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October 2, 2006

Mr. Ken Hollingshead
National Marine Fisheries Service
Office of Protected Resources
1315 East West Hwy
Silver Springs, MD 20910-3282

Certified Mail
7004 2890 0004 5153 2925
Return Receipt Requested

RE: Application for an Incidental Harassment Authorization - Open Water Seismic Operations in Cook Inlet, Alaska

Dear Mr. Hollingshead:

ConocoPhillips Alaska, Inc. ("CPAI") and its geophysical contractor Veritas DGC propose to conduct a small marine geophysical survey program in Cook Inlet, Alaska. CPAI hereby submits an Incidental Harassment Authorization application for the proposed program. CPAI enlisted the support of Mr. Jay Brueggeman of Canyon Creek Consulting to compile biological information and to write a good portion of the application.

To minimize the environmental impact associated with submitting hard copies of other agencies' permit applications for this project, they are available electronically for your review at www.conocophillipsalaska.com/permits/. The majority of permit applications will be available after October 10, 2006. If you have any questions or require additional information, please do not hesitate to contact me at the numbers or address listed above.

Sincerely,

Jason Charton
Senior Environmental Coordinator

Enclosure

Cc: Brad Smith – NMFS
Robert Merryman – CIMMC

APPLICATION FOR INCIDENTAL HARASSMENT AUTHORIZATION TO THE NATIONAL MARINE FISHERIES SERVICE

FOR
OPEN WATER SEISMIC OPERATIONS IN THE BELUGA RIVER AREA OF

COOK INLET, ALASKA

Submitted by ConocoPhillips Alaska, Inc.

October 2006

1. Description of the Specific Activity or Class of Activities that can be Expected to Result in Incidental Taking of Marine Mammals.

ConocoPhillips Alaska, Inc. ("CPAI") is planning to conduct an ocean bottom-cable seismic survey during the spring of 2007 in Cook Inlet immediately offshore and south of the Beluga River area. The operation will be confined to a single 25 sq km (10 sq mi) block of area bordering the shoreline, extending from shore to a water depth of 25 m (80 ft). The seismic operation will involve a 900 cu in BOLT airgun array with two sub-arrays of 3-225 cu in guns and 3-75 cu in guns. The array will be much smaller than most large arrays used for seismic operations elsewhere in Alaska. The seismic operation will be active 24 hours per day, but the airguns will only be active for 1-2 hours during each of the 3-4 slack tide periods. Vessels will lay and retrieve cable on the bottom between the periods of acquiring seismic data. The seismic vessel currently planned for use is the M/V Peregrine Falcon, which will be supported by 3-4 bow pickers. The project is anticipated to start on 15 March and end no later than 15 May, depending on ice conditions.

Overview of Ocean Bottom-Cable Seismic Surveys

The following provides a general overview of ocean-bottom cable seismic surveys compared to 3D streamer seismic surveys. The configuration and features of the ocean-bottom cable ("OBC") seismic survey CPAI will use in the Beluga project is described later in this section.

OBC seismic surveys are used in Alaska to acquire seismic data in water that is too shallow for the data to be acquired using a marine-streamer vessel and/or too deep to have static ice in the winter. This type of seismic survey requires the use of multiple vessels for cable layout/pickup, recording, shooting, and possibly one or two smaller utility boats. The vessels are generally smaller than those used in streamer operations, and the utility boats can be very small, in the range of 10-15 m.

An OBC operation begins by laying cables off the back of the layout vessel. Cable length typically is 4-6 km but can be up to 12 km. Groups of seismic-survey receivers (usually a combination of both hydrophones and vertical-motion geophones) are attached to the cable in intervals of 25-70 m. Multiple cables are laid on the seafloor parallel to each other using this layout method, with a cable spacing of less than ½ mile, depending on the geophysical objective of the survey. When the cable is in place, a vessel towing the source array passes over the cables with the source being activated every 25 -50m. The sound source levels (zero to peak) associated with the OBC seismic survey are the same for most 2D and 3D marine seismic surveys (233-240 dB re 1uPA at 1 m). The ship speed is typically between 4-5 knots.

After one source line is acquired, the source vessel takes about 10-15 minutes to turn around and pass over the next source path. When a cable is no longer needed to record seismic survey data, it is recovered by the cable-pickup vessel and moved to the next recording position. A particular cable can lay on the seafloor anywhere from 2 hours to several days, depending upon operation conditions. An OBC seismic survey covers a smaller area and spends several days in the area. In contrast, a 3D streamer seismic survey covers a much larger area and only stays in a particular area for a few hours.

2007 Spring Acquisition Program

The spring acquisition proposal incorporates the use of a lightweight Sercel 408 recording system, several shallow draft vessels and a team of seasoned personnel with extensive experience in Cook Inlet Sea transition zone operations. Veritas will use a light weight Heli-portable recorder which can be positioned onshore or on the mother ship. The M/V Peregrine Falcon is self contained and able to house their 24 hour crew compliment, although, smaller cable support vessels will house their crew compliment on a mother ship offshore. The recording staff ("observers") will be capable of 24 hour recording and trouble shooting, which will allow acquisition to proceed efficiently throughout the short window where ice coverage is at a minimum and operations are not restrained by marine mammal issues.

Mobilization

The Mobilization effort for the survey would be split into vessel rig up and cable dressing. The M/V Peregrine Falcon and 3-4 bow pickers would be mobilized from Homer Alaska to the site in early-mid March. The vessel rig up would be completed in Homer, Alaska. The rigging of three vessels would include navigation, source equipment, cable deployment and retrieval systems and safety equipment. The cable dressing activity would be completed at Veritas' ("VTS'") Anchorage shop. Cables would be QC'd and rigged with lead line and weighting systems to anchor the cable on the sea floor and reduce any chance for movement.

The cable would then be transported to Homer where it would be loaded on to the vessels. The entire rig up is anticipated to take 30 days to complete. Once assembled, the deployment and retrieval system, sources and navigation systems would be tested prior to departure to the project site.

Navigation

The proposed navigation system would remotely link five operating systems located on each of the vessels assigned to the survey. It is VTS' intent to supply an integrated navigation system ("INS") utilizing DGPS for both prime and secondary positioning. A minimum of two differential base stations would be maintained at all times. The raw data used to calculate the corrections would be gathered on an exhibit archiving system. The INS would be capable of many features that are critical to efficient Transition Zone operations.

The system would include a Hazard display system that can be loaded with known obstructions along with pre plotted source and receiver line positions. Typically the hazard displays are also loaded with the day-to-day operational hazards, buoys etc. These daily hazards are added and subtracted to the Hazard database as the crew occupies and abandons patches.

The asset monitor would update the position of each of the vessels in the survey area every few seconds. Individual ship's positions are polled port to port from the recording truck and then displayed on the Hazard screen along with the other details that are part of its database. This feature gives the crew a quick heads up display as to each vessels position relative to the various obstructions. It also allows the crew administrators to properly manage the vessels in the most efficient manner dependent on their location. This display gives a quick reference when a potential question regarding positioning or tracking arises. In the case of inclement weather the hazard display can and has been used to vector vessels to safety. For this reason VTS feels that this INS is a valuable safety attribute.

Receiver Positioning

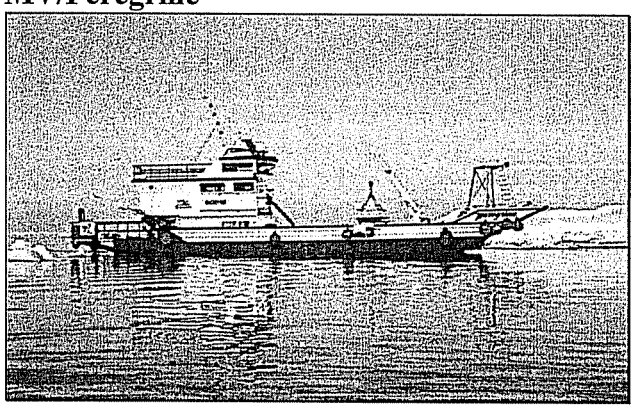
Receiver positioning would be required for all receiver lines. The positions of each receiver are established through a first arrival technique. Prior to the acquisition of a stroke the source vessel would be driven down either side of the receiver line (50 m offset is typical). The source vessel fires an accurately positioned single gun multiple times along either side of the receiver cables. Multiple gun locations are then calculated along with the first arrival times at a given receiver to triangulate an accurate position for the receiver. In shallower water (under 20 feet) it is typical to use the as laid positions of the receivers as first arrival or acoustical data is often skewed in shallow water depths.

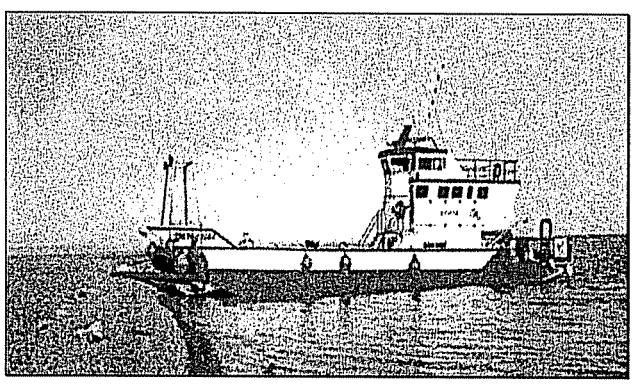
Cable Deployment and Retrieval

The deployment and retrieval of the bottom cables would be accomplished with the use of the M/V Peregrine Falcon and 3-4 bow pickers during high tides. These vessels would be rigged with hydraulically driven deployment and retrieval "Squirters". The M/V Arctic Wolf vessel would serve as the vessel to house the bow picker workers. The marine mammal observers may also be best to conduct observations off of this vessel during shooting activities. This vessel house crews, store cable/parts and can be used as a cable repair facility. The larger of the two cable vessels, Peregrine Falcon, is self-contained and would maintain 24-hour operations. The Peregrine is capable of carrying 600 channels of dressed 408. The smaller bow picker style cable vessels can carry 300 channels of dressed 408. All three vessels are capable of beach landings where crews could then interconnect to the land spreads. The 408 cables are extremely small while still allowing a pull of 800 pounds. Each of the cable vessels are powered with, twin jet diesels. The Arctic Wolf (Mother Ship) is a prop driven vessel.

