DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 217

[Docket No. 190214112–9112–01]

RIN 0648–BI62

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Oil and Gas Activities in Cook Inlet, Alaska

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Proposed rule; request for comments.

SUMMARY: NMFS has received a request from Hilcorp Alaska LLC (Hilcorp) for authorization to take marine mammals incidental to oil and gas activities in Cook Inlet, Alaska, over the course of five years (2019–2024). As required by the Marine Mammal Protection Act (MMPA), NMFS is proposing regulations to govern that take, and requests comments on the proposed regulations. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorization, and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than May 1, 2019.

ADDRESSES: You may submit comments, identified by NOAA–NMFS–2019–0026, by any of the following methods:

- *Electronic submissions:* Submit all electronic public comments via the Federal eRulemaking Portal, Go to *www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2019-0026,* click the ''Comment Now!'' icon, complete the required fields, and enter or attach your comments.
- *Mail:* Submit comments to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address, etc.), confidential business information, or otherwise sensitive information submitted voluntarily by the sender may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information. NMFS will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Sara Young, Office of Protected Resources, NMFS, (301) 427–8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-oil-and-gas.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Purpose and Need for Regulatory Action

This proposed rule would establish a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to Hilcorp's oil and gas activities in Cook Inlet, Alaska.

We received an application from Hilcorp requesting five-year regulations and authorization to take multiple species of marine mammals. Take would occur by Level A and Level B harassment incidental to a variety of sources including: 2D and 3D seismic surveys, geohazard surveys, vibratory sheet pile driving, and drilling of exploratory wells. Please see ''Background'' below for definitions of harassment.

Legal Authority for the Proposed Action

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1371(a)(5)(A)) directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region for up to five years if, after notice and public comment, the agency makes certain findings and issues regulations that set forth permissible methods of taking pursuant to that activity and other means of effecting the least practicable adverse impact on the affected species or stocks and their habitat (see the discussion below in the ''Proposed Mitigation'' section), as well as monitoring and reporting requirements. Section 101(a)(5)(A) of the MMPA and the implementing regulations at 50 CFR part 216, subpart I provide the legal basis for issuing this proposed rule containing five-year regulations, and for any subsequent letters of authorization (LOAs). As directed by this legal authority, this proposed rule contains mitigation, monitoring, and reporting requirements.

Summary of Major Provisions Within the Proposed Rule

Following is a summary of the major provisions of this proposed rule regarding Hilcorp's activities. These measures include:

- Required monitoring of the ensonified areas to detect the presence of marine mammals before beginning activities;
- Shutdown of activities under certain circumstances to minimize injury of marine mammals;
- Ramp up at the beginning of seismic surveying to allow marine mammals the opportunity to leave the area prior to beginning the survey at full power, as well as power downs, and vessel strike avoidance;
- Ramp up of impact hammering of the drive pipe for the conductor pipe driven from the drill rig; and
- Ceasing noise producing activities within 10 miles (16 km) of the mean higher high water (MHHW) line of the Susitna Delta (Beluga River to the Little Susitna River) between April 15 and October 15.

Background

The MMPA prohibits the ''take'' of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other means of effecting the least practicable adverse impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stocks for taking for certain subsistence uses (referred to in shorthand as ''mitigation''); and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS has defined ''negligible impact'' in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The MMPA states that the term ''take'' means to harass, hunt, capture, kill or attempt to harass, hunt, capture, or kill any marine mammal. Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must review our proposed action (*i.e.,* the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment.

Accordingly, NMFS is preparing an Environmental Assessment (EA) to consider the environmental impacts associated with the issuance of the proposed rule. NMFS' EA will be made available at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-oil-and-gas* on the date of publication of the proposed rule.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the rulemaking request.

Summary of Request

On April 17, 2018, NMFS received an application from Hilcorp requesting authorization to incidentally take marine mammals, by Level A and Level B harassment, incidental to noise exposure resulting from oil and gas activities in Cook Inlet, Alaska, from May 2019 to April 2024. These regulations would be valid for a period of five years. On October 8, 2018, NMFS deemed the application adequate and complete.

The use of sound sources such as those described in the application (*e.g.,* seismic airguns) may result in the take of marine mammals through disruption of behavioral patterns or may cause auditory injury of marine mammals. Therefore, incidental take authorization under the MMPA is warranted.

Description of Proposed Activity

Overview

The scope of Hilcorp's Petition includes four stages of activity, including exploration, development, production, and decommissioning activities within the Applicant's area of operations in and adjacent to Cook Inlet within the Petition's geographic area (Figures 3 and 8 in the application). Table 1 summarizes the planned activities within the geographic scope of this Petition, and the following text describes these activities in more detail. This section is organized into two primary areas within Cook Inlet: lower Cook Inlet (south of the Forelands to Homer) and middle Cook Inlet (north of the Forelands to Susitna/Point Possession).

TABLE 1—SUMMARY OF PLANNED ACTIVITIES INCLUDED IN INCIDENTAL TAKE REGULATIONS (ITR) PETITION

Project name	Cook Inlet region	Year(s) planned	Seasonal timing	Anticipated duration	Anticipated noise sources
Anchor Point 2D seismic survey.	Lower Cook Inlet, Anchor Point to Kasilof.	2021 or 2022	April–October	30 days	Marine: 1 source vessel with airgun, 1 node vessel Onshore/Intertidal: Shot holes, tracked vehicles, helicopters.
Outer Continental Shelf (OCS) 3D seismic survey.	Lower Cook Inlet OCS	2019	April–June	45–60 days	1 source vessel with airguns, 2 support vessels, 1 mitigation vessel potentially.
OCS geohazard survey	Lower Cook Inlet OCS	2019 or 2020	Fall 2019 or spring 20202.	30 days	1 vessel with chosounders and/or sub-bottom profilers.
OCS exploratory wells	Lower Cook Inlet OCS	2020–2022	April–October	40–60 days per well, 2–4 wells per year.	1 jack-up rig, drive pipe installation, vertical seismic profiling, 2–3 tugs for towing rig, support vessels, helicopters.
Iniskin Peninsula exploration and development.	Lower Cook Inlet, west side.	2019–2020	April–October	180 days	Construction of causeway, vibratory sheet pile driving, dredging, vessels.
Platform & pipeline maintenance.	Middle Cook Inlet	2019–2024	April–October	180 days	Vessels, water jets, hydraulic grinders, pingers, helicopters, and/or sub-bottom profilers.
North Cook Inlet Unit subseawell geohazard survey.	Middle Cook Inlet	2020	May	14 days	1 vessel with echosounders and/or sub-bottom profilers.
North Cook Inlet Unit well abandonment activity.	Middle Cook Inlet	2020	May–July	90 days	1 jack-up rig, tugs towing rig, support vessel, helicopters.
Trading Bay area geohazard survey.	Middle Cook Inlet	2020	May	30 days	1 vessel with echosounders and/or sub-bottom profilers.
Trading Bay area exploratory wells.	Middle Cook Inlet	2020	May–October	120–150 days	1 jack-up rig, drive pipe installation, vertical seismic profiling, tugs towing rig, support vessel, helicopters.
Drift River terminal decommissioning.	Lower Cook Inlet, west side.	2023	April–October	120 days	Vessels.

Dates and Duration

The scope of the Petition includes exploration, development, production, and decommissioning activities within the Applicant's area of operations in and adjacent to Cook Inlet within the Petition's geographic area (Figures 3 and 8 in the application) for the period of five years beginning May 1, 2019, extending through April 30, 2024.

Specific Geographic Region

The geographic area of activity covers a total of approximately 2.7 million acres (10,926 km^2) in Cook Inlet. It includes land and adjacent waters in Cook Inlet including both State of Alaska and Federal OCS waters (Figure 3 and 8 in the application). The area extends from the north at the Susitna Delta on the west side (61°10′ 48 N, 151°0′ 55 W) and Point Possession on the east side (61°2′ 11 N, 150°23′ 30 W) to the south at Ursus Cove on the west side (59°26′ 20 N, 153°45′ 5 W) and Nanwalek on the east side (59°24′ 5 N, 151°56′ 30 W). The area is depicted in Figures 3 amd 8 of the application.

Detailed Description of Specific Activity

Activities in Lower Cook Inlet

Based on potential future lease sales in both State and Federal waters, operators collect two-dimensional (2D) seismic data to determine the location of possible oil and gas prospects. Generally, 2D survey lines are spaced farther apart than three-dimensional (3D) surveys and are conducted in a regional pattern that provides less detailed geological information. 2D surveys are used to cover wider areas to map geologic structures on a regional scale. Airgun array sizes used during 2D surveys are similar to those used during 3D surveys.

Activities in Middle Cook Inlet

2D Seismic Survey

During the timeframe of this Petition, the region of interest for the 2D survey is the marine, intertidal, and onshore area on the eastern side of Cook Inlet from Anchor Point to Kasilof. The area of interest is approximately 8 km (5 miles) offshore of the coastline. The anticipated timing of the planned 2D survey is in the open water season (April through October) in either 2020 or 2021. The actual survey duration is approximately 30 days in either year.

The 2D seismic data are acquired using airguns in the marine zone, airguns in the intertidal zone when the tide is high and drilled shot holes in the intertidal zone when the tide is low and drilled shot holes in the land zone. The data are recorded using an autonomous nodal system (*i.e.,* no cables) that are deployed in the marine, intertidal, and land zones. The planned source lines (airgun and shot holes) are approximately 16 km (10 mi) in length running perpendicular to the coastline (see Figure 1 in application). The source lines are spaced every 8 km (5 mi) in between Anchor Point and Kasilof, with approximately 9–10 lines over the area of interest.

In the marine and high tide intertidal zones, data will be acquired using a shallow water airgun towed behind one source vessel. Although the precise volume of the airgun array is unknown at this time, Hilcorp will use an airgun array similar to what has been used for surveys in Cook Inlet by Apache (2011–2013) and SAExploration (2015): Either a 2,400 cubic inch (cui) or 1,760 cui array. A 2,400 cui airgun was assumed for analysis in this proposed rule to be conservative in take estimation. In addition, the source vessel will be equipped with a 440 cui shallow water source which it can deploy at high tide in the intertidal area in less than 1.8 meter (6 feet) of water. Source lines are oriented along the node line. A single vessel is capable of acquiring a source line in approximately 1–2 hours (hrs). In general, only one source line will be collected in one day to allow for all the node deployments and retrievals, and intertidal and land zone shot holes drilling. There are up to 10 source lines, so if all operations run smoothly, there will only be 2 hr per day over 10 days of airgun activity. Hilcorp anticipates the entire operation to take approximately 30 days to complete to account for weather and equipment contingencies.

The recording system that will be employed is an autonomous system ''nodal'' (*i.e.,* no cables), which is expected to be made up of at least two types of nodes; one for the land and one for the intertidal and marine environment. For the intertidal and marine zone, this will be a submersible multi-component system made up of three velocity sensors and a hydrophone. These systems have the ability to record continuous data. Inline receiver intervals for the node systems are approximately 50 m (165 ft). For 2D seismic surveys, the nodes are deployed along the same line as the seismic source. The deployment length is restricted by battery duration and data storage capacity. The marine nodes will be placed using one node vessel. The vessels required for the 2D seismic survey include just a source vessel and a node vessel that is conducting only passive recording.

In the marine environment, once the nodes are placed on the seafloor, the exact position of each node is required. In very shallow water, the node positions are either surveyed by a land surveyor when the tide is low, or the position is accepted based on the position at which the navigator has laid the unit. In deeper water, a hull or pole mounted pinger to send a signal to the transponder which is attached to each node will be used. The transponders are coded and the crew knows which transponder goes with which node prior to the layout. The transponders response (once pinged) is added together with several other responses to create a suite of range and bearing between the pinger boat and the node. Those data are then calculated to precisely position the node. In good conditions, the nodes can be interrogated as they are laid out. It is also common for the nodes to be pinged after they have been laid out. Onshore and intertidal locating of source and receivers will be accomplished with Differential Global Positioning System/roving units (DGPS/RTK) equipped with telemetry radios which will be linked to a base station established on the source vessel. Survey crews will have both helicopter and light tracked vehicle support. Offshore source and receivers will be positioned with an integrated navigation system (INS) utilizing DGPS/RTK link to the land base stations. The integrated navigation system will be capable of many features that are critical to efficient safe operations. The system will include a hazard display system that can be loaded with known obstructions, or exclusion zones. Apache conducted a sound source verification (SSV) for the 440 cui and 2,400 cui arrays in 2012 (Austin and Warner 2012; 81 FR 47239). The location of the SSV was in Beshta Bay on the western side of Cook Inlet (between Granite Point and North Forelands). Water depths ranged from 30–70 m (98–229 ft).

For the 440 cui array, the measured levels for the broadside direction were 217 decibel (dB) re: 1microPa (μPa) peak, 190 dB sound exposure level (SEL), and 201 dB root mean square (rms) at a distance of 50 m. The estimated distance to the 160 dB rms (90th percentile) threshold assuming the empirically measured transmission loss of 20.4 log R (Austin and Warner, 2012) was 2,500 m. Sound level near the source were highest between 30 and 300 hertz (Hz) in the endfire direction and between 20 Hz and 300 Hz in the broadside direction.

For the 2,400 cui array, the measured levels for the endfire direction were 217 dB peak, 185 dB SEL, and 197 dB rms at a distance of 100 m. The estimate distance to the 160 dB rms (90th percentile) thresholds assuming the empirically measured transmission loss of 16.9 log R was 7,770 m. Sound levels near the source were highest between 30 and 150 Hz in the endfire direction and between 50 and 200 Hz in the broadside direction. These measured levels were used to evaluate potential Level A (217 dB peak and 185 dB SEL at 100 m assuming 15 log transmission loss) and Level B (7,330 m distance to 160 dB threshold) harassment isopleths from these sound sources (see Estimated Take section).

3D Seismic Survey

During the timeframe of this Petition, Hilcorp plans to collect 3D seismic data for approximately 45–60 days starting May 1, 2019 over 8 of the 14 OCS lease blocks in lower Cook Inlet. The 3D seismic survey is comprised of an area of approximately 790 km² (305 mi²) through 8 lease blocks (6357, 6405, 6406, 6407, 6455, 6456, 6457, 6458). Hilcorp submitted an application for an Incidental Harassment Authorization (IHA) in late 2017 for a planned survey in 2018 but withdrew the application and now plan for the survey to take place in 2019 and cover several years of surveying and development. The survey program is anticipated to begin May 1, 2019, and last for approximately 45–60 days through June 2019 in compliance with identified Bureau of Ocean Energy Management (BOEM) lease stipulations. The length of the survey will depend on weather, equipment, and marine mammal delays (contingencies of 20 percent weather, 10 percent equipment, 10 percent marine mammal were assumed in this analysis, or a 40 percent increase in expected duration to account for the aforementioned delays).

Polarcus is the intended seismic contractor, and the general seismic survey design is provided below. The 3D seismic data will be acquired using a specially designed marine seismic vessel towing between 8 and 12 ~2,400-m (1.5 mi) recording cables with a dual air gun array. The survey will involve one source vessel, one support vessel, one chase vessel, and potentially one mitigation vessel. The anticipated seismic source to be deployed from the source vessel is a 14-airgun array with a total volume of 1,945 cui. Crew changes are expected to occur every four to six weeks using a helicopter or support vessel from shore bases in lower Cook Inlet. The proposed seismic survey will be active 24 hrs per day. The array will be towed at a speed of approximately 7.41 km/hr (4 knots), with seismic data collected continuously. Data acquisition will occur for approximately 5 hrs, followed by a 1.5-hr period to turn and reposition the vessel for another pass. The turn radius on the seismic vessel is approximately 3,200 m (2 mi).

The data will be shot parallel to the Cook Inlet shorelines in a north/south direction. This operational direction will keep recording equipment/streamers in line with Cook Inlet currents and tides and keep the equipment away from shallow waters on the east and west sides. The program may be modified if the survey cannot be conducted as a result of noise conditions onsite (*i.e.,* ambient noise). The airguns will typically be turned off during the turns. However, depending on the daylight hours and length of the turn, Hilcorp may use the smallest gun in the array (45 cui) as a mitigation airgun where needed for no longer than 3 hours. The vessel will turn into the tides to ensure the recording cables/streamers remain in line behind the vessel.

Hilcorp plans to use an array that provides for the lowest possible sound source to collect the target data. The proposed array is a Bolt 1900 LLXT dual gun array. The airguns will be configured as two linear arrays or ''strings;'' each string will have 7 airguns shooting in a ''flip-flop'' configuration for a total of 14 airguns. The airguns will range in volume from 45 to 290 cui for a total of 1,945 cui. The first and last are spaced approximately 14 m (45.9 ft) apart and the strings are separated by approximately 10 m (32.8 ft). The two airgun strings will be distributed across an approximate area of 30 x 14 m (98.4 x 45.9 ft) behind the source vessel and will be towed 300–400 m (984–1,312 ft) behind the vessel at a depth of 5 m (16.4 ft). The firing pressure of the array is 2,000 pounds per square inch (psi). The airgun will fire every 4.5 to 6 seconds, depending on the exact speed of the vessel. When fired, a brief (25 milliseconds [ms] to 140 ms) pulse of sound is emitted by all airguns nearly simultaneously. Hilcorp proposes to use a single 45 cui airgun, the smallest airgun in the array, for mitigation purposes.

Hilcorp intends to use 8 Sercel-type solid streamers or functionally similar for recording the seismic data (Figure 5 in the application). Each streamer will be approximately 2,400 m (150 mi) in length and will be towed approximately 8–15 m (26.2–49.2 ft) or deeper below the surface of the water. The streamers will be placed approximately 50 m (165 ft) apart to provide a total streamer spread of 400 m (1,148 ft). Hilcorp recognizes solid streamers as best in class for marine data acquisition because of unmatched reliability, signal to noise ratio, low frequency content, and noise immunity.

The survey will involve one source vessel, one support vessel, one or two chase vessels, and potentially one mitigation vessel. The source vessel tows the airgun array and the streamers. The support vessel provides general support for the source vessel, including supplies, crew changes, etc. The chase vessel monitors the in-water equipment and maintains a security perimeter around the streamers. The mitigation vessel provides a viewing platform to augment the marine mammal monitoring program.

The planned volume of the airgun array is 1,945 cui. Hilcorp and their partners will be conducting detailed modeling of the array output, but a detailed SSV has not been conducted for this array in Cook Inlet. Therefore, for the purposes of estimating acoustic harassment, results from previous seismic surveys in Cook Inlet by Apache and SAExploration, particularly the 2,400 cui array, were used. Apache conducted an SSV for the 440 cui and 2,400 cui arrays in 2012 (Austin and Warner 2012; 81 FR 47239). The location of the SSV was in Beshta Bay on the western side of Cook Inlet (between Granite Point and North Forelands). Water depths ranged from 30–70 m (98–229 ft). For the 2,400 cui array, the measured levels for the endfire direction were 217 dB peak, 185 dB SEL, and 197 dB rms at a distance of 100 m. The estimate distance to the 160 dB rms (90th percentile) thresholds assuming the empirically measured transmission loss of 16.9 log R was 7,770 m. Sound levels near the source were highest between 30 and 150 Hz in the endfire direction and between 50 and 200 Hz in the broadside direction.

These measured levels were used to evaluate potential Level A (217 dB peak and 185 dB SEL at 100 m assuming 15 log transmission loss) and B (7,330 m distance to 160 dB threshold) acoustic harassment of marine mammals in this Petition.

Geohazard and Geotechnical Surveys

Upon completion of the 3D seismic survey over the lower Cook Inlet OCS leases, Hilcorp plans to conduct a geohazard survey on site-specific regions within the area of interest prior to conducting exploratory drilling. The precise location is not known, as it depends on the results of the 3D seismic survey, but the location will be within the lease blocks. The anticipated timing of the activity is in either the fall of 2019 or the spring of 2020. The actual survey duration will take approximately 30 days.

The suite of equipment used during a typical geohazards survey consists of single beam and multi-beam echosounders, which provide water depths and seafloor morphology; a side scan sonar that provides acoustic images of the seafloor; a sub-bottom profiler which provides 20 to 200 m (66 to 656 ft) sub-seafloor penetration with a 6- to 20-centimeter (cm, 2.4–7.9-inch [in]) resolution. Magnetometers, to detect ferrous items, may also be used. Geotechnical surveys are conducted to collect bottom samples to obtain physical and chemical data on surface and near sub-surface sediments. Sediment samples typically are collected using a gravity/piston corer or grab sampler. The surveys are conducted from a single support vessel.

The echosounders and sub-bottom profilers are generally hull-mounted or towed behind a single vessel. The ship travels at 3–4.5 knots (5.6–8.3 km/hr). Surveys are site specific and can cover less than one lease block in a day, but the survey extent is determined by the number of potential drill sites in an area. BOEM guidelines at NTL–A01 require data to be gathered on a 150 by 300 m (492 by 984 ft) grid within 600 m (1,969 ft) of the surface location of the drill site, a 300 by 600 m (984 by 1,969 ft) grid along the wellbore path out to 1,200 m (3,937 ft) beyond the surface projection of the conductor casing, and extending an additional 1,200 m beyond that limit with a 1,200 by 1,200 m grid out to 2,400 m (7,874 ft) from the well site.

