and summer. On wintering grounds, mainly along the west coast of Baja California, gray whales utilize shallow, nearly land-locked lagoons and bays (Rice et al. 1981). From late-February to June, the population migrates back to arctic and subarctic seas (Rice and Wolman 1971).

Most summering gray whales congregate in the northern Bering Sea, particularly off St. Lawrence Island and in the Chirikov Basin (Moore et al. 2000b & c), and in the southern Chukchi Sea. More recently, Moore et al. (2003) suggested that gray whale use of Chirikov Basin was reduced, likely as a result of the combined effects of changing currents resulting in altered secondary productivity dominated by lower quality food. The northeastern-most of the recurring feeding areas is in the northeastern Chukchi Sea southwest of Barrow (Clarke et al. 1989).

Small numbers of gray whales has been observed entering the Beaufort Sea east of Point Barrow. Maher (1960) reported hunters at Cross Island took one gray whale in 1933. Aerial surveys conducted in the central Alaskan Beaufort Sea documented only one gray whale from 1979 to 1997. Since 1997, small numbers of gray whales have been documented on several occasions in the central Alaskan Beaufort Sea mainly in the Harrison Bay area (Miller et al. 1999; Treacy 2000). Other reports of single gray whale sightings have been documented farther east of Harrison Bay (Rugh and Fraker 1981). In August 2001, Williams and Coltrane (2002) reported a single sighting of a gray whale near the Northstar production facility, indicating that small numbers do travel through the waters offshore from the Prudhoe Bay region during some summers. Given their rare occurrence in the eastern portion of the Beaufort Sea in summer, no more than a few are expected during the summer and early fall.

Gray whales have been counted as they migrate southward past Granite Canyon in central California each year since 1967. The most recent abundance estimates are from southbound migration counts in 1997/98, 2000/01, and 2001/02 periods with abundance estimates for the aforementioned periods of 29,758, 19,448, and 18,178, respectively (Rugh et al. [in press] *in* Angliss and Outlaw 2005).

Previous variations in estimates may be attributed to differences in the proportion of the gray whale stock migrating as far as the central California coast each year. The decline in abundance estimates between 2000/01, and 2001/02 may be an indication that the abundance was responding to environmental limitations as the population approaches carrying capacity (Angliss and Outlaw 2005). The lower counts conducted in 2000/01 and 2001/02 may have been due to a large number of whales that did not migrate as

far south as Granite Canyon, or possibly, abundance may have actually declined following high mortality rates documented in 1999 and 2000 (Rugh et al. [in press] *cited in* Angliss and Outlaw 2005; Gulland et al. 2005).

Using the mean of the 2000/01 and 2001/02 abundance estimates noted above is 18,813 animals (Angliss and Outlaw 2005). Gray whale numbers increased steadily until at least 1998, with an estimated annual growth rate of 3.3 percent between 1967 and 1988 (Buckland et al. 1993). More recent estimated growth rates from 1967/68 through 2001/02 indicate and annual growth rate of 1.9 percent (SE = 0.32 percent) (Rugh et al. [In press] *in* Angliss and Outlaw 2005). In addition, Rugh et al. (in press) estimated carrying capacity of 26,290 (CV = 0.059), indicating that recent reductions in abundance estimates may be a function of the population reaching its carrying capacity.

The eastern Pacific stock was removed from the Endangered Species List in 1994 and is not considered by NMFS to be a strategic stock.

Beluga Whale (*Delphinapterus leucas*)

The beluga whale is an Arctic and subarctic species with several populations (stocks) occurring in Alaska: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet (O'Corry-Crowe et al. 1997, Angliss and Lodge 2004). For the proposed project, only the Beaufort Sea stock and eastern Chukchi Sea stocks will be encountered. Some eastern Chukchi Sea animals enter the Beaufort Sea in late summer (Suydam et al. 2001).

Beluga whales of the Beaufort stock winter in the Bering Sea, summer in the eastern Beaufort Sea, and migrate around western and northern Alaska (Angliss and Lodge 2002). The majority of belugas in the Beaufort stock migrate into the Beaufort Sea in April or May, although some whales may pass Point Barrow as early as late March and as late as July (Braham et al. 1984; Ljungblad et al. 1984; Richardson et al. 1995).

Much of the Beaufort Sea seasonal population enters in the Mackenzie River estuary for a short period during July and August to molt their epidermis, but they spend most of the summer in offshore waters of the eastern Beaufort Sea and Amundsen Gulf (Davis and Evans 1982; Harwood et al. 1996). Belugas are rarely seen in the central Alaskan Beaufort Sea during the summer. During late summer and autumn, most belugas migrate far offshore near the pack ice front (Hazard 1988; Clarke et al. 1993; Miller et al. 1998) and may select deeper slope water independent of ice cover (Moore et al. 2000b). Small numbers of belugas are sometimes observed near the north coast of Alaska during the westward migration in late-summer and autumn (Johnson 1979) but the main fall migration corridor of beluga whales is greater than 100 km (62 mi) north of the coast. Aerial- and vessel-based seismic monitoring programs conducted in the central Alaskan Beaufort Sea from 1996 through 2001 observed only a few beluga whales migrating along or near the coast (LGL and Greeneridge 1996; Miller et al. 1998, 1999). The vast majority of belugas seen during those projects were far offshore. Satellite-linked telemetry data show that some belugas migrate west considerably farther offshore, as far north as 78 degrees N latitude (Richard et al. 1997, 2001).

The Beaufort population was estimated to contain 39,258 individuals as of 1992 (Angliss and Lodge 2002). This estimate is based on the application of a sightability correction factor of 2 times to the 1992 uncorrected census of 19,629 individuals made by Harwood et al. (1996). This estimate was obtained from a partial survey of the known range of the Beaufort Sea population and may be an underestimate of the true population size. This population is not considered by NMFS to be a strategic stock but the current population trend of the Beaufort Sea stock of beluga whales is unknown (Angliss and Outlaw 2005).

The abundance estimate considered the "most reliable" for the eastern Chukchi Sea beluga whale stock is 3,710, a result from 1989 to1991 aerial surveys (Frost et al. 1993, Angliss and Lodge 2004). Additional surveys were conducted in 1998 (DeMaster et al. 1998) and again in July 2002 (Lowry and Frost 2002, *cited in* Angliss and Outlaw 2005), but both were partial surveys and therefore, a more recent abundance estimate is not available.

This Chukchi Sea stock will not likely be encountered during the tophole section drilling or geotechnical program in the eastern Beaufort Sea. The population size is considered stable and not considered to be a strategic stock.

Ringed Seal (*Phoca hispida*)

In the North Pacific, ringed seals are found in the southern Bering Sea and range as far south as the Seas of Okhotsk and Japan. Ringed seals have an affinity for ice-covered waters and are well adapted to occupying seasonal and permanent ice, and are year-round residents throughout the Beaufort, Chukchi, and Bering Seas, as far south as Bristol Bay in years of extensive ice coverage. They tend to prefer large floes (more than 48 m in diameter) and are often found in the interior ice pack where the sea ice coverage is greater than 90 percent (Simpkins et al. 2003), and remain in contact with ice most of the year and pup on the ice in late winter to early spring.

During winter, ringed seals occupy landfast ice and offshore pack ice of the Bering, Chukchi, and Beaufort Seas. Ringed seals maintain breathing holes in the ice and occupy lairs in accumulated snow (Smith and Stirling 1975). They give birth in lairs from mid-March through April, nurse their pups in the lairs for 5 to 8 weeks, and mate in late April and May (Smith 1973; Hammill et al. 1991; Lydersen and Hammill 1993).

During late April through June, ringed seals are distributed throughout their range from the southern ice edge northward (Braham et al. 1984). Preliminary results from recent surveys conducted in the Chukchi Sea in May and June 1999 and 2000 indicate that ringed seal density is higher in nearshore fast and pack ice, and lower in offshore pack ice (Bengtson et al. (in review) *cited in* Angliss and Outlaw 2005). Frost and Lowry (1999) conducted surveys in May and results indicated that, in the Alaskan Beaufort Sea, the density of ringed seals in May and June is greater to the east of Flaxman Island than to the west.

No estimate for the size of the Alaska ringed seal stock is currently available (Angliss and Outlaw 2005). Past ringed seal population estimates in the Bering, Chukchi, and Beaufort Sea areas ranged from 1 to 3.6 million (Frost et al. 1988). Frost and Lowry (1981) estimated 80,000 ringed seals in the Beaufort Sea during summer and 40,000 during winter.

Aerial surveys within 20 nautical miles (nm) of shore were conducted in May and June between 1986 and 1987 for a portion of the range of the ringed seal estimated a population of 44,360 +/-9,130 (96 percent CI) (Frost et al. 1988). Spring density estimates in the same area from 1985 to 1987 ranged from 1.01 to 2.94 seals/square kilometers (km^2) (Frost et al. 1988). Similar surveys for the Alaska Beaufort Sea between Kaktovik and Barrow occurred in the spring during several years in the 1990s with density estimates for all years ranging from 0.81-1.17 seals/km^2 with a mean of 0.98 seals/km^2 or approximately 18,000 hauled out ringed seals in the survey area. Surveys conducted in 1999 and 2000 between Shishmaref to Barrow in the eastern Chukchi Sea estimated abundance of ringed seals at 252,488 (SE = 47,204) and 208,857 (SE = 25,502), respectively (Bengtson et al. [in review] *cited in* Angliss and Outlaw 2005). Combining the numbers of Alaska Beaufort Sea ringed seals with the average abundance estimate of 230,673 seals from the eastern Chukchi Sea, results in a total of 249,000 seals.