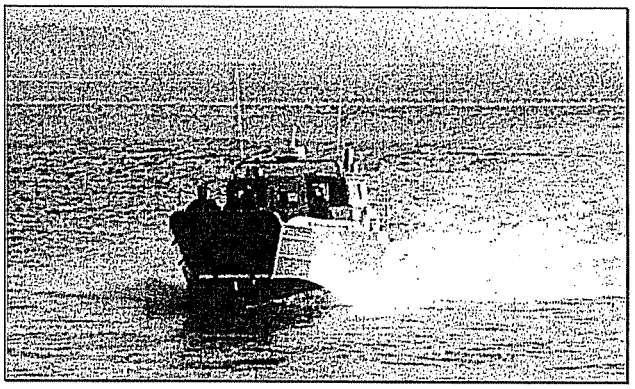
The proposed cable vessels are depicted below:

MV/Peregrine





Bow Pickers

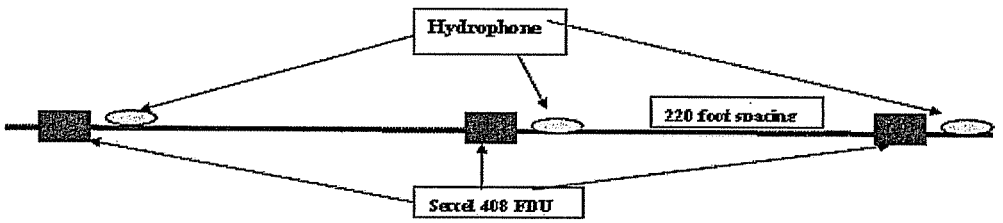


All vessels have been used extensively on previous Cook Inlet bottom cable and streamer efforts.

All equipment would be QC'd prior to re-deployment to insure a minimal amount of down time due to "out of spec" equipment. If VTS can insure that the equipment is within spec prior to deploying the gear, the procedure would result in a better quality product.

Recording:

As outlined above VTS would utilize a 1500 channel Sercel 408 recording system. This system is lightweight and robust and rated to 75 feet of water depth, which would allow it to operate well in the water depths anticipated on this program. The system would be configured with a hydrophones taped to the cable, weighted with chain. The 408 are a single channel unit, which is located at each hydrophone group. The fact that each sensor plugs directly into the telemetry box should reduce the risk of leakage caused by cable jacket damage.



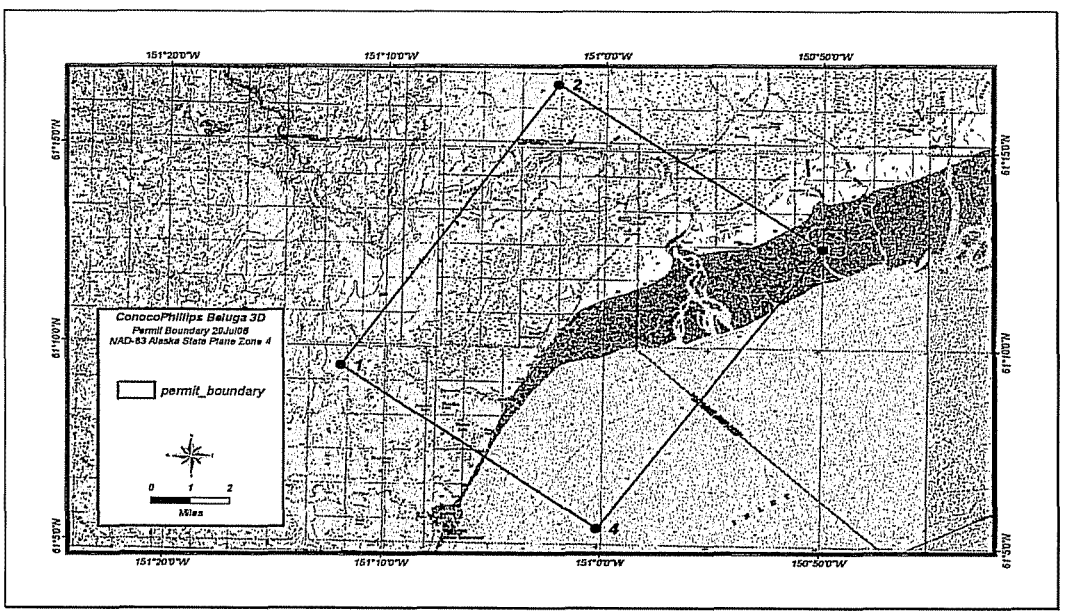
VTS would use its winter recording room as the recorder for the project. This recorder would be truck mounted and can be located onshore.

Client, equipment manufacturers, and our own standards and procedures would be followed throughout on all phases of the project. Industry standard test equipment and specifications would be used. Veritas has an internal audit system to ensure compliance with all QC/QA requirements.

Source

The source for acquisition would be a 900 CUI Bolt air gun array situated on the source vessel which is the Peregrine Falcon. VTS will have a second complete backup source rigged on a second A frame if needed. The array would be made up of two sub arrays, each with two three gun clusters separated by 1.5 meters off the stern of the vessel. One cluster will consist of 3-225 cu in guns and the second cluster will have 3-75 cu in guns. During recording, the sub-arrays will fire at 25-50 m intervals and they are designed to focus energy in the downward direction as the vessel travels at 4 to 5 knots. A near-field hydrophone is mounted about 1 meter above each gun station (one phone is used per cluster), one depth transducer per position is mounted on the gun's ultrabox, and a high pressure transducer is mounted at the aft end of the sub-array to monitor high pressure air supply. The Sercel 408 recording cable system is lightweight and robust and rated to 75 feet of water depth. The system would be configured with hydrophones taped to the cable, weighted with chain and laid on the sea floor. All the data from these sensors are transmitted to the vessel for input into the onboard systems and recording to tape. A single 200 CFM PRICE compressor would supply air for the array. There will be two back up compressors one located on the vessel the second on the dock in Homer. The compressor would be run though a pressure regulated valve tree. Water separators and dehumidifiers are also part of the source system. The array would be located with the use of DGPS antennas located on top of the A-Frames. The A frame would be lowered and raised based on water depth before the firing of the guns. All airgun activity would occur during the 3-4 daily slack tides, representing about 3-8 hours per day for seismic data acquisition.

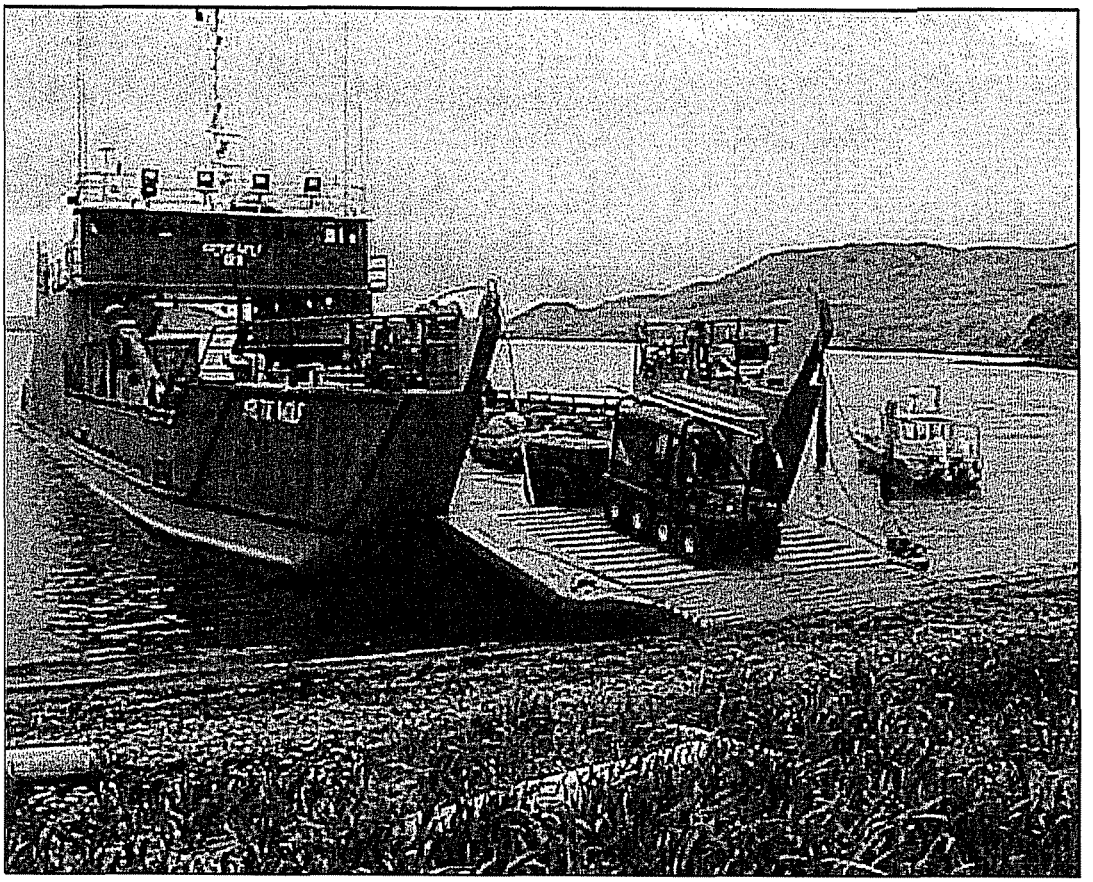
FIGURE 1. Map of proposed survey areas.



The *Arctic Wolf* will also serve as the platform from which vessel-based marine mammal observers will watch for marine mammals before and during airgun operations. The Arctic Wolf will also house personnel that are working on the bow picker vessels.