The multibeam echosounder, single beam echosounder, and side scan sonar operate at frequencies of greater than 200 kHz. Based on the frequency ranges of these pieces of equipment and the hearing ranges of the marine mammals that have the potential to occur in the action area, the noise produced by the echosounders and side scan sonar are not likely to result in take of marine mammals and are not considered further in this document.

The geophysical surveys include use of a low resolution and high resolution sub-bottom profiler. The proposed high-resolution sub-bottom profiler operates at source level of 210 dB re 1 μPa RMS at 1 m. The proposed system emits energy in the frequency bands of 2 to 24 kHz. The beam width is 15 to 24 degrees. Typical pulse rate is between 3 and 10 Hz. The secondary low-resolution sub-bottom profiler will be utilized as necessary to increase sub-bottom profile penetration. The proposed system emits energy in the frequency bands of 1 to 4 kHz.

Exploratory Drilling

Operators will drill exploratory wells based on mapping of subsurface structures using 2D and 3D seismic data and historical well information. Hilcorp plans to conduct the exploratory drilling program April to October between 2020 and 2022. The exact start date is currently unknown and is dependent on the results of the seismic survey, geohazard survey, and scheduling availability of the drill rig. It is expected that each well will take approximately 40–60 days to drill and test. Beginning in spring 2020, Hilcorp Alaska plans to possibly drill two and as many as four exploratory wells, pending results of the 3D seismic survey in the lower Cook Inlet OCS leases. After testing, the wells may be plugged and abandoned.

Hilcorp Alaska proposes to conduct its exploratory drilling using a rig similar to the Spartan 151 drill rig. The Spartan 151 is a 150 H class independent leg, cantilevered jack-up drill rig with a drilling depth capability of 7,620 m (25,000 ft) that can operate in maximum water depths up to 46 m (150 ft). Depending on the rig selection and location, the drilling rig will be towed on site using up to three ocean-going tugs licensed to operate in Cook Inlet. Rig moves will be conducted in a manner to minimize any potential risk regarding safety as well as cultural or environmental impact. While under tow to the well sites, rig operations will be monitored by Hilcorp and the drilling contractor management. Very High Frequency (VHF) radio, satellite, and cellular phone communication systems will be used while the rig is under tow. Helicopter transport will also be available.

Similarly to transiting vessels, although some marine mammals could receive sound levels in exceedance of the general acoustic threshold of 120 dB from the tugs towing the drill rig during this project, take is unlikely to occur, primarily because of the predictable movement of vessels and tugs. Marine mammal population density in the project area is low (see Estimated Take section below), and those that are present are likely habituated to the existing baseline of commercial ship traffic. Further, there are no activity-, location-, or species-specific circumstances or other contextual factors that would increase concern and the likelihood of take from towing of the drill rig.

The drilling program for the well will be described in detail in an Exploration Plan to BOEM. The Exploration Plan will present information on the drilling mud program; casing design, formation evaluation program; cementing programs; and other engineering information. After rig up/rig acceptance by Hilcorp Alaska, the wells will be spudded and drilled to bottom-hole depths of approximately 2,100 to 4,900 m (7,000 to 16,000 ft) depending on the well. It is expected that each well will take about 40–60 days to drill and up to 10–21 days of well testing. If two wells are drilled, it will take approximately 80–120 days to complete the full program; if four wells are drilled, it will take approximately 160–240 days to complete the full program.

Primary sources of rig-based acoustic energy were identified as coming from the D399/D398 diesel engines, the PZ–10 mud pump, ventilation fans (and associated exhaust), and electrical generators. The source level of one of the strongest acoustic sources, the diesel engines, was estimated to be 137 dB re 1 μPa rms at 1 m in the 141–178 Hz bandwidth. Based on this measured level, the 120 dB rms acoustic received level isopleth would be 50 m (154 ft) away from where the energy enters the water (jack-up leg or drill riser). Drilling and well construction sounds are similar to vessel sounds in that they are relatively low-level and low-frequency. Since the rig is stationary in a location with low marine mammal density, the impact of drilling and well construction sounds produced from the jack up rig is expected to be lower than a typical large vessel. There is open water in all directions from the drilling location. Any marine mammal approaching the rig would be fully aware of its presence long before approaching or entering the zone of influence for behavioral harassment, and we are unaware of any specifically important habitat features (*e.g.,* concentrations of prey or refuge from predators) within the rig's zone of influence that would encourage marine mammal use and exposure to higher levels of noise closer to the source. Given the absence of any activity-, location-, or species-specific circumstances or other contextual factors that would increase concern, we do not expect routine drilling noise to result in the take of marine mammals.

When planned and permitted operations are completed, the well will be suspended according to Bureau of Safety and Environmental Enforcement (BSEE) regulations. The well casings will be landed in a mudline hanger after each hole section is drilled. When the well is abandoned, the production casing is sealed with mechanical plugging devices and cement to prevent the movement of any reservoir fluids between various strata. Each casing string will be cutoff below the surface and sealed with a cement plug. A final shallow cement plug will be set to approximately 3.05 m (10 ft) below the mudline. At this point, the surface casing, conductor, and drive pipe will be cutoff and the three cutoff casings and the mudline hanger are pulled to the deck of the jack-up rig for final disposal. The plugging and abandonment procedures are part of the Well Plan which is reviewed by BSEE prior to being issued an approved Permit to Drill.

A drive pipe is a relatively short, large-diameter pipe driven into the sediment prior to the drilling of oil wells. The drive pipe serves to support the initial sedimentary part of the well, preventing the looser surface layer from collapsing and obstructing the wellbore. Drive pipes are installed using pile driving techniques. Hilcorp proposed to drive approximately 60 m of 76.2-cm pipe at each well site prior to drilling using a Delmar D62–22 impact hammer (or similar). This hammer has an impact weight of 6,200 kg (13,640 lbs). The drive pipe driving event is expected to last one to three days at each well site, although actual pounding of the pipe will only occur intermittently during this period. Conductors are slightly smaller diameter pipes than the drive pipes used to transport or ''conduct'' drill cuttings to the surface. For these wells, a 50.8-cm [20-in] conductor pipe may be drilled, not hammered, inside the drive pipe, dependent on the integrity of surface formations.

Illingworth & Rodkin (2014) measured the hammer noise for hammering the drive pipe operating from the rig *Endeavour* for Buccaneer in 2013 and report the source level at 190 dB at 55 m, with underwater levels exceeding 160 dB rms threshold at 1.63 km (1 mi). The measured sound levels for the pipe driving were used to evaluate potential Level A (source level of 221dB @1m and assuming 15 logR transmission loss) and Level B (1,630 m distance to the 160 dB threshold) acoustic harassment of marine mammals. Conductors are slightly smaller diameter pipes than the drive pipes used to transport or ''conduct'' drill cuttings to the surface. For these wells, a 50.8-cm (20-in) conductor pipe may be drilled, not hammered, inside the drive pipe, dependent on the integrity of surface formations. There are no noise concerns associated with the conductor pipe drilling.

Once the well is drilled, accurate follow-up seismic data may be collected by placing a receiver at known depths in the borehole and shooting a seismic airgun at the surface near the borehole, called vertical seismic profiling (VSP). These data provide high-resolution images of the geological layers penetrated by the borehole and can be used to accurately correlate original surface seismic data. The actual size of the airgun array is not determined until the final well depth is known, but typical airgun array volumes are between 600 and 880 cui. VSP typically takes less than two full days at each well site. Illingworth & Rodkin (2014) measured a 720 cui array for Buccaneer in 2013 and report the source level at 227 dB at 1 m, with underwater levels exceeding 160 dB rms threshold at 2.47 km (1.54 mi). The measured sound levels for the VSP were used to evaluate potential Level A (227 dB rms at 1 m assuming 15 logR transmission loss) and Level B (2,470 m distance to the 160 dB threshold) harassment isopleths.

Iniskin Peninsula Exploration

Hilcorp Alaska initiated baseline exploratory data collection in 2013 for a proposed land-based oil and gas exploration and development project on the Iniskin Peninsula of Alaska, near Chinitna Bay. The proposed project is approximately 97 km (60 mi) west of Homer on the west side of Cook Inlet in the Fitz Creek drainage. New project infrastructure includes material sites, a 6.9 km (4.3 mi) long access road, prefabricated bridges to cross four streams, an air strip, barge landing/staging areas, fuel storage facilities, water wells and extraction sites, an intertidal causeway, a camp/staging area, and a drill pad. Construction is anticipated to start in 2020.

An intertidal rock causeway is proposed to be constructed adjacent to the Fitz Creek staging area to improve the accessibility of the barge landing during construction and drilling operations. The causeway will extend seaward from the high tide line approximately 366 m (1,200 ft) to a landing area 46 m (150 ft) wide. A dock face will be constructed around the rock causeway so that barges will be able to dock along the causeway. Rock placement for the causeway is not known to generate sound at levels expected to disturb marine mammals. The causeway is also not proposed at a known pinniped haulout or other biologically significant location for local marine mammals. Therefore, rock laying for the causeway is not considered further in this document.

The causeway will need to be 75 percent built before the construction of the dock face will start. The dock face will be constructed with 18-m (60-ft) tall Z-sheet piles, all installed using a vibratory hammer. It will take approximately 14–25 days, depending on the length of the work shift, assuming approximately 25 percent of the day actual pile driving. The timing of pile driving will be in late summer or early winter, after the causeway has been partially constructed. Illingworth & Rodkin (2007) compiled measured near-source (10 m [32.8 ft]) SPL data from vibratory pile driving for different pile sizes ranging in diameter from 30.5 to 243.8 cm (12 to 96 in). For this petition, the source level of the 61.0-cm (24-in) AZ steel sheet pile from Illingworth & Rodkin (2007) was used for the sheet pile. The measured sound levels of 160 dB rms at 10 m assuming 15 logR transmission loss for the vibratory sheet pile driving was used to evaluate potential Level A and B harassment isopleths.

Activities in Middle Cook Inlet

Offshore Production Platforms

Of the 17 production platforms in central Cook Inlet, 15 are owned by Hilcorp. Hilcorp performs routine construction on their platforms, depending on needs of the operations. Construction activities may take place up to 24 hrs a day. In-water activities include support vessels bringing supplies five days a week up to two trips per day between offshore systems at Kenai (OSK) and the platform. Depending on the needs, there may also be barges towed by tugs with equipment and helicopters for crew and supply changes. Routine supply-related transits from vessels and helicopters are not substantially different from routine vessel and air traffic already occurring in Cook Inlet, and take is not expected to occur from these activities.

Offshore Production Drilling

Hilcorp routinely conducts development drilling activities at offshore platforms on a regular basis to meet the asset's production needs. Development drilling activities occurs from existing platforms within the Cook Inlet through either open well slots or existing wellbores in existing platform legs. Drilling activities from platforms within Cook Inlet are accomplished by using conventional drilling equipment from a variety of rig configurations.

Some other platforms in Cook inlet have permanent drilling rigs installed that operate under power provided by the platform power generation systems, while others do not have drill rigs, and the use of a mobile drill rig is required. Mobile offshore drill rigs may be powered by the platform power generation (if compatible with the platform power system) or self-generate power with the use of diesel fired generators. For the reasons outlined above for the Lower Inlet, noise from routine drilling is not considered further in this document.

Helicopter logistics for development drilling programs operations will include transportation for personnel and supplies. The helicopter support will be managed through existing offshore services based at the OSK Heliport to support rig crew changes and cargo handling. Helicopter flights to and from the platform while drilling is occurring is anticipated to increase (on average) by two flights per day from normal platform operations.

Major supplies will be staged on-shore at the OSK Dock in Nikiski. Required supplies and equipment will be moved from the staging area to the platform in which drilling occurring by existing supply vessels that are currently in use supporting offshore operations within Cook Inlet. Vessel trips to and from the platform while drilling is occurring is anticipated to increase (on average) by two trips per day from normal platform operations. During mobile drill rig mobilization and demobilization, one support vessel is used continuously for approximately 30 days to facilitate moving rig equipment and materials.

Oil and Gas Pipeline Maintenance

Each year, Hilcorp Alaska must verify the structural integrity of their platforms and pipelines located within Cook Inlet. Routine maintenance activities include: subsea pipeline inspections, stabilizations, and repairs; platform leg inspections and repairs; and anode sled installations and/or replacement. In general, pipeline stabilization and pipeline repair are anticipated to occur in succession for a total of 6–10 weeks. However, if a pipeline stabilization location also requires repair, the divers will repair the pipeline at the same time they are stabilizing it. Pipeline repair activities are only to be conducted on an as-needed basis whereas pipeline stabilization activities will occur annually. During underwater inspections, if the divers identify an area of the pipeline that requires stabilization, they will place Sea-Crete bags at that time rather than waiting until the major pipeline stabilization effort that occurs later in the season.

Natural gas and oil pipelines located on the seafloor of the Cook Inlet are inspected on an annual basis using ultrasonic testing (UT), cathodic protection surveys, multi-beam sonar surveys, and sub-bottom profilers. Deficiencies identified are corrected using pipeline stabilization methods or USDOT-approved pipeline repair techniques. The Applicant employs dive teams to conduct physical inspections and evaluate cathodic protection status and thickness of subsea pipelines on an annual basis. If required for accurate measurements, divers may use a water jet to provide visual access to the pipeline. For stabilization, inspection dive teams may place Sea-Crete bags beneath the pipeline to replace any materials removed by the water jet. Results of the inspections are recorded and significant deficiencies are noted for repair.

Multi-beam sonar and sub-bottom profilers may also be used to obtain images of the seabed along and immediately adjacent to all subsea pipelines. Elements of pipeline inspections that could produce underwater noise include: the dive support vessel, water jet, multi-beam sonar/sub-bottom profiler and accompanying vessel.

A water jet is a zero-thrust water compressor that is used for underwater removal of marine growth or rock debris underneath the pipeline. The system operates through a mobile pump which draws water from the location of the work. Water jets likely to be used in Cook Inlet include, but are not limited to, the CaviDyne CaviBlaster® and the Gardner Denver Liqua-Blaster. Noise generated during the use of the water jets would be very short in duration (30 minutes or less at any given time) and intermittent.

Hilcorp Alaska conducted underwater measurements during 13 minutes of CaviBlaster® use in Cook Inlet in April 2017 (Austin 2017). Received sound levels were measured up to 143 dB re 1 μPa rms at 170 m and up to 127 dB re 1 μPa rms at 1,100 m. Sounds from the Caviblaster® were clearly detectable out to the maximum measurement range of 1.1 km. Using the measured transmission loss of 19.5 log R (Austin 2017), the source level for the Caviblaster® was estimated as 176 dB re 1 μPa at 1 m. The sounds were broadband in nature, concentrated above 500 Hz with a dominant tone near 2 kHz.

Specifications for the GR 29 Underwater Hydraulic Grinder state that the SPL at the operator's position would be 97 dB in air (Stanley 2014). There are no underwater measurements available for the grinder, so using a rough estimate of converting sound level in dB in air to water by adding 61.5 dB would result in an underwater level of approximately 159 dB2. The measured sound levels for the water jet and grinder were used to evaluate potential Level A and B acoustic harassment isopleths.

If necessary, Hilcorp may use an underwater pipe cutter to replace existing pipeline segments in Cook Inlet. The following tools are likely to be used for pipeline cutting activities:

- A diamond wire saw used for remote cutting underwater structures such as pipes and I-Beams. These saws use hydraulic power delivered by a dedicated power source. The saw usually uses a method that pushes the spinning wire through the pipe.
- A hydraulically-powered Guillotine saw which uses an orbital cutting movement similar to traditional power saws.

Generally, sound radiated from the diamond wire cutter is not easily discernible from the background noise during the cutting operation. The Navy measured underwater sound levels when the diamond saw was cutting caissons for replacing piles at an old fuel pier at Naval Base Point Loma (Naval Base Point Loma Naval Facilities Engineering Command Southwest 2017). They reported an average SPL for a single cutter at 136.1–141.4 dB rms at 10 m.

Specifications for the Guillotine saw state that the SPL at the operator's position would be 86 dB in air (Wachs 2014). There are no underwater measurements available for the grinder, so using a rough estimate of converting sound level in dB in air to water by adding 61.5 dB would result in an underwater level of approximately 148 dB.

Because the measured levels for use of underwater saws do not exceed the NMFS criteria, the noise from underwater saws was not considered further in this document. Scour spans beneath pipelines greater than 23 m (75 ft) have the potential to cause pipeline failures. To be conservative, scour spans of 15 m (50 ft) or greater identified using multi-beam sonar surveys are investigated using dive teams. Divers perform tactile inspections to confirm spans greater than 15 m (50 ft). The pipeline is stabilized along these spans with Sea-Crete concrete bags. While in the area, the divers will also inspect the external coating of the pipeline and take cathodic protection readings if corrosion wrap is found to be absent. Elements of pipeline stabilization that could produce underwater noise include: Dive support vessel and water jet.

Significant pipeline deficiencies identified during pipeline inspections are repaired as soon as practicable using methods including, but not limited to, USDOT-approved clamps and/or fiber glass wraps, bolt/flange replacements, and manifold replacements. In some cases, a water jet may be required to remove sand and gravel from under or around the pipeline to allow access for assessment and repair. The pipeline surface may also require cleaning using a hydraulic grinder to ensure adequate repair. If pipeline replacement is required, an underwater pipe cutter such as a diamond wire saw or hydraulically-powered Guillotine saw may be used. Elements of pipeline repair that could produce underwater noise include: Dive support vessel, water jet, hydraulic grinder, and underwater pipe cutter.

Platform Leg Inspection and Repair

Hilcorp's platforms in Cook Inlet are inspected on a routine basis. Divers and certified rope access technicians visually inspect subsea platform legs. These teams also identify and correct significant structural deficiencies. Platform leg integrity and pipeline-to-platform connections beneath the water surface are evaluated by divers on a routine basis. Platform legs, braces, and pipeline-to-platform connections are evaluated for cathodic protection status, structure thickness, excessive marine growth, damage, and scour. If required, divers may use a water jet to clean or provide access to the structure. If necessary, remedial grinding using a hydraulic under water grinder may be required to determine extent damage and/or to prevent further crack propagation. All inspection results are recorded and significant deficiencies are noted for repair. Elements of subsea platform leg inspection and repair that could produce underwater noise include: Dive support vessel, hydraulic grinder, water jet.

Platform leg integrity along the tidal zone is inspected on a routine basis. Difficult-to-reach areas may be accessed using either commercially-piloted unmanned aerial systems (UAS). Commercially-piloted UASs may be deployed from the top-side of the platform to obtain images of the legs. Generally, the UAS is in the air for 15–20 minutes at a time due to battery capacity, which allows for two legs and part of the underside of the platform to be inspected. The total time to inspect a platform is approximately 1.5 hrs of flight time. The UAS is operated at a distance of up to 30.5 m (100 ft) from the platform at an altitude of 9–15 m (30–50 ft) above sea level. To reduce potential harassment of marine mammals, the area around the platform would be inspected prior to launch of the UAS to ensure there are no flights directly above marine mammals. As no flights will be conducted directly over marine mammals, the effects of drone use for routine maintenance are not considered further in this application.

Anode Sled Installation and Replacement

Galvanic and impressed current anode sleds are used to provide cathodic protection for the pipelines and platforms in Cook Inlet. Galvanic anode sleds do not require a power source and may be installed along the length of the pipelines on the seafloor. Impressed current anode sleds are located on the seafloor at each of the corners of each platform and are powered by rectifiers located on the platform. Anodes are placed at the seafloor using dive vessels and hand tools. If necessary, a water jet may be used to provide access for proper installation. Anodes and/or cables may be stabilized using Sea-Crete bags.

Pingers

Several types of moorings are deployed in support of Hilcorp operations; all of which require an acoustic pinger for location or release. The pinger is deployed over the side of a vessel and a short signal is emitted to the mooring device. The mooring device responds with a short signal to indicate that the device is working, to indicate range and bearing data, or to illicit a release of the unit from the anchor. These are used for very short periods of time when needed.

The types of moorings requiring the use of pingers anticipated to be used in the Petition period include acoustic moorings during the 3D seismic survey (assumed 2–4 moorings), node placement for the 2D survey (used with each node deployment), and potential current profilers deployed each season (assumed 2–4 moorings). The total amount of time per mooring device is less than 10 minutes during deployment and retrieval. To avoid disturbance, the pinger would not be deployed if marine mammals have been observed within 135 m (443 ft) of the vessel. The short duration of the pinger deployment as well as Hilcorp's mitigation suggests take of marine mammals from pinger use is unlikely to occur and pingers are not considered further in this analysis.