It is not known whether the more recent lower densities correspond to an actual reduction in the population or are related to earlier survey dates in 1990s. At earlier dates, a higher proportion of the seals

are still using their lairs and are unavailable to be counted by aerial surveyors (Kelly et al. 2005). Frost et al. (2002) reanalyzed the earlier estimates for 1985-87 and reported ringed seal densities surveyed between Oliktok Point and Flaxman Island ranged from 0.56 to 1.16 seals/km^2 (about half the density originally reported) during the spring seasons of 1985 to 1987. Based on more recent surveys from 1996 through 1999, ringed seal density in fast-ice areas between Oliktok Point and Flaxman Island ranged from 0.48 to 0.77 seals/km^2 (Frost et al. 2002).

BP's Northstar project, located near Prudhoe Bay, developed a seal survey and monitoring program to establish a baseline prior to construction and to monitor during initial operations for comparison. Ringed seal densities reported by Moulton et al. (2002) ranged from 0.39 to 0.63 seals/km^2 prior to construction in the Northstar development area. Ringed seal densities close to Northstar in 2000, 2001, and 2002 were not reduced relative to those farther away or to those during the 1997 to 1999 pre-development period (Moulton et al. 2003 a, b); however, because aerial surveys will underestimate actual seal densities, the above density figures should be used as minimum estimates.

During summer, ringed seals are found dispersed throughout open water areas, although in some regions they move into coastal areas (Smith 1987; Harwood and Stirling 1992). During the open water period, ringed seals in the eastern Beaufort Sea are widely dispersed as single animals or small groups (Harwood and Stirling 1992). Marine mammal monitoring in the nearshore central Beaufort Sea confirms these generalities (Moulton and Lawson 2002; Williams et al. 2004).

Large concentrations of ringed seals are not expected to be encountered during the tophole section drilling or geotechnical program. The Alaska stock of ringed seals is not classified as a strategic stock by the NMFS.

Spotted Seal (*Phoca largha*)

Spotted seals occur in the Beaufort, Chukchi, Bering and Okhotsk Seas, and south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay 1977). Based on satellite tagging studies, spotted seals migrate south from the Chukchi Sea in October and pass through the Bering Strait in November and overwinter in the Bering Sea along the ice edge (Lowry et al. 1998).

During spring when pupping, breeding and molting occur, spotted seals tend to prefer small floes (less than 20 m in diameter), and inhabit mainly the southern margin of the ice in the Okhotsk and Bering Seas, with movement to coastal habitats after the retreat of the sea ice (Shaughnessy and Fay 1977; Quakenbush 1988; Rugh et al. 1997; Simpkins et al. 2003).

In summer, the majority of spotted seals are found in the Bering and Chukchi Seas, but do range into the Beaufort Sea (Rugh et al. 1997; Lowry et al. 1998) from July until September. At this time of year, spotted seals haul out on land part of the time, but also spend extended periods at sea. The seals are most commonly seen in bays, lagoons, and estuaries and are typically not associated with pack ice unless it is near to shore.

A small number of spotted seal haul-outs are documented in the central Beaufort Sea near the deltas of the Colville River and, previously, the Sagavanirktok River. Historically, these sites supported as many as 400 to 600 spotted seals, but in recent times less than 20 seals have been seen at any one site (Johnson et al. 1999).

As the ice cover thickens with the onset of winter, spotted seals leave the northern portions of their range and move into the Bering Sea (Lowry et al. 1998).

Previous studies from 1996 to 2001 indicate that few spotted seals (a few tens) utilize the central Alaskan Beaufort Sea (Moulton and Lawson 2002; Treacy 2002 a, b). In total, there are probably no more than a

few tens of spotted seals along the coast of the central Alaska Beaufort Sea during summer and early fall with very few, if any, occurring in the eastern portion of the Beaufort Sea.

A reliable abundance estimate for spotted seal is not currently available (Angliss and Outlaw 2005), however, early estimates of the size of the world population of spotted seals was 335,000 to 450,000 animals and the size of the Bering Sea population, including animals in Russian waters, was estimated to be 200,000–250,000 animals (Burns 1973 *cited in* Angliss and Lodge 2004). The total number of spotted seals in Alaskan waters is not known (Angliss and Lodge 2004), but the estimate is most likely between several thousand and several tens of thousands (Rugh et al. 1997). Using maximum counts at known haul-outs from 1992 (4,135 seals), and a preliminary correction factor for missed seals developed by the Alaska Department of Fish and Game (Lowry et al. 1994), an abundance estimate of 59,214 was calculated for the Alaska stock (Angliss and Lodge 2004).

The activities associated with the tophole section drilling or geotechnical program in the Beaufort Sea are expected to encounter few to no spotted seals. The Alaska stock of spotted seals is not classified as a strategic stock by NMFS.

Bearded Seal (*Erignathus barbatus*)

Bearded seals are associated with sea ice and have a circumpolar distribution (Burns 1981). Bearded seals are predominately benthic feeders, and prefer waters less than 200 m in depth.

Seasonal movements of bearded seals are directly related to the advance and retreat of sea ice and to water depth (Kelly 1988). During winter they are most common in broken pack ice and in some areas also inhabit shorefast ice (Smith and Hammill 1981). In Alaska waters, bearded seals are distributed over the continental shelf of the Bering, Chukchi, and Beaufort Seas, but are more concentrated in the northern part of the Bering Sea from January to April (Burns 1981).

During winter, most bearded seals in Alaskan waters are found in the Bering Sea. In the Chukchi and Beaufort Seas, favorable conditions are more limited, and consequently, bearded seals are less abundant there during winter. From mid- to late-April to June, as the ice recedes, some of the bearded seals migrate northward through the Bering Strait and spend the summer along the ice edge in the Chukchi Sea (Burns 1967; Burns 1981).

Recent spring surveys along the Alaskan coast indicate that bearded seals tend to prefer areas of between 70 and 90 percent sea-ice coverage, and are typically more abundant greater than 20 nm of shore, with the exception of high concentrations nearshore to the south of Kivalina in the Chukchi Sea (Bengtson et al. 2000; Simpkins et al. 2003).

During the summer in the Chukchi Sea, bearded seals are most associated with the pack ice edge near the continental shelf. The nearshore areas of the central and western Beaufort Sea provide somewhat more limited habitat because the continental shelf is narrower and the pack ice edge frequently occurs seaward of the shelf and over waters greater than 200 m in depth. The preferred habitat in the Beaufort Sea during the open water period is the continental shelf seaward of the scour zone.

A reliable abundance estimate for the Alaska stock of bearded seals is currently not available. The most recent surveys occurred in May-June of 1999 and 2000 between Shishmaref and Barrow with average densities of 0.07 seals per km^2 and 0.14 seals per km^2, respectively, however, there is no correction factor available for these data. Early estimates of the Bering and Chukchi Sea population ranged from 250,000 to 300,000 (Burns 1981).

No reliable estimate of bearded seal abundance is available for the Beaufort Sea (Angliss and Lodge 2002). Aerial surveys conducted by MMS in fall 2000 and 2001 sighted a total of 46 bearded seals

during survey flights conducted between September and October (Treacy 2002 a, b), with all but two sightings recorded east of 147 degrees W and all sightings were within 40 nm of shore. Aerial surveys conducted from 1997 to 2002 in the vicinity of Northstar Island also reported small numbers (up to 15) of bearded seals (Moulton et al. 2003c).

The tophole section drilling or geotechnical program may encounter bearded seals during the open-water season, however, the number of bearded seals is expected to be small. The Alaska stock of bearded seals is not classified by NMFS as a strategic stock.

5. The type of incidental taking authorization that is being requested (i.e. takes by harassment only; takes by harassment, injury and /or death) and the method of incidental taking:

The only type of incidental taking sought in this application is that of takes by noise harassment. The only sources of project created noise for the tophole section drilling will be those stemming from the Kulluk and its support vessels, while noise for the geotechnical program will be solely from the geotechnical vessel. Although the bulk of the activity will be centered in the area of tophole section drilling or geotechnical activities, potential exposures, or impacts to marine mammals also will occur as the drilling vessel, and ice management vessels, and/or geotechnical vessel mobilize to and from Camden Bay for the respective programs.

Historical noise propagation studies were performed on the Kulluk (Hall et al. 1994) in the Kuvlum prospect drill sites (approximately 12 miles east of SOI's Sivulliq prospect) that SOI is proposing to drill during 2008 and 2009. Acoustic recording devices were established at 10 m and 20 m depths below water surface at varying distances from the Kulluk and decibel (dB) levels were recorded during drilling operations. There were large differences between sound propagation between the different depths. At 10 m water depth, the 120-db threshold had a 0.7 km radius around the Kulluk, and the 105 db threshold was an 8.5 km radius. At depth of 20 m below water surface, the 120-db thresholds had a radius of 8.5 km and the 105 db had a radius of 100 km. There is no obvious explanation for the large differences in propagation at the different levels. Possible explanations include the presence of an acoustic layer due to melting ice during the sound studies and/or sound being channeled into the lower depths due to the seafloor topography.

New sound propagation studies may be performed on the Kulluk, ice management, and geotechnical vessel, once these are on locations for tophole section drilling or geotechnical activities in the Beaufort Sea.

6. Numbers of marine mammals that may potentially be taken:

SOI seeks authorization for potential "taking" of small numbers of marine mammals under the jurisdiction of the NMFS in the proposed region of activity. Species for which authorization is sought are bowhead, gray, and beluga whales, and ringed, spotted, and bearded seals. Exposure estimates and requests for takes of harbor porpoise and narwhal are included, but are very minimal.

The only anticipated impacts to marine mammals are associated with noise propagation from tophole section drilling activities and associated support vessels, or the geotechnical program. Impacts would consist of temporary and short term displacement of seals and whales from within ensonified zones produced by such noise sources.

The tophole section drilling activities and geotechnical program in the Beaufort Sea proposed by SOI are not expected to "take" more than small numbers of marine mammals, or have more than a negligible

effect on their populations. Discussions of estimated "takes by harassment" are presented below separately for the tophole section drilling and the geotechnical program. The discussion of exposure estimates for the tophole section drilling also includes a subset discussion of exposures due to transit of the Kulluk from the Canadian Beaufort Sea to the Alaskan Beaufort Sea and back at the end of tophole section drilling.