Other details of the *Arctic Wolf* include the following:

Owner:	Fairweather Marine
Operator:	Fairweather Captain
Flag:	United States of America
Length:	135'
Beam:	38"
Draft:	3'
Hull:	Steel
Gross Tonnage:	2516
Fathometers:	2
Accommodation Capacity:	24 crew



2. **The Date(s) and Duration of Such Activity and the Specific Geographical Region Where it will Occur.**

CPAI seeks incidental take authorization for a period of approximately two months (15 March to 15 May, 2007). Mobilization of operations will occur in early March, and seismic operations are proposed to begin in mid March depending on the time of breakup. Open water seismic operations ordinarily can not begin until after the project area is ice free, which normally occurs in mid to late March, but can be delayed into April. The geographic region of activity encompasses a 25 sq km-area (10 sq mi) in northwestern Cook Inlet, paralleling the shoreline from just offshore of the Beluga River south for about 6 km (3.75 ft) and extending from shore into the inlet an average of about 4 km (2.68 ft) (Figure 1). There will be a 1.6 km (1 mi) setback of airguns from the mouth of the Beluga River to comply with ADFG restrictions. Water depths range from 0 to 24 m (80 ft). The approximate boundaries of the region of the project area are N 61 09.473, W 151 11.987, N 61 16.638, W 151 02.198, N 61 12.538, W 150 49.979, and N 61 05.443, W 151 00.165.

3. **Species and Numbers of Marine Mammals Likely to be Found within the Activity Area.**

A total of three cetacean and two pinniped species are known to occur in the vicinity of the project area. One of the species, the northern sea lion, is listed as Endangered under the Endangered Species Act (ESA). The beluga whale is listed as depleted under the Marine Mammal Protection Act (MMPA). The other species (killer whale, harbor porpoise, and harbor seals) have no special designation under the ESA or the MMPA. The National Marine Fisheries Service ("NMFS") is currently reviewing the status of the Cook Inlet beluga whale population to make a determination for possible listing under the ESA.

The table below summarizes the estimated abundance and ESA/MMPA status of each species (Angliss and Outlaw 2005; David Rugh, NMML, personal communications, July 25, 2006). There are no estimates for these species in Cook Inlet, except for beluga whales, so estimates are for the entire stocks. The population estimate for the harbor porpoise and harbor seal are for the Gulf of Alaska stocks, which include Cook Inlet. The population estimate for resident killer whales is for the Eastern North Pacific stock, whereas the estimate for the transient population is for the Gulf of Alaska, Aleutian Islands, and Bering Sea stock, both of which overlap Cook Inlet. The northern sea lion estimate is for the western U.S. stock, which also includes Cook Inlet. Only the population estimate for the beluga whale stock is exclusively for Cook Inlet, since the stock resides in the inlet year-round. Except for the beluga whale, very small proportions of the populations for the other species occur in Cook Inlet, and even fewer in the upper Cook Inlet near the project site. Each species is more fully discussed in question number 4.

Species	Estimated Abundance	ESA Status	MMPA Status
Beluga Whale	278 (CV=0.18)	None	*Depleted*
Harbor Porpoise	30,506 (CV=0.214)	None	None
Killer Whale	-	None	None
Resident	1,123	None	None
Transient	314	None	None
Harbor Seal	29,175 (CV=0.052)	None	None
Northern Sea Lion	38,513	*Endangered*	*Depleted*

Note: Coefficient of Variation (CV) is provided where available for a given species.

4. **Description of the Status, Distribution, and Seasonal Distribution (When Applicable) of the Affected Species or Stocks or Marine Mammals Likely to be Affected by such Activities.**

The information developed for the technical elements of the application was derived from published and unpublished literature, personal communications with marine mammal scientists, other IHA applications, and CPAI.

Beluga Whale

In Alaska, beluga whales comprise five distinct stocks: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet (O'Corry-Crowe et al. 1997). For the proposed project, only the Cook Inlet stock occurs in the project area. The Cook Inlet stock is the most isolated of the five stocks, since it is separated from the others by the Alaska Peninsula (Laidre et al. 2000). Beluga whales from the Cook Inlet stock are an important subsistence resource for native communities along the Inlet.

The most recent estimate for the size of the Cook Inlet beluga whale stock is 278 whales (Confidence Interval 194-398) based on the June 2005 surveys (David Rugh, NMML, personal communication July 25, 2006). The estimate is 25% below the 2004 estimate, but it is not significantly different from the average population size over the period of 1999 to 2004 (Rugh personal communications July 25, 2006). While the 2005 estimate is the lowest recorded to date, the population appears to be stable but not recovering to higher levels recorded before years of decline from over-harvest by native subsistence hunters (Rugh et al. 2005, Hobbs et al. 2000). The NMFS has conducted annual aerial surveys covering an estimated 13-33% of the inlet including a 3 km (1.9 mi) wide strip along the ashore and approximately 100 km (521 mi) of off-shore transects from 1994 to the present (Rugh et al. 2005). Abundance estimates from these surveys indicated the population declined an average of about 14% per year during the mid 1990s, but stabilized over the past eight years (NMFS 2005, Angliss and

Outlaw 2005). From 1994 to 1998, the beluga whale abundance declined from an estimated 653 to 347 whales. From 1998 to 2005, abundance estimates ranged from an estimated 278 to 435 whales. The most current population estimate (278) places the population at about one third of the Optimum Sustainable Populations (OSP) of 780 whales (60% of the estimated carrying capacity (k) of 1,300 whales). The estimate has remained below half of the OSP, which is the threshold NMFS is required to use to designate the population as depleted under the MMPA (Angliss and Outlaw 2005).

Historically, beluga whales believed to be from the Cook Inlet population were reported in areas outside of the inlet such as Yakutat and Prince William Sound (Angliss and Outlaw 2005). In recent years, the reduced population appears to be confined to the inlet (Hobbs et al. 2005). Current summer and fall activity is concentrated in the upper inlet where belugas congregate near the mouths of rivers and along tidal flats (Hobbs et al. 2005, Rugh et al. 2005). Movements during summer and fall appear to be influenced by the timing and locations of eulachon and salmon runs (NMFS 2005) and tidal fluctuations (Funk et al. 2005). During summer and fall beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay, where they often remain stationary for many weeks or move back and forth between them in response to fish runs (Hobbs et al. 2005). During winter, belugas concentrate in offshore deeper waters in the mid-inlet to lower inlet as far as Chinitna and Tuxedni bays (Hobbs et al. 2005), although belugas are occasionally reported in the upper inlet in Knik and Turnagain arms. Within this distribution, NMFS (2005) classified beluga habitat in the inlet into 4 types in descending order of relative value, of which the Beluga River area is in the extreme southern edge of the area classified as type 2. Type 2 habitat is high value and includes summer feeding areas and winter habitats where whale occur in lesser densities or in deeper water where they may be less prone to disturbance. The area comprised of this type in the inlet includes the west side of Knik Arm, Turnagain Arm, and the northern portion of Upper Cook Inlet.

Cook Inlet belugas demonstrate site fidelity to summer concentration areas, where they regularly occur in just a few areas each year (Seaman et al. 1985), typically near river mouths and the associated shallow, warm and low salinity waters (Moore et al. 2000). While there is inter-annual variability in beluga use among areas, generally belugas occur in the Susitna and Chickaloon areas in May to July, Turnagain Arm in August, Knik Arm in September, and the mid-Cook Inlet between Point Possession and Kalgin Island in January through April (Rugh et al. 2000, 2004; Hansen and Hubbard 1999). These patterns are consistent with those recorded for 14 tagged beluga whales tracked by satellite from 2000 to 2003 (Hobbs et al. 2005).

Beluga whale use and distribution near the Beluga River between nearby the Chuitna and the Susitna rivers is relatively well documented from satellite tracking of tagged whales from 1999 to 2003 (Hobbs et al. 2005). In 1999, one

whale remained primarily between the Little Susitna River and the Beluga River from late May to mid-September when it moved into Turnagain Arm and Chickaloon Bay. It was recorded near the Beluga River for a few days in early July. In 2000, two tagged whales transited through the Beluga River vicinity sometime between September and mid January with one recorded briefly for several times during October through December and the other recorded briefly in mid to late December. In 2001, one tagged whale spent a few days near the Beluga River in September, while other tagged whales briefly occurred at the Chuitna River vicinity in August, late November, and early to mid December. No belugas were seen near the Beluga River from mid-December, 2001 through mid March, 2002. Several tagged whales tracked between August, 2002 and March, 2003 spent some time in September near the mouth of the Beluga River, although most whale locations were farther up the inlet. Tagged whales appeared to sporadically use the Chuitna River area during October, December, January, and April, and the Beluga River area in May. Consequently, small numbers of belugas appear to temporarily occur in the project vicinity most months of the year as they seasonally move between the upper and lower inlet.

More recently, surveys conducted offshore in 2006 between North Foreland and the Beluga River found no belugas during six days of survey in April, relatively small numbers in May and June, and only one in July (unpublished report, 2006). The largest groups included one group of 22 belugas and another group of 25 in May, but most groups were considerably smaller. Belugas were recorded on only 4 of 19 survey days in May and 5 of 22 survey days in June indicating use is transitory and widely spaced in time and area. These results show that relatively small numbers belugas occur in the Beluga River area during early spring when seismic operation are planned, and use is generally brief, widely scattered, and associated with transiting from the lower inlet to the upper inlet, where belugas concentrate in summer and fall.

Beluga whales calve from mid May to mid July (Calkins 1983). Alaska natives reported a slightly more extended calving period lasting from April through August, with calving believed to occur in Kachemak Bay in the lower inlet in April and May, off the Beluga and Susitna Rivers in May, and in Chickaloon Bay during summer (Huntington 2000). Belugas with near-term fetuses have been harvested in the Susitna delta in May and neonates are seen there throughout the summer, indicating the area may be important for calving or nursing (Huntington 2000). Mating is thought to follow the calving period, as is common in many marine mammal species (NMFS 2005). Calving is not known to occur in the project area.

Belugas commonly feed in river mouths and shallow estuaries, but also feed in deep submarine canyons (Reeves et al. 2002). They often congregate at river mouths and estuaries where fish concentrate during seasonal runs (Fried et al. 1979; Hazard 1988; NMFS 2005). During spring and summer, belugas prey on salmon and eulachon, often entering river channels on high tide to capture fish

(Huntington 2000). Funk et al. (2005) reported beluga whales also feeding at low tide in Eagle Bay and Sixmile Creek in the Knik Arm. There is little information on winter diet of beluga whales, although stomach contents of a dead beached whale in Cook Inlet included saffron cod, walleye Pollock, Pacific cod, eulachon, tanner crab, bay shrimp, and polychaetes suggesting belugas prey on a wide variety of prey (NMFS 2005).