North Cook Inlet Unit Subsea Well Plugging and Abandonment

The discovery well in the North Cook Inlet Unit was drilled over 50 years ago and is planned to be abandoned, so Hilcorp Alaska plans to conduct a geohazard survey to locate the well and conduct plugging and abandonment (P&A) activities for a previously drilled subsea exploration well in 2020. The geohazard survey location is approximately 402–804 m (¼-½ mi) south of the Tyonek platform and will take place over approximately seven days with a grid spacing of approximately 250 m (820 ft). The suite of equipment used during a typical geohazards survey consists of single beam and multi-beam echosounders, which provide water depths and seafloor morphology; a side scan sonar that provides acoustic images of the seafloor; a sub-bottom profiler which provides 20 to 200 m (66 to 656 ft) sub-seafloor penetration with a 6- to 20-cm (2.4–7.9-in) resolution. The echosounders and sub-bottom profilers are generally hull-mounted or towed behind a single vessel. The vessel travels at 3–4.5 knots (5.6–8.3 km/hr).

After the well has been located, Hilcorp plans to conduct plugging and abandonment activities over a 60–90 day time period in May through July in 2020. The jack-up rig will be similar to what is described above (the Spartan 151 drill rig, or similar). The rig will be towed onsite using up to three ocean-going tugs. Once the jack-up rig is on location, divers working off a boat will assist in preparing the subsea wellhead and mudline hanger for the riser to tie the well to the jack-up. Once the riser is placed, the BOP equipment is made up to the riser. At this point, the well will be entered and well casings will be plugged with mechanical devices and cement and then cutoff and pulled. A shallow cement plug will be set in the surface casing to 3.05 m (10 ft) below the mudline hanger. The remaining well casings will be cutoff and the mudline hanger will be recovered to the deck of the jack-up rig for disposal. The well abandonment will be performed in accordance to Alaska Oil and Gas Conservation Commission (AOGCC) regulations.

Trading Bay Exploratory Drilling

Hilcorp plans to conduct exploratory drilling activities in the Trading Bay area. The specific sites of interest have not yet been identified, but the general area is shown in Figure 3 in the application. Hilcorp will conduct geohazard surveys over the areas of interest to locate potential hazards prior to drilling with the same suite of equipment as described above for exploratory drilling in the lower Inlet. The survey is expected to take place over 30–60 days in 2019 from a single vessel.

The exploratory drilling and well completion activities will take place in site-specific areas based on the geohazard survey. Hilcorp plans to drill 1–2 exploratory wells in this area in the open water season of 2020 with the same equipment and methods as described above for lower Inlet exploratory drilling. The noise of routine drilling is not considered further as explained in the description of activities in the Lower Inlet. However, drive pipe installation and vertical seismic profiling will be considered further.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see *Proposed Mitigation* and *Proposed Monitoring and Reporting*).

Description of Marine Mammals in the Area of Specified Activities

Eleven species of marine mammal have the potential to occur in the action area during the five year period of activities proposed by Hilcorp. These species are described in further detail below.

Fin Whales

For management purposes, three stocks of fin whales are currently recognized in U.S. Pacific waters: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii. Recent analyses provide evidence that the population structure should be reviewed and possibly updated. However, substantially new data on the stock structure is lacking (Muto *et al.* 2017). Fin whales, including the Northeastern Pacific stock, are listed as endangered under the ESA.

Mizroch *et al.* (2009) provided a comprehensive summary of fin whale sightings data, including whaling catch data and determined there could be at least six populations of fin whales. Evidence suggests two populations are migratory (eastern and western North Pacific) and two to four more are year-round residents in peripheral seas such as the Gulf of California, East China Sea, Sanriku-Hokkaido, and possibly the Sea of Japan. The two migratory stocks are likely mingling in the Bering Sea in July and August. Moore *et al.* (1998, 2006), Watkins *et al.* (2000), and Stafford *et al.* (2007) documented high rates of calling along the Alaska coast beginning in August/September and lasting through February. Fin whales are regularly observed in the Gulf of Alaska during the summer months, even though calls are seldom detected during this period (Stafford *et al.* 2007). Instruments moored in the southeast Bering Sea detected calls over the course of a year and found peaks from September to November as well as in February and March (Stafford *et al.* 2010). Delarue *et al.* (2013) detected calls in the northeastern Chukchi Sea from instruments moored from July through October from 2007 through 2010.

Fin whales are found seasonally in the Gulf of Alaska, Bering Sea, and as far north as the northern Chukchi Sea (Muto *et al.* 2017). Surveys conducted in coastal waters of the Aleutians and the Alaska Peninsula found that fin whales occurred primarily from the Kenai Peninsula to the Shumagin Islands and were abundant near the Semidi Islands and Kodiak Island (Zerbini *et al.* 2006). An opportunistic survey conducted on the shelf of the Gulf of Alaska found fin whales concentrated west of Kodiak Island in Shelikof Strait, and in the southern Cook Inlet region. Smaller numbers were also observed over the shelf east of Kodiak to Prince William Sound (AFSC, 2003). In the northeastern Chukchi Sea, visual sightings and acoustic detections have been increasing, which suggests the stock may be re-occupying habitat used prior to large-scale commercial whaling (Muto *et al.* 2017). Most of these areas are feeding habitat for fin whales. Fin whales are rarely observed in Cook Inlet, and most sightings occur near the entrance of the inlet. During the NMFS aerial surveys in Cook Inlet from 2000–2016, 10 sightings of 26 estimated individual fin whales in lower Cook Inlet were observed (Shelden *et al.* 2013, 2015, 2016).

Humpback Whales

Currently, three populations of humpback whales are recognized in the North Pacific, migrating between their respective summer/fall feeding areas and winter/spring calving and mating areas as follows (Baker *et al.* 1998; Calambokidis *et al.* 1997). Although there is considerable distributional overlap in the humpback whale stocks that use Alaska, the whales seasonally found in lower Cook Inlet are probably of the Central North Pacific stock (Muto *et al.* 2017). Listed as endangered under the ESA, this stock has recently been estimated at 7,890 animals (Muto *et al.* 2017). The Central North Pacific stock winters in Hawaii and summers from British Columbia to the Aleutian Islands (Calambokidis *et al.* 1997), including Cook Inlet.

Humpback whales in the high latitudes of the North Pacific Ocean are seasonal migrants that feed on euphausiids and small schooling fishes (Muto *et al.* 2017). During the spring, these animals migrate north and spend the summer feeding in the prey-rich sub-polar waters of southern Alaska, British Columbia, and the southern Chukchi Sea. Individuals from the Western North Pacific (endangered), Hawaii (not listed under the ESA), and the Mexico (threatened) DPSs migrate to areas near and potentially in the Petition region. However, most of the individuals that migrate to the Cook Inlet area are likely from the Hawaii DPS and not the Western North Pacific or Mexico DPSs (NMFS 2017).

In the summer, humpback whales are regularly present and feeding in the Cook Inlet region, including Shelikof Strait, Kodiak Island bays, and the Barren Islands, in addition to Gulf of Alaska regions adjacent to the southeast side of Kodiak Island (especially Albatross Banks), the Kenai and Alaska peninsulas, Elizabeth Island, as well as south of the Aleutian Islands. Humpbacks also may be present in some of these areas throughout autumn (Muto *et al.* 2017).

Humpback whales have been observed during marine mammal surveys conducted in Cook Inlet. However, their presence is largely confined to lower Cook Inlet. Recent monitoring by Hilcorp in upper Cook Inlet has also included sightings of humpbacks near Tyonek. During SAExploration's 2015 seismic program, three humpback whales were observed in Cook Inlet; two near the Forelands and one in Kachemak Bay (Kendall *et al.* 2015). During NMFS' Cook Inlet beluga whale aerial surveys from 2000–2016, there were 88 sightings of 191 estimated individual humpback whales in lower Cook Inlet (Shelden *et al.* 2017). They have been regularly seen near Kachemak Bay during the summer months (Rugh *et al.* 2005). There are observations of humpback whales as far north as Anchor Point, with recent summer observations extending to Cape Starichkof (Owl Ridge 2014). Although several humpback whale sightings occurred mid-inlet between Iniskin Peninsula and Kachemak Bay, most sightings occurred outside of the Petition region near Augustine, Barren, and Elizabeth Islands (Shelden *et al.* 2013, 2015, 2017).

Ferguson *et al.* (2015) has established Biologically Important Areas (BIAs) as part of the NOAA Cetacean Density and Distribution Mapping Working Group (CetMap) efforts. This information supplements the quantitative information on cetacean density, distribution, and occurrence by: (1) Identifying areas where cetacean species or populations are known to concentrate for specific behaviors, or be range-limited, but for which there is not sufficient data for their importance to be reflected in the quantitative mapping effort; and (2) providing additional context within which to examine potential interactions between cetaceans and human activities. A ''Feeding Area''

BIA for humpback whales in the Gulf of Alaska region encompasses the waters east of Kodiak Island (the Albatross and Portlock Banks), a target for historical commercial whalers based out of Port Hobron, Alaska (Ferguson *et al.* 2015; Reeves *et al.* 1985; Witteveen *et al.* 2007). This BIA also includes waters along the southeastern side of Shelikof Strait and in the bays along the northwestern shore of Kodiak Island. The highest densities of humpback whales around the Kodiak Island BIA occur from July-August (Ferguson *et al.* 2015).

Minke Whale

Minke whales are most abundant in the Gulf of Alaska during summer and occupy localized feeding areas (Zerbini *et al.* 2006). Concentrations of minke whales have occurred along the north coast of Kodiak Island (and along the south coast of the Alaska Peninsula (Zerbini *et al.* 2006). The current estimate for minke whales between Kenai Fjords and the Aleutian Islands is 1,233 individuals (Zerbini *et al.* 2006). During shipboard surveys conducted in 2003, three minke whale sightings were made, all near the eastern extent of the survey from nearshore Prince William Sound to the shelf break (NMML 2003).

Minke whales become scarce in the Gulf of Alaska in fall; most whales are thought to leave the region by October (Consiglieri *et al.* 1982). Minke whales are migratory in Alaska, but recently have been observed off Cape Starichkof and Anchor Point year-round (Muto *et al.* 2017). During Cook Inlet-wide aerial surveys conducted from 1993 to 2004, minke whales were encountered three times (1998, 1999, and 2006), both times off Anchor Point 16 miles northwest of Homer (Shelden *et al.* 2013, 2015, 2017). A minke whale was also reported off Cape Starichkof in 2011 (A. Holmes, pers. comm.) and 2013 (E. Fernandez and C. Hesselbach, pers. comm.), suggesting this location is regularly used by minke whales, including during the winter. Several minke whales were recorded off Cape Starichkof in early summer 2013 during exploratory drilling (Owl Ridge 2014), suggesting this location is regularly used by minke whales year-round. During Apache's 2014 survey, a total of 2 minke whale groups (3 individuals) were observed during this time period, one sighting to the southeast of Kalgin Island and another sighting near Homer (Lomac-MacNair *et al.* 2014). SAExploration noted one minke whale near Tuxedni Bay in 2015 (Kendall *et al.* 2015). This species is unlikely to be seen in upper Cook Inlet but may be encountered in the mid and lower Inlet.

Killer Whales

Two different stocks of killer whales inhabit the Cook Inlet region of Alaska: the Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock (Muto *et al* 2017). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982), where whales have been labeled as ''resident,'' ''transient,'' and ''offshore'' type killer whales (Dahlheim *et al.* 2008; Ford *et al.* 2000). The killer whales using Cook Inlet are thought to be a mix of resident and transient individuals from two different stocks: the Alaska Resident Stock, and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock (Allen and Angliss 2015). Although recent studies have documented movements of Alaska Resident killer whales from the Bering Sea into the Gulf of Alaska as far north as southern Kodiak Island, none of these whales have been photographed further north and east in the Gulf of Alaska where regular photo-identification studies have been conducted since 1984 (Muto *et al.* 2017).

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Shelden *et al.* 2003; Rugh *et al.* 2005). The few whales that have been photographically identified in lower Cook Inlet belong to resident groups more commonly found in nearby Kenai Fjords and Prince William Sound (Shelden *et al.* 2003). The availability of these prey species largely determines the likeliest times for killer whales to be in the area. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area (Rugh *et al.* 2005). However, anecdotal reports of killer whales feeding on belugas in upper Cook Inlet began increasing in the 1990s, possibly in response to declines in sea lion and harbor seal prey elsewhere (Shelden *et al.* 2003).

One killer whale group of two individuals was observed during the 2015 SAExploration seismic program near the North Foreland (Kendall *et al.* 2015). During NMFS aerial surveys, killer whales were observed in 1994 (Kamishak Bay), 1997 (Kachemak Bay), 2001 (Port Graham), 2005 (Iniskin Bay), 2010 (Elizabeth and Augustine Islands), and 2012 (Kachemak Bay; Shelden *et al.* 2013). Eleven killer whale strandings have been reported in Turnagain Arm, six in May 1991, and five in August 1993. This species is expected to be rarely seen in upper Cook Inlet but may be encountered in the mid and lower Inlet.

Gray Whales

Gray whales have been reported feeding near Kodiak Island, in southeastern Alaska, and south along the Pacific Northwest (Allen and Angliss 2013). Because most gray whales migrating through the Gulf of Alaska region are thought to take a coastal route, BIA boundaries for the migratory corridor in this region were defined by the extent of the continental shelf (Ferguson *et al.* 2015).

Most gray whales calve and breed from late December to early February in protected waters along the western coast of Baja California, Mexico. In spring, the ENP stock of gray whales migrates approximately 8,000 km (5,000 mi) to feeding grounds in the Bering and Chukchi seas before returning to their wintering areas in the fall (Rice and Wolman 1971). Northward migration, primarily of individuals without calves, begins in February; some cow/calf pairs delay their departure from the calving area until well into April (Jones and Swartz 1984).

Gray whales approach the proposed action area in late March, April, May, and June, and leave again in November and December (Consiglieri *et al.* 1982; Rice and Wolman 1971) but migrate past the mouth of Cook Inlet to and from northern feeding grounds. Some gray whales do not migrate completely from Baja to the Chukchi Sea but instead feed in select coastal areas in the Pacific Northwest, including lower Cook Inlet (Moore *et al.* 2007). Most of the population follows the outer coast of the Kodiak Archipelago from the Kenai Peninsula in spring or the Alaska Peninsula in fall (Consiglieri *et al.* 1982; Rice and Wolman 1971). Though most gray whales migrate past Cook Inlet, small numbers have been noted by fishers near Kachemak Bay, and north of Anchor Point (BOEM 2015). During the NMFS aerial surveys, gray whales were observed in the month of June in 1994, 2000, 2001, 2005 and 2009 on the east side of Cook Inlet near Port Graham and Elizabeth Island but also on the west side near Kamishak Bay (Shelden *et al.* 2013). One gray whale was sighted as far north at the Beluga River. Additionally, summering gray whales were seen offshore of Cape Starichkof by marine mammal observers monitoring Buccaneer's Cosmopolitan drilling program in 2013 (Owl Ridge 2014). During Apache's 2012 seismic program, nine gray whales were observed in June and July (Lomac-MacNair *et al.* 2013). During Apache's seismic program in 2014, one gray whale was observed (Lomac- MacNair *et al.* 2014). During SAExploration's seismic survey in 2015, no gray whales were observed (Kendall *et al.* 2015). This species is unlikely to be seen in upper Cook Inlet but may be encountered in the mid and lower Inlet.

Cook Inlet Beluga Whales

The Cook Inlet beluga whale DPS is a small geographically isolated population that is separated from other beluga populations by the Alaska Peninsula. The population is genetically distinct from other Alaska populations suggesting the peninsula is an effective barrier to genetic exchange (O'Corry-Crowe *et al.* 1997). The Cook Inlet beluga whale population is estimated to have declined from 1,300 animals in the 1970s (Calkins 1989) to about 340 animals in 2014 (Shelden *et al.* 2015). The precipitous decline documented in the mid-1990s was attributed to unsustainable subsistence practices by Alaska Native hunters (harvest of >50 whales per year) (Mahoney and Shelden 2000). In 2006, a moratorium to cease hunting was agreed upon to protect the species. In April 2011, NMFS designated critical habitat for the beluga under the ESA (76 FR 20180) as shown on Figure 13 of the application. NMFS finalized the Conservation Plan for the Cook Inlet beluga in 2008 (NMFS 2008a). NMFS finalized the Recovery Plan for Cook Inlet beluga whales in 2016 (NMFS 2016a).

The Cook Inlet beluga stock remains within Cook Inlet throughout the year (Goetz *et al.* 2012a). Two areas, consisting of 7,809 km² (3,016 mi²) of marine and estuarine environments considered essential for the species' survival and recovery were designated critical habitat. However, in recent years the range of the beluga whale has contracted to the upper reaches of Cook Inlet because of the decline in the population (Rugh *et al.* 2010). Area 1 of the Cook Inlet beluga whale critical habitat encompasses all marine waters of Cook Inlet north of a line connecting Point Possession (61.04° N, 150.37° W) and the mouth of Three Mile Creek (61.08.55° N, 151.04.40° W), including waters of the Susitna, Little Susitna, and Chickaloon Rivers below mean higher high water (MHHW). This area provides important habitat during ice-free months and is used intensively by Cook Inlet beluga between April and November (NMFS 2016a).

Since 1993, NMFS has conducted annual aerial surveys in June, July or August to document the distribution and abundance of beluga whales in Cook Inlet. The collective survey results show that beluga whales have been consistently found near or in river mouths along the northern shores of upper Cook Inlet (*i.e.,* north of East and West Foreland). In particular, beluga whale groups are seen in the Susitna River Delta, Knik Arm, and along the shores of Chickaloon Bay. Small groups had also been recorded seen farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996 but very rarely thereafter. Since the mid-1990s, most (96 to 100 percent) beluga whales in upper Cook Inlet have been concentrated in shallow areas near river mouths, no longer occurring in the central or southern portions of Cook Inlet (Hobbs *et al.* 2008). Based on these aerial surveys, the concentration of beluga whales in the northernmost portion of Cook Inlet appears to be consistent from June to October (Rugh *et al.* 2000, 2004a, 2005, 2006, 2007).

Though Cook Inlet beluga whales can be found throughout the inlet at any time of year, they spend the ice-free months generally in the upper Cook Inlet, shifting into the middle and lower Inlet in winter (Hobbs *et al.* 2005). In 1999, one beluga whale was tagged with a satellite transmitter, and its movements were recorded from June through September of that year. Since 1999, 18 beluga whales in upper Cook Inlet have been captured and fitted with satellite tags to provide information on their movements during late summer, fall, winter, and spring. Using location data from satellite-tagged Cook Inlet belugas, Ezer *et al.* (2013) found most tagged whales were in the lower to middle inlet (70 to 100 percent of tagged whales) during January through March, near the Susitna River Delta from April to July (60 to 90 percent of tagged whales) and in the Knik and Turnagain Arms from August to December.

During the spring and summer, beluga whales are generally concentrated near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore *et al.* 2000). Beluga whales in Cook Inlet are believed to mostly calve between mid-May and mid-July, and concurrently breed between late spring and early summer (NMFS 2016a), primarily in upper Cook Inlet. Movement was correlated with the peak discharge of seven major rivers emptying into Cook Inlet. Boat-based surveys from 2005 to the present (McGuire and Stephens 2017), and initial results from passive acoustic monitoring across the entire inlet (Castellote *et al.* 2016) also support seasonal patterns observed with other methods. Other surveys also confirm Cook Inlet belugas near the Kenai River during summer months (McGuire and Stephens 2017).

During the summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth *et al.* 2007) where they feed on migrating eulachon (Thaleichthys pacificus) and salmon (Onchorhyncus spp.) (Moore *et al.* 2000). Data from tagged whales (14 tags between July and March 2000 through 2003) show beluga whales use upper Cook Inlet intensively between summer and late autumn (Hobbs *et al.* 2005). Critical Habitat Area 1 reflects this summer distribution.

As late as October, beluga whales tagged with satellite transmitters continued to use Knik Arm and Turnagain Arm and Chickaloon Bay, but some ranged into lower Cook Inlet south to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) in the fall (Hobbs *et al.* 2005). Data from NMFS aerial surveys, opportunistic sighting reports, and satellite-tagged beluga whales confirm they are more widely dispersed throughout Cook Inlet during the winter months (November–April), with animals found between Kalgin Island and Point Possession. In November, beluga whales moved between Knik Arm, Turnagain Arm, and Chickaloon Bay, similar to patterns observed in September (Hobbs *et al.* 2005). By December, beluga whales were distributed throughout the upper to mid-inlet. From January into March, they moved as far south as Kalgin Island and slightly beyond in central offshore waters. Beluga whales also made occasional excursions into Knik Arm and Turnagain Arm in February and March despite ice cover greater than 90 percent (Hobbs *et al.* 2005).