6.1 Exposure Estimates for Open Water Exploration Drilling - Tophole Sections

All anticipated takes would be "takes by harassment", involving temporary changes in behavior. The mitigation measures to be applied will minimize the possibility of injurious takes. (However, there is no specific information demonstrating that injurious "takes" would occur even in the absence of the planned mitigation measures.) In the sections below, we describe methods to estimate "take by harassment" and present estimates of the numbers of marine mammals that might be affected during the proposed tophole section drilling program in the Beaufort Sea. The estimates are based on data obtained during marine mammal surveys in and near the proposed tophole section drilling sites and on estimates of the sizes of the areas where effects could potentially occur. Adjustments to reported population or density estimates were made to account for population increases or declines insofar as possible.

The main sources of distributional and numerical data used in deriving the estimates are described in the next subsection. There is some uncertainty about the representativeness of those data and the assumptions used below to estimate the potential "take by harassment". However, the approach used here seems to be the best available at this time.

This section provides estimates of the number of individuals potentially exposed to continuous sound levels ≥160 dB re 1 µPa (rms) produced by a single drilling vessel and non-continuous sounds produced by at least two ice-management vessels, and two support vessels. We also estimate the number of individuals potentially exposed to sound levels ≥120 dB re 1 µPa (rms) because some species, like the bowhead whale, have been observed under certain circumstances to avoid impulsive and continuous sound sources at approximately those levels. Other species, such as ringed and bearded seals, are unlikely to react at those sound levels and distances, but data are lacking for those species. There is no evidence that avoidance at those levels would have significant effects on individual animals or that the subtle changes in behavior or movements would "rise to the level of taking" according to guidance by NMFS (NMFS 2001). Any changes in behavior caused by sounds at or near the 120 dB level fall within the normal variation in such activities that would occur in the absence of drilling activities. For its 2008 tophole section drilling program, SOI will not operate the Kulluk and associated vessels in Camden Bay until after the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests are completed. For estimating purposes, exposure estimates are based on a single drilling vessel (*Kulluk*) and associated vessels operating in Camden Bay by the nominal start date of September 10th. This is a conservative assumption and was used to preserve the option to begin drilling activities on this date, if the hunt ends soon. While it is possible that the bowhead whale subsistence hunt could last beyond September 10th, sounds created by tophole section drilling activities in Camden Bay have been assumed to begin approximately September 10th and end approximately November 10th. Actual drilling activities may occur on approximately 50 days that the Kulluk is assumed to be in Camden Bay, while 60 days have been assumed for the overall tophole section drilling program including transit of the Kulluk from and to the Canadian Beaufort Sea.

Basis for Estimating "Take by Harassment"

Numbers of marine mammals that might be present and potentially disturbed are estimated below based on available data about mammal distribution and densities in the eastern Alaskan Beaufort Sea during the fall (Sep - Nov). The area of water within which received sounds from drilling activities may, at times, be ≥160 dB and ≥120 dB covers two general habitat zones of beluga and bowhead whales with varying

densities within those zones: (1) nearshore, and (2) outer continental shelf. The nearshore habitat zone has been defined as the area between the shoreline and the 50 m depth contour while the continental shelf habitat extends from the 50 m to the 200 m depth contour. For all other species, waters between the shoreline and the 200 m depth contour can be considered a single habitat zone (nearshore) and the area of water that may be ensonified to ≥ 160 dB or ≥120 dB is not expected to extend beyond 200 m water depth. Sea ice presence and concentration in the Beaufort Sea varies greatly from year to year. If sea ice is present near planned activities in 2008, tophole drilling program activities will likely be able to proceed. We have therefore assumed that about 20% of the ensonified area will be in ice margin habitat and have therefore identified densities for all species in ice margin habitat.

As noted above, there is some uncertainty about the representativeness of the data and assumptions used in the calculations and exposure to sounds near 120 dB are not likely to cause changes in behavior or migration routes that lie outside of the normal variation of those activities for marine mammals and they are not likely to have any biologically significant consequences for individual animals. To provide some allowance for the uncertainties, "maximum estimates" as well as "average estimates" of the numbers potentially affected have been derived. For a few marine mammal species, several density estimates were available, and in those cases, the mean and maximum estimates were from the survey data. In other cases only one, or no applicable estimate was available so arbitrary correction factors were used to arrive at "average" and "maximum" estimates. These are described in detail in the following sections. Except where noted, the "maximum" estimates have been calculated as 4× the "average" estimates. The densities presented are believed to be similar to, or in most cases higher than, the densities that will actually be encountered during the survey.

Detectability bias, quantified in part by $f(0)$, is associated with diminishing sightability with increasing lateral distance from the trackline. Availability bias [$g(0)$] refers to the fact that there is <100% probability of sighting an animal that is present along the survey trackline. These correction factors were applied to the data from Moore et al. (2000) and were already included in data provided by Richardson and Thompson (eds., 2002) on beluga and bowhead whales. Where possible, they were applied to the data available for other species.

Cetaceans

Starting in August and continuing through early November, belugas and bowheads migrate through the Alaskan Beaufort Sea, sometimes interrupting their migration to feed. ***Beluga*** density estimates are derived from data in Moore et al. (2000). The fall densities in nearshore and shelf regions are relatively less than the offshore/pack ice densities (Table 6-1) because the beluga migration in the fall tends to occur well offshore. "Takes by harassment" of beluga whales during this time period in the Beaufort Sea were not calculated in the same manner as described for bowhead whales because of the relatively lower expected densities of beluga whales in the nearshore area near tophole section drilling activities and the lack of detailed data on the likely timing and rate of migration through the area.

TABLE 6-1
Expected autumn (Sep - Nov) densities of beluga and bowhead whales in the eastern Alaskan Beaufort Sea. Densities are corrected for f(0) and g(0) biases. Species listed under the U.S. ESA as endangered are in italics.

Species	Nearshore [a]		Outer Shelf [b]		Ice Margin [c]	
	Average Density (# / km2)	Maximum Density (# / km2)	Average Density (# / km2)	Maximum Density (# / km2)	Average Density (# / km2)	Maximum Density (# / km2)
Beluga	0.0016	0.0064	0.0180	0.0720	0.0312	0.1248
Bowhead whale [d]	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

[a] Water between 0–50 m in depth.

[b] Water between 50–200 m in depth.

[c] 10% of nearshore and outer shelf zones

For ***bowhead whales***, both "average" and "maximum" densities are available in Chapter 9 of Richardson and Thomson (eds., 2002). In most cases, bowhead whales will be migrating west past the tophole section drilling activities during the fall, so it is not accurate to assume that the same individuals would be present in the area from one day to the next. We have therefore developed an alternate method of calculating the number of individuals exposed to sounds >120 dB to the one used for non-migratory species. The method is founded on estimates of the proportion of the population that would pass within the >120 dB zone on a given day.

Drilling activities planned in the Beaufort Sea during the fall migration are assumed to occur from approximately September 10th to November 10th with approximately 50 of the 60 days involving actual drilling. If the bowhead population has continued to grow at an annual rate of 3.4%, the current population size would be ~13,326 individuals based on a 2001 population of 10,545 (Zeh and Punt 2005). Based on data in Richardson and Thomson (2002, Appendix 9.1) the number of whales expected to pass each day after September 10th was estimated as a proportion of the population. Richardson and Thomson (2002) also calculated the proportion of animals within water depth bins (<20m, 20-40m, 40-200m, >200m). Using this information we multiplied the total number of whales expected to pass the drilling activities each day by the proportion of whales that would be in each depth category to estimate how many individuals would be within each depth bin on a given day. The proportion of each depth bin within ≥120 dB zone was then multiplied by the number of whales within the respective bins to estimate the total number of individuals that would be exposed on each day. This was repeated for 14 days between September 10th and November 10th and the results were summed to estimate the total number of bowhead whales estimated to be exposed to ≥120 dB during the migration period in the Beaufort Sea.

A few ***other cetacean*** species may be encountered in the Beaufort Sea, but numbers are expected to be low. Narwhals are not expected to be encountered within the drilling activities area. However, there is a chance that a few individuals may be present if ice is nearby and therefore an arbitrary low density has been applied to the ice margin region (Table 6-2). Harbor porpoises and gray whales are not expected to be present in large numbers in the Beaufort Sea during the fall but small numbers may be encountered during the summer. They are most likely to be present in nearshore waters. Arbitrarily assigned low densities have therefore been used in nearshore waters for those species (Table 6-2).

Pinnipeds

Extensive surveys of ringed and bearded seals have been conducted in the Beaufort Sea, but most surveys have been conducted over the landfast ice, and few seal surveys have occurred in open water or in the pack ice. Kingsley (1986) conducted ***ringed seal*** surveys of the offshore pack ice in the central and eastern Beaufort Sea during late spring (late June). These surveys provide the most relevant information on densities of ringed seals in the ice margin zone of the Beaufort Sea. The density estimate in Kingsley (1986) was used as the average density of ringed seals that may be encountered in the ice margin (Table

6-2). The average ringed seal density in the nearshore zone of the Alaskan Beaufort Sea was estimated from results of ship surveys at times without seismic operations reported by Moulton and Lawson (2002; Table 6-2)

Densities of ***bearded seals*** were estimated by multiplying the ringed seal densities by 0.051 based on the proportion of bearded seals to ringed seals reported in Stirling et al. (1982; Table 6-2). ***Spotted seal*** densities in the nearshore zone were estimated by summing the ringed seal and bearded seal densities and multiplying the result by 0.015 based on the proportion of spotted seals to ringed and bearded seals reported in Moulton and Lawson (2002; Table 6-2). Minimal values were assigned as densities in the open water and ice margin zones (Table 6-2).

TABLE 6-2
Expected Densities of Cetaceans (Excluding Beluga and Bowhead Whale) and Seals in the Alaskan Beaufort Sea During the Fall (Sep - Nov).