Sources of beluga mortality in Cook Inlet include strandings, predation by killer whales, commercial fishing, and subsistence harvest. Stranding events are fairly common in Cook Inlet, particularly during spring tides (NMFS 2005). Approximately 7.6 belugas have died from strandings each year in Cook Inlet since 1988 because of high tides or possible killer whales (NMFS 2005). Killer whales killed an estimated one beluga per year between 1985 and 2002 (Sheldon et al. 2003). Five killer whales were observed in the mid to upper inlet between 2000 and 2002, which was at the same time killer whales reportedly attacked a pod of belugas (Hobbs et al. 2005). Killer whale predation in Cook Inlet appears to be random, and no clear seasonal patterns have been identified (Shelden et al, 2003), leaving no conclusive evidence that summer beluga distribution is influenced by killer whale occurrence (Hobbs et al. 2005). No beluga whale mortalities have been reported from commercial fishing in recent years (NMFS 2005). Lastly, subsistence harvest was reduced by NMFS to two whales per year after years of taking (struck and lost) as many as 67 per year (NMFS 2005). While a number of factors contribute to beluga mortalities, over-harvest by subsistence communities has had the most significant impact on the status of the Cook Inlet beluga whale population.

Harbor Seal

The size of the Gulf of Alaska stock is estimated at 29,175 seals (Angliss and Outlaw 2005). A relatively small proportion of the population occurs in Cook Inlet. Harbor seals are more abundant in lower Cook Inlet than in the upper inlet, but they occur in the upper inlet throughout most of the year (Rugh et al. 2005). In the upper inlet harbor seals occur in the Little Susitna River, Susitna River, Turnagain Arm, Chickaloon Bay, Knik Arm and Beluga River from May through October (Rugh et al. 2005, LGL unpublished report 2006). Typically, fewer than about 100 harbor seals have been recorded in any one of these locations with the majority in the Chickaloon Bay and the Susitna River areas and very few at the Beluga River (Rugh et al 2005). One to three harbor seals have been annually reported in or near the Beluga River area (Rugh et al. 2005). Shore-based surveys conducted in 2006 between the Chuitna and Beluga rivers, reported sighting 1 seal in April, 72 in May, and none in June or July (unpublished data, 2006). Seals were reported on 13 of 20 survey days in May, with 6 or fewer seals seen on 9 of the 13 days seals were observed in May. The most seen on any one survey day was 17. Consequently, small numbers of harbor seals are likely in the Beluga River vicinity from at least May through October based on their reported use of the upper inlet, but few if any are expected to be present in March or April during

the seismic survey. Sea ice generally prevents harbor seal access to many of these areas during winter and early spring.

A traditional haul out site is located near West Forelands, and harbor seals have also been reported to intermittently haul out near the Susitna Flats and in Turnagain Arm at Chickaloon Bay (D. Rugh personal communications 2006). There are no documented haul out sites or concentration areas in the Beluga River vicinity.

Northern Sea Lion

The most recent estimate of the western U.S. stock of northern seal lion is 35,513 animals (Angliss and Outlaw 2005). They are most abundant in the Aleutians and Gulf of Alaska but range throughout the North Pacific Ocean from California to the Bering Sea and Japan. Northern sea lions are much more abundant in lower Cook Inlet than in the upper inlet (Rugh et al. 205). Portions of the lower inlet but not the upper inlet are designated as critical habitat for this species. Critical habitat includes a 20-nautical mile buffer around all major haul out sites and rookeries, which are located in Prince William Sound, the south side of the Kenai and Alaska Peninsula, Kodiak Island, and throughout the Aleutian Islands. Haul out sites in the lower Cook Inlet include near the mouth of the inlet at Gore Point, Elizabeth Island, Perl Island, the Barren Islands, and Chugach Island. Northern sea lions gather at these traditional sites from mid May through mid July to pup and breed. No haul outs or concentration areas occur in upper Cook Inlet and sea lions are rarely seen north of Nikiski (Rugh et al. 2005). There are no recent records of northern sea lions in the Beluga River vicinity (Rugh et al. 2005, LGL unpublished monthly report 2006).

Harbor Porpoise

The size of the Gulf of Alaska stock is estimated at 30,506 animals (Angliss and Outlaw 2005). Harbor porpoise occur throughout Alaska waters where they are often observed in harbors, bays, and near river mouths but also occur offshore. They typically occur as solitary animals and can travel great distances. They mate sometime between July and August and give birth the following year between May and July.

A small proportion of the Gulf of Alaska harbor porpoise stock occurs in Cook Inlet. Dahlheim et al. (2000) estimated the average density of harbor porpoises in Cook Inlet was 7.2 animals per 1000 sq km (386 square miles) or 1 animal per 139 sq km (53 sq mi), which indicate densities are very low in the inlet. Harbor porpoises are more abundant in upper Cook Inlet than in the lower inlet (Rugh et al. 2005). Small numbers of harbor porpoise have been reported in the upper inlet including sightings of two single animals just south of the Beluga River in May 2006 and four animals in Knik Arm (LGL unpublished reports).

Killer Whales

The Eastern North Pacific stock of killer whales includes transient and resident killer whales in the Gulf of Alaska and Cook Inlet. The resident portion of the stock is estimated at 1,123 animals and the transient portion at 314 animals (Angliss and Outlaw 2005). Killer whales are more abundant in the lower inlet than in the upper inlet, where they are rarely observed. Shelden et al. (2003) reported 11 sightings of killer whales in the upper inlet from the Susitna Flats east into Turnagain Arm and north into Knik Arm over the last 20 years. Rugh et al. (2005) reported observing no killer whales in the upper inlet and only 23 in the lower inlet during survey from 1993 to 2004. Similarly, two recent marine mammal studies in the upper inlet and Knik Arm did not observe any killer whales (Funk et al. 2005; Ireland et al. 2005). There are no records of killer whales in the Beluga River area.

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.

CPAI is requesting authorization for incidental taking by harassment (Level B as defined in 50 CFR 216.3) of small numbers of marine mammals during its planned geophysical project in the Beluga River region of Cook Inlet during mid-March and early May, 2007, depending on breakup of sea ice. The operations outlined in § 1 and 2 have the potential to take (Level B) small numbers of marine mammals by harassment. Sounds will mainly be generated by the airguns used during the seismic survey, which is the focus of this request for an IHA

"Takes" by harassment will potentially result when marine mammals near the seismic activities are exposed to the pulsed sounds generated by the airguns. The effects will depend on the species of cetacean or pinniped, the behavior of the animal at the time of reception of the stimulus, as well as the distance and received level of the sound (see § 7). Temporary, short term disturbance reactions (Level B) are likely amongst some of the marine mammals in the general vicinity of the project when air guns are activated. No take by serious injury (Level A) is anticipated, given the nature of the planned operations and the planned mitigation measures (see § 11, "MITIGATION MEASURES"). No intentional or lethal takes are expected.

6. By Age, Sex, and Reproductive Condition (if Possible), the Number of Marine Mammals (By Species) that May be Taken by Each Type of Taking, and the Number of Times such Takings by Each Type of Taking are Likely to Occur.

All anticipated takes would be "takes by harassment", involving short term, 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 seismic survey. The estimates are based on data obtained during marine mammal surveys by the NMFS in 2004 in the Susitna Delta, which is bordered by Beluga River and Point MacKenzie (Rugh et al. 2005). There are no published density estimates for the Beluga River area.

The estimated take of marine mammals is presented in Table 2 based on the density estimates in Table 1 and noise transmission loss estimates in Table 3. Disturbance was assumed to occur at and above the 160 dB level for all marine mammal species based on NOAA guidelines. Estimated distances at received levels were calculated using data from the University of Alaska IHA for the Healey (See section 11), which is a larger array (1200 vs 900 cu in) than the array to be used by CPAI for the Beluga River project. CPAI also anticipates the actual track line shot will likely be less than the estimated planned track line distance because of weather and other factors causing unsuitable conditions for seismic surveys.

Table 1. Estimated density of marine mammals in the Susitna Delta during 2007 seismic operations

Species	Average Density (#/km²)	Source	Comment
Beluga Whale	0.08	Rugh et al. (2005)	See estimation method below
Harbor Seal	0.06	Rugh et al. (2005)	See estimation method below
Harbor Porpoise	N/A		
Northern Sea Lion	N/A		
Killer Whale	N/A		

Density was calculated by dividing the highest daily count of beluga whales (99) and harbor seals (75) by the approximate area (1,248 km2) surveyed in the Susitna Delta (Beluga River to Pt. MacKenzie) during the most recently published survey or June, 2004 (Rugh et al. 2005). Approximately, 52% (3,120 km2) of the 6,000 km2 surveyed in 2004 was in the upper inlet, and approximately 40% (1,248 km2) of the area surveyed in the upper inlet was in the Susitna Delta. The 2004 was the most recent published survey of the inlet, and the Susitna Delta was the only one of the six survey zones encompassing the 2007 seismic study area.
There are no density estimates available (N/A) for harbor porpoise, northern seal lion, and killer whales, since they are rare to uncommon in the upper inlet. None of these species were sighted in the upper inlet during the 2004 survey (Rugh et al. 2005).

Table 2. Estimated take of marine mammals during 2007 seismic survey in Cook Inlet

Month	Track Planned (km)	Beluga Whale	Harbor Seal	Harbor Porpoise	N. Sea Lion	Killer Whale
March	37 (23 mi)	0	0	0	0	0
April	125 (78 mi)	<30	<11	<1	<1	<1
May	24 (15 mi)	<6	<4	<1	<1	<1
Total	**186 (116 mi)**	**<36**	**<15**	**<2**	**<2**	**<2**

Take = (A) x (2B) x (C), where
A = planned km of track shot with the 6 gun array (Table 2)
B = estimated transmission loss distance (km) to 160dB for the 6 gun arrays for all species multiplied by 2 to account for both sides of array (Table 3)
C = estimated average density (Table 1).
CPAI estimates that actual trackline shot may be less than planned because of weather and other factors causing conditions not suitable for seismic surveys.
Take Calculation Example: 125 km x (1.52 km x 2) x 0.08 (density) = 30 belugas for April for the 6 gun array.