During Apache's seismic test program in 2011 along the west coast of Redoubt Bay, lower Cook Inlet, a total of 33 beluga whales were sighted during the survey (Lomac-MacNair *et al.* 2013). During Apache's 2012 seismic program in mid-inlet, a total of 151 sightings of approximately 1,463 estimated individual beluga whales were observed (Lomac-MacNair *et al.* 2013). During SAExploration's 2015 seismic program, a total of eight sightings of approximately 33 estimated individual beluga whales were visually observed during this time period and there were two acoustic detections of beluga whales (Kendall *et al.* 2015). Hilcorp recently reported 143 sightings of beluga whales while conducting pipeline work near Ladd Landing in upper Cook Inlet, which is not near the area that seismic surveys are proposed but near some potential well sites.

Ferguson *et al.* (2015) delineated one ''Small'' and ''Resident'' BIA for Cook Inlet beluga whales. Small and Resident BIAs are defined as ''areas and time within which small and resident populations occupy a limited geographic extent'' (Ferguson *et al.* 2015). The Cook Inlet beluga whale BIA was delineated using the habitat model results of Goetz *et al.* 2012 and the critical habitat boundaries (76 FR 20180).

Harbor Porpoise

In Alaskan waters, three stocks of harbor porpoises are currently recognized for management purposes: Southeast Alaska, Gulf of Alaska, and Bering Sea Stocks (Muto *et al.* 2017). Porpoises found in Cook Inlet belong to the Gulf of Alaska Stock which is distributed from Cape Suckling to Unimak Pass and most recently was estimated to number 31,046 individuals (Muto *et al.* 2017). They are one of the three marine mammals (the other two being belugas and harbor seals) regularly seen throughout Cook Inlet (Nemeth *et al.* 2007), especially during spring eulachon and summer salmon runs.

Harbor porpoises primarily frequent the coastal waters of the Gulf of Alaska and Southeast Alaska (Dahlheim *et al.* 2000, 2008), typically occurring in waters less than 100 m deep (Hobbs and Waite 2010). The range of the Gulf of Alaska stock includes the entire Cook Inlet, Shelikof Strait, and the Gulf of Alaska. Harbor porpoises have been reported in lower Cook Inlet from Cape Douglas to the West Foreland, Kachemak Bay, and offshore (Rugh *et al.* 2005a). Although they have been frequently observed during aerial surveys in Cook Inlet (Shelden *et al.* 2014), most sightings are of single animals, and are concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet (Rugh *et al.* 2005) and in the upper inlet. The occurrence of larger numbers of porpoise in the lower Cook Inlet may be driven by greater availability of preferred prey and possibly less competition with beluga whales, as belugas move into upper inlet waters to forage on Pacific salmon during the summer months (Shelden *et al.* 2014).

The harbor porpoise frequently has been observed during summer aerial surveys of Cook Inlet, with most sightings of individuals concentrated at Chinitna and Tuxedni Bays on the west side of lower Cook Inlet (Figure 14 of the application; Rugh *et al.* 2005). Mating probably occurs from June or July to October, with peak calving in May and June (as cited in Consiglieri *et al.* 1982). Small numbers of harbor porpoises have been consistently reported in the upper Cook Inlet between April and October, except for a recent survey that recorded higher numbers than typical. NMFS aerial surveys have identified many harbor porpoise sightings throughout Cook Inlet.

During Apache's 2012 seismic program, 137 sightings (190 individuals) were observed between May and August (Lomac-MacNair *et al.* 2013). Lomac-MacNair *et al.* 2014 identified 77 groups of harbor porpoise totaling 13 individuals during Apache's 2014 seismic survey, both from vessels and aircraft, during the month of May. During SAExploration's 2015 seismic survey, 52 sightings (65 individuals) were observed north of the Forelands (Kendall *et al.* 2015).

Recent passive acoustic research in Cook Inlet by Alaska Department of Fish and Game (ADF&G) and the Marine Mammal Laboratory (MML) have indicated that harbor porpoises occur more frequently than expected, particularly in the West Foreland area in the spring (Castellote *et al.* 2016), although overall numbers are still unknown at this time.

Dall's Porpoise

Dall's porpoises are widely distributed throughout the North Pacific Ocean including preferring deep offshore and shelf-slopes, and deep oceanic waters (Muto *et al.* 2017). The Dall's porpoise range in Alaska extends into the southern portion of the Petition region (Figure 14 of the application). Dall's porpoises are present year-round throughout their entire range in the northeast including the Gulf of Alaska, and occasionally the Cook Inlet area (Morejohn 1979). This porpoise also has been observed in lower Cook Inlet, around Kachemak Bay, and rarely near Anchor Point (Owl Ridge 2014; BOEM 2015).

Throughout most of the eastern North Pacific they are present during all months of the year, although there may be seasonal onshore-offshore movements along the west coast of the continental United States and winter movements of populations out of areas with ice such as Prince William Sound (Muto *et al.* 2017). Dall's porpoises were observed (2 groups, 3 individuals) during Apache's 2014 seismic survey which occurred in the summer months (Lomac-MacNair *et al.* 2014). Dall's porpoises were observed during the month of June in 1997 (Iniskin Bay), 199 (Barren Island), and 2000 (Elizabeth Island, Kamishak Bay and Barren Island) (Shelden *et al.* 2013). Dall's porpoises have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point (Owl Ridge 2014). One Dall's porpoise was observed in August north of Nikiski in the middle of the Inlet during SAExploration's 2015 seismic program (Kendall *et al.* 2015).

Harbor Seal

Harbor seals occupy a wide variety of habitats in freshwater and saltwater in protected and exposed coastlines and range from Baja California north along the west coasts of Washington, Oregon, and California, British Columbia, and Southeast Alaska; west through the Gulf of Alaska, Prince William Sound, and the Aleutian Islands; and north in the Bering Sea to Cape Newenham and the Pribilof Islands. Harbor seals are found throughout the entire lower Cook Inlet coastline, hauling out on beaches, islands, mudflats, and at the mouths of rivers where they whelp and feed (Muto *et al.* 2017).

The major haul out sites for harbor seals are located in lower Cook Inlet. The presence of harbor seals in upper Cook Inlet is seasonal. In Cook Inlet, seal use of western habitats is greater than use of the eastern coastline (Boveng et al. 2012). NMFS has documented a strong seasonal pattern of more coastal and restricted spatial use during the spring and summer for breeding, pupping, and molting, and more wide- ranging seal movements within and outside of Cook Inlet during the winter months (Boveng et al. 2012). Large-scale patterns indicate a portion of harbor seals captured in Cook Inlet move out of the area in the fall, and into habitats within Shelikof Strait, Northern Kodiak Island, and coastal habitats of the Alaska Peninsula, and are most concentrated in Kachemak Bay, across Cook Inlet toward Iniskin and Iliamna Bays, and south through the Kamishak Bay, Cape Douglas and Shelikof Strait regions (Boveng et al. 2012).

A portion of the Cook Inlet seals move into the Gulf of Alaska and Shelikof Strait during the winter months (London *et al.* 2012). Seals move back into Cook Inlet as the breeding season approaches and their spatial use is more concentrated around haul-out areas (Boveng *et al.* 2012; London *et al.* 2012). Some seals expand their use of the northern portion of Cook Inlet. However, in general, seals that were captured and tracked in the southern portion of Cook Inlet remained south of the Forelands (Boveng *et al.* 2012). Important harbor seal haul-out areas occur within Kamishak and Kachemak Bays and along the coast of the Kodiak Archipelago and the Alaska Peninsula. Chinitna Bay, Clearwater and Chinitna Creeks, Tuxedni Bay, Kamishak Bay, Oil Bay, Pomeroy and Iniskin Islands, and Augustine Island are also important spring- summer breeding and molting areas and known haul-outs sites (Figure

15 of the application). Small-scale patterns of movement within Cook Inlet also occur (Boveng *et al.* 2012). Montgomery *et al.* (2007) recorded over 200 haul out sites in lower Cook Inlet alone. However, only a few dozen to a couple hundred seals seasonally occur in upper Cook Inlet (Rugh *et al.* 2005), mostly at the mouth of the Susitna River where their numbers vary in concert with the spring eulachon and summer salmon runs (Nemeth *et al.* 2007; Boveng *et al.* 2012).

The Cook Inlet/Shelikof Stock is distributed from Anchorage into lower Cook Inlet during summer and from lower Cook Inlet through Shelikof Strait to Unimak Pass during winter (Boveng *et al.* 2012). Large numbers concentrate at the river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay, and several haul outs have been identified on the southern end of Kalgin Island in lower Cook Inlet (Rugh *et al.* 2005; Boveng *et al.* 2012). Montgomery *et al.* (2007) recorded over 200 haul-out sites in lower Cook Inlet alone. During Apache's 2012 seismic program, harbor seals were observed in the project area from early May until the end of the seismic operations in late September (Lomac-MacNair *et al.* 2013). Also in 2012, up to 100 harbor seals were observed hauled out at the mouths of the Theodore and Lewis rivers during monitoring activity associated with Apache's 2012 Cook Inlet seismic program. During Apache's 2014 seismic program, 492 groups of harbor seals (613 individuals) were observed. This was the highest sighting rate of any marine mammal observed during the summer of 2014 (Lomac-MacNair *et al.* 2014). During SAExploration's 2015 seismic survey, 823 sightings (1,680 individuals) were observed north and between the Forelands (Kendall *et al.* 2015).

Steller Sea Lions

The western DPS (WDPS) stock of Steller sea lions most likely occurs in Cook Inlet (78 FR 66139). The center of abundance for the Western DPS is considered to extend from Kenai to Kiska Island (NMFS 2008b). The WDPS of the Steller sea lion is defined as all populations west of longitude 144° W to the western end of the Aleutian Islands. The range of the WDPS includes 38 rookeries and hundreds of haul out sites. The Hilcorp action area only considers the WDPS stock. The most recent comprehensive aerial photographic and land-based surveys of WDPS Steller sea lions in Alaska were conducted during the 2014 and 2015 breeding seasons (Fritz *et al.* 2015).

The WDPS of Steller sea lions is currently listed as endangered under the ESA (55 FR 49204) and designated as depleted under the MMPA. Critical habitat was designated on August 27, 1993 (58 FR 45269) south of the proposed project area in the Cook Inlet region (Figure 16 of the application). The critical habitat designation for the WDPS of Steller sea lions was determined to include a 37 km (20 nm) buffer around all major haul outs and rookeries, and associated terrestrial, atmospheric, and aquatic zones, plus three large offshore foraging areas (Figure 16 of the application). NMFS also designated no entry zones around rookeries (50 CFR 223.202). Designated critical habitat is located outside Cook Inlet at Gore Point, Elizabeth Island, Perl Island, and Chugach Island (NMFS 2008b).

The geographic center of Steller sea lion distribution is the Aleutian Islands and the Gulf of Alaska, although as the WDPS has declined, rookeries in the west became progressively smaller (NMFS 2008b). Steller sea lion habitat includes terrestrial sites for breeding and pupping (rookeries), resting (haul outs), and marine foraging areas. Nearly all rookeries are at sites inaccessible to terrestrial predators on remote rocks, islands, and reefs. Steller sea lions inhabit lower Cook Inlet, especially near Shaw Island and Elizabeth Island (Nagahut Rocks) haul out sites (Rugh *et al.* 2005) but are rarely seen in upper Cook Inlet (Nemeth *et al.* 2007). Steller sea lions occur in Cook Inlet but south of Anchor Point around the offshore islands and along the west coast of the upper inlet in the bays (Chinitna Bay, Iniskin Bay, etc.) (Rugh *et al.* 2005). Portions of the southern reaches of the lower inlet are designated as critical habitat, including a 20-nm buffer around all major haulout sites and rookeries. Rookeries and haul out sites in lower Cook Inlet include those near the mouth of the inlet, which are far south of the project area.

Steller sea lions feed largely on walleye pollock, salmon, and arrowtooth flounder during the summer, and walleye pollock and Pacific cod during the winter (Sinclair and Zeppelin 2002). Except for salmon, none of these are found in abundance in upper Cook Inlet (Nemeth *et al.* 2007).

Steller sea lions can travel considerable distances (Baba *et al.* 2000). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late May to early July; Jemison *et al.* 2013; Allen and Angliss 2014). Most adult Steller sea lions inhabit rookeries during the breeding season (late May to early July). Some juveniles and non-breeding adults occur at or near rookeries during the breeding season, but most are on haul outs. Adult males may disperse widely after the breeding season and, during fall and winter, many sea lions increase use of haul outs, especially terrestrial sites but also on sea ice in the Bering Sea (NMFS 2008b).

Steller sea lions have been observed during marine mammal surveys conducted in Cook Inlet. In 2012, during Apache's 3D Seismic surveys, there were three sightings of approximately four individuals in upper Cook Inlet (Lomac-MacNair *et al.* 2013). Marine mammal observers associated with Buccaneer's drilling project off Cape Starichkof observed seven Steller sea lions during the summer of 2013 (Owl Ridge 2014). During SAExploration's 3D Seismic Program in 2015, four Steller sea lions were observed in Cook Inlet. One sighting occurred between the West and East Forelands, one near Nikiski and one northeast of the North Foreland in the center of Cook Inlet (Kendall *et al.* 2015). During NMFS Cook Inlet beluga whale aerial surveys from 2000–2016, there were 39 sightings of 769 estimated individual Steller sea lions in lower Cook Inlet (Shelden *et al.* 2017). Sightings of large congregations of Steller sea lions during NMFS aerial surveys occurred outside the Petition region, on land in the mouth of Cook Inlet (*e.g.,* Elizabeth and Shaw Islands).

California Sea Lions

There is limited information on the presence of California sea lions in Alaska. From 1973 to 2003, a total of 52 California sea lions were reported in Alaska, with sightings increasing in the later years. Most sightings occurred in the spring; however, they have been observed during all seasons. California sea lion presence in Alaska was correlated with increasing population numbers within their southern breeding range (Maniscalco *et al.* 2004).

There have been relatively few California sea lions observed in Alaska, most are often alone or occasionally in small groups of two or more and usually associated with Steller sea lions at their haulouts and rookeries (Maniscalco *et al.* 2004). California sea lions are not typically observed farther north than southeast Alaska, and sightings are very rare in Cook Inlet. California sea lions have not been observed during the annual NMFS aerial surveys in Cook Inlet. However, a sighting of two California sea lions was documented during the Apache 2012 seismic survey (Lomac-MacNair *et al.* 2013). Additionally, NMFS' anecdotal sighting database has four sightings in Seward and Kachemak Bay.

The California sea lion breeds from the southern Baja Peninsula north to Año Nuevo Island, California. Breeding season lasts from May to August, and most pups are born from May through July. Their nonbreeding range extends northward into British Columbia and occasionally farther north into Alaskan waters. California sea lions have been observed in Alaska during all four seasons; however, most of the sightings have occurred during the spring (Maniscalco *et al.* 2004).

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SAR; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region*), and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' website (*https://www.fisheries.noaa.gov/species-directory/*).

Table 2 lists all species with expected potential for occurrence in Cook Inlet and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2016). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' 2017 U.S. Alaska and Pacific SARs (Muto *et al,* 2017; Carretta *et al,* 2017). All values presented in Table 2 are the most recent available at the time of publication and are available in the 2017 SARs and draft 2018 SARs (available online at: *https://www.fisheries.noaa.gov/action/2018-draft-marine-mammal-stock-assessment-reports-available*).

TABLE 2—SPECIES WITH THE POTENTIAL TO OCCUR IN COOK INLET, ALASKA

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae:						
Gray whale	*Eschrichtius robustus*	Eastern Pacific	-/-; N	20,990 (0.05, 20,125, 2011)	624	4.25
Family Balaenopteridae (rorquals):						
Fin whale	*Balaenoptera physalus*	Northeastern Pacific	E/D; Y	3,168 (0.26,2,554 2013)	5.1	0.4
Minke whale	*Balaenoptera acutorostrata*	Alaska	-/-; N	N/A	N/A	0
Humpback whale	*Megaptera novaeangliae*	Western North Pacific	E/D; Y	1,107 (0.3, 865, 2006)	3	3.2
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae:						
Beluga whale	*Delphinapterus leucas*	Cook Inlet	E/D; Y	312 (0.1, 287, 2014)	0.54	0.57
Killer whale	*Orcinus orca*	Alaska Resident	-/-; N	2,347 (N/A, 2,347, 2012)	24	1
		Alaska Transient	-/-; N	587 (N/A, 587, 2012)	5.9	1
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena*	Gulf of Alaska	-/-; Y	31,046 (0.214, N/A, 1998)	Undet	72
Dall's porpoise	*Phocoenoides dalli*	Alaska	-/-; N	83,400 (0.097, N/A, 1993)	Undet	38
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
Steller sea lion	*Eumetopias jubatus*	Western	E/D; Y	53,303 (N/A, 53,303, 2016)	320	241
California sea lion	*Zalophus californianus*	U.S.	-/-; N	296,750 (153,337, N/A, 2011)	9,200	331
Family Phocidae (earless seals):						
Harbor seal	*Phoca vitulina*	Cook Inlet/Shelikof	-/-; N	27,386 (25,651, N/A, 2011)	770	234

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2] NMFS marine mammal stock assessment reports online at: *www.nmfs.noaa.gov/pr/sars/*. CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable [explain if this is the case]

[3] These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

Note: Italicized species are not expected to be taken or proposed for authorization.

All species that could potentially occur in the proposed survey areas are included in Table 2. As described below, all 11 species (with 12 managed stocks) temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur, and we have proposed authorizing it.

In addition, sea otters may be found in Cook Inlet. However, sea otters are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

- Low-frequency cetaceans (mysticetes): generalized hearing is estimated to occur between approximately 7 Hz and 35 kHz;
- Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): generalized hearing is estimated to occur between approximately 150 Hz and 160 kHz;
- High-frequency cetaceans (porpoises, river dolphins, and members of the genera Kogia and Cephalorhynchus; including two members of the genus Lagenorhynchus, on the basis of recent echolocation data and genetic data): generalized hearing is estimated to occur between approximately 275 Hz and 160 kHz;
- Pinnipeds in water; Phocidae (true seals): generalized hearing is estimated to occur between approximately 50 Hz to 86 kHz; and
- Pinnipeds in water; Otariidae (eared seals): generalized hearing is estimated to occur between 60 Hz and 39 kHz.

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.,* 2006; Kastelein *et al.,* 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Eleven marine mammal species (eight cetacean and three pinniped (two otariid and one phocid) species) have the reasonable potential to co-occur with the proposed survey activities. Please refer to Table 2. Of the cetacean species that may be present, four are classified as low-frequency cetaceans (*i.e.,* all mysticete species), two are classified as mid-frequency cetaceans (*i.e.,* all delphinid and ziphiid species and the sperm whale), and two are classified as high-frequency cetaceans (*i.e.,* harbor porpoise and Kogia spp.).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The *Estimated Take by Incidental Harassment* section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis and Determination* section considers the content of this section, the *Estimated Take by Incidental Harassment* section, and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Description of Active Acoustic Sound Sources

This section contains a brief technical background on sound, the characteristics of certain sound types, and on metrics used in this proposal in as much as the information is relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document.

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in Hz or cycles per second. Wavelength is the distance between two peaks or corresponding points of a sound wave (length of one cycle). Higher frequency sounds have shorter wavelengths than lower frequency sounds, and typically attenuate (decrease) more rapidly, except in certain cases in shallower water. Amplitude is the height of the sound pressure wave or the ''loudness'' of a sound and is typically described using the relative unit of the dB. A sound pressure level (SPL) in dB is described as the ratio between a measured pressure and a reference pressure (for underwater sound, this is 1 microPascal (μPa)) and is a logarithmic unit that accounts for large variations in amplitude; therefore, a relatively small change in dB corresponds to large changes in sound pressure. The source level (SL) represents the SPL referenced at a distance of 1 m from the source (referenced to 1 μPa) while the received level is the SPL at the listener's position (referenced to 1 μPa).

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Root mean square is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick, 1983). Root mean square accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper, 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

Sound exposure level (SEL; represented as dB re 1 μPa2-s) represents the total energy contained within a pulse and considers both intensity and duration of exposure. Peak sound pressure (also referred to as zero-to-peak sound pressure or 0-p) is the maximum instantaneous sound pressure measurable in the water at a specified distance from the source and is represented in the same units as the rms sound pressure. Another common metric is peak-to-peak sound pressure (pk-pk), which is the algebraic difference between the peak positive and peak negative sound pressures.

Peak-to-peak pressure is typically approximately 6 dB higher than peak pressure (Southall *et al.,* 2007).

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in a manner similar to ripples on the surface of a pond and may be either directed in a beam or beams or may radiate in all directions (omnidirectional sources), as is the case for pulses produced by the airgun arrays considered here. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson *et al.,* 1995), and the sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.,* wind and waves, earthquakes, ice, atmospheric sound), biological (*e.g.,* sounds produced by marine mammals, fish, and invertebrates), and anthropogenic (*e.g.,* vessels, dredging, construction) sound. A number of sources contribute to ambient sound, including the following (Richardson *et al.,* 1995):

- *Wind and waves:* The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient sound for frequencies between 200 Hz and 50 kilohertz (kHz) (Mitson, 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf sound becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions;
- *Precipitation:* Sound from rain and hail impacting the water surface can become an important component of total sound at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times;
- *Biological:* Marine mammals can contribute significantly to ambient sound levels, as can some fish and snapping shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz; and
- *Anthropogenic:* Sources of ambient sound related to human activity include transportation (surface vessels), dredging and construction, oil and gas drilling and production, seismic surveys, sonar, explosions, and ocean acoustic studies. Vessel noise typically dominates the total ambient sound for frequencies between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly. Sound from identifiable anthropogenic sources other than the activity of interest (*e.g.,* a passing vessel) is sometimes termed background sound, as opposed to ambient sound.