Species	Nearshore [a]		Ice Margin [b]	
	Average Density (# / km2)	Maximum Density (# / km2)	Average Density (# / km2)	Maximum Density (# / km2)
Odontocetes				
Monodontidae				
Narwhal	0.0000	0.0000	0.0000	0.0001
Phocoenidae				
Harbor porpoise	0.0001	0.0004	0.0000	0.0000
Mysticetes				
Gray whale	0.0001	0.0004	0.0000	0.0000
Pinnipeds				
Bearded seal	0.0181	0.0724	0.0128	0.0512
Ringed seal	0.3547	1.4188	0.2510	1.0040
Spotted seal	0.0037	0.0149	0.0001	0.0004
Walrus				

[a] Water between 0–200 m in depth.

[b] 10% of the nearshore region

Potential Number of "Takes by Harassment"

Best and Maximum Estimates of the Number of Individuals that may be Exposed to ≥160 and ≥120 dB

The number of different individuals of each species potentially exposed to received levels ≥160 dB and ≥120 dB re 1 μPa (rms) in each habitat zone was estimated by multiplying

- the expected species density, by
- the anticipated area to be ensonified to that level in the given habitat zone to which the density applies.

The numbers of exposures were then summed for each species across the habitat zones.

Estimates at ≥160 dB

The ≥160 dB radius for the *Kulluk* was modeled by JASCO to be ~55 m. A radius of 82.5 m (55 × 1.5) was used to estimate the area ensonified to ≥160 dB around the drilling vessel and multiplied by 3 drill

sites equals (~0.6414 km^2). If ice is present, ice management activities may be necessary for an estimated 3 week period in late October and early November. Sounds produced by an icebreaker, the *Robert Lamonte*, actively managing ice in this area were estimated to fall below 160 dB at <100 m from the source based on measurements in Greene (1987). Thus, an additional area of 0.1884 km^2 (3 x 0.0628 km^2) was added to the estimate of area ensonified to ≥160 dB for a total area of 0.8298 km^2.

For analysis of potential effects on migrating bowhead whales we calculated the total distance in a north-south direction (perpendicular to the migration path) ensonified to >160 dB (165 m x 3 drill sites = 495 m). This represents 0.9% of the distance between the barrier islands and the 50 m bathymetry line so it was assumed that 0.9% of the bowheads migrating within the nearshore zone (water depth 0-50 m) may be exposed to sounds ≥160 dB.

Estimates at ≥120 dB

The total area covered by three, mostly overlapping, 19.9 km radius circle representing 1.5× the ≥120 dB radius (13.27 km) modeled by JASCO for the *Kulluk* was used to calculate the area ensonified to ≥120 dB around three potential drill sites located within ~5 km of each other. Koski and Johnson (1987) identified a similar (10-20 km) effect range for bowhead whales around drilling activities in the Alaskan Beaufort Sea. If ice is present, ice management activities may be necessary for an estimated 3 week period in late October through early November. Sounds produced by an icebreaker, the *Robert Lemure*, actively managing ice in this area were estimated to fall below 120 dB at ~8 km from the source based on measurements in Greene (1987). Although most of this sound would likely occur within waters already assumed to be ensonified to ≥120 dB by the drilling operation, we have simply added this area (329 km^2) to that calculated for the drilling activity.

The overlapping 19.9 km radius circles with an area of ~1551 km^2 plus the additional 329 km^2 described above for a total of 1880 km^2 extends into water between 50–60 m in depth. Approximately 90% of the area is in water >50 m so 1692 km^2 is considered in the nearshore zone and the remaining 188 km^2 is within the continental shelf zone. The ice margin area is considered 10% of each of the two zones. For migrating bowhead whales, all animals traveling in the nearshore zone and 10% of those traveling in the shelf zone have been assumed exposed to ≥120 dB.

Cetaceans

The estimates (Tables 6-3 and 6-4) show that one endangered cetacean species (the bowhead whale) is expected to be exposed to sounds ≥120 dB and ≥160 dB unless bowheads avoid the area around the tophole section drilling activities. Migrating bowheads are likely to do so, though many of the bowheads engaged in other activities, particularly feeding and socializing, probably will not. Our estimate of the number of bowhead whales potentially exposed to ≥120 dB is 4315 and to ≥ 160 dB is 36 (Table 6-3).

Cetaceans exposed to seismic sounds with received levels ≥120 dB would involve mysticetes (bowheads and gray whales), monodontids (belugas), and porpoise (harbor porpoise). Average and maximum estimates of the number of individual cetaceans exposed other than bowheads, in descending order, are beluga (11 and 45), gray whale (0 and 5), and harbor porpoise (0 and 5). No animals are expected to be exposed to sounds ≥160 dB, but minimal estimates have been used to account for chance encounters.

TABLE 6-3

Estimates of the Numbers of Beluga and Bowhead Whales in Areas Where Maximum Received Sound Levels in the Water Would Be ≥120 dB and (≥160 dB) During SOI's Proposed Tophole Section Drilling Program in the Beaufort Sea, Alaska, Sep – Nov 2008. Not All Marine Mammals Will Change Their Behavior When Exposed to these Sound Levels.

	Number of Exposure to Sound Levels ≥120 dB and (≥160 dB)							
	Nearshore [a]		Outer Shelf [b]		Ice Margin [c]		Total	
	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
Beluga	2 (0)	10 (0)	3 (0)	12 (0)	6 (0)	23 (0)	11 (0)	45 (0)
Bowhead whale [d]	4029 (36)	4029 (36)	286 N/A	286 N/A	N/A	N/A	4315 (36)	4315 (36)

[a] Water between 0–50 m in depth.

[b] Water between 50–200 m in depth.

[c] 10% of nearshore and outer shelf zones

[d] See text for description of bowhead whale estimates for the Fall in the Beaufort Sea

TABLE 6-4

Estimates of the Numbers of Marine Mammals (Excluding Beluga and Bowhead Whales, Which are Shown in Table 6-3) in Areas Where Maximum Received Sound Levels in the Water Would Be ≥120 dB and (≥160 dB) During SOI's Proposed Tophole Section Drilling Program in the Beaufort Sea, Alaska, Sep – Nov, 2008. Not All Marine Mammals Will Change Their Behavior When Exposed to these Sound Levels.

	Number of Exposure to Sound Levels ≥120 dB and (≥160 dB)					
	Nearshore [a]		Ice Margin [b]		Total	
Species	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**
Odontocetes						
Monodontidae						
Narwhal	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phocoenidae						
Harbor porpoise	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	1 (0)
Mysticetes						
Gray whale	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	1 (0)
Pinnipeds						
Bearded seal	31 (0)	122 (0)	2 (0)	10 (0)	33 (0)	132 (0)
Ringed seal	600 (0)	2401 (0)	47 (0)	189 (0)	647 (0)	2589 (0)
Spotted seal	6 (0)	25 (0)	0 (0)	0 (0)	6 (0)	25 (0)
Total Pinnipeds	637 (0)	2548 (0)	50 (0)	198 (0)	687 (0)	2747 (0)

[a] Water between 0–200 m in depth.

[b] 10% of nearshore and outer shelf zones

TABLE 6-5

Summary of the Number of Potential Exposures of Marine Mammals to Received Sound Levels in the Water of ≥120 dB and (≥160 dB) During SOI's Proposed Tophole Section Drilling Activities in the Beaufort Sea, Alaska, Sep – Nov 2008. Arbitrary Minimum Estimates have been Requested at the ≥160 dB Level to Account for Any Chance Encounters. Not All Marine Mammals Will Change Their Behavior When Exposed to these Sound Levels.

	Beaufort Sea		Requested Take
Species	**Avg.**	**Max.**	**Authorization**
Odontocetes			
Monodontidae			
Beluga	11 (0)	45 (0)	**45 (5)**
Narwhal	0 (0)	0 (0)	**5 (5)**
Phocoenidae			
Harbor porpoise	0 (0)	1 (0)	**5 (5)**
Mysticetes			
Bowhead whale [a]	4315 (36)	4315 (36)	**4315 (36)**
Gray whale	0 (0)	1 (0)	**5 (5)**
Total Cetaceans	4315 (36)	4316 (36)	
Pinnipeds			
Bearded seal	33 (0)	132 (0)	**132 (10)**
Ringed seal	647 (0)	2589 (0)	**2589 (50)**
Spotted seal	6 (0)	25 (0)	**25 (5)**
Total Pinnipeds	687 (0)	2747 (0)	

[a] See text for description of bowhead whale estimate for the Beaufort Sea

The far right column in Table 6-5, "Requested Take Authorization", shows the numbers of animals for which "harassment take authorization" is requested. As noted above, many of the animals exposed to sound levels near 120 dB re 1 µPa would not react to those sound levels, particularly pinnipeds, and so should not be considered takes. Even for species that may change their behavior or alter their migration route, those changes are mostly within the normal range of those activities for the animals and may not rise to the level of taking based on guidance in NMFS (2001). Animals that divert around the activity at the lower sound levels would not approach close enough that they would alter their behavior to the degree that they would be "taken by harassment". For the common species, the requested numbers are calculated as indicated above, based on the maximum densities calculated from the data reported in the different studies mentioned above and overestimate the number actually estimated to be exposed to these levels. Thus actual number of animals that will be "taken" lies somewhere between the number exposed to 120 and 160 dB, and particularly for pinnipeds, probably is closer to the number exposed to 160 dB than 120 dB.

Pinnipeds

Ringed Seals

The ringed seal is the most widespread and abundant pinniped in ice-covered arctic waters, and there is a great deal of annual variation in population size and distribution of these marine mammals. Ringed seals account for the vast majority of marine mammals expected to be encountered, and hence exposed to drilling activity sounds with received levels ≥120 dB re 1 µPa (rms). The average (and maximum) estimate is that 647 (2589) ringed seals might be exposed to seismic sounds with received levels ≥120 dB. No ringed seals are expected to be exposed to sounds ≥160 dB.