Densities were based on the following sources and calculations:

- Density was calculated by dividing the highest daily count of beluga whales (99) and harbor seals (75) by the approximate area (1248 km2) surveyed in the Susitna Delta (Beluga River to Pt. MacKenzie) during June, 2004 (NMFS 2005). Approximately, 52% (3,120 km2) of the 6000 km2 surveyed in 2004 was in the upper inlet and approximately 40% (1248 km2) of the area surveyed in the upper inlet was in the Susitna Delta. The 2004 was the most recent published survey of the inlet, and the Susitna Delta was the only one of the six survey zones encompassing the 2007 seismic study area.
- There are no estimates available (N/A) for harbor porpoise, northern seal lion, and killer whales to calculate density, since they are rare to uncommon in the upper inlet. None were sighted in the upper inlet during the 2004 survey (Rugh et al. 2005). Two animals for each species were included Table 2 to compensate for the remote possibility of a take of small numbers of these species by the seismic program.

Take was calculated for each month of the seismic survey period to account for seasonal use patterns by the marine mammals in the project area. Belugas and particularly harbor seals are not expected to be in the project area during March because of sea ice, but small numbers of them may pass through the project area during April and May. Most animals from both species move north of the project area to summer in the Susitna River, Knik Arm. Turnagain Arm, and Chickaloon Bay. Consequently, take was only calculated for April and May. Since most of the belugas and harbor seals occur north of the project area during late spring and summer, and only small numbers of them have been recorded passing through the project area during spring, CPAI believes the estimated take is quite conservative for both species.

7. The Anticipated Impact of the Activity on the Species or Stock

This section includes a description of the impact of seismic activities on marine mammals.

Potential Effects of Airgun Sounds.

The effects of sounds from airguns on marine mammals might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, and at least in theory, temporary (>180 dB for cetaceans and >190 dB for pinnipeds as determined by NMFS) or permanent hearing impairment, or non-auditory physical effects (Richardson et al. 1995); temporary or permanent impairment and non-auditory physical effects are theoretical and also not likely to occur due to mitigation measures required by NMFS for seismic program and, therefore they are not discussed in this application. Because the air guns will only be active during slack tides or about 3-4, 1-2 hour sessions per 24 hour day, the seismic program will be occur for a only small proportion of each day, and the mitigation procedures will be implemented when marine mammals are in the project area, it is unlikely there would be any temporary or especially permanent hearing impairment, or non-auditory physical effects on marine mammals. In addition, most of the upper Cook Inlet is a poor acoustic environment because of its shallow depth, soft bottom, and high background noise from currents and glacial silt which greatly reduces the distance sound travels (Blackwell and Greene 2003). Consequently, any behavioral disturbance is expected to be short term, temporary, and limited to relatively short distances from the noise source.

Tolerance

Studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. Numerous studies have shown that marine mammals at distances over a few kilometers from operating seismic vessels often show no apparent response. That is often true even when pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to temporarily react behaviorally to airgun pulses under some conditions, at other times they have shown no overt reactions. In general, pinnipeds and small odontocetes are more tolerant of exposure to airgun pulses than baleen whales.

Masking

Masking of marine mammal calls and other natural sounds are expected to be limited, although there are very few specific data of relevance. Some whales are known to continue calling in the presence of seismic pulses. Their calls can be heard between seismic pulses (e.g., Richardson et al. 1986; McDonald et al. 1995; Greene et al. 1999; Nieukirk et al. 2004). Masking effects of seismic pulses are

expected to be negligible in the case of the odontocete cetaceans, given the intermittent nature of seismic pulses. Also, the sounds important to small odontocetes are predominantly at much higher frequencies than are airgun sounds. Therefore, the potential problem of auditory masking for beluga whales is diminished by the small amount of overlap between frequencies produced by seismic and other industrial noise (<1 kHz) and frequencies which beluga whales call (0.26-20 kHz) and ecolocate (40-60 kHz and 100-120 kHz) (Blackwell and Greene 2003).

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Based on NMFS (2001, p. 9293), we assume that simple exposure to sound, or brief reactions that do not disrupt behavioral patterns in a potentially significant manner, do not constitute harassment or "taking". By potentially significant, we mean "in a manner that might have deleterious effects to the well-being of individual marine mammals or their populations".

Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors (Richardson et al. 1995). If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a short distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, which is not anticipated in the proposed seismic program, impacts on the animals could be significant. Given the many uncertainties in predicting the quantity and types of impacts of noise on marine mammals, it is common practice to estimate how many mammals were present within a particular distance of industrial activities, or exposed to a particular level of industrial sound to assess behavioral disturbance. However, this procedure likely overestimates the numbers of marine mammals that are affected in some biologically important manner.

The sound criteria used to estimate how many marine mammals might be disturbed to some biologically important degree by a seismic program are based on behavioral observations during studies of several species. However, information is largely lacking for many species including those species likely to occur in the Beluga River project areas. Detailed studies have been done on other species found elsewhere in Alaska waters including gray whales, bowhead whales, and ringed seals. The criteria established for these marine mammals, which are applied to others are conservative and have not been demonstrated to significantly affect individuals or populations of marine mammals in Alaska waters. Therefore, the effect of the Beluga River seismic program on the behavior of marine mammals should be no more than negligible for reasons stated earlier, and since the immediate project area is not an important feeding or

breeding area, and it appears to be primarily a transition area that marine mammals seasonally pass through while going between the mid or lower inlet to the upper inlet. Furthermore, the proposed seismic array is much smaller than arrays typically used in Alaska, which have not been shown to have a biologically significant effect on individuals or populations of seals or whales (Richardson et al. 1995).

Toothed Whales

Little systematic information is available about reactions of beluga whales, killer whales, and harbor porpoise to noise pulses. Beluga whales exhibit changes in behavior when exposed to strong, pulsed sounds similar in duration to those typically used in seismic surveys (Finneran et al. 2000, 2002). However, the animals tolerated high received levels of sound (peak–peak level >200 dB re 1 μPa) before exhibiting aversive behaviors (Richardson et al. 1995). Some belugas summering in the Eastern Beaufort Sea may have avoided the specific area of seismic operations (2 arrays with 24 airguns per array) much larger than the proposed program (2 arrays of 3 airguns per array) by 10-20 km, although belugas occurred as close as 1540 m to the line of seismic operations (Miller et al 2005). Observers stationed on seismic vessels operating off the United Kingdom from 1997–2000 have provided data on the occurrence and behavior of various toothed whales exposed to seismic pulses (Stone 2003; Gordon et al. 2004). Killer whales were found to be significantly farther from large airgun arrays during periods of shooting compared with periods of no shooting. The displacement of the median distance from the array was ~0.5 km (0.3 n.mi.) or more. Killer whales also appear to be more tolerant of seismic shooting in deeper water. Killer whales as well as harbor porpoises are rare to uncommon in the upper inlet, and the planned seismic program with its relatively small array and narrow window of operations should have no more than a negligible affect on them or beluga whales and no affect on the populations.

Pinnipeds

While there are no published data on seismic affect on sea lions or harbor seals, anecdotal data and data on arctic seals indicate that sea lions and other pinnipeds generally tolerate strong noise pulses (Richardson et al 1995). Monitoring studies in the Alaskan and Canadian Beaufort Sea during 1996–2002 provided considerable information regarding behavior of arctic seals exposed to seismic pulses (Miller et al. 2005; Harris et al. 2001; Moulton and Lawson 2002). These seismic projects usually involved arrays of 6 to 16 with as many as 24 airguns with total volumes 560 to 1500 cubic inches. The combined results suggest that some seals avoid the immediate area around seismic vessels. In most survey years, ringed seal sightings tended to be farther away from the seismic vessel when the airguns were operating then when they were not (Moulton and Lawson 2002). However, these avoidance movements were relatively small, on the order of 100 m (328 ft) to (at most) a few hundred meters, and many seals remained within 100–200 m (328–656 ft) of the trackline as the operating airgun array

passed by. Seal sighting rates at the water surface were lower during airgun array operations than during no-airgun periods in each survey year except 1997. Miller et al (2005) also reported higher sighting rates during non-seismic than during line seismic operations, but there was no difference for mean sighting distances during the two conditions nor was there evidence ringed or bearded seals were displaced from the area by the operations.

The operation of the airgun array had minor and variable effects on the behavior of seals visible at the surface within a few hundred meters of the array. The behavioral data from these studies indicated that some seals were more likely to swim away from the source vessel during periods of airgun operations and more likely to swim towards or parallel to the vessel during non-seismic periods. No consistent relationship was observed between exposure to airgun noise and proportions of seals engaged in other recognizable behaviors, e.g. "looked" and "dove". Such a relationship might have occurred if seals seek to reduce exposure to strong seismic pulses, given the reduced airgun noise levels close to the surface where "looking" occurs (Miller et al. 2005; Moulton and Lawson 2002).

Consequently, by using the responses of bearded, ringed, and spotted seals (least amount of data on reaction to seismic operations) to seismic operations as surrogates for harbor seals and sea lions, it is reasonable to conclude that harbor seals and the very small number of sea lions possibly in the project area are not likely to show a strong avoidance reaction to the proposed airgun sources. Pinnipeds frequently do not avoid the area within a few hundred meters of operating airgun arrays, even for airgun arrays much larger than that planned for the proposed project (e.g., Harris et al. 2001). Reactions are expected to be very localized and confined to relatively small distances and durations, with no long-term effects on individuals or populations.

Strandings and Mortality

There is no evidence in the literature that airgun pulses can cause serious injury, death, or stranding of marine mammals even in the case of much larger airgun arrays than planned for the proposed program. While strandings have been associated with military mid frequency sonar pulses, CPAI does not plan to use any sonar systems during the 2007 seismic program. Seismic pulses and military mid-frequency sonar pulses are quite different. Sounds produced by airgun arrays are broadband with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2-10 kHz, generally with a relatively narrow bandwidth at any one time. Thus, it is inappropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals.