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise ''ambient'' or ''background'' sound—depends not only on the source levels (as determined by current weather conditions and levels of biological and human activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10–20 dB from day to day (Richardson *et al.,* 1995). The result is that, depending on the source type and its intensity, sound from a given activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals. Details of source types are described in the following text.

Sounds are often considered to fall into one of two general types: Pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.,* Ward, 1997 in Southall *et al.,* 2007). Please see Southall *et al.* (2007) for an in-depth discussion of these concepts.

Pulsed sound sources (*e.g.,* airguns, explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI, 1986, 2005; Harris, 1998; NIOSH, 1998; ISO, 2003) and occur either as isolated events or repeated in some succession. Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-pulsed sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI, 1995; NIOSH, 1998). Some of these non-pulsed sounds can be transient signals of short duration but without the essential properties of pulses (*e.g.,* rapid rise time). Examples of non-pulsed sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (such as those used by the U.S. Navy). The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Airgun arrays produce pulsed signals with energy in a frequency range from about 10–2,000 Hz, with most energy radiated at frequencies below 200 Hz. The amplitude of the acoustic wave emitted from the source is equal in all directions (*i.e.,* omnidirectional), but airgun arrays do possess some directionality due to different phase delays between guns in different directions. Airgun arrays are typically tuned to maximize functionality for data acquisition purposes, meaning that sound transmitted in horizontal directions and at higher frequencies is minimized to the extent possible.

As described above, two types of sub-bottom profiler would also be used by Hilcorp during the geotechnical and geohazard surveys: A low resolution unit (1–4 kHz) and a high resolution unit (2–24 kHz).

Potential Effects of Underwater Sound—Please refer to the information given previously (''Description of Active Acoustic Sound Sources'') regarding sound, characteristics of sound types, and metrics used in this document. Note that, in the following discussion, we refer in many cases to a recent review article concerning studies of noise-induced hearing loss conducted from 1996–2015 (*i.e.,* Finneran, 2015). For study-specific citations, please see that work. Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following: Temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al.,* 1995; Gordon *et al.,* 2004; Nowacek *et al.,* 2007; Southall *et al.,* 2007; Götz *et al.,* 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. We first describe specific manifestations of acoustic effects before providing discussion specific to the use of airguns.

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.,* when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects certain non-auditory physical or physiological effects only briefly as we do not expect that use of airgun arrays, sub-bottom profilers, drill rig construction, or sheet pile driving are reasonably likely to result in such effects (see below for further discussion). Potential effects from impulsive sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, slight injury of the internal organs and the auditory system, or mortality (Yelverton *et al.,* 1973). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g.,* change in dive profile as a result of an avoidance reaction) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007; Zimmer and Tyack, 2007; Tal *et al.,* 2015). The suite of activities considered here do not involve the use of devices such as explosives or mid-frequency tactical sonar that are associated with these types of effects.

1. Threshold Shift—Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al.,* 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.,* tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al.,* 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.,* Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals. There is no PTS data for cetaceans, but such relationships are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several decibels above (a 40-dB threshold shift approximates PTS onset; *e.g.,* Kryter *et al.,* 1966; Miller, 1974) which would induce mild TTS (a 6-dB threshold shift approximates TTS onset; *e.g.,* Southall *et al.* 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulse sounds (such as airgun pulses as received close to the source) are at least 6 dB higher than the TTS threshold on a peak-pressure basis, and PTS cumulative sound exposure level (SELcum) thresholds are 15 to 20 dB higher than TTS SELcum thresholds (Southall *et al.,* 2007). Given the higher level of sound combined with longer exposure duration necessary to cause PTS, it is expected that limited PTS could occur from the proposed activities. For mid-frequency cetaceans in particular, potential protective mechanisms may help limit onset of TTS or prevent onset of PTS. Such mechanisms include dampening of hearing, auditory adaptation, or behavioral amelioration (*e.g.,* Nachtigall and Supin, 2013; Miller *et al.,* 2012; Finneran *et al.,* 2015; Popov *et al.,* 2016). Given the higher level of sound, longer durations of exposure necessary to cause PTS, it is possible but unlikely PTS would occur during the proposed seismic surveys, geotechnical surveys, or other exploratory drilling activities.

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts.

Finneran *et al.* (2015) measured hearing thresholds in three captive bottlenose dolphins before and after exposure to ten pulses produced by a seismic airgun in order to study TTS induced after exposure to multiple pulses. Exposures began at relatively low levels and gradually increased over a period of several months, with the highest exposures at peak SPLs from 196 to 210 dB and cumulative (unweighted) SELs from 193–195 dB. No substantial TTS was observed. In addition, behavioral reactions were observed that indicated that animals can learn behaviors that effectively mitigate noise exposures (although exposure patterns must be learned, which is less likely in wild animals than for the captive animals considered in this study). The authors note that the failure to induce more significant auditory effects is likely due to the intermittent nature of exposure, the relatively low peak pressure produced by the acoustic source, and the low-frequency energy in airgun pulses as compared with the frequency range of best sensitivity for dolphins and other mid-frequency cetaceans.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin (*Tursiops truncatus*), beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)) and five species of pinnipeds (northern elephant seal, harbor seal, and California sea lion) exposed to a limited number of sound sources (*i.e.,* mostly tones and octave-band noise) in laboratory settings (Finneran, 2015). TTS was not observed in trained spotted (*Phoca largha*) and ringed (*Pusa hispida*) seals exposed to impulsive noise at levels matching previous predictions of TTS onset (Reichmuth *et al.,* 2016). In general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran, 2015). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007), Finneran and Jenkins (2012), Finneran (2015), and Table 5 in NMFS (2018).

Critical questions remain regarding the rate of TTS growth and recovery after exposure to intermittent noise and the effects of single and multiple pulses. Data at present are also insufficient to construct generalized models for recovery and determine the time necessary to treat subsequent exposures as independent events. More information is needed on the relationship between auditory evoked potential and behavioral measures of TTS for various stimuli. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007), Finneran and Jenkins (2012), Finneran (2015), and NMFS (2016).

Marine mammals in the action area during the proposed activities are less likely to incur TTS hearing impairment from some of the sources proposed to be used due to the characteristics of the sound sources, particularly sources such as the water jets, which include lower source levels (176 dB @1m) and generally very short pulses and duration of the sound. Even for high-frequency cetacean species (*e.g.,* harbor porpoises), which may have increased sensitivity to TTS (Lucke *et al.,* 2009; Kastelein *et al.,* 2012b), individuals would have to make a very close approach and also remain very close to vessels operating these sources in order to receive multiple exposures at relatively high levels, as would be necessary to cause TTS. Intermittent exposures—as would occur due to the brief, transient signals produced by these sources—require a higher cumulative SEL to induce TTS than would continuous exposures of the same duration (*i.e.,* intermittent exposure results in lower levels of TTS) (Mooney *et al.,* 2009a; Finneran *et al.,* 2010). Moreover, most marine mammals would more likely avoid a loud sound source rather than swim in such close proximity as to result in TTS (much less PTS). Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a sub-bottom profiler emits a pulse is small—because if the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause temporary threshold shift and would likely exhibit avoidance behavior to the area near the transducer rather than swim through at such a close range. Further, the restricted beam shape of the sub-bottom profiler and other geophysical survey equipment makes it unlikely that an animal would be exposed more than briefly during the passage of the vessel. Boebel *et al.* (2005) concluded similarly for single and multibeam echosounders, and more recently, Lurton (2016) conducted a modeling exercise and concluded similarly that likely potential for acoustic injury from these types of systems is negligible, but that behavioral response cannot be ruled out. Animals may avoid the area around the survey vessels, thereby reducing exposure. Effects of non-pulsed sound on marine mammals, such as vibratory pile driving, are less studied. In a study by Malme *et al.* (1986) on gray whales as well as Richardson *et al.* (1997) on beluga whales, the only reactions documented in response to drilling sound playbacks were behavioral reactions. Any disturbance to marine mammals is likely to be in the form of temporary avoidance or alteration of opportunistic foraging behavior near the survey location.

2. Behavioral Effects—Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.,* minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.,* species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.,* Richardson *et al.,* 1995; Wartzok *et al.,* 2003; Southall *et al.,* 2007; Weilgart, 2007; Archer *et al.,* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.,* 2012), and can vary depending on characteristics associated with the sound source (*e.g.,* whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B–C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; NRC, 2003; Wartzok *et al.,* 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.,* 1997). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds, 2002; see also Richardson *et al.,* 1995; Nowacek *et al.,* 2007). However, many delphinids approach acoustic source vessels with no apparent discomfort or obvious behavioral change (*e.g.,* Barkaszi *et al.,* 2012).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.,* Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark 2000; Ng and Leung 2003; Nowacek *et al.* 2004; Goldbogen *et al.* 2013). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.* 2001; Nowacek *et al.* 2004; Madsen *et al.* 2006; Yazvenko *et al.* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Visual tracking, passive acoustic monitoring, and movement recording tags were used to quantify sperm whale behavior prior to, during, and following exposure to airgun arrays at received levels in the range 140–160 dB at distances of 7–13 km, following a phase-in of sound intensity and full array exposures at 1–13 km (Madsen *et al.,* 2006; Miller *et al.,* 2009). Sperm whales did not exhibit horizontal avoidance behavior at the surface. However, foraging behavior may have been affected. The sperm whales exhibited 19 percent less vocal (buzz) rate during full exposure relative to post exposure, and the whale that was approached most closely had an extended resting period and did not resume foraging until the airguns had ceased firing. The remaining whales continued to execute foraging dives throughout exposure; however, swimming movements during foraging dives were six percent lower during exposure than control periods (Miller *et al.,* 2009). These data raise concerns that seismic surveys may impact foraging behavior in sperm whales, although more data are required to understand whether the differences were due to exposure or natural variation in sperm whale behavior (Miller *et al.,* 2009).

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.,* Kastelein *et al.,* 2001, 2005, 2006; Gailey *et al.,* 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004), while right whales have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Cerchio *et al.* (2014) used passive acoustic monitoring to document the presence of singing humpback whales off the coast of northern Angola and to opportunistically test for the effect of seismic survey activity on the number of singing whales. Two recording units were deployed between March and December 2008 in the offshore environment, and the numbers of singers were counted every hour. Generalized Additive Mixed Models were used to assess the effect of survey day (seasonality), hour (diel variation), moon phase, and received levels of noise (measured from a single pulse during each ten minute sampled period) on singer number. The number of singers significantly decreased with increasing received level of noise, suggesting that humpback whale breeding activity was disrupted to some extent by the survey activity.

Castellote *et al.* (2012) reported acoustic and behavioral changes by fin whales in response to shipping and airgun noise. Acoustic features of fin whale song notes recorded in the Mediterranean Sea and northeast Atlantic Ocean were compared for areas with different shipping noise levels and traffic intensities and during a seismic airgun survey. During the first 72 hours of the survey, a steady decrease in song received levels and bearings to singers indicated that whales moved away from the acoustic source and out of the study area. This displacement persisted for a time period well beyond the 10-day duration of seismic airgun activity, providing evidence that fin whales may avoid an area for an extended period in the presence of increased noise. The authors hypothesize that fin whale acoustic communication is modified to compensate for increased background noise and that a sensitization process may play a role in the observed temporary displacement.

Seismic pulses at average received levels of 131 dB re 1 μPa2-s caused blue whales to increase call production (Di Iorio and Clark, 2010). In contrast, McDonald *et al.* (1995) tracked a blue whale with seafloor seismometers and reported that it stopped vocalizing and changed its travel direction at a range of 10 km from the acoustic source vessel (estimated received level 143 dB pk-pk). Blackwell *et al.* (2013) found that bowhead whale call rates dropped significantly at onset of airgun use at sites with a median distance of 41–45 km from the survey. Blackwell *et al.* (2015) expanded this analysis to show that whales actually increased calling rates as soon as airgun signals were detectable before ultimately decreasing calling rates at higher received levels (*i.e.,* 10-minute SELcum of ~127 dB). Overall, these results suggest that bowhead whales may adjust their vocal output in an effort to compensate for noise before ceasing vocalization effort and ultimately deflecting from the acoustic source (Blackwell *et al.,* 2013, 2015). These studies demonstrate that even low levels of noise received far from the source can induce changes in vocalization and/or behavior for mysticetes.

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al.,* 1984). Humpback whales showed avoidance behavior in the presence of an active seismic array during observational studies and controlled exposure experiments in western Australia (McCauley *et al.,* 2000). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.,* Bowles *et al.,* 1994; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Bejder *et al.,* 2006; Teilmann *et al.,* 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England, 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves, 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.,* when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.,* Beauchamp and Livoreil 1997; Purser and Radford 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.,* decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.,* Harrington and Veitch 1992; Daan *et al.* 1996; Bradshaw *et al.* 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Stone (2015) reported data from at-sea observations during 1,196 seismic surveys from 1994 to 2010. When large arrays of airguns (considered to be 500 cui or more) were firing, lateral displacement, more localized avoidance, or other changes in behavior were evident for most odontocetes. However, significant responses to large arrays were found only for the minke whale and fin whale. Behavioral responses observed included changes in swimming or surfacing behavior, with indications that cetaceans remained near the water surface at these times. Cetaceans were recorded as feeding less often when large arrays were active. Behavioral observations of gray whales during a seismic survey monitored whale movements and respirations pre-, during and post-seismic survey (Gailey *et al.,* 2016). Behavioral state and water depth were the best 'natural' predictors of whale movements and respiration and, after considering natural variation, none of the response variables were significantly associated with seismic survey or vessel sounds.

Marine mammals are likely to avoid the proposed activities, especially harbor porpoises, while the harbor seals might be attracted to them out of curiosity. However, because the sub-bottom profilers and seismic equipment operate from moving vessels, the area (relative to the available habitat in Cook Inlet) and time that this equipment would be affecting a given location is very small. Further, for mobile sources, once an area has been surveyed, it is not likely that it will be surveyed again, therefore reducing the likelihood of repeated geophysical and geotechnical survey impacts within the survey area. The isopleths for harassment for the stationary sources considered in this document are small relative to those for mobile sources. Therefore, while the sound is concentrated in the same area for the duration of the activity (duration of pile driving, VSP, etc), the amount of area affected by noise levels which we expect may cause harassment are small relative to the mobile sources. Additionally, animals may more predictably avoid the area of the disturbance as the source is stationary. Overall duration of these sound sources is still short and unlikely to cause more than temporary disturbance.

We have also considered the potential for severe behavioral responses such as stranding and associated indirect injury or mortality from Hilcorp's use of high resolution geophysical survey equipment, on the basis of a 2008 mass stranding of approximately one hundred melon-headed whales in a Madagascar lagoon system. An investigation of the event indicated that use of a high-frequency mapping system (12-kHz multibeam echosounder) was the most plausible and likely initial behavioral trigger of the event, while providing the caveat that there is no unequivocal and easily identifiable single cause (Southall *et al.,* 2013). The investigatory panel's conclusion was based on (1) very close temporal and spatial association and directed movement of the survey with the stranding event; (2) the unusual nature of such an event coupled with previously documented apparent behavioral sensitivity of the species to other sound types (Southall *et al.,* 2006; Brownell *et al.,* 2009); and (3) the fact that all other possible factors considered were determined to be unlikely causes. Specifically, regarding survey patterns prior to the event and in relation to bathymetry, the vessel transited in a north-south direction on the shelf break parallel to the shore, ensonifying large areas of deep-water habitat prior to operating intermittently in a concentrated area offshore from the stranding site. This may have trapped the animals between the sound source and the shore, thus driving them towards the lagoon system. The investigatory panel systematically excluded or deemed highly unlikely nearly all potential reasons for these animals leaving their typical pelagic habitat for an area extremely atypical for the species (*i.e.,* a shallow lagoon system). Notably, this was the first time that such a system has been associated with a stranding event. The panel also noted several site- and situation-specific secondary factors that may have contributed to the avoidance responses that led to the eventual entrapment and mortality of the whales. Specifically, shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the event may have played a role (Southall *et al.,* 2013). The report also notes that prior use of a similar system in the general area may have sensitized the animals and also concluded that, for odontocete cetaceans that hear well in higher frequency ranges where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low frequency systems that have more typically been considered in terms of anthropogenic noise impacts. It is, however, important to note that the relatively lower output frequency, higher output power, and complex nature of the system implicated in this event, in context of the other factors noted here, likely produced a fairly unusual set of circumstances that indicate that such events would likely remain rare and are not necessarily relevant to use of lower-power, higher-frequency systems more commonly used for high resolution geophysical (HRG) survey applications. The risk of similar events recurring may be very low, given the extensive use of active acoustic systems used for scientific and navigational purposes worldwide on a daily basis and the lack of direct evidence of such responses previously reported.

3. Stress Responses—An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.,* Seyle, 1950; Moberg 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.,* Moberg 1987; Blecha 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.* 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and ''distress'' is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficiently to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Lankford *et al.,* 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker, 2000; Romano *et al.,* 2002) and, more rarely, studied in wild populations (*e.g.,* Romano *et al.,* 2002). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as ''distress.'' In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

In general, there are few data on the potential for strong, anthropogenic underwater sounds to cause non-auditory physical effects in marine mammals. Such effects, if they occur at all, would presumably be limited to short distances and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.,* 2007). There is no definitive evidence that any of these effects occur even for marine mammals in close proximity to an anthropogenic sound source. In addition, marine mammals that show behavioral avoidance of survey vessels and related sound sources, are unlikely to incur non-auditory impairment or other physical effects. NMFS does not expect that the generally short-term, intermittent, and transitory seismic and geophysical surveys would create conditions of long-term, continuous noise and chronic acoustic exposure leading to long-term physiological stress responses in marine mammals. While the noise from drilling related activities are more continuous and longer term, those sounds are generated at a much lower level than the mobile sources discussed earlier.

4. Auditory Masking—Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.,* those used for intraspecific communication and social interactions, prey detection, predator avoidance,

navigation) (Richardson *et al.,* 1995; Erbe *et al.,* 2016). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.,* snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.,* shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.,* signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.,* sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting or altering critical behaviors. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds, such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.,* Miller *et al.* 2000; Foote *et al.* 2004; Parks *et al.* 2007; Holt *et al.* 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.* 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore 2014). Masking can be tested directly in captive species (*e.g.,* Erbe 2008) but, in wild populations, it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.,* Branstetter *et al.* 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.,* from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Marine mammal communications would not likely be masked appreciably by the sub-profiler or seismic survey's signals given the directionality of the signal and the brief period when an individual mammal is likely to be within its beam. The probability for conductor pipe driving masking acoustic signals important to the behavior and survival of marine mammal species is low. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for short durations. It is possible that vibratory pile driving resulting from this proposed action may mask acoustic signals important to the behavior and survival of marine mammal species, but the short-term duration and limited affected area would result in insignificant impacts from masking. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory pile and conductor pipe driving, and which have already been taken into account in the exposure analysis. Pile driving would occur for limited durations across multiple widely dispersed sites, thus we do not anticipate masking to significantly affect marine mammals.

Ship Strike

Vessel collisions with marine mammals, or ship strikes, can result in death or serious injury of the animal. Wounds resulting from ship strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus 2001). An animal at the surface may be struck directly by a vessel, a surfacing animal may hit the bottom of a vessel, or an animal just below the surface may be cut by a vessel's propeller. Superficial strikes may not kill or result in the death of the animal. These interactions are typically associated with large whales (*e.g.,* fin whales), which are occasionally found draped across the bulbous bow of large commercial ships upon arrival in port. Although smaller cetaceans are more maneuverable in relation to large vessels than are large whales, they may also be susceptible to strike. The severity of injuries typically depends on the size and speed of the vessel, with the probability of death or serious injury increasing as vessel speed increases (Knowlton and Kraus 2001; Laist *et al.* 2001; Vanderlaan and Taggart 2007; Conn and Silber 2013). Impact forces increase with speed, as does the probability of a strike at a given distance (Silber *et al.* 2010; Gende *et al.* 2011).

Pace and Silber (2005) also found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 10 to 14 kn, and exceeded 90 percent at 17 kn. Higher speeds during collisions result in greater force of impact, but higher speeds also appear to increase the chance of severe injuries or death through increased likelihood of collision by pulling whales toward the vessel (Clyne and Kennedy, 1999;). In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 8.6 and 15 kt. The chances of a lethal injury decline from approximately 80 percent at 15 kt to approximately 20 percent at 8.6 kt. At speeds below 11.8 kt, the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward one hundred percent above 15 kt.