Other Pinniped Species

Two additional pinniped species (other than the Pacific walrus) are expected to be encountered. They are the bearded seal (33 and 132, average and maximum estimates, respectively), and the spotted seal (6 and 25; Table 6-5). The harbor seal and ribbon seal are unlikely to be encountered, but their presence cannot be ruled out. No bearded or spotted seals are expected to be exposed to ≥160 dB.

Conclusions

The proposed tophole section drilling activities in the Beaufort Sea will involve one drilling vessel that will introduce continuous sounds into the ocean while it is active and possibly two ice-management vessels that would introduce non-continuous sounds if they must break ice. Other routine vessel operations are conventionally assumed not to affect marine mammals sufficiently to constitute "taking".

Cetaceans

Effects on cetaceans are generally expected to be restricted to avoidance of a limited area around the drilling operation and short-term changes in behavior, falling within the MMPA definition of "Level B harassment". Furthermore, the estimated numbers of animals potentially exposed to sound levels sufficient to cause appreciable disturbance are relatively low percentages of the population sizes in the Bearing–Chukchi–Beaufort seas, as described below.

Based on the 120 dB criterion, the *best (average) estimates* of the numbers of individual cetaceans *exposed* to sounds ≥120 dB re 1 μPa (rms) represent varying proportions of the populations of each species in the Beaufort Sea and adjacent waters. For species listed as "Endangered" under the ESA, our estimates include ~4315 bowheads. The latter is ~32% of the Bering-Chukchi-Beaufort population of >13,326 assuming 3.4% annual population growth from the 2001 estimate of >10,545 animals (Zeh and Punt 2005). Only 36 individuals are estimated to be exposed to sounds ≥160 dB equaling <1% of the population

Some monodontids may be exposed to sounds produced by the drilling activities, and the numbers potentially affected are small relative to the population sizes (Table 6-5). Narwhals are extremely rare in the U.S. Beaufort Sea and few, if any, are expected to be encountered during the survey. The best estimate of the number of belugas that might be exposed to ≥120 dB (11) represents <1% of their population. No species other than the bowhead are expected to be exposed to levels ≥160 dB although minimal numbers have been requested to allow for chance encounters.

Pinnipeds

A few pinniped species are likely to be encountered in the study area, but the ringed seal is by far the most abundant marine mammal that will be encountered. The best (average) estimates of the numbers of individuals exposed to sounds at received levels ≥120 dB re 1 μPa (rms) during the drilling activities are as follows: ringed seals (647), bearded seals (33), and spotted seals (6), (representing <1% of their Beaufort populations). Pinnipeds are unlikely to react to steady sounds until they are much stronger than 120 dB re 1 μPa, so it is probable that only a small percentage of those would actually be disturbed. No pinnipeds are estimated to be exposed to sounds ≥160 dB although minimal estimates have been included to allow for chance encounters.

6.1.1 Exposure Estimates for Open Water Exploration Drilling – Transit of Kulluk

A vessel towing the *Kulluk* through the Beaufort Sea from Tuktoyaktuk to the US-Canadian border would travel ~358 km. Transit from the US-Canadian border to the Sivulliq prospect in western Camden Bay would be ~170 km in length for a total transit length of ~528 km.

Sounds produced by a vessel towing the *Kulluk* have not been measured. As a surrogate, measurements of sounds produced by the *Gilavar* in Camden Bay while it towed 32 airguns and four hydrophone streamers were used as estimates of the ≥160 dB and ≥120 dB distances. The estimated ≥160 dB distance from the *Gilavar* measurements is 10 m and the ≥120 dB distance is 6.3 km. Using these distances and the estimated trackline distance above the area of water potentially ensonified to ≥160 dB would be ~11 km^2 and to ≥120 dB would be ~6653 km^2.

Average and maximum estimates of bowhead whale densities along the transit route were estimated from aerial survey data collected during the month of September near Kaktovik reported in Richardson and Thompson (eds. 2002, Table 6-6). Densities of beluga used in this analysis are the same as shown in the "ice margin" column of Table 6-1 (see Section 6.1) as these densities are also reasonable estimates of beluga density in the waters through which this transit will likely occur. All other species densities are the same as those presented in the "nearshore" (0-200 m water depth) column in Table 6-2 (see Section 6.1).

TABLE 6-6
Densities of marine mammals expected to be encountered during transit of the Beaufort Sea from Tuktoyaktuk to Camden Bay in September.

Species	Average Density (# / km2)	Maximum Density (# / km2)
Odontocetes		
Monodontidae		
Beluga	0.0312	0.1248
Narwhal	0.0000	0.0000
Phocoenidae		
Harbor porpoise	0.0001	0.0004
Mysticetes		
Bowhead Whale	0.0295	0.1843
Gray whale	0.0001	0.0004
Pinnipeds		
Bearded seal	0.0181	0.0724
Ringed seal	0.3547	1.4188
Spotted seal	0.0037	0.0149

Table 6-7 shows the estimated number of marine mammals that may be exposed to ≥160 dB and ≥120 dB during a transit of the Beaufort Sea from Tuktoyaktuk to Camden Bay using the ensonified area and density estimates described above.

TABLE 6-7
Estimates of the Number of Marine Mammals in Areas Where Maximum Received Sound Levels in Water Would Be ≥120 dB and (≥160 dB) During SOI's Proposed Transit from Tuktoyaktuk to Camden Bay Towing the Kulluk.

Species	Average	Maximum	Requested Take Authorization
Odontocetes			
Monodontidae			
Beluga	208 (0)	830 (4)	**830 (5)**
Narwhal	0 (0)	0 (0)	**5 (5)**
Phocoenidae			
Harbor porpoise	1 (0)	3 (0)	**5 (5)**
Mysticetes			
Bowhead whale	196 (0)	1226 (2)	**1226 (5)**
Gray whale	1 (0)	3 (0)	**5 (5)**
Total Cetaceans	197 (0)	1229 (2)	
Pinnipeds			
Bearded seal	120 (0)	481 (1)	**481 (10)**
Ringed seal	2360 (4)	9439 (15)	**9439 (50)**
Spotted seal	25 (0)	99 (0)	**99 (5)**
Total Pinnipeds	2505 (4)	10020 (16)	

6.2 Exposure Estimates for Open Water Geotechnical Program

All anticipated takes would be "takes by harassment", involving temporary changes in behavior. The mitigation measures to be applied will minimize the possibility of injurious takes. (However, there is no specific information demonstrating that injurious "takes" would occur even in the absence of the planned mitigation measures.) In the sections below, we describe methods to estimate "take by harassment" and present estimates of the numbers of marine mammals that might be affected during the proposed open water geotechnical program activities in the Beaufort Sea. The estimates are based on data obtained during marine mammal surveys in and near the proposed operations and on estimates of the sizes of the areas where effects could potentially occur. Adjustments to reported population or density estimates were made to account for population increases or declines insofar as possible.

The main sources of distributional and numerical data used in deriving the estimates are described in the next subsection. There is some uncertainty about the representativeness of those data and the assumptions used below to estimate the potential "take by harassment". However, the approach used here seems to be the best available at this time.

This section provides estimates of the number of individuals potentially exposed to continuous sound levels ≥160 dB re 1 µPa (rms) produced by a single vessel conducting geotechnical activities in multiple locations in and near the Sivulliq prospect and Pt. Thomson, Camden Bay, Alaska We also estimate the number of individuals potentially exposed to sound levels ≥120 dB re 1 µPa (rms) because some species, like the bowhead whale, have been observed under certain circumstances to avoid impulsive and continuous sound sources at approximately those levels. Other species, such as ringed and bearded seals, are unlikely to react at those sound levels and distances, but data are lacking for those species. There is no evidence that avoidance at those levels would have significant effects on individual animals or that the subtle changes in behavior or movements would "rise to the level of taking" according to guidance by

NMFS (NMFS 2001). Any changes in behavior caused by sounds at or near the 120 dB level fall within the normal variation in such activities that would occur in the absence of the geotechnical activities. SOI acknowledges that these minor effects on bowhead whale distribution could potentially have effects on their availability to subsistence hunting of this species. SOI plans to complete the geotechnical program prior to the fall bowhead whale subsistence harvests of the communities of Kaktovik and Nuiqsut. SOI will not operate the geotechnical program in Camden Bay during the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests. If SOI is unable to complete the planned geotechnical program before the onset of fall whaling for Kaktovik and Nuiqsut, SOI would return to Sivulliq, and/or prospective pipeline corridor after the conclusion of the harvest to complete the program. For purposes of estimating exposures of marine mammals in this document, it is assumed that geotechnical activities will stop on August 25th and potentially restart (if needed) as early as September 10th. It is also assumed that 90% of the activities will be completed prior to August 25th and the remaining 10% will be completed after the subsistence hunt. While it is possible, or even likely, that the bowhead whale subsistence hunt will last beyond September 10th, exposure estimates are based on this nominal date as a conservative estimate and to preserve the option to re-start operations on this date, if the hunt has ended. The estimates are based on an operational plan including a single geotechnical vessel operating in western Camden Bay, Beaufort Sea, Alaska beginning in July and completing work by October 31st. Including operational delays, it is anticipated that geotechnical activities may be completed in approximately 50 days of work.

Basis for Estimating "Take by Harassment"

Numbers of marine mammals that might be present and potentially disturbed are estimated below based on available data about mammal distribution and densities in the eastern Alaskan Beaufort Sea during the summer (July and August) and fall (September). Because some species show seasonal patterns of use in this area, estimates of marine mammal densities have been derived separately for the two time periods. Some species present in the Alaskan Beaufort Sea have a longitudinal gradient in their distribution during some seasons. The 146°W line of longitude (passing through Flaxman Island) has previously been used to divide the Alaskan Beaufort Sea into East and West regions. Geotechnical activities will be centered very near to that line so the greater of the two density estimates has been used.