8. The Anticipated Impact of the Activity on the Availability of the Species or Stocks of Marine Mammals for Subsistence Uses

Marine mammals, particularly beluga whales, have been an integral part of the subsistence economy of the native community bordering the project area. Tyonek, which is predominately a Dena' in Athabaskan community, is about 15 miles south of the project area. While it is the only village that hunts beluga whales, Alaska natives unaffiliated with a Cook Inlet community who have moved to the region and visit the region also have historically harvested beluga whales in the inlet (Mahoney and Shelden 2000). The role of marine mammals in the subsistence economy of Tyonek and other Alaska natives has been diminished by the almost complete elimination of the harvest of Cook Inlet beluga whales because of their greatly reduced stock size. While Tyonek natives may harvest one beluga whale per year and occasionally harbor seals (Huntington 2000), their primary source of red meat is moose (Foster 1982). Salmon and other fish also contribute substantially to their subsistence diet (Foster 1982).

The past harvest levels by subsistence hunters significantly reduced the Cook Inlet beluga whale population, particularly over the last 20 years (NMFS 2005). The substantial decline in the population can be accounted for by the estimates of subsistence harvest of beluga whales between 1994 and 1998. During this time, NMFS estimated that the average annual takes, including whales struck and lost, was over 60 whales per year (NMFS 2005). Annual harvest estimates were 21 whales in 1994, 70 in 1995, 98 in 1996, 70 in 1997, and 50 in 1998 representing over 300 whales harvested in five years. The harvest, which was 20% of the stock in 1996, was sufficiently high to account for a 14% annual rate of decline in the stock during this period (Hobbs et al. 2000). Since 1999, a moratorium was enacted to prohibit the harvest of beluga whales except through a co-management agreement between the NMFS and the Alaska Native Organization. Under this agreement, one whale was taken by subsistence hunters in 2001, 2002, and 2003.

The project area is not an important subsistence area for Tyonek hunters. The Tyonek native community has been displaced from traditional hunting (and trapping and fishing) areas north of Tyonek including the Beluga River during the twentieth century. As more non-natives utilized and occupied traditional subsistence areas combined with harvest regulation restrictions, changes in the abundance and distribution of subsistence resources, and other factors, Tyonek native subsistence activities have focused closer to the village. These features alone should result in the proposed project having no more than a negligible affect on the availability of species for subsistence harvest.

Other factors will further reduce the likelihood of any impact on the availability of marine mammals for subsistence harvest. These include the size, location, timing, duration, and mitigation of the seismic program. The seismic array will be much smaller than most arrays used for seismic programs in Alaska, which should reduce potential affects on beluga and seal behavior. The location of the

seismic program is considerably north of the village, which should not affect the behavior or movements of belugas or harbor seals as they move past the village on their migration northward to summer in the upper inlet. The timing of the seismic program will be for a relatively short period from mid March to early May, and airguns will only be activated during the 3-4 slack tide periods each day. The physical characteristics of the site (shallow and soft mud bottom), the relatively high background noise level (95-120 dB) caused by surface noise from the extremely high tides, sea ice, and glacial till in the water column in the inlet will also greatly reduce the distance seismic sound is transmitted in the water, which will limit any behavioral disturbance of marine mammals to near the seismic array. Lastly, mitigation measures will be implements to ramp down or shut down seismic operations if marine mammals enter the safety radii. These aspects of the proposed seismic program and the site along with the Beluga River area not being used for subsistence hunting should result in the seismic program having no more than a negligible affect on the availability of marine mammals for subsistence.

As an additional action, CPAI will meet with the Cook Inlet Marine Mammal Commission (CIMMC), Tyonek Village Council, and the affected native community, if practicable, to discuss the proposed seismic program.

9. The Anticipated Impact of the Activity upon the Habitat of the Marine Mammal Populations, and the Likelihood of Restoration of the Affected Habitat.

The proposed seismic survey will not cause any permanent impact on habitats and the prey used by marine mammals as described in earlier responses and restated below regarding prey.

There is a relative lack of knowledge about the potential physical (pathological and physiological) effects of seismic energy on marine fish and invertebrates. Available data suggest that there may be physical impacts on eggs and on, larval, juvenile, and adult stages at very close range (within meters) to seismic energy sources. Considering typical source levels associated with seismic arrays, close proximity to the source would result in exposure to very high energy levels. Whereas egg and larval stages are not able to escape such exposures, juveniles and adults most likely would avoid them. In the cases of eggs and larvae, it is likely that the numbers adversely affected by such exposure would be very small in relation to natural mortality. Limited data regarding physiological impacts on fish and invertebrates indicate that these impacts are short-term and are most apparent after exposure at very close range (McCauley et al. 2000a,b, Dalen et al. 1996).

As in the case with physical effects of seismic on fish and invertebrates, available information on behavioral effects is relatively scant and often contradictory. There have been well-documented observations of fish and invertebrates

exhibiting behaviors that appeared to be responses to exposure to seismic energy (i.e., startle response, change in swimming direction and speed, and change in vertical distribution (Wardle et al. 2001, Pearson et al. 1992). Some studies indicate that such behavioral changes are very temporary, whereas others imply that fish might not resume pre-seismic behaviors or distributions for a number of days (Engås et al. 1996). The type of behavioral reaction (startle, alarm, and avoidance) appears to depend on many factors, including the type of behavior being exhibited before exposure, and proximity and energy level of the sound source. The ultimate importance of those behaviors is unclear, but they do appear to be local and temporary.

Only a small fraction (<0.1%) of the potentially available habitat (19,863 sq km) in Cook Inlet would be impacted by noise at any given time during the seismic survey, the constant movement of the seismic vessel would prevent any area from sustaining high noise levels for extended periods of time, and any impacts would be limited to 1-2 hours for each of the 3-4 slack tide periods airguns would be activated each day. Disturbance to fish and other prey species would be short-term, temporary, and very localized. Thus, the proposed activity is not expected to have any effects on habitat or prey that could cause permanent or long-term consequences for individual marine mammals or their populations, since seismic operations will be limited in duration, location, timing, and intensity.

10. The Anticipated Impact of the Loss or Modification of the Habitat on the Marine Mammal Populations Involved

The proposed seismic program will not result in any permanent impact on habitats used by marine mammals, or to the food sources they utilize. The main issues are direct and indirect impacts to habitat. Direct impacts are physical destruction or alteration of habitat, which will not occur from the seismic program. Indirect impacts are primarily caused by ensonification of habitat from noise, which will be very localized and short term, since the proposed seismic surveys will be of short duration and confined to one location. Ensonification from seismic operations should have no more than a negligible effect on marine mammal habitat because:

- The seismic program will be in a relatively small area bordered on one side by the shoreline and the air guns will be active for about 3-4, 1-2 hour periods per day during slack tide, thereby confining noise levels to one location for short time periods widely spaced throughout a 24-hour day resulting in affecting a very small proportion of the available habitat in Cook Inlet for prey species or their habitats.
- No studies have demonstrated that seismic noise affects the life stages, condition, or amount of food resources (fish, invertebrates, eggs) comprising habitats used by marine mammals, except when exposed to sound within a few meters of the seismic source or in a few very isolated cases. Where fish or invertebrates did respond to seismic noise, the

affects were of temporary and of short duration (See above). Consequently, disturbance to fish species would be short-term and fish would return to their pre-disturbance behavior once the seismic activity ceases. Thus, the proposed survey would have little, if any, impact on the abilities of marine mammals to feed in the area where seismic work is planned. Furthermore, the seismic program would occur one mile outside of the mouth of the Beluga River to avoid effecting spawning salmon which are a key prey for belugas and the other marine mammal species.

- The seismic area covers a small percentage (<0. 1%) of the potentially available habitat used by marine mammals in Cook Inlet allowing beluga and other marine mammal to move away from any seismic program sounds to feed, rest, migrate or conduct other elements of their life history.

Thus, the proposed activity is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations, since operations will be limited in duration, location, timing, and intensity.

11. **Mitigation Measures (The Availability and Feasibility (Economic and Technological) of Equipment, Methods, and Manner of Conducting Such Activity or means of Effecting the Least Practicable Adverse Impact upon the Affected Species or Stocks, Their Habitat, and on Their Availability for Subsistence Uses, Paying Particular Attention to Rookeries, Mating Grounds, and Areas of Similar Significance).**

CPAI's seismic operations will deploy a 900 cu in bolt airgun array consisting of two sub-arrays each with three 225 cu in airguns and three 75 cu in airguns in a 25 km2 area (< 0.1% of Cook Inlet) extending offshore approximately 4 km in an area that should attenuate the sounds because of its near shore location characterized with a soft, mud bottom in relatively shallow water (0-25 m deep). The primary marine mammal species potentially exposed to seismic sounds will be beluga whales and harbor seals. With the short duration, limited daily activation of the airguns, relatively small array, early spring start, and rapid transmission loss of sound combined with the proposed monitoring, ramp-up, power-down, and shut-down mitigation provisions described below, the planned seismic program is expected to have no more than negligible impacts on the marine mammals species and stocks, and their availability for subsistence. There are no known rookeries, mating grounds, or areas of similar significance in the project area.

Marine Mammal Monitoring

Vessel-based observers will monitor marine mammals at the seismic program during all daytime airgun operations and during any nighttime startups of the airguns. These observations will provide the real-time data needed to implement

some of the key mitigation measures. When marine mammals are observed within, or about to enter, designated safety zones (see below) where there is a possibility of significant effects on hearing or other physical effects, airgun operations will be powered down (or shut down if necessary) immediately.

During daylight, vessel-based observers will watch for marine mammals at the seismic operation during all periods with shooting and for a minimum of 30 minutes prior to the planned start of airgun operations after an extended shut down. CPAI proposes to also conduct daytime and nighttime operations (though there will be little night). Marine mammal observers will not be on duty during ongoing seismic operations at night. At night, CPAI personnel will watch for marine mammals (insofar as practical at night) and will call for the airgun(s) to be shut down if marine mammals are observed in or about to enter the safety radii. If the airguns are started up at night, marine mammal observers will monitor marine mammals near the array for 30 minutes prior to start up of the airguns using night vision devices.