Hilcorp's seismic vessels would travel at approximately 4 knots (7.41 km/hour) while towing seismic survey gear and a maximum of 4.5 knots (8.3 km/hr) while conducting geotechnical and geohazard surveys (Faithweather, 2018). At these speeds, both the possibility of striking a marine mammal and the possibility of a strike resulting in serious injury or mortality are discountable. At average transit speed, the probability of serious injury or mortality resulting from a strike is less than 50 percent. However, the likelihood of a strike actually happening is again discountable. Ship strikes, as analyzed in the studies cited above, generally involve commercial shipping, which is much more common in both space and time than is geophysical survey activity. Jensen and Silber (2004) summarized ship strikes of large whales worldwide from 1975–2003 and found that most collisions occurred in the open ocean and involved large vessels (*e.g.,* commercial shipping). Commercial fishing vessels were responsible for three percent of recorded collisions, while no such incidents were reported for geophysical survey vessels during that time period.

It is possible for ship strikes to occur while traveling at slow speeds. For example, a hydrographic survey vessel traveling at low speed (5.5 kt) while conducting mapping surveys off the central California coast struck and killed a blue whale in 2009. The State of California determined that the whale had suddenly and unexpectedly surfaced beneath the hull, with the result that the propeller severed the whale's vertebrae, and that this was an unavoidable event. This strike represents the only such incident in approximately 540,000 hours of similar coastal mapping activity ($p = 1.9 \times 10^{-6}$; 95% CI = $0 - 5.5 \times 10^{-6}$; NMFS, 2013b). In addition, a research vessel reported a fatal strike in 2011 of a dolphin in the Atlantic, demonstrating that it is possible for strikes involving smaller cetaceans to occur. In that case, the incident report indicated that an animal apparently was struck by the vessel's propeller as it was intentionally swimming near the vessel. While indicative of the type of unusual events that cannot be ruled out, neither of these instances represents a circumstance that would be considered reasonably foreseeable or that would be considered preventable.

Although the likelihood of the vessel striking a marine mammal is low, we require a robust ship strike avoidance protocol (see ''Proposed Mitigation''), which we believe eliminates any foreseeable risk of ship strike. We anticipate that vessel collisions involving a seismic data acquisition vessel towing gear, while not impossible, represent unlikely, unpredictable events for which there are no preventive measures. Given the required mitigation measures, the relatively slow speed of the vessel towing gear, the presence of marine mammal observers, and the short duration of the survey, we believe that the possibility of ship strike is discountable. Further, were a strike of a large whale to occur, it would be unlikely to result in serious injury or mortality. No incidental take resulting from ship strike is anticipated, and this potential effect of the specified activity will not be discussed further in the following analysis.

Stranding

When a living or dead marine mammal swims or floats onto shore and becomes ''beached'' or incapable of returning to sea, the event is a ''stranding'' (Geraci *et al.* 1999; Perrin and Geraci 2002; Geraci and Lounsbury 2005). The legal definition for a stranding under the MMPA is (A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.

Marine mammals strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most strandings are unknown (Eaton, 1979; Best 1982). Numerous studies suggest that the physiology, behavior, habitat relationships, age, or condition of cetaceans may cause them to strand or might pre-dispose them to strand when exposed to another phenomenon. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Fair and Becker 2000; Moberg, 2000; Romero 2004; Sih *et al.* 2004).

Use of military tactical sonar has been implicated in a majority of investigated stranding events, although one stranding event was associated with the use of seismic airguns. This event occurred in the Gulf of California, coincident with seismic reflection profiling by the R/V Maurice Ewing operated by Lamont-Doherty Earth Observatory (LDEO) of Columbia University and involved two Cuvier's beaked whales (Hildebrand 2004). The vessel had been firing an array of 20 airguns with a total volume of 8,500 cui (Hildebrand 2004). Most known stranding events have involved beaked whales, though a small number have involved deep-diving delphinids or sperm whales (*e.g.,* Southall *et al.* 2013). In general, long duration (~1 second) and high-intensity sounds (>235 dB SPL) have been implicated in stranding events (Hildebrand 2004). With regard to beaked whales, mid-frequency sound has been implicated in a few specific cases (when causation can be determined) (Hildebrand 2004). Although seismic airguns create predominantly low-frequency energy, the signal does include a mid-frequency component. Based on the information presented above, we have considered the potential for the proposed survey to result in marine mammal stranding and have concluded that, based on the best available information, stranding is not expected to occur.

Other Potential Impacts

Here, we briefly address the potential risks due to entanglement and contaminant spills. We are not aware of any records of marine mammal entanglement in towed arrays such as those considered here. The discharge of trash and debris is prohibited (33 CFR 151.51–77) unless it is passed through a machine that breaks up solids such that they can pass through a 25-mm mesh screen. All other trash and debris must be returned to shore for proper disposal with municipal and solid waste. Some personal items may be accidentally lost overboard. However, U.S. Coast Guard and Environmental Protection Act regulations require operators to become proactive in avoiding accidental loss of solid waste items by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. There are no meaningful entanglement risks posed by the described activity, and entanglement risks are not discussed further in this document.

Marine mammals could be affected by accidentally spilled diesel fuel from a vessel associated with proposed survey activities. Quantities of diesel fuel on the sea surface may affect marine mammals through various pathways: Surface contact of the fuel with skin and other mucous membranes, inhalation of concentrated petroleum vapors, or ingestion of the fuel (direct ingestion or by the ingestion of oiled prey) (*e.g.,* Geraci and St. Aubin, 1980, 1990). However, the likelihood of a fuel spill during any particular geophysical survey is considered to be remote, and the potential for impacts to marine mammals would depend greatly on the size and location of a spill and meteorological conditions at the time of the spill. Spilled fuel would rapidly spread to a layer of varying thickness and break up into narrow bands or windows parallel to the wind direction. The rate at which the fuel spreads would be determined by the prevailing conditions such as temperature, water currents, tidal streams, and wind speeds. Lighter, volatile components of the fuel would evaporate to the atmosphere almost completely in a few days. Evaporation rate may increase as the fuel spreads because of the increased surface area of the slick. Rougher seas, high wind speeds, and high temperatures also tend to increase the rate of evaporation and the proportion of fuel lost by this process (Scholz *et al.,* 1999). We do not anticipate potentially meaningful effects to marine mammals as a result of any contaminant spill resulting from the proposed survey activities, and contaminant spills are not discussed further in this document.

Similarly, marine mammals could be affected by spilled hazardous materials generated by the drilling process. Large and small quantities of hazardous materials, including diesel fuel and gasoline, would be handled, transported, and stored following the rules and procedures described in the Spill Prevention, Control, and Countermeasure (SPCC) Plan. Spills and leaks of oil or wastewater arising from the proposed activities that reach marine waters could result in direct impacts to the health of exposed marine mammals. Individual marine mammals could show acute irritation or damage to their eyes, blowhole or nares, and skin; fouling of baleen, which could reduce feeding efficiency; and respiratory distress from the inhalation of vapors (Geraci and St. Aubin 1990). Long-term impacts from exposure to contaminants to the endocrine system could impair health and reproduction (Geraci and St. Aubin 1990). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (Geraci and St. Aubin 1990). However, the measures outlined in Hilcorp's spill plan minimize the risk of a spill such that we do not anticipate potentially meaningful effects to marine mammals as a result of oil spills from this activity, and oil spills are not discussed further in this document.

Anticipated Effects on Marine Mammal Habitat

Effects to Prey—Marine mammal prey varies by species, season, and location and, for some, is not well documented. Fish react to sounds which are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pulsed sound on fish, although several are based on studies in support of construction projects (*e.g.,* Scholik and Yan 2001, 2002; Popper and Hastings 2009). Sound pulses at received levels of 160 dB may cause subtle changes in fish behavior, although the behavioral threshold currently observed is < 150 dB RMA re 1 μPa. SPLs of 180 dB may cause noticeable changes in behavior (Pearson *et al.* 1992; Skalski *et al.* 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality. The most likely impact to fish from survey activities at the project area would be temporary avoidance of the area. The duration of fish avoidance of a given area after survey effort stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated.

Information on seismic airgun impacts to zooplankton, which represent an important prey type for mysticetes, is limited. However, McCauley *et al.* (2017) reported that experimental exposure to a pulse from a 150 cui airgun decreased zooplankton abundance when compared with controls, as measured by sonar and net tows, and caused a two- to threefold increase in dead adult and larval zooplankton. Although no adult krill were present, the study found that all larval krill were killed after air gun passage. Impacts were observed out to the maximum 1.2 km range sampled. The reaction of fish to airguns depends on the physiological state of the fish, past exposures, motivation (*e.g.,* feeding, spawning, migration), and other environmental factors. While we agree that some studies have demonstrated that airgun sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (*e.g.,* Fewtrell and McCauley, 2012; Pearson *et al.,* 1992; Skalski *et al.,* 1992; Santulli *et al.,* 1999; Paxton *et al.,* 2017), other studies have shown no or slight reaction to airgun sounds (*e.g.,* Pena *et al.,* 2013; Wardle *et al.,* 2001; Jorgenson and Gyselman, 2009; Cott *et al.,* 2012).

In general, impacts to marine mammal prey are expected to be limited due to the relatively small temporal and spatial overlap between the proposed survey and any areas used by marine mammal prey species. The proposed activities would occur over a relatively short time period in a given area and would occur over a very small area relative to the area available as marine mammal habitat in Cook Inlet. We do not have any information to suggest the proposed survey area represents a significant feeding area for any marine mammal, and we believe any impacts to marine mammals due to adverse effects to their prey would be insignificant due to the limited spatial and temporal impact of the proposed activities. However, adverse impacts may occur to a few species of fish and to zooplankton. Packard *et al.* (1990) showed that cephalopods were sensitive to particle motion, not sound pressure, and Mooney *et al.* (2010) demonstrated that squid statocysts act as an accelerometer through which particle motion of the sound field can be detected. Auditory injuries (lesions occurring on the statocyst sensory hair cells) have been reported upon controlled exposure to low-frequency sounds, suggesting that cephalopods are particularly sensitive to low-frequency sound (Andre *et al.,* 2011; Sole *et al.,* 2013). However, these controlled exposures involved long exposure to sounds dissimilar to airgun pulses (*i.e.,* 2 hours of continuous exposure to 1-second sweeps, 50–400 Hz). Behavioral responses, such as inking and jetting, have also been reported upon exposure to low-frequency sound (McCauley *et al.,* 2000b; Samson *et al.,* 2014).

Indirect impacts from spills or leaks could occur through the contamination of lower-trophic-level prey, which could reduce the quality and/or quantity of marine mammal prey. In addition, individuals that consume contaminated prey could experience long-term effects to health (Geraci and St. Aubin 1990). However, the likelihood of spills and leaks, as described above, is low. This likelihood, in combination with Hilcorp's spill plan to reduce the risk of hazardous material spills, is such that its effect on prey is not considered further in this document.

Acoustic Habitat—Acoustic habitat is the soundscape—which encompasses all of the sound present in a particular location and time, as a whole—when considered from the perspective of the animals experiencing it. Animals produce sound for, or listen for sounds produced by, conspecifics (communication during feeding, mating, and other social activities), other animals (finding prey or avoiding predators) and the physical environment (finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (*e.g.,* produced by earthquakes, lightning, wind, rain, waves) make up the natural contributions to the total acoustics of a place. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat.

Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic or may be intentionally introduced to the marine environment for data acquisition purposes (as in the use of airgun arrays or other sources). Anthropogenic noise varies widely in its frequency content, duration, and loudness and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please see also the previous discussion on masking under ''Acoustic Effects''), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). For more detail on these concepts see, *e.g.,* Barber *et al.,* 2010; Pijanowski *et al.* 2011; Francis and Barber 2013; Lillis *et al.* 2014.

Problems arising from a failure to detect cues are more likely to occur when noise stimuli are chronic and overlap with biologically relevant cues used for communication, orientation, and predator/prey detection (Francis and Barber 2013). Although the signals emitted by seismic airgun arrays are generally low frequency, they would also likely be of short duration and transient in any given area due to the nature of these surveys. Sub-bottom profiler use is also expected to be short term and not concentrated in one location for an extended period of time. The activities related to exploratory drilling, while less transitory in nature, are anticipated to have less severe effects due to lower source levels and therefore smaller disturbance zones than the mobile sources considered here. Nonetheless, we acknowledge the general addition of multiple sound source types into the area, which are expected to have intermittent impacts on the soundscape, typically of relatively short duration in any given area.

In summary, activities associated with the proposed action are not likely to have a permanent, adverse effect on any fish habitat or populations of fish species or on the quality of acoustic habitat. Thus, any impacts to marine mammal habitat are not expected to cause significant or long-term consequences for individual marine mammals or their populations.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this proposed rule, which will inform both NMFS' consideration of ''small numbers'' and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would primarily be by Level B harassment, as use of seismic survey and construction equipment has the potential to result in disruption of behavioral patterns for individual marine mammals. There is also some potential for auditory injury (Level A harassment) to result from equipment such as seismic airguns, primarily for mysticetes and high frequency species, because predicted auditory injury zones are larger than for mid-frequency species and otariids. Auditory injury is unlikely to occur for mid-frequency cetaceans. The proposed mitigation and monitoring measures are expected to minimize the severity of such taking to the extent practicable.

As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) Acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimate.

Acoustic Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to experience behavioral disturbance (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment for non-explosive sources—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.,* frequency, predictability, duty cycle), the environment (*e.g.,* bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.,* 2012). Based on the available science and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral disturbance rising to the level of Level B Harassment. NMFS predicts that marine mammals are likely to experience behavioral disturbance sufficient to constitute Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa (rms) for continuous (*e.g.,* vibratory pile-driving, drilling) and above 160 dB re 1 μPa (rms) for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources.

Hilcorp's proposed activity includes the use of continuous (vibratory pile driving, water jet) and impulsive (seismic airguns, sub-bottom profiler, conductor pipe driving, VSP) sources, and therefore the 120 and 160 dB re 1 μPa (rms) are applicable.

Level A harassment for non-explosive sources—NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury

(Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). Hilcorp's proposed activity includes the use of impulsive (seismic airguns, sub-bottom profiler, conductor pipe driving, VSP) and non-impulsive (vibratory pile driving, water jet) sources.

These thresholds for PTS are provided in the table below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at: *http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.*

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Table 3. Thresholds identifying the onset of Permanent Threshold Shift.

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	**Impulsive**	**Non-impulsive**
Low-Frequency (LF) Cetaceans	*Cell 1* $L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	*Cell 2* $L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	*Cell 3* $L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	*Cell 4* $L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	*Cell 5* $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	*Cell 6* $L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 7* $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	*Cell 8* $L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	*Cell 9* $L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	*Cell 10* $L_{E,OW,24h}$: 219 dB

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa, and cumulative sound exposure level (L_E) has a reference value of 1µPa^{2}s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

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Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include source levels and transmission loss coefficient.

2D Seismic Survey—The area of ensonification for the 2D seismic survey was calculated by multiplying the distances (in km) to the NMFS thresholds (Level A harassment distances from the User spreadsheet and Level B harassment distances to the 160dB isopleth) on both sides of the vessel by the distance of the line (in km) to be surveyed each day. The in-water source line is 6 km in length and only one line will be surveyed each day. Therefore, the line length surveyed each day for the 2D seismic survey is 6 km.

3D Seismic Survey—The area of ensonification for the 3D seismic survey was calculated by multiplying the distances (in km) to the NMFS thresholds by the distance of the line (in km) to be surveyed each day. The line length is approximately 27.78 km (15 nm), which will take approximately 3.75 hrs to survey at a vessel speed of

4 knots (7.5 km/hr) with a turn of 1.5 hrs. In a 24-hr period, assuming no delays, the survey team will be able to collect data on 4.5 lines or approximately 127 km. The distance in between line lengths is 3.7 km (2 nm), so there will be overlap of the area of Level B ensonification, resulting in an overestimation of exposures. Instead, the total daily area of ensonification was calculated using GIS. The Level B radii were added to each track line estimated to be traveled in a 24-hour period, and when there was overlapping areas, the resulting polygons were merged to one large polygon to eliminate the chance that the areas could be summed multiple times over the same area. The results of the overall area are summarized in Table 6 below and shown on Figure 19 in the application (only showing Level B).

Geohazard Sub-bottom Profiler for Well Sites—The area of ensonification for the sub-bottom profiler used during the geohazard surveys for the well sites was calculated by multiplying the distances (in km) to the NMFS thresholds by the distance of the line (in km) to be surveyed each day. The maximum required monitoring distance from the well site per BOEM is 2,400 m (or a total length of 4,800 m in diameter) and the minimum transect width is 150 m, so the total maximum number of transects to be surveyed is 32 (4,800 m/150 m). The total distance to be surveyed is 153.60 km (4.8 km × 32 transects). Assuming a vessel speed of 4 knots (7.41 km/hr), it will take approximately 0.65 hrs (38 minutes) to survey a single transect of 4.8 km (time = distance/rate). Assuming the team is surveying for 50 percent of the day (or 12 hrs), the total number of days it will take to survey the total survey grid is 7.77 days (0.65 hr × 12 hr). Similar to the 3D seismic survey, there will be overlap in the Level B ensonification of the sound because of the distance in between the transects. However, because the area and grid to be surveyed depends on the results of the 3D survey and the specific location, Hilcorp Alaska proposes to use this overestimate for purposes of this proposed rulemaking. The total line length to be surveyed per day is 19.76 km (total distance to be surveyed 153.6 km/total days 7.77).

Geohazard Sub-bottom Profiler for Pipeline Maintenance—The area of ensonification for the sub-bottom profiler used during geohazard surveys for the pipeline maintenance was calculated by multiplying the distances (in km) to the NMFS thresholds by the distance of the line (in km) to be surveyed each day. The assumed transect grid is 300 m by 300 m with 150 m transect widths, so the total to be surveyed is 2,400 m (2.4 km). Assuming a vessel speed of 4 knots (7.41 km/hr), it will take approximately 0.08 hrs (4.86 min) to survey a single transect. The total number of days it will take to survey the grid is 1 day. Similar to the 3D seismic survey, there will be overlap of the Level B ensonification area because of the distance in between the transects. However, because the area and grid to be surveyed depends on the results of the 3D survey and the specific location, Hilcorp Alaska proposes to use this overestimate for purposes of this proposed rule. The total line length to be surveyed per day is 2.4 km.

Other sources—For stationary sources, area of a circle to the relevant Level A or Level B harassment isopleths was used to determine ensonified area. These sources include: Conductor pipe driving, VSP, vibratory sheet pile driving, and water jets.

When the NMFS Technical Guidance (2016) was published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, we developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes by Level A harassment. We note that because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimate of Level A harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available; and NMFS continues to develop ways to quantitatively refine these tools and will qualitatively address the output where appropriate. For stationary sources such as conductor pipe driving or vibratory pile driving, NMFS User Spreadsheet predicts the closest distance at which, if a marine mammal remained at that distance the whole duration of the activity, it would not incur PTS. For mobile sources such as seismic airguns or sub-bottom profilers, the User Spreadsheet predicts the closest distance at which a stationary animal would not incur PTS if the sound source traveled by the animal in a straight line at a constant speed. Inputs used in the User Spreadsheet, and the resulting isopleths are reported below (Tables 4, 5, and 6). Transmission loss used for all calculation was practical spreading (15 LogR).

TABLE 4—NMFS USER SPREADSHEET INPUTS

Activity	Type of source	Source level	Weighting factor adjustment	Source velocity	Pulse duration	Repetition rate	Duration per day
2D/3D seismic	mobile, impulsive	217 dB peak @100 m; 185 dB SEL @100 m.	1 kHz	2.05 m/s	N/A	every 6 s	N/A.
Sub-bottom profiler	mobile, impulsive	212 dB rms @1 m	4 kHz	2.05 m/s	0.02 s	every 0.30 s	N/A.
Pipe driving	stationary, impulsive	195 dB rms @55 m	2 kHz	N/A	0.02 s	600 strikes/hr	2 hrs/day.
VSP	stationary, impulsive	227 dB rms @1m	1 kHz	N/A	0.02 s	Every 6 s	4 hrs/day.
Vibratory sheet pile driving.	stationary, non-impulsive.	160 dB rms @10 m	2.5 kHz	N/A	N/A	N/A	4 hrs/day.
Water jet	stationary, non-impulsive.	176 dB rms @1 m	2 kHz	N/A	N/A	N/A	0.5 hrs/day.