The area of water within which received sounds from geotechnical activities may, at times, be ≥160 dB and ≥120 dB is within the nearshore (0-50 m water depth) habitat zone for all species including beluga and bowhead whales. Sea ice presence and concentration in the Beaufort Sea varies greatly from year to year. If Sea ice is present near planned operations in 2008, activities are not likely to proceed. Therefore we have assumed that no ice margin habitat will be ensonified.

As noted above, there is some uncertainty about the representativeness of the data and assumptions used in the calculations and exposure to sounds near 120 dB are not likely to cause changes in behavior or migration routes that lie outside of the normal variation of those activities for marine mammals and they are not likely to have any biologically significant consequences for individual animals. To provide some allowance for the uncertainties, "maximum estimates" as well as "average estimates" of the numbers potentially affected have been derived. For a few marine mammal species, several density estimates were available, and in those cases, the mean and maximum estimates were from the survey data. In other cases only one, or no applicable estimate was available so arbitrary correction factors were used to arrive at "average" and "maximum" estimates. These are described in detail in the following sections. Except where noted, the "maximum" estimates have been calculated as 4× the "average" estimates. The densities presented are believed to be similar to, or in most cases higher than, the densities that will actually be encountered during the survey.

Detectability bias, quantified in part by $f(0)$, is associated with diminishing sightability with increasing lateral distance from the trackline. Availability bias [$g(0)$] refers to the fact that there is <100%

probability of sighting an animal that is present along the survey trackline. These correction factors were applied to the data from Moore et al. (2000) and were already included in data provided by Richardson and Thompson (eds., 2002) on beluga and bowhead whales, and where possible were applied to the data available data for other species.

Cetaceans

During the early and mid-summer, most belugas and bowheads are found in the Canadian Beaufort Sea and Amundsen Gulf or adjacent areas. Low numbers have been found in the eastern Alaskan Beaufort Sea. Belugas begin to move across the northern Beaufort Sea in August, and bowheads do so toward the end of August. During fall, both species migrate through the Alaskan Beaufort Sea, sometimes interrupting their migration to feed.

Beluga density estimates are derived from data in Moore et al. (2000). During the summer, beluga whales are most likely to be in offshore waters in the eastern Beaufort Sea. Thus calculated densities from Moore et al. (2000) are relatively small for the nearshore zone (Table 6-8). Fall densities in nearshore regions are also estimated to be relatively low as the beluga migration in the fall tends to occur well offshore.

TABLE 6-8
Expected Summer (July and August) and Fall (September) Densities of Marine Mammals in the Alaskan Beaufort Sea. Densities are Corrected for f(0) and g(0) biases. Species Listed Under the U.S. ESA as Endangered are in Italics.

Species	Summer		Fall	
	Average Density (# / km^2)	Maximum Density (# / km^2)	Average Density (# / km^2)	Maximum Density (# / km^2)
Odontocetes				
Monodontidae				
Beluga	0.0030	0.0120	0.0312	0.1248
Narwhal	0.0000	0.0000	0.0000	0.0000
Phocoenidae				
Harbor porpoise	0.0001	0.0004	0.0001	0.0004
Mysticetes				
Bowhead whale	0.0005	0.0033	NA	NA
Gray whale	0.0001	0.0004	0.0001	0.0004
Pinnipeds				
Bearded seal	0.0181	0.0724	0.0181	0.0724
Ringed seal	0.3547	1.4188	0.3547	1.4188
Spotted seal	0.0037	0.0149	0.0037	0.0149

For ***bowhead whales***, both "average" and "maximum" densities for the summer period (July and August) were estimated from August survey data summarized in Richardson and Thomson (2002). Few bowhead whales were observed by Richardson and Thomson (2002) in waters of the nearshore zone in summer, so nearshore densities have been estimated as 10% of the density calculated from sightings in offshore areas. Bowhead whales encountered during this time will likely not be migrating so these densities have been used in the standard method (described below) of calculating "takes by harassment."

In most cases bowhead whales will be migrating past the geotechnical activities during the fall period, so it is not accurate to assume that the same individuals would be present in the area from one day to the next. We have therefore developed an alternate method of calculating the number of individuals exposed to sounds >120 dB (or ≥160 dB) to the one used for non-migratory species. The method is founded on estimates of the proportion of the population that would pass within the >120 dB zone on a given day.

If geotechnical activities are not completed prior to the subsistence hunt, the portion of the bowhead population that did not pass during the hunt period would pass while the remaining geotechnical activities were completed. If the bowhead population has continued to grow at an annual rate of 3.4%, the current population size would be ~13,326 individuals based on a 2001 population of 10,545 (Zeh and Punt 2005). Based on data in Richardson and Thomson (2002, Appendix 9.1) the number of whales expected to pass each day was estimated as a proportion of the population. Richardson and Thomson (2002) also calculated the proportion of animals within water depth bins (<20m, 20-40m, 40-200m, >200m). Using this information we multiplied the total number of whales expected to pass the geotechnical activities each day by the proportion of whales that would be in each depth category to estimate how many individuals would be within each depth bin on a given day. The proportion of each depth bin within ≥120 dB zone (and ≥160 dB) was then multiplied by the number of whales within the respective bins to estimate the total number of individuals that would be exposed on each day. This was repeated for each day after September 10th on which geotechnical activities might occur (a total of ~10 d) and the results were summed to estimate the total number of bowhead whales estimated to be exposed to ≥120 dB (and ≥160 dB) during the migration period in the Beaufort Sea.

For ***other cetacean*** species that may be encountered in the Beaufort Sea, densities are likely to vary somewhat by season, but differences are not expected to be great enough to estimate separate densities for the two seasons. Narwhals are not expected to be encountered within the geotechnical activity area. Harbor porpoises and gray whales are not expected to be present in large numbers in the Beaufort Sea but small numbers may be encountered so arbitrarily assigned low densities have therefore been used in Table 6-8.

Pinnipeds

Although densities are likely to vary somewhat by season, there is neither sufficient data nor are differences expected to be great enough to justify estimating separate densities of pinnipeds for the two seasons. Extensive surveys of ringed and bearded seals have been conducted in the Beaufort Sea, but most surveys have been conducted over the landfast ice, and few seal surveys have occurred in open water or in the pack ice. The average ringed seal density in the nearshore zone of the Alaskan Beaufort Sea was estimated from results of ship surveys at times without seismic operations (Moulton and Lawson 2002; Table 6-8)

Densities of ***bearded seals*** were estimated by multiplying the ringed seal densities by 0.051 based on the proportion of bearded seals to ringed seals reported in Stirling et al. (1982; Table 6-8). ***Spotted seal*** densities in the nearshore zone were estimated by summing the ringed seal and bearded seal densities and multiplying the result by 0.015 based on the proportion of spotted seals to ringed and bearded seals reported in Moulton and Lawson (2002; Table 6-8).

Potential Number of "Takes by Harassment"

Best and Maximum Estimates of the Number of Individuals that may be Exposed to ≥160 and ≥120 dB

The number of different individuals of each species potentially exposed to received levels ≥160 dB and ≥120 dB re 1 μPa (rms) in each season was estimated by multiplying:

- the expected species density, by
- the anticipated area to be ensonified to that level in the season to which the density applies.

The numbers of exposures were then summed for each species across the seasons.

Estimates at ≥160 dB

The ≥160 dB radius for the geotechnical activities was modeled by JASCO to be ~30 m. A radius of 45 m (30 × 1.5) was therefore used to estimate the area ensonified to ≥160 dB around the geotechnical vessel and multiplied by 20 sites equaling a total area of 0.13 km^2. For analysis of potential effects on migrating bowhead whales if geotechnical activities occur after the subsistence hunt, the total distance in a north-south direction (perpendicular to the migration path) ensonified to >160 dB was calculated to be ~90 m. This represents 0.16% of the distance between the barrier islands and the 50 m bathymetry line so it was assumed that 0.16% of the bowheads migrating within the nearshore zone might be exposed to sounds ≥160 dB.

Estimates at ≥120 dB

The total area covered by 20, 7.37 km radius circles (1.5 times the JASCO modeled 4.91 km ≥120 dB radius) equals ~3408 km^2. Much of the geotechnical activity will likely occur within a 7 km radius in the Sivulliq prospect so 50% overlap of the ≥120 dB areas was assumed. Therefore, 1704 km^2 is the estimated area expected to be ensonified to ≥120 dB. For analysis of potential effects on migrating bowhead whales if geotechnical activities occur after the subsistence hunt, the total distance in a north-south direction (perpendicular to the migration path) ensonified to >120 dB was calculated to be ~14.7 km. This represents 26.8% of the distance between the barrier islands and the 50 m bathymetry line so it was assumed that 26.8% of the bowheads migrating within the nearshore zone might be exposed to sounds ≥120 dB.

Cetaceans

The estimates show that one endangered cetacean species (the bowhead whale) is expected to be exposed to sounds ≥120 dB and ≥160 dB unless bowheads avoid the area around the geotechnical activity (Table 6-9). Migrating bowheads are likely to do so, though many of the bowheads engaged in other activities, particularly feeding and socializing that may occur during the summer period probably will not. Our estimate of the number of bowhead whales potentially exposed to ≥120 dB is 425 and to ≥ 160 dB is 3 (Table 6-9).

Average and maximum estimates of the number of individual cetaceans exposed, other than bowheads, in descending order, are beluga (10 and 40), gray whale (0 and 5), and harbor porpoise (0 and 5). Accept for 3 bowheads, no individuals are expected to be exposed to sounds ≥160 dB, but minimal estimates have been used to account for chance encounters.

TABLE 6-9

Estimates of the Numbers of Marine Mammals in Areas Where Maximum Received Sound Levels in the Water Would Be ≥120 dB and (≥160 dB) During SOI's Proposed Geotechnical Activities in the Beaufort Sea, Alaska, During Summer (July – August) and Fall (September). Not All Marine Mammals Will Change Their Behavior When Exposed to these Sound Levels.