Proposed Safety Radii

Received sound levels were derived from data presented in the University of Alaska IHA for the Healey. The sound levels are for a 1200 cu in Bolt array, which is larger than the array the 900 cu in Bolt array CPAI will use in the Beluga seismic program. Consequently, the data used to derive take for the Beluga program is very conservative, and actual take will be much lower due to the size of the array and the sound characteristics of the near shore site. Water depths of survey area are shallow (0-80 ft) with a soft mud bottom that gradually slopes outward from shore, creating typically poor conditions for sound transmission (Richardson et al. 1995). Ambient noise levels are also high and range from 95 to 120 dB in the upper Cook Inlet (Blackwell and Greene 2003). The maximum distances from the airgun(s) where sound levels of 190, 180, and 160 dB re 1 µPa (rms) are predicted to be received are shown Table 3.

Table 3. Estimated distances sound levels ≥ 190, 180, and 160 dB RMS might be received from an array of 6 airguns used in seismic surveys in Cook Inlet. (Data in table is for a single 1200 cu in Bolt airgun recorded in the Beaufort Sea, since no transmission loss data are available for the 900 cu in Bolt array)

Seismic Source	190dB (Safety Criterion for Seals, Sea Lions)	180dB (Safety Criterion for Whales)	160dB (Assumed Onset of Behavioral Harassment)
900 cu in Bolt Airgun array with 6 airguns including 3 @ 225 cu in and 3 @ 75 cu in	<313 m (0.31 km)	<370 m (0.37 km)	<1527 m (1.52 km)

RMS values referred to 1 µPa
RMS can be converted to Peak-to-Peak by adding 9 dB

Data will be acquired to verify the 190, 180, and 160 dB (rms) distances for the airgun configurations during the 2007 seismic operations in Cook Inlet. JASCO, or another independent marine acoustic firm, will be used to acquire the data. They will follow a scientifically valid sampling design will collect data at the beginning of the seismic program. The data will be used to calibrate the CPAI model. The safety radii will be adjusted to match the field values for the 190, 180, and 160 dB distances for each array, if different from the estimated values in the IHA.

Airguns will be powered down (or shut down if necessary) immediately when marine mammals are detected within or about to enter the appropriate radius: 180-dB (rms) for cetaceans, and 190-dB (rms) for pinnipeds. The 180 and 190 dB shutdown criteria are consistent with guidelines listed for cetaceans and pinnipeds, respectively, by NMFS (2000) and other guidance by NMFS.

Mitigation During Operations

The mitigation and marine mammal monitoring measures listed and described below will be adopted during the proposed seismic program, provided that doing so will not compromise operational safety requirements:

1. Speed and course alteration
2. Power-down procedures
3. Shut down procedures; and
4. Ramp-up procedures.

Speed or Course Alteration

If a marine mammal is detected outside the safety radius and based on its position and the relative motion is likely to enter the safety radius, the vessel's speed and/or direct course may, when practical and safe, be changed that also minimizes the effect on the seismic program. The marine mammal activities and movements relative to the seismic and support vessels will be closely monitored to ensure that the marine mammal does not approach within the safety radius. If the mammal appears likely to enter the safety radius, further mitigative actions will be taken (i.e., either further course alterations or power down or shut down of the airgun(s)).

Power-down Procedures

A power down involves decreasing the number of airguns in use such that the radius of the 180-dB (or 190-dB) zone is decreased to the extent that marine mammals are not in the safety zone. During a power down, one airgun is operated. The continued operation of one airgun is intended to alert marine mammals to the presence of the seismic guns in the area. In contrast, a shut down occurs when all airgun activity is suspended.

If a marine mammal is detected outside the safety radius but is likely to enter the safety radius, the airguns may (as an alternative to a complete shut down) be powered down before the mammal is within the safety radius. Likewise, if a marine mammal is already within the safety zone when first detected, the airguns will be powered down immediately if this is a reasonable alternative to a complete shut down.

Following a power down, airgun activity will not resume until the marine mammal has cleared the safety zone. The animal will be considered to have cleared the safety zone if it:

- Is visually observed to have left the safety zone, or
- Has not been seen within the zone for 15 min in the case of pinnipeds and small odontocetes, or
- Has not been seen within the zone for 30 min in the case of mysticetes/large odontocetes.

Shut-down Procedures

The operating airgun(s) will be shut down completely if a marine mammal approaches or enters the applicable safety radius and a power down is not practical. The operating airgun(s) will also be shut down completely if a marine mammal approaches or enters the estimated safety radius of the source that would be used during a power down. The shutdown procedure should be accomplished within several seconds (of a "one shot" period) of the determination that a marine mammal is within or about to enter the safety zone.

Airgun activity will not resume until the marine mammal has cleared the safety radius. The animal will be considered to have cleared the safety radius if it is visually observed to have left the safety radius, or if it has not been seen within the radius for 15 minutes (beluga, harbor porpoise, killer whales, seals, and sea lions).

Ramp-up Procedures

A "ramp up" procedure will be followed when the airgun array begins operating after a specified-duration period without airgun operations. NMFS normally requires that the rate of ramp up be no more than 6 dB per 5 minute period. Ramp up will begin with the smallest gun in the array that is being used for all subsets of the 6-gun array. Guns will be added in a sequence such that the source level in the array will increase at a rate no greater than 6 dB per 5-minutes, which is the normal rate of ramp up for larger airgun arrays. During the ramp up (i.e., when only one airgun is operating), the safety zone for the full 6-airgun system will be maintained.

If the complete safety radius has not been visible for at least 30 minutes prior to the start of operations in daylight or nighttime, ramp up will not commence unless one gun has been operating during the interruption of seismic survey operations. This means that it will not be permissible to ramp up the 6-gun source from a complete shut down in thick fog or at other times when the outer part of the safety zone is not visible. If the entire safety radius is visible using NVDs (as may be possible under moonlit and calm conditions), then start up of the airguns from a shut down may occur at night. If one airgun has operated during a power-down period, ramp up to full power will be permissible at night or in poor visibility, on the assumption that marine mammals will be alerted to the seismic operations by the sounds from the single airgun and could move away if they choose. Ramp up of the airguns will not be initiated if a marine mammal is sighted within or near the applicable safety radii during the day or a night.

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 Either a Plan of Cooperation or Information that Identifies What Measures have Been Taken and/or Will be Taken to Minimize any Adverse Effect on the Availability of Marine Mammals for Subsistence Uses.

Mitigation measures related to minimizing potential subsistence impacts from the CPAI seismic operation are outlined below.

- Timing of the Seismic Program – Seismic program will occur outside of the area and period for hunting marine mammals. The annual Beluga hunt typically occurs in July near the village of Tyonek. The proposed seismic program will take place between mid March and mid May, north of the village of Tyonek.

- Meeting with Stakeholders – If acceptable to the stakeholders and if their schedules permit, CPAI will meet with the Cook Inlet Marine Mammal Counsel (CIMMC) and the Village of Tyonek prior to commencement of operations. CPAI will provide information on the program timing, program location, features of the seismic operations, opportunities for involvement by local people, and proposed mitigation measures. CPAI will seek and incorporate input from the village and hunters where operationally possible.

- Using Marine Mammal Monitors – Marine mammal monitors will be used during the proposed program. The marine mammal monitors' sole duty is marine mammal observations. Their presence will minimize the potential for adverse interactions from seismic operations with local marine mammals, should they be present. Additionally, their observation data will be presented in a peer review format, following program completion, resulting in an increased understanding of species composition, seasonal distribution,

abundance, and use of the Beluga project area by marine mammals in Cook Inlet.

- Potential Staffing of a Local Resident – CPAI wishes to staff one of the marine mammal observer positions with a qualified local resident. The resident should have knowledge of marine mammals and be knowledgeable of local hunters and hunting practices. Staffing a local resident will provide real time input by affected stakeholders leading to reduced potential for adverse interaction and providing industry personnel with a greater understanding of stakeholders' concerns, provide an effective communication link between the seismic operations and local boats, should they be present, and provide unprecedented access to the seismic operations leading to a greater understanding of industry practices and industry's commitment to health, environment, and safety excellence.

- Operational Practices – There are a number of operational practices that will be used to reduce the potential to affect the availability of marine mammals. They include;
    a. Active seismic shoots will be limited to slack tides.
    b. A source verification will be conducted to determine exact safety radii
    c. Relatively small array
    d. Speed and Course Alteration
    e. Power Down Procedures
    f. Shut Down Procedures
    g. Ramp Up Procedures

  For additional information on operational practices refer to Section 11.

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.**

CPAI's proposed Monitoring Plan is described below. CPAI understands that this Monitoring Plan will be subject to review by NMFS and others and that refinements may be required.

The monitoring work described has been planned as a self-contained project independent of any other related monitoring projects occurring simultaneously in

the same regions. CPAI is prepared to discuss coordination of its monitoring program with any related work be done by other groups insofar as this is practical and desirable.

Vessel-based Visual Monitoring

Vessel-based observers will monitor marine mammals near the seismic vessel during (1) all daytime hours; (2) start ups, and (3) at night when marine mammals are suspected of either approaching or within the safety radii. When feasible, observations will also be made during daytime periods during transits, moving cable, and other operations when guns are inactive.

During seismic operations two observers will be based aboard the Arctic Wolf. Marine mammal observers (MMOs) will be hired by CPAI, with NMFS consultation. One resident from the local native community, preferably from Tyonek who is knowledgeable about marine mammals of the project area may be included as part of the two member MMO team aboard the vessel. Observers will follow a schedule so observers will monitor marine mammals near the seismic vessel during ongoing daytime operations and nighttime start ups of the airguns. MMO(s) will normally be on duty in shifts no longer than 4 hours. The vessel crew will also be instructed to assist in detecting marine mammals and implementing mitigation requirements (if practical). Before the start of the seismic survey the crew will be given additional instruction on how to do so.