TABLE 5—CALCULATED DISTANCES TO NMFS LEVEL A HARASSMENT THRESHOLDS

Activity	Level A														
	Low frequency cetaceans			Mid frequency cetaceans			High frequency cetaceans			Phocids			Otariids		
	Impulsive		Non-impulsive	Impulsive		Non-impulsive	Impulsive		Non-impulsive	Impulsive		Non-impulsive	Impulsive		Non-impulsive
	219 dB pk	183 dB SEL	199 dB SEL	230 dB pk	185 dB SEL	198 dB SEL	202 dB pk	155 dB SEL	173 dB SEL	218 dB pk	185 dB SEL	201 dB SEL	232 dB pk	203 dB SEL	219 dB SEL
2D/3D seismic	74	399		14	<1		1,000	45		86	66		10	1	
Sub-bottom profiler	<1	77		<1	4		5	1,108		<1	48		<1	<1	
Pipe driving	1	134		<1	103		19	3,435		2	1,543		<1	112	
VSP	3	11,217		<1	96		46	2,617		4	3,371		<1	249	
Vibratory sheet pile driving			15			1			22			9			<1
Water jet			14			<1			13			8			1
Hydraulic grinder			1			<1			1			<1			<1
Tugs towing			<1			<1			<1			<1			<1

TABLE 6—CALCULATED DISTANCES TO NMFS LEVEL B THRESHOLDS

Activity	Level B	
	Impulsive	Non-impulsive
	160 dB rms	120 dB rms
2D/3D seismic	7,330	
Sub-bottom profiler	2,929	
Pipe driving	1,630	
VSP	2,470	
Vibratory sheet pile driving		4,642
Water jet		5,411
Hydraulic grinder	<1	398
Tugs towing		2,514

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations.

Beluga whale—Historically, beluga whales were observed in both upper and lower Cook Inlet in June and July (Rugh *et al.* 2000). However, between 1993 and 1995, less than 3 percent of all of the annual sightings were in the lower inlet, south of the East and West Forelands, hardly any (one whale in Tuxedni Bay in 1997 and two in Kachemak Bay in 2001) have been seen in the lower inlet during these surveys 1996–2016 (Rugh *et al.* 2005; Shelden *et al.* 2013, 2015, 2017). Because of the extremely low sighting rates, it is difficult to provide an accurate estimate of density for beluga whales in the mid and lower Cook Inlet region.

Goetz *et al.* (2012b) developed a habitat-based model to estimate Cook Inlet beluga density based on seasonally collected data. The model was based on sightings, depth soundings, coastal substrate type, environmental sensitivity index, anthropogenic disturbance, and anadromous fish streams to predict densities throughout Cook Inlet. The result of this work is a beluga density map of Cook Inlet, which predicts spatially explicit density estimates for Cook Inlet belugas. Figure 1 shows the Goetz *et al.* (2012b) estimates with the project area. Using data from the GIS files provided by NMFS and the different project locations, the resulting estimated density is shown in Table 7. The water jets would be used on pipelines throughout the middle Cook Inlet region, so the higher density for the Trading Bay area was used.

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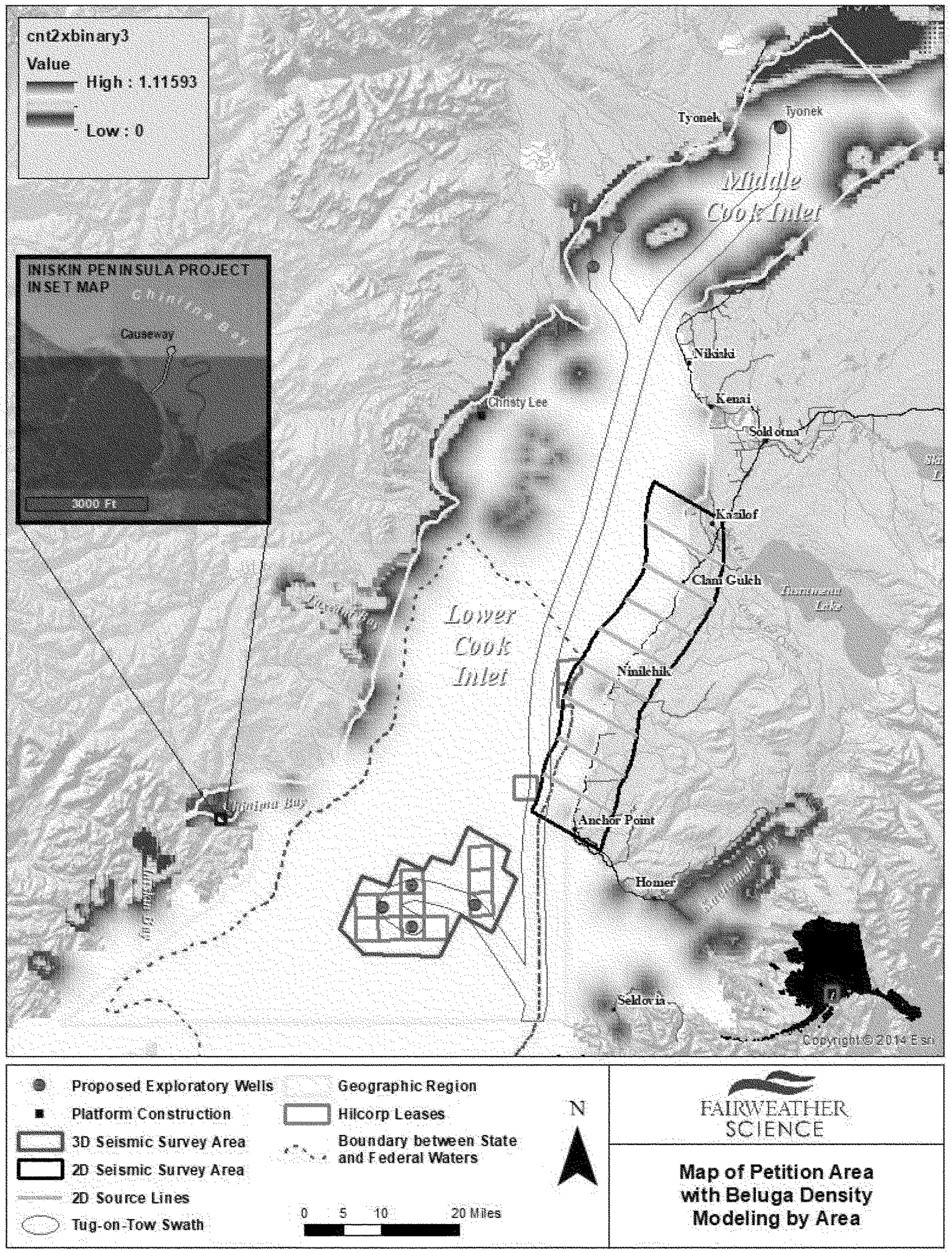

Figure 1. Beluga whale density as defined by Goetz *et al.* (2012b) in action area.

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Densities resulting from this model are summarized in Table 7 below.

TABLE 7—COOK INLET BELUGA WHALE DENSITY BASED ON GOETZ HABITAT MODEL

Project location	Project activity	Beluga whale density (ind/km^2)
Lower Cook Inlet (OCS)	3D seismic, geohazard, pipe driving	0.00
Lower Cook Inlet (east side)	2D seismic	0.00–0.011106
Iniskin Bay area	Sheet pile driving	0.024362
North Cook Inlet Unit	Geohazard, pipe driving	0.001664
Trading Bay area	Geohazard, pipe driving, water jets	0.004453–0.015053

Other Marine Mammals—Density estimates of species other than beluga whales were estimated from the NMFS June aerial surveys conducted for beluga whales between 2000 and 2016 (Rugh *et al.* 2005; Shelden *et al.* 2013, 2015, 2017). Although these surveys are only flown for a few days in one month, they represent the best available relatively long-term dataset for marine mammal sightings in Cook Inlet. Table 8 below summarizes the maximum marine mammals observed for each year for the survey and area covered. To estimate density, the total number of individuals per species sighted during surveys was divided by the distance flown on the surveys. The total number of animals observed accounts for both lower and upper Cook Inlet, so this density estimate is higher than what is anticipated for the lower Cook Inlet area. There are no density estimates available for California sea lions for Cook Inlet so largest potential group size was used.

TABLE 8—DENSITY ESTIMATES FOR MARINE MAMMALS IN ACTION AREA

Species	Estimated density (# marine mammals/km^2) [3]
Beluga whale:	
Lower and Middle Cook Inlet [1]	0.00006
Lower Cook Inlet [2]	0.01111
North Cook Inlet Unit [2]	0.00166
Trading Bay area [2]	0.01505
Iniskin Peninsula [2]	0.02436
Humpback whale	0.00009
Minke whale	0.00000
Gray whale	0.00001
Fin whale	0.00005
Killer whale	0.00011
Dall's porpoise	0.00006
Harbor porpoise	0.00037
Harbor seal	0.00655
Steller sea lion	0.00035

[1] NMFS aerial survey combined lower and middle Cook Inlet density.
[2] Goetz *et al.* 2012(b) habitat-based model density.
[3] When using data from NMFS aerial surveys, the survey year with the greatest calculated density was used to calculate exposures.
No density available for California sea lions in Cook Inlet.

Duration

The duration was estimated for each activity and location. For some projects, like the 3D seismic survey, the design of the project is well developed; therefore, the duration is well-defined. However, for some projects, the duration is not well developed, such as activities around the lower Cook Inlet well sites, because the duration depends on the results of previous studies and equipment availability. Our assumptions regarding these activities, which were used to estimate duration, are discussed below.

2D Seismic—A single vessel is capable of acquiring a source line in approximately 1–2 hrs and only one source line will be collected in one day to allow for all the node deployments and retrievals, and intertidal and land zone shot holes drilling. There are up to 10 source lines, so assuming all operations run smoothly, there will only be 2 hrs per day over 10 days of airgun activity. The duration that was used to assess exposures from the 2D seismic survey is 10 days.

3D Seismic—The total anticipated duration of the survey is 45–60 days, including delays due to equipment, weather, tides, and marine mammal shut downs. The duration that was used to assess exposures from the 3D seismic survey is 60 days.

Geohazard Surveys (Sub-bottom profiler)—Assuming surveying occurs 50 percent of the day (or 12 hrs), the total number of days it will take to survey the total geohazard survey grid for a single well is 7.77 days. This duration was multiplied by the number of wells per site resulting in 31.1 days for the four Lower Cook Inlet OCS wells, 7.7 days for the North Cook Inlet Unit well, and 15.5 days for the two Trading Bay area wells.

The total number of days it will take to survey the geohazard survey grid for a pipeline maintenance is 1 day. This duration was multiplied by the number of anticipated surveys per year (high estimate of 3 per year), for a total of 3 days.

Drive Pipe—It takes approximately 3 days to install the drive pipe per well with only 25 percent of the day necessary for actual pipe driving. This duration was multiplied by the number of wells per site resulting in 3 days for the four lower Cook Inlet wells and 1.5 days for the two Trading Bay area wells. Drive pipe installation is not part of the activities planned at the North Cook Inlet site.

VSP—It takes approximately 2 days to perform the VSP per well with only 25 percent of the day necessary for actual seismic work. VSP is not part of the plugging and abandonment (P&A) activities at the North Cook Inlet site. This duration was multiplied by the number of wells per site, resulting in 2 days for the four lower Cook Inlet wells and 1 day for the two Trading Bay area wells.

Vibratory Sheet Pile Driving—The total number of days expected to install the sheet pile dock face using vibratory hammers on the rock causeway is 14 days with only 25 percent of the day for actual pile driving, resulting in 3.5 days of sound for the Iniskin project.

Water jets—Water jets are only used when needed for maintenance; therefore, the annual duration was estimated to evaluate exposures. Each water jet event was estimated to be 30 minutes or less in duration. We acknowledge that due to the short duration of this activity, it is possible that take will not occur—however, we are including consideration of potential take to conservatively ensure coverage for the applicant. It was estimated that a water jet event occurs 3 times a month, resulting in only 1.5 hrs per month of water jet operation. Water jets are used during ice-free months, so this duration was multiplied by 7 months (May–November) resulting in 10.5 days.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate. The numbers of each marine mammal species that could potentially be exposed to sounds associated with the proposed activities that exceed NMFS' acoustic Level A and B harassment criteria were estimated per type of activity and per location. The specific years when these activities might occur are not known at this time, so this method of per activity per location allows for flexibility in operations and provides NMFS with appropriate information for assessing potential exposures. Individual animals may be exposed to received levels above our harassment thresholds more than once per day, but NMFS considers animals only ''taken'' once per day. Exposures refer to any instance in which an animal is exposed to sound sources above NMFS' Level A or Level B harassment thresholds. The estimated exposures (without any mitigation) per activity per location were calculated by multiplying the density of marine mammals (# of marine mammals/km^2) by the area of ensonification (km^2) and the duration (days per year). These results of these calculations are presented in Tables 9 and 10 below.

TABLE 9—ESTIMATED NUMBER OF LEVEL A EXPOSURES PER ACTIVITY AND LOCATION

Species	3D seismic	2D seismic	Iniskin vibratory sheet pile	Water jets [6]	Sub-bottom profiler				Pipe driving		Vertical seismic profiling	
	LCI [1]	LCI [1]	LCI [1]		MCI [4]	LCI [1]	NCI [2]	TB [3]	LCI [1]	TB [3]	LCI [1]	TB [3]
Humpback whale	6.80	0.05	0.00	0.00	0.00	0.09	0.02	0.04	0.00	0.00	5.97	2.98
Minke whale	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02
Gray whale	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13
Fin whale	1.19	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	1.05	0.52
Killer whale	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beluga whale	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Dall's porpoise	1.31	0.01	0.00	0.00	0.00	0.11	0.03	0.06	0.00	0.00	0.03	0.01
Harbor porpoise	37.25	0.29	0.00	0.00	0.04	3.20	0.80	1.60	0.00	0.00	0.81	0.40
Harbor seal	287.11	2.26	0.00	0.00	0.09	7.39	1.85	3.69	0.05	0.02	5.80	2.90
Steller sea lion	0.70	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01

[1] LCI—Lower Cook Inlet Wells, [2] NCI—North Cook Inlet Unit well, [3] TB = Trading Bay wells, [4] MCI—Middle Cook Inlet Pipeline Maintenance.

TABLE 10—ESTIMATED NUMBER OF LEVEL B EXPOSURES PER ACTIVITY AND LOCATION

Species	3D seismic	2D seismic	Iniskin vibratory sheet pile	Water jets [6]	Sub-bottom profiler				Pipe driving		Vertical seismic profiling	
	LCI [1]	LCI [1]	LCI [1]		MCI [4]	LCI [1]	NCI [2]	TB [3]	LCI [1]	TB [3]	LCI [1]	TB [3]
Humpback whale	85.43	0.83	0.64	0.01	0.04	3.40	0.85	1.70	0.05	0.02	0.07	0.04
Minke whale	0.45	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.04
Gray whale	3.60	0.04	0.03	0.00	0.00	0.14	0.04	0.07	0.00	0.00	0.00	0.04
Fin whale	14.99	0.15	0.11	0.00	0.01	0.60	0.15	0.30	0.01	0.00	0.01	0.04
Killer whale	29.02	0.28	0.22	0.00	0.01	1.15	0.29	0.58	0.02	0.01	0.02	0.04
Beluga whale	0.00	0.00	8.24	0.05	0.00	0.00	0.75	13.54	0.00	0.19	0.00	0.04
Dall's porpoise	7.42	0.07	0.06	0.00	0.00	0.30	0.07	0.15	0.00	0.00	0.01	0.04
Harbor porpoise	211.70	2.06	1.58	0.02	0.10	8.42	2.10	4.21	0.12	0.06	0.18	0.04
Harbor seal	11,255.01	109.38	84.17	0.83	5.24	447.52	111.88	223.76	6.23	3.11	9.53	0.04
Steller sea lion	366.99	3.57	2.74	0.03	0.17	14.59	3.65	7.30	0.20	0.10	0.31	0.04

[1] LCI—Lower Cook Inlet Wells, [2] NCI—North Cook Inlet Unit well, [3] TB = Trading Bay wells, [4] MCI—Middle Cook Inlet Pipeline Maintenance.

The take estimates by activity and location discussed in the previous section are not representative of the estimated takes per year (*i.e.,* annual takes). It is difficult to characterize each year accurately because many of the activities are progressive (*i.e.,* they depend on results and/or completion of the previous activity). This results in much uncertainty in the timing, duration, and complete scope of work. Each year, the applicant will submit an application for an LOA with the specific details of the planned work for that year with estimated take numbers. The most realistic scenario used to estimate annual takes includes 3D seismic surveys in the first season, activities for one well in the second season in lower Cook Inlet, as well as the plugging and abandonment activities in North Cook Inlet Unit and the two wells in the Trading Bay area. For the third season, we have included activities for drilling two wells in lower Cook Inlet and the final well in the fourth season. Table 17 summarizes the activities included in this second scenario.

TABLE 11—SUMMARY OF ACTIVITIES CONSIDERED BY YEAR

Year	Activity	Area
May 2019–2020	3D seismic	LCI.
	Geohazard	LCI.
	Sheet pile driving	Iniskin (LCI).
	Pipeline maintenance (geohazard, water jet, grinder)	MCI.
April 2020–2021	Drilling activities (tugs, geohazard, pipe driving, VSP) at all 1 well	LCI.
	Drilling activities (tugs, geohazard, pipe driving, VSP) at 2 wells	TB.
	P&A activities (tugs, geohazard) at 1 well	NCI.
	Pipeline maintenance (geohazard, water jet, grinder)	MCI
April 2021–2022	Drilling activities (tugs, geohazard, pipe driving, VSP) at 2wells	LCI.
	2D seismic	LCI.
	Pipeline maintenance (geohazard, water jet, grinder)	MCI.
April 2022–2023	Drilling activities (tugs, geohazard, pipe driving, VSP) at 1 well	LCI.
	Pipeline maintenance (geohazard, water jet, grinder)	MCI.
April 2023–2024	Pipeline maintenance (geohazard, water jet, grinder)	MCI.

LCI—Lower Cook Inlet Wells, NCI—North Cook Inlet Unit well, TB = Trading Bay wells, MCI—Middle Cook Inlet Pipeline Maintenance.

TABLE 12—ESTIMATED EXPOSURES FOR FIRST YEAR OF ACTIVITY

Species	Level A						Level B					
	MCI pipeline geohazard	MCI pipeline water jet	LCI 3D seismic	LCI sub-bottom profiler	LCI sheet pile driving	Total	MCI pipeline geohazard	MCI pipeline water jet	LCI 3D seismic	LCI sub-bottom profiler	LCI sheet pile driving	Total
Humpback whale	0	0	6.8	0.09	0	6.89	0.04	0.15	85.43	3.4	2.56	91.57
Minke whale	0	0	0.04	0	0	0.04	0	0	0.45	0.02	0.01	0.48
Gray whale	0	0	0.29	0	0	0.29	0	0.01	3.60	0.14	0.11	3.86
Fin whale	0	0	0.29	0.02	0	0.31	0.01	0.03	3.60	0.60	0.45	4.68
Killer whale	0	0	1.19	0	0	1.19	0.01	0.05	14.99	1.15	0.87	17.08
Beluga whale	0	0	0	0	0	0	0	1.2	0	0	32.98	34.18
Dall's porpoise	0	0	1.31	0.11	0	1.42	0	0.01	7.42	0.3	0.22	7.95
Harbor porpoise	0.04	0	37.25	3.2	0	40.49	0.1	0.37	211.70	8.42	6.33	226.92
Harbor seal	0.09	0	287.11	7.39	0	294.58	5.24	19.85	11255.01	447.52	336.67	12064.29
Steller sea lion	0	0	0.7	0	0	0.7	0.17	0.65	366.99	14.59	10.98	393.38
California sea lion	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 13—ESTIMATED EXPOSURES FOR SECOND YEAR OF ACTIVITY

	Level A					Level B				
	MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (1 well only)			MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (1 well only)		
Humpback whale	0	0	1.51	....	....	0.04	0.15	0.97	....	....
Minke whale	0	0	0.01	....	....	0	0	0.01	....	....
Gray whale	0	0	0.06	....	....	0	0.01	0.04	....	....
Fin whale	0	0	0.27	....	....	0.01	0.03	0.17	....	....
Killer whale	0	0	0	....	....	0.01	0.05	0.33	....	....
Beluga whale	0	0	0	....	....	0	1.2	0	....	....
Dall's porpoise	0	0	0.04	....	....	0	0.01	0.08	....	....
Harbor porpoise	0.04	0	1	....	....	0.10	0.37	2.4	....	....
Harbor seal	0.09	0	3.31	....	....	5.24	19.85	127.64	....	....
Steller sea lion	0	0	0	....	....	0.17	0.65	4.16	....	....
California sea lion	0	0	0	....	....	0	0	0	....	....
	Level A				Subtotal for all activities	Level B				Subtotal for all activities
	NCI geohazard (1 well)	TB geohazard (2 wells)	TB pipe driving (2 wells)	TB VSP		NCI geohazard (1 well)	TB geohazard (2 wells)	TB pipe driving (2 wells)	TB VSP	
Humpback whale	.02	.04	0	2.98	**4.57**	0.85	1.7	0.09	0.14	**3.95**
Minke whale	0	0	0	0.02	**0.02**	0	0.01	0	0	**0.02**
Gray whale	0	0	0	0.13	**0.19**	0.04	0.07	0	0.01	**0.17**
Fin whale	0	0.01	0	0.52	**0.8**	0.15	0.3	0.02	0.03	**0.69**
Killer whale	0	0	0	0	**0**	0.85	0.58	0.03	0.05	**1.9**
Beluga whale	0.02	0.02	0	0	**0.04**	0.85	13.54	0.75	1.15	**17.5**