	Number of Exposure to Sound Levels ≥120 dB and (≥160 dB)						
	Summer		Fall		Total		Requested Take
Species	Avg	Max	Avg	Max	Avg	Max	Authorization
Odontocetes							
Monodontidae							
Beluga	5 (0)	18 (0)	5 (0)	21 (0)	10 (0)	40 (0)	**40 (5)**
Narwhal	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**5 (5)**
Phocoenidae							
Harbor porpoise	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	1 (0)	**5 (5)**
Mysticetes							
Bowhead whale	1 (0)	5 (0)	420 (3)	420 (3)	421 (3)	425 (3)	**425 (5)**
Gray whale	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	1 (0)	**5 (5)**
Pinnipeds							
Bearded seal	28 (0)	111 (0)	3 (0)	12 (0)	31 (0)	123 (0)	**123 (5)**
Ringed seal	544 (0)	2176 (0)	60 (0)	242 (0)	604 (0)	2418 (0)	**2418 (5)**
Spotted seal	6 (0)	23 (0)	1 (0)	3 (0)	6 (0)	25 (0)	**25 (5)**
Total Pinnipeds	577 (0)	2310 (0)	64 (0)	257 (0)	642 (0)	2566 (0)	

The far right column in Table 6-9, "Requested Take Authorization", shows the numbers of animals for which "harassment take authorization" is requested. As noted above, many of the animals exposed to sound levels near 120 dB re 1 µPa would not react to those sound levels, particularly pinnipeds, and so should not be considered takes. Even for species that may change their behavior or alter their migration route, those changes are mostly within the normal range of those activities for the animals and may not rise to the level of taking based on guidance in NMFS (2001). Animals that divert around the activity at the lower sound levels would not approach close enough that they would alter their behavior to the degree that they would be "taken by harassment". For the common species, the requested numbers are calculated as indicated above, based on the maximum densities calculated from the data reported in the different studies mentioned above and overestimate the number actually estimated to be exposed to these levels. Thus actual number of animals that will be "taken" lies somewhere between the number exposed to 120 and 160 dB, and particularly for pinnipeds, probably is closer to the number exposed to 160 dB than 120 dB.

Pinnipeds

Ringed Seals

The ringed seal is the most widespread and abundant pinniped in ice-covered arctic waters, and there is a great deal of annual variation in population size and distribution of these marine mammals. Ringed seals account for the vast majority of marine mammals expected to be encountered, and hence exposed to geotechnical activity sounds with received levels ≥120 dB re 1 µPa (rms). The average (and maximum) estimate is that 604 (2418) ringed seals might be exposed to seismic sounds with received levels ≥120 dB. No ringed seals are expected to be exposed to sounds ≥160 dB.

Other Pinniped Species

Two additional pinniped species (other than the Pacific walrus) are expected to be encountered. They are the bearded seal (31 and 123, average and maximum estimates, respectively), and the spotted seal (6 and 25; Table 6-9). No bearded or spotted seals are expected to be exposed to ≥160 dB.

Conclusions

The proposed geotechnical program activities in the Beaufort Sea will involve one geotechnical vessel that will introduce continuous sounds into the ocean while it is active. Other routine vessel operations are conventionally assumed not to affect marine mammals sufficiently to constitute "taking".

Cetaceans

Effects on cetaceans are generally expected to be restricted to avoidance of a limited area around the geotechnical activities and short-term changes in behavior, falling within the MMPA definition of "Level B harassment". Furthermore, the estimated numbers of animals potentially exposed to sound levels sufficient to cause appreciable disturbance are relatively low percentages of the population sizes in the Bearing–Chukchi–Beaufort seas, as described below.

Based on the 120 dB criterion, the *best (average) estimates* of the numbers of individual cetaceans *exposed* represent varying proportions of the populations of each species in the Beaufort Sea and adjacent waters. For species listed as "Endangered" under the ESA, our estimates include ~604 bowheads. The latter is ~4.5% of the Bering-Chukchi-Beaufort population of >13,326 assuming 3.4% annual population growth from the 2001 estimate of >10,545 animals (Zeh and Punt 2005). Only 3 individuals are estimated to be exposed to sounds ≥160 dB equaling <1% of the population

Some monodontids may be exposed to sounds produced by the geotechnical activities, and the numbers potentially affected are small relative to the population sizes (Table 6-8). Narwhals are extremely rare in the U.S. Beaufort Sea and few, if any, are expected to be encountered during the survey. The best estimate of the number of belugas that might be exposed to ≥120 dB (10) represents <1% of their population. No species, other than the bowhead whale, are expected to be exposed to levels ≥160 dB although minimal numbers have been requested to allow for chance encounters.

Pinnipeds

A few pinniped species are likely to be encountered in the geotechnical activities area, but the ringed seal is by far the most abundant marine mammal that will be encountered. The best (average) estimates of the numbers of individuals exposed to sounds at received levels ≥120 dB re 1 µPa (rms) during the geotechnical activities are as follows: ringed seals (604), bearded seals (31), and spotted seals (6), (representing <1% of their Beaufort populations). Pinnipeds are unlikely to react to steady sounds until they are much stronger than 120 dB re 1 µPa, so it is probable that only a small percentage of those would actually be disturbed. No pinnipeds are estimated to be exposed to sounds ≥160 dB.

7. The anticipated impact of the activity on the species or stock:

The only anticipated impacts to marine mammals associated with tophole section drilling activities or geotechnical program, respectively are with respect to noise propagation from the Kulluk and associated support vessels, or the geotechnical vessel. The impacts would be temporary and result in only short-term displacement of seals and whales from within ensonified zones produced by such noise sources. Any impacts on the whale and seal populations of the Beaufort Sea activity area are likely to be short term and transitory arising from the temporary displacement of individuals or small groups from locations they may occupy at the times they are exposed to tophole section drilling sounds or geotechnical activities at

the 160-190 db received levels. As noted in Section 6, above, it is highly unlikely that animals will be exposed to sounds of such intensity and duration as to physically damage their auditory mechanisms. In the case of bowhead whales that displacement might well take the form of a deflection of the swim paths of migrating bowheads away from (seaward of) received noise levels greater than 160 db (Richardson et al. 1999). The cited and other studies conducted to test the hypothesis of the deflection response of bowheads have determined that bowheads return to the swim paths they were following at relatively short distances after their exposure to the received sounds. There is no evidence that bowheads so exposed have incurred injury to their auditory mechanisms. Additionally, there is no conclusive evidence that exposure to sounds exceeding 160 db have displaced bowheads from feeding activity (Richardson and Thomson 2002).

There is no evidence that seals are more than temporarily displaced from ensonified zones and no evidence that seals have experienced physical damage to their auditory mechanisms even within ensonified zones.

8. The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses:

There could be an adverse impact on an Inupiat bowhead subsistence hunt if whales were deflected seaward (further from shore) in the traditional hunting areas north of Pt. Thomson in Camden Bay. The impact would be that whaling crews would have to travel greater distances to intercept westward migrating whales thereby creating a safety hazard for whaling crews and/or limiting chances of successfully striking and landing bowheads. For 2008, the geotechnical program is planned to occur before whaling, while the tophole section drilling will not. In all seasons, potential impact to bowhead whale deflection is mitigated by application of the procedures established in a POC. This traditionally includes a CAA successfully negotiated, between industry operators and the AEWC and the Whaling Captains' Associations of Kaktovik, Nuiqsut, and Barrow. Regardless of whether a 2008 CAA is successfully negotiated, SOI is committed to the mitigation measures described in Section 12 (iii) below.

There should be no adverse impacts on the availability of the whale species for subsistence uses.

9. Anticipated impact on habitat:

The proposed activities will not result in any permanent impact on habitats used by marine mammals, or to their prey sources. Any effects would be temporary and of short duration at any one place. The primary potential impacts to marine mammals are associated with elevated sound levels from tophole section drilling operations and their support vessels, or geotechnical program activities.

10. Anticipated impact of habitat loss or modification:

The effects of the planned tophole drilling activities or geotechnical activities are expected to be negligible. It is estimated that only a small portion of the animals utilizing the areas of the proposed activities would be temporarily displaced. During the period of tophole drilling activities (September through November), most marine mammals would be dispersed throughout the area. Starting in late-August, when bowheads start to migrate eastward, some may travel in proximity to the geotechnical program; some of these might be temporarily displaced seaward by the planned activities. The peak of the bowhead whale migration through the Beaufort Sea typically occurs in September and October. Again, some bowheads might be temporarily displaced seaward during this time. The numbers of

cetaceans and pinnipeds subject to displacement are small in relation to abundance estimates for the mammals addressed under this IHA.

In addition, feeding does not appear to be an important activity by bowheads migrating through the eastern and central part of the Alaskan Beaufort Sea in most years. In the absence of important feeding areas, the potential diversion of a small number of bowheads is not expected to have any significant or long-term consequences for individual bowheads or their population. Bowheads, gray, or beluga whales are not predicted to be excluded from any habitat.

The proposed activities are not expected to have any habitat-related effects that would produce long-term affects to marine mammals or their habitat due to the limited extent of the acquisition areas and timing of the activities.

11. The availability and feasibility (economic and technological), methods, and manner of conducting such activity or means of effecting the least practicable impact upon affected species or stock, their habitat, and of their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance:

Details of the proposed mitigations are discussed in the Marine Mammal Monitoring and Mitigation Plan (4MP; Attachment B).

12. Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses. A plan must include the following:

i. A statement that the applicant has notified and provided the affected subsistence community with a draft plan of cooperation.

Pre-2008 POC Meetings

SOI has summarized concerns received during 2006 and 2007 into the 2007 POC, which was submitted during June 2007 to federal agencies as well as to subsistence stakeholders, and updated again in July 2007. SOI is carrying this POC forward to proposed 2008 activities. SOI has developed the POC to mitigate and avoid any unreasonable interference by SOI's planned activities on North Slope subsistence uses and resources. The POC is the result of numerous meetings and consultations between SOI, affected subsistence communities and stakeholders, and federal agencies beginning in October 2006. The POC identifies and documents potential conflicts and associated measures that will be taken to minimize any adverse effects on the availability of marine mammals for subsistence use. To be effective, the POC must be a dynamic document, which will expand to incorporate the communications, and consultation that will continue to occur throughout 2008. Outcomes of POC meetings are included in quarterly updates attached to the POC as addenda and distributed to federal, state, and local agencies as well as local

stakeholder groups. The 2007 POC Addendum 1 was issued on July 11, 2007, and SOI issued 2007 POC Addendum 2 on November 16, 2007.