The vessel is a suitable platform for marine mammal observations. When stationed on the flying bridge, the observer will have an unobstructed view around the entire vessel. If surveying from the bridge, the observer's eye level will be about 6 m (20 ft). During daytime, the MMO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7 × 50 Bushnell or equivalent) and with the naked eye. Laser range finders (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist with distance estimation. They are useful in training observers to estimate distances visually, but are generally not useful in measuring distances to animals directly. During darkness, NVDs (Night Vision Device) will be available (ITT F500 Series Generation 3 binocular-image intensifier or equivalent), if and when required.

When mammals are detected within or about to enter the designated safety radius, the airgun(s) will be powered down (or shut down if necessary) immediately. The observer(s) will continue to maintain watch to determine when the animal(s) are outside the safety radius. Airgun operations will not resume until the animal is outside the safety radius. The animal will be considered to have cleared the safety radius if it is visually observed to have left the safety radius, or if it has not been seen within the radius for 15 minutes (beluga whales, harbor porpoise, seals, and sea lions) or 30 minutes (killer whales).

All observations and airgun shut downs will be recorded in a standardized format. Data will be entered into a custom database using a notebook computer. The

accuracy of the data entry will be verified by computerized validity data checks as the data are entered and by subsequent manual checking of the database. These procedures will allow initial summaries of data to be prepared during and shortly after the field program, and will facilitate transfer of the data to statistical, graphical, or other programs for further processing and archiving.

Results from the vessel-based observations will provide;

1. The basis for real-time mitigation (airgun shut down).
2. Information needed to estimate the number of marine mammals potentially taken by harassment, which must be reported to NMFS.
3. Data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted.
4. Information to compare the distance and distribution of marine mammals relative to the source vessel at times with and without seismic activity.
5. Data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

Reporting

A report will be submitted to NMFS within 90 days after the end of the project. The report will describe the operations that were conducted and the marine mammals that were detected near the operations. The report will be submitted to NMFS, providing full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report will summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities). The report will also include estimates of the amount and nature of potential "take" of marine mammals by harassment or in other ways.

14. Suggested Means of Learning of, Encouraging, and Coordinating Research Opportunities, Plans, and Activities Relating to Reducing such Incidental taking and Evaluating its Effects.

Open-water seismic operations have been conducted in Alaska waters for over 25 years and, during this time there have been no noticeable adverse impacts from them on the marine mammal populations or their availability for subsistence uses. This includes seismic operations involving air gun arrays far more powerful than that proposed for the Beluga River project. Over the time period these larger air gun arrays have been used in the Chukchi and Beaufort seas, bowheads, gray whales, and other species have increased to where they are approaching or at carrying capacity of the habitat. Furthermore, the subsistence harvest of bowhead whales has been very consistent over the last ten years among the whaling villages suggesting no decrease in their availability for harvest (Suydam and George 2004). While seismic studies have not been conducted in Cook Inlet, those referred above for the Alaska Arctic suggest the nearshore location, site

characteristic, short time frame, limited number and length of time of active seismic operations each day, and relative small airgun array of the proposed seismic program should have no more than a negligible affect on the marine mammal populations.

However, to further ensure that there will be no adverse effects resulting from the planned seismic operations, CPAI will continue to cooperate with the NMFS, MMS, other appropriate federal agencies, the State of Alaska, the Cook Inlet Marine Mammal Commission (CIMMC), Tyonek Village Council, the affected communities, and other monitoring programs to coordinate research opportunities and assess all measures than can be taken to eliminate or minimize any impacts from these activities.

15. Literature Cited

Angliss, R.P. and Outlaw. 2005 draft. National Oceanic and Atmospheric Administration Technical Memorandum National Marine Fisheries Service-AFSC-133. U.S. Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service, Alaska Fisheries Science Center, National Marine Mammal Laboratory. Seattle Washington

Blackwell, S.B. and C.R. Greene, Jr. 2003. Acoustic measurements in Cook Inlet, Alaska, during August 2001. Greeneridge Rep. 271-2, Rep. from Greeneridge Sciences Inc., Santa Barbara, CA, for National Marine Fisheries Service, Anchorage, AK, 43 pp.

Engås, A, S. Løkkeborg, E. Ona and A.V. Soldal. 1996. Effects of seismic shooting on local abundance and catch rates of cod (G. morhua) and haddock (M. aeglefinus). Can. J. Fish. Aquatic. Sci. 53(10):2238-2249.

Finneran, J.J., C.E. Schlundt, R. Dear, D.A. Carder and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. J. Acoust. Soc. Am. 111(6):2929-2940.

Finneran, J.J., C.E. Schlundt, D.A. Carder, J.A. Clark, J.A. Young, J.B. Gaspin and S.H. Ridgway. 2000. Auditory and behavioral responses of bottlenose dolphins (Tursiops truncatus) and beluga whale (Delphinapterus leucas) to impulsive sounds resembling distant signatures of underwater explosions. J. Acoust. Soc. Am. 108(1):417-431

Funk, D.E., T.M. Markowitz, and R. Rodrigues. 2005. Baseline studies of beluga whale habitat us in Knik Arm, Upper Cook Inlet, Alaska, July 2004-July 2005. Rep. from LGL Alaska Research Associates, Inc., Anchorage, AK, in association with HDR Alaska, Inc., Anchorage, AK, for the Knik Arm Bridge and Toll

Authority, Anchorage, AK, the Department of Transportation and Public Facilities.

Greene, C.R., Jr., N.S. Altman and W.J. Richardson. 1999. Bowhead whale calls. p. 6-1 to 6-23 In: W.J. Richardson (ed.), Marine mammal and acoustical monitoring of Western Geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. from LGL Ltd., King City, ON, and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and U.S. Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 390 p.

Harris, R.E., G.W. Miller and W.J. Richardson. 2001. Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. Mar. Mamm. Sci. 17(4):795-812.

Hobbs, R.C., K.L. Laidre, D.J. Vos, B.A. Mahoney, and M. Eagleton. 2005. Movements and area use of belugas in a subarctic Alaskan estuary. Arctic.58(4): 331-340.

Hobbs, R.C. D.J. Rugh, and D.P. DeMaster. 2000. Abundance of beluga whales in Cook Inlet, 1994-2000. Mar. Fish. Rev. 62(3):37-45.

Laidre, K.L., K.E.W. Shelden, D.J. Rugh, and B.A. Mahoney. 2000. Beluga distribution and survey effort in the Gulf of Alaska. Mar. Fish. Rev. 62(3):27-36.

McDonald, M.A., J.A. Hildebrand and S.C. Webb. 1995. Blue and fin whales observed on a seafloor array in the Northeast Pacific. J. Acoust. Soc. Am. 98(2 Pt.1):712-721

Mahoney, B.A. and K.E.W. Sheldon. 2000. Harvest history of Belugas in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):124-133.

Miller, G.W., V.D. Moulton, R.A. Davis, M. Holst, P. Millman, A. MacGillivray and D. Hannay. 2005. Monitoring seismic effects on marine mammals-southeastern Beaufort Sea, 2001-2002. In: S.L. Armsworthy, P.J. Cranford, and K. Lee (eds.), Offshore oil and gas environmental effects monitoring/Approaches and technologies. Battelle Press, Columbus, OH.

Moulton, V.D. and J.W. Lawson. 2002. Seals, 2001. p. 3-1 to 3-46 In: W.J. Richardson and J.W. Lawson (eds.), Marine mammal monitoring of WesternGeco's open-water seismic program in the Alaskan Beaufort Sea, 2001. LGL Rep. TA2564-4. Rep. from LGL Ltd., King City, Ont., for WesternGeco LLC, Anchorage, AK; BP Explor. (Alaska) Inc., Anchorage, AK; and Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 95 p.

Nieukirk, S.L., K.M. Stafford, D.K. Mellinger, R.P. Dziak and C.G. Fox. 2004. Low-frequency whale and seismic airgun sounds recorded in the mid-Atlantic Ocean. J. Acoust. Soc. Am. 115(4):1832-1843.

National Marine Fisheries Service. 2005. Draft conservation plan for the Cook Inlet Beluga Whale. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Protected Resource Division, Alaska Region, Juneau, AK. 149 pp.

O'Corry-Crowe, G.M., R.S. Suydam, A. Rosenberg, K.J. Frost and A.E. Dizon. 1997. Phylogeography, population structure and dispersal patterns of the beluga whale Delphinapterus leucas in the western Nearctic revealed by mitochondrial DNA. Molec. Ecol. 6(10):955-970.

Pearson, W.H., J.R. Skalski and C.I. Malme. 1992. Effects of sounds from a geophysical survey device on behavior of captive rockfish (Sebastes spp.). Can. J. Fish. Aquatic. Sci. 49(7):1343-1356.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme and D.H. Thomson. 1995. Marine mammals and noise. Academic Press, San Diego. 576 p.

Richardson, W.J., B. Würsig and C.R. Greene. 1986. Reactions of bowhead whales, Balaena mysticetus, to seismic exploration in the Canadian Beaufort Sea. J. Acoust. Soc. Am. 79(4):1117-1128.

Rugh, D.J., K.E.W. Shelden, C.L. Sims, B.A. Mahoney, B.K. Smith, L.K. Litzky, and R.C. Hobbs. 2005. Aerial surveys of belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. NOAA Technical Memorandum NMFS-AFSC-149.71 p.

Sheldon, K.E.W., D.J. Rugh, B.A. Mahoney, M.E. Dahlheim. 2003. Killer whale predation on belugas in Cook Inlet Alaska: implications for a depleted population. Mar. Mammal Science. 19(3):529-544.

Suydam, R.R. and J.C. George. 2004. Subsistence harvest of bowhead whales by Alaskan Eskimos, 1974-2003. Paper SC/56/BRG12 presented to the Scientific Committee of the International Whaling Commission.

Wardle, C.S., T.J. Carter, G.G. Urquhart, A.D.F. Johnstone, A.M. Ziolkowski, G. Hampton and D. Mackie. 2001. Some effects of seismic air guns on marine fish. Cont. Shelf Res. 21(8-10):1005-1027