SOI attended 22 POC meetings regarding SOI's 2007 programs, (Table 12-1). Meetings for SOI's 2007 open water activities in the Beaufort Sea were held in Nuiqsut and Barrow on October 16-17, 2006, and on January 30, February 1, 2007, respectively and in Kaktovik on November 10, 11, and 28, 2006 and followed with meetings in 2007 on January 29 and March 14. SOI held POC meetings with the Chukchi Sea villages of Point Hope and Wainwright on February 21 and 22, 2007 respectively and again on March 12 and 17, 2007. SOI also met with the village of Point Lay on June 11 and 21, 2007 and Shishmaref on August 30. Additional meetings were held with the Eskimo Walrus Commission, Alaska Beluga Committee, Ice Seal Committee, and the Nanuuq Commission in April and June 2007 (the Ice Seal Commission did not attend the April meeting). At these meetings, SOI presented all components of open water activities and discussed local concerns regarding subsistence-related activities.

November 6, 2007, SOI held an all-agency and stakeholder pre-application teleconference meeting attended by federal, state, and NSB agency representatives. At this teleconference, SOI introduced the objectives and intended operations for the planned 2008 open water activities.

TABLE 12-1
2006 and 2007 POC Meeting Dates and Locations

2006	Meeting Location
October 16	Nuiqsut
October 17	Barrow
November 8	Nuiqsut (MMS)
November 10	Kaktovik (MMS)
November 11	Kaktovik (MMS)
November 28	Kaktovik
2007	**Meeting Location**
January 29	Kaktovik
January 30	Nuiqsut
February 1	Barrow
February 21	Point Hope
February 22	Wainwright
March 12	Point Hope
March 13	Nuiqsut
March 14	Kaktovik
March 15	Nuiqsut
March 16	Barrow
March 17	Wainwright
April 25	Anchorage
June 7	Anchorage
June 11	Point Lay
June 21	Point Lay
August 30	Shishmaref

2008 POC Meetings

SOI met with AEWC and the whaling captains associations of Nuiqsut, Kaktovik, Wainwright, Pt. Hope, and Barrow between February 7-11, 2008 to capture concerns from affected bowhead whale subsistence users regarding SOI's 2007 open water program and planned upcoming 2008 open water activities. SOI is scheduled to meet with AEWC again on February 28, 2008 to discuss the 2008 CAA. If successfully negotiated and signed, a CAA would be a component of SOI's 2008-2009 POC and is anticipated it will cover the proposed Beaufort Sea exploratory drilling program. Subsequent to meeting again with AEWC, SOI will begin community POC meetings during late March and/or April 2008 for the 2008 open water programs in the Beaufort and Chukchi Seas.

In order to capture the concerns of other affected subsistence users, SOI also met with the marine mammal commissioners of the Eskimo Walrus Commission, Alaska Beluga Whale Committee, Ice Seal Committee, and the Nanuuq Commission during a two-day meeting December 12-13, 2007 in Anchorage to discuss 2007/2008 programs. SOI anticipates the next quarterly meeting with these marine mammal commissioners will occur during Spring 2008.

ii A schedule for meeting with the affected subsistence communities to discuss proposed activities and to resolve potential conflicts regarding any aspects of either the operation or the plan of cooperation.

SOI will hold community meetings in Barrow, Nuiqsut, Kaktovik, Wainwright, Point Hope, and Point Lay, regarding its Beaufort and Chukchi Seas 2008 open water programs. During these meetings, SOI will focus on lessons learned from the 2007 open water program and, present the proposed 2008 program activities, and describe SOI's adaptive management approach toward conducting its activities. SOI will continue to hold meetings with the above mentioned marine mammal commissions that are focused on ice seals, walrus, polar bears, and beluga. SOI anticipates issuing a third addenda to the 2007/2008 POC in early 2008 which will document SOI's measures to continue to avoid any unreasonable interference to affected subsistence activities with all 2008 proposed programs.

iii A description of what measures the applicant has taken and/or will take to ensure that proposed activities will not interfere with subsistence whaling or sealing;

Open Water Exploration Drilling – Tophole Sections

The Kulluk and all support vessels will operate in accordance with the provisions of a POC. The POC is developed to mitigate effects of SOI's proposed program(s) where activities would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses. SOI will consult with affected Beaufort and Chukchi Sea communities and marine mammal associations for the development of a POC. For this drilling program, SOI's POC with Chukchi Sea villages primarily will address the issue of transit of vessels, whereas the POC with Beaufort Sea villages will address vessel transit, drilling and associated activities. It is the intention of SOI to negotiate a CAA with the AEWC, and whaling captain's associations of affected Beaufort and Chukchi Sea villages, as a component of the POC. If a CAA is negotiated with AEWC, then the provisions of the CAA will be included in the POC. In the absence of a final CAA, SOI is committed to the mitigation measures described in this section of the IHA application (see below) and will instigate these measures, which are intended to minimize any adverse effects on the availability of marine mammals for subsistence uses.

The POC will specify times and areas to avoid in order to minimize possible conflicts with traditional subsistence hunts by North Slope villages for transit and drilling operations. For its 2008 tophole section drilling program, SOI will not operate the Kulluk and associated vessels in Camden Bay until after the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests are completed. Appropriate operational restrictions applicable for future open-water drilling activities (2009 and beyond) will be developed in consultation with affected communities; however, in future years, SOI specifically reserves the option to drill with one or more drilling rigs in the Beaufort Sea prior to and after the fall bowhead subsistence whale harvests of Kaktovik and Nuiqsut.

Open Water Geotechnical Program

The geotechnical vessel will operate in accordance with the provisions of a POC. SOI plans to complete the geotechnical program prior to the fall bowhead whale subsistence harvests of the communities of Kaktovik and Nuiqsut. SOI will not operate the geotechnical program in Camden Bay during the Kaktovik and Nuiqsut fall bowhead whale subsistence harvests. If SOI is unable to complete the planned geotechnical program before the onset of fall whaling for Kaktovik and Nuiqsut, SOI would return to Sivulliq, and/or prospective pipeline corridor after the conclusion of the harvest to complete the program.

Mitigation Measures

Regardless of whether a CAA is signed, SOI will implement mitigation measures. The following are the some of the key mitigation concepts that will be included in SOI's POC:

1. If not completed, the cessation of the geotechnical program during the Kaktovik and Nuiqsut (Cross Island) fall bowhead whale subsistence harvests. The geotechnical vessel shall be relocated out of Camden Bay during this time.
2. Communications system between operator's vessels and the whaling hunting crews. This includes the 24 hours per day operation of communication centers in Kaktovik (Call center) and Deadhorse (Com center) areas, which are staffed by Inupiat operators, and the installation of radio equipment in the whaler's boats. The Deadhorse Com center and Kaktovik Call center also provides a method for other subsistence hunters, such as seal hunters, who can communicate with the industry vessels.
3. Provision for marine mammal observers (MMOs) aboard all project vessels.
4. Conflict resolution procedures.
5. Plan all vessel and aircraft routes to minimize the impact on subsistence hunts. Aircraft shall not operate below 1000 ft. unless approaching, landing or taking off, or unless engaged in providing assistance, or in poor weather low ceiling, or other emergency situation.
6. A "Good Neighbor Policy" that provides for financial compensation in the unlikely event that an oil spill diminishes the availability or usability of subsistence resources such as bowhead or beluga whales, seals, walrus, polar bear, fish or water fowl.
7. Provisions for rendering emergency assistance to subsistence hunting crews.

iv <u>What plans the applicant has to continue to meet with the affected communities, both prior to and while conducting activity, to resolve conflicts and to notify the communities of any changes in the operation.</u>

SOI's approach includes the pre-application, all-agency and stakeholder teleconference November 6, 2007 with federal, state, and local agencies as well as non-governmental stakeholders during which SOI introduced the 2008 open water programs. This meeting served to facilitate early identification of key issues. The agencies and stakeholder attendees assisted SOI with constructive discussion of the success

for the 2007 POC mitigation measures and to assist SOI and affected subsistence communities continue a communicative relationship for conflict avoidance during the 2008 program. As recently as February 4, 2008, SOI updated responses to questions from the pre-application teleconference and posted these at the following web-site address, http://www.asrcenergy.com/shell. All stakeholders are invited to visit the website address to understand SOI's proposed 2008 open water program activities.

Further, POC meetings will be held in spring 2008, and potentially again in early summer in the affected communities.

13. The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on the population of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding:

Attachment B includes the 4MP that will address the issues in item 13.

14. Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects:

Various agencies and programs may undertake marine mammal studies in the Beaufort Sea during the course of the 2008 open-water season. It is unclear if these studies might be relevant to SOI's proposed activities. SOI is prepared to share information obtained during implementation of our marine mammal monitoring program with a variety of groups who may find the data useful in their research. A suggested list of recipients includes:

- The NSB Department of Wildlife Management (T. Hepa)
- The USFWS Office of Marine Mammal Management (C. Perham and J. Garlic-Miller)
- The MMS's Bowhead Whale Aerial Survey Program (C. Monnett)
- The Kuukpik Subsistence Oversight Panel (KSOP**)**
- Alaska Eskimo Whaling Commission (H. Brower -Barrow)
- Beluga Whale Committee (W. Goodwin -Kotzebue)
- Inupiat Community of the Arctic Slope (A. Brower -Barrow)
- North Slope Science Initiative (J. Payne)
- MMS Field Supervisor (Jeff Walker)
- Alaska Department of Natural Resources (D. Perrin)

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