TABLE 13—ESTIMATED EXPOSURES FOR SECOND YEAR OF ACTIVITY—Continued

	Level A					Level B				
	MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (1 well only)			MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (1 well only)		
Dall's porpoise	0.02	0.06	0	0.01	**0.13**	0.85	0.15	0.01	0.01	**1.12**
Harbor porpoise	0.02	1.6	0	0.4	**3.07**	0.85	4.21	0.23	0.36	**8.52**
Harbor seal	0.02	3.69	0.02	2.9	**10.04**	0.85	223.76	12.46	19.07	**408.87**
Steller sea lion	0.02	0	0	0.01	**0.03**	0.85	7.3	0.41	0.62	**14.15**
California sea lion	0	0	0	**0**	0	0	0	0	0	**0**

TABLE 14—ESTIMATED EXPOSURES FOR THIRD YEAR OF ACTIVITY

	Level A				Total	Level B				Total
	MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (2 wells only)	LCI 2D seismic		MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (2 wells only)	LCI 2D seismic	
Humpback whale	0	0	3.03	0.05	**3.08**	0.04	0.15	1.94	0.83	**2.96**
Minke whale	0	0	0.02	0	**0.02**	0	0	0.01	0	**0.02**
Gray whale	0	0	0.13	0	**0.13**	0	0.01	0.08	0.04	**0.12**
Fin whale	0	0	0.53	0.01	**0.54**	0.01	0.03	0.34	0.15	**0.52**
Killer whale	0	0	0	0	**0**	0.01	0.05	0.66	0.28	**1.01**
Beluga whale	0	0	0	0.01	**0.01**	0	1.2	0	4.8	**6.09**
Dall's porpoise	0	0	0.07	0.01	**0.08**	0	0.01	0.17	0.07	**0.26**
Harbor porpoise	0.04	0	2	0.29	**2.34**	0.1	0.37	4.8	2.06	**7.33**
Harbor seal	0.09	0	6.62	2.26	**8.97**	5.24	19.85	255.28	109.38	**389.76**
Steller sea lion	0	0	0.01	0.01	**0.01**	0.17	0.65	8.32	3.57	**12.71**
California sea lion	0	0	0	0	**0**	0	0	0	0	**0**

TABLE 15—ESTIMATED EXPOSURES FOR FOURTH YEAR OF ACTIVITY

	Level A			Total	Level B			Total
	MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (1 well only)		MCI pipeline geohazard	MCI pipeline water jet	LCI geohazard, pipe driving, VSP (1 well only)	
Humpback whale	0	0	1.51	**1.52**	0.04	0.15	0.97	**1.16**
Minke whale	0	0	0.01	**0.01**	0	0	0.01	**0.01**
Gray whale	0	0	0.06	**0.06**	0	0.01	0.04	**0.05**
Fin whale	0	0	0.27	**0.27**	0.01	0.03	0.17	**0.2**
Killer whale	0	0	0	**0**	0.01	0.05	0.33	**0.39**
Beluga whale	0	0	0	**0**	0	1.2	0	**1.2**
Dall's porpoise	0	0	0.04	**0.04**	0	0.01	0.08	**0.10**
Harbor porpoise	0.04	0	1	**1.04**	0.1	0.37	2.40	**2.87**
Harbor seal	0.09	0	3.31	**3.40**	5.24	19.85	127.64	**152.74**
Steller sea lion	0	0	0	**0**	0.17	0.65	4.16	**4.98**
California sea lion	0	0	0	**0**	0	0	0	**0**

TABLE 16—ESTIMATED EXPOSURES FOR FIFTH YEAR OF ACTIVITY

	Level A			Level B		
	MCI pipeline geohazard	MCI pipeline water jet	Total	MCI pipeline geohazard	MCI pipeline water jet	Total
Humpback whale	0	0	0	0.04	0.15	0.19
Minke whale	0	0	0	0	0	0
Gray whale	0	0	0	0	0.01	0.01
Fin whale	0	0	0	0.01	0.03	0.03
Killer whale	0	0	0	0.01	0.05	0.06
Beluga whale	0	0	0	0	1.2	1.2
Dall's porpoise	0	0	0	0	0.01	0.02
6.09+Harbor porpoise	0.04	0	0.04	0.1	0.37	0.47
Harbor seal	0.09	0	0.09	5.24	19.85	25.10
Steller sea lion	0	0	0	0.17	0.65	0.82
California sea lion	0	0	0	0	0	0

TABLE 17—ESTIMATED MAXIMUM EXPOSURES THAT MAY BE AUTHORIZED IN ONE YEAR, BASED ON FIRST YEAR OF ACTIVITY

Species	Level A			Level B		
	Total calculated	Total authorized	Percent of stock	Total calculated	Total authorized	Percent of stock
Humpback whale	6.89	7	0.63	91.57	92	8.31
Minke whale	0.04	0	0	0.48	1	0.08
Gray whale	0.29	0	0	3.86	4	0.02
Fin whale	0.31	0	0	4.68	5	0.16
Killer whale	1.19	0	0	17.08	17	0.72 (resident) or 2.90 (transient)
Beluga whale	0	0	0	34.18	30	9.62
Dall's porpoise	1.42	2	0.0024	7.95	8	0.01
Harbor porpoise	40.49	40	0.13	226.92	227	0.73
Harbor seal	294.58	295	1.1	12064.29	6,000	21.91
Steller sea lion	0.7	1	0	393.38	394	0.74
California sea lion	0	0	0	0	5	0

TABLE 18—TOTAL EXPOSURES CALCULATED AND REQUESTED OVER THE 5-YEAR REGULATIONS

Group	Species	Calculated Exposures		Authorized Exposures	
		Level A	Level B	Level A	Level B
LF Cetaceans	Humpback whale	16.06	99.82	16	100
	Minke whale	0.08	0.53	0	5
	Gray whale	0.68	4.21	0	5
	Fin whale	1.91	6.93	0	7
MF Cetaceans	Killer whale	0.2	20.44	0	20
	Beluga whale	0.05	60.17	0	35
HF Cetaceans	Dall's porpoise	1.67	9.45	5	10
	Harbor porpoise	46.97	246.12	47	246
Phocids	Harbor seal	317.07	13040.77	317	6847
Otariids	Steller sea lion	0.76	426.04	5	426
	California sea lion	0	0	0	5

Based on the results of the acoustic harassment analysis, Hilcorp Alaska is requesting a small number of takes by Level A harassment for humpback whales, Dall's porpoises, harbor porpoises, Steller sea lions, and harbor seals. Hilcorp Alaska does not anticipate that any of the activities will result in mortality or serious injury to marine mammals, but these species may be exposed to levels exceeding the Level A harassment thresholds. Seals are highly curious and exhibit high tolerance for anthropogenic activity, so they are likely to enter within the larger Level A harassment isopleths. Porpoises are difficult to observer at greater distances and usually only remain in an area for a short period of time. The total requested takes by Level A harassment are for 16 humpback whales, 5 Dall's porpoises, 47 harbor porpoises, and 317 harbor seals. Note this is not a request for annual takes, but total takes over the 5-year period.

The requested takes by Level B harassment for minke and gray whale are rounded up to 5 animals, based on the assumption that one could be taken per year for five years. The requested takes by Level B harassment for humpback whales is 100 animals, although it is not expected to approach this number as humpbacks are easily observable during monitoring efforts. The requested takes by Level B harassment for killer whales are rounded up to 20 animals to allow for small groups. The requested takes by Level B harassment for Dall's and harbor porpoise are rounded up to 10 and 246 animals, respectively, due to the inconspicuous nature of porpoises.

The requested takes by Level B harassment for harbor seals is 6,847 animals. The estimated number of instances of takes by Level B harassment of 13,041 resulting from the calculations outlined above is an overestimate due to the inclusion of haul out sites numbers in the underlying density estimate used to calculate take. Using the daily ensonified area x number of survey days x density method results in a reasonable estimate of the instances of take, but likely significantly overestimates the number of individual animals expected to be taken. With most species, even this overestimated number is still very small, and additional analysis is not really necessary to ensure minor impacts. However, because of the number and density of harbor seals in the area, a more accurate understanding of the number of individuals likely taken is necessary to fully analyze the impacts and ensure that the total number of harbor seals taken is small.

As described below, based on monitoring results from the area, it is likely that the modeled number of estimated instances of harbor seal take referenced above is overestimated. The density estimate from NMFS aerial surveys includes harbor seal haulouts far south of the action area that may never move to an ensonified area. Further, we believe that we can reasonably estimate the comparative number of individual harbor seals that will likely be taken, based both on monitoring data, operational information, and a general understanding of harbor seal habitat use.

Using the daily ensonified area × number of survey days × density, the number of instances of exposure above the 160-dB threshold estimated for Hilcorp's activity in Cook Inlet is large.

However, when we examine monitoring data from previous activities, it is clear this number is an overestimate—compared to both aerial and vessel based observation efforts. Apache's monitoring report from 2012 details that they saw 2,474 harbor seals from 29 aerial flights (over 29 days) in the vicinity of the survey during the month of June, which is the peak month for harbor seal haulout. In surveying the literature, correction factors to account for harbor seals in water based on land counts vary from 1.2 to 1.65 (Harvey & Goley, 2011). Using the most conservative factor of 1.65 (allowing us to consider that some of the other individuals on land may have entered the water at other points in day), if Apache saw 2,474 seals hauled out then there were an estimated 1,500 seals in the water during those 29 days. To account for the limited number of surveys (29 surveys), NMFS conservatively multiplied the number of seals by 5.5 to estimate the number of seals that might have been seen if the aerial surveys were conducted for 160 days. This yields an estimate of 8,250 instances of seal exposure in the water, which is far less than the exposure estimate resulting from Hilcorp's calculations. NMFS further reduced the estimate given the context of the activity. The activity with the highest potential take of harbor seal according to calculations is 3D seismic surveying, primarily due to the high source levels. However, the 3D seismic surveying is occurring primarily offshore, which is also the area where they are least likely to encounter harbor seals. The calculated exposures from 3D seismic surveying account for 92 percent of the total calculated harbor seal exposures across the five years of the project, accounting for a high proportion of the takes allocated to deeper water seismic activity which is less likely to spatially overlap with harbor seals. That the number of potential instances of exposure is likely less than calculated is also supported by the visual observations from Protected Species Observers (PSOs) on board vessels. PSOs in Cook Inlet sighted a total of 285 seals in water over 147 days of activity, which would rise to about 310 if adjusted to reflect 160 days of effort. Given the size of the disturbance zone for these activities, it is likely that not all harbor seals that were exposed were seen by PSOs. However 310 is still far less than the estimate given by the density calculations.

Further, based on the residential nature of harbor seals and the number of offshore locations included in Hilcorp's project, where harbor seals are unlikely to reside, NMFS estimated the number of individual harbor seals exposed, given the instances of exposures. Given these multiple methods, as well as the behavioral preferences of harbor seals for haulouts in certain parts of the Inlet (Montgomery *et al.,* 2007), and high concentrations at haulouts in the lower Inlet, it is unreasonable to expect that more than 25 percent of the population, or 6,847 individuals, will be taken by Level B harassment during Hilcorp's activity. Therefore, we estimate that 6,847 individuals are taken, which equates to 25 percent of the estimated abundance in NMFS stock assessment report.

Effects of Specified Activities on Subsistence Uses of Marine Mammals

The availability of the affected marine mammal stocks or species for subsistence uses may be impacted by this activity. The subsistence uses that may be affected and the potential impacts of the activity on those uses are described below. Measures included in this proposed rule to reduce the impacts of the activity on subsistence uses are described in the *Proposed Mitigation* section. Last, the information from this section and the *Proposed Mitigation* section is analyzed to determine whether the necessary findings may be made in the *Unmitigable Adverse Impact Analysis and Determination* section.

The ADF&G conducted studies to document the harvest and use of wild resources by residents of communities on the east and west sides of Cook Inlet (Jones and Kostick 2016). Data on wild resource harvest and use were collected, including basic information about who, what, when, where, how, and how much wild resources are being used to develop fishing and hunting opportunities for Alaska residents. Tyonek was surveyed in 2013 (Jones *et al.,* 2015), and Nanwalek, Port Graham, and Seldovia were surveyed in 2014 (Jones and Kostick 2016). Marine mammals were harvested by three (Seldovia, Nanwalek, Port Graham) of the four communities but at relatively low rates. The harvests consisted of harbor seals, Steller sea lions, and northern sea otters (*Enhydra lutris*), the latter of which is managed by the U.S. Fish and Wildlife Service and not mentioned further.

TABLE 19—MARINE MAMMAL HARVEST BY TYONEK IN 2013 AND NIKISKI, PORT GRAHAM, SELDOVIA, AND NANWALEK IN 2014

Village	Harvest (pounds per capita)	Households attempting harvest number (% of residents)	Number of marine mammals harvested			
			Harbor seal	Steller sea lion	Northern sea otter	Beluga whale
Tyonek	2	6 (6%)	6	0	0	0
Seldovia	1	2 (1%)	5	0	3	0
Nanwalek	11	17 (7%)	22	6	1	0
Port Graham	8	27 (18%)	16	1	24	0

In Tyonek, harbor seals were harvested between June and September by 6 percent of the households (Jones *et al.* 2015). Seals were harvested in several areas, encompassing an area stretching 20 miles along the Cook Inlet coastline from the McArthur River Flats north to the Beluga River. Seals were searched for or harvested in the Trading Bay areas as well as from the beach adjacent to Tyonek (Jones *et al.* 2015). In Seldovia, the harvest of harbor seals (5 total) occurred exclusively in December (Jones and Kostick 2016).

In Nanwalek, 22 harbor seals were harvested in 2014 between March and October, the majority of which occur in April. Nanwalek residents typically hunt harbor seals and Steller sea lions at Bear Cove, China Poot Bay, Tutka Bay, Seldovia Bay, Koyuktolik Bay, Port Chatam, in waters south of Yukon Island, and along the shorelines close to

Nanwalek, all south of the Petition region (Jones and Kosick 2016).

According to the results presented in Jones and Kostick (2016) in Port Graham, harbor seals were the most frequently used marine mammal; tribal members harvested 16 in the survey year. Harbor seals were harvested in January, February, July, August, September, November, and December. Steller sea lions were used noticeably less and harvested in November and December.

The Cook Inlet beluga whale has traditionally been hunted by Alaska Natives for subsistence purposes. For several decades prior to the 1980s, the Native Village of Tyonek residents were the primary subsistence hunters of Cook Inlet beluga whales. During the 1980s and 1990s, Alaska Natives from villages in the western, northwestern, and North Slope regions of Alaska either moved to or visited the south-central region and participated in the yearly subsistence harvest (Stanek 1994). From 1994 to 1998, NMFS estimated 65 whales per year were taken in this harvest, including those successfully taken for food, and those struck and lost. NMFS has concluded that this number is high enough to account for the estimated 14 percent annual decline in population during this time (Hobbs *et al.* 2008). Actual mortality may have been higher, given the difficulty of estimating the number of whales struck and lost during the hunts. In 1999, a moratorium was enacted (Pub. L. 106–31) prohibiting the subsistence take of Cook Inlet beluga whales except through a cooperative agreement between NMFS and the affected Alaska Native organizations.

On October 15, 2008, NMFS published a final rule that established long-term harvest limits on the Cook Inlet beluga whales that may be taken by Alaska Natives for subsistence purposes (73 FR 60976). That rule prohibits harvest for a 5-year period (2008–2012), if the average abundance for the Cook Inlet beluga whales from the prior five years (2003–2007) is below 350 whales. The next 5-year period that could allow for a harvest (2013–2017) would require the previous five-year average (2008–2012) to be above 350 whales. Since the Cook Inlet beluga whale harvest was regulated in 1999 requiring cooperative agreements, five beluga whales have been struck and harvested. Those beluga whales were harvested in 2001 (one animal), 2002 (one animal), 2003 (one animal), and 2005 (two animals). The Native Village of Tyonek agreed not to hunt or request a hunt in 2007, when no co-management agreement was to be signed (NMFS 2008).

The 2008 Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement (NMFS 2008a) authorizes how many beluga whales can be taken during a 5-year interval based on the 5-year population estimates and 10-year measure of the population growth rate. Based on the 2008–2012 5-year abundance estimates, no hunt occurred between 2008 and 2012 (NMFS 2008a). The Cook Inlet Marine Mammal Council, which managed the Alaska Native Subsistence fishery with NMFS, was disbanded by a unanimous vote of the Tribes' representatives on June 20, 2012. No harvest has occurred since then and no harvest is likely in 2018.

Residents of the Native Village of Tyonek are the primary subsistence users in Knik Arm area (73 FR 60976). No households hunted beluga whale locally in Cook Inlet due to conservation concerns (Jones *et al.* 2015). The proposed project should not have any effect because no beluga harvest has taken place since 2005, and beluga hunts are not expected during the next five-year period.

Proposed Mitigation

In order to issue an LOA under section 101(a)(5)(A) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses. NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat, as well as subsistence uses. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned) and;

(2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

Mitigation for Marine Mammals and Their Habitat

Hilcorp has reviewed mitigation measures employed during seismic research surveys authorized by NMFS under previous incidental harassment authorizations, as well as recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), Weir and Dolman (2007), Nowacek *et al.* (2013), Wright (2014), and Wright and Cosentino (2015), and has incorporated a suite of proposed mitigation measures into their project description based on the above sources.

To reduce the potential for disturbance from acoustic stimuli associated with the activities, Hilcorp has proposed to implement the following mitigation measures for marine mammals:

(1) Vessel-based and shore-based visual mitigation monitoring;

(2) Establishment of a marine mammal exclusion zone (EZ) and safety zone (SZ);

(3) Shutdown procedures;

(4) Power down procedures;

(5) Ramp-up procedures; and

(6) Vessel strike avoidance measures.

In addition to the measures proposed by Hilcorp, NMFS has proposed the following mitigation measures: Aerial overflights for pre-clearance and seasonal closure of the Susitna River Delta.

Exclusion and safety zones—The Exclusion Zone (EZ) is defined as the area in which all operations are shut down in the event a marine mammal enters or is about to enter this zone based on distances to the Level A harassment threshold or what can be effectively monitored for the species. The Safety Zone (SZ) is an area larger than the EZ and is defined as the area within which operations may power down in the event a marine mammal enters or is about to enter, and may be considered a Level B harassment. For all activities, if a marine mammal for which take is not authorized is seen within or entering the SZ, operations will shut down. A minimum 10 meter shutdown zone will be observed for all in-water construction and heavy machinery.

The distances for the EZ and SZ for the activities are summarized in Table 20 and described in the following text:

(1) The distances to the Level A harassment thresholds for the 2D/3D seismic activity were calculated using the methods described above and are indicated in Table 5 above. As in several recent IHAs authorizing take from seismic surveys (*e.g.,* five surveys in the Atlantic (82 FR 26244) and NSF (83 FR 44578)), we have proposed a more standardized 500-m EZ, which is practicable to implement and minimizes the likelihood of injury or more severe behavioral responses. The SZ for all marine mammals is 1,000 m. The distances to the thresholds for the sub-bottom profiler were calculated using the methods described above. The EZ for all marine mammals is rounded up to 100 m.

(2) The distances to the Level A harassment thresholds for the pipe driving were calculated using methods above and the distance to the Level B harassment threshold is based on Illingworth & Rodkin (2014) measurements of 1,600 m to the 160 dB zone. The EZ for all marine mammals is rounded up to 100 m. The SZ for all marine mammals is 1,600 m.

(3) The distances to the Level A harassment thresholds for VSP were calculated using methods described in above and the distance to the Level B harassment threshold is based on Illingworth & Rodkin (2014) measurements of 2,470 m to the 160 dB zone. The EZ for all marine mammals is 500 m.

(4) The distances to the Level A and B harassment thresholds for the vibratory sheet pile driving were calculated using the methods described above. The EZ for all marine mammals is 100 m. The SZ for all marine mammals is 2,500 m.

(5) The distances to the Level A harassment thresholds for the water jet were calculated using methods described above and the distance to the Level B harassment threshold is based on Austin (2017) measurements of 860 m to the 120 dB zone. The EZ for all marine mammals is rounded up to 15 m. The SZ for all marine mammals is 860 m.

(6) NMFS proposes that Hilcorp shut down if a beluga is observed within or entering the EZ or SZ for seismic airgun or sub-bottom profiler use.

TABLE 20—RADII OF EXCLUSION ZONE (EZ) AND SAFETY ZONE (SZ) FOR HILCORP'S ACTIVITIES

Activity	Exclusion zone (EZ) radius (m)	Safety zone (SZ) radius (m)
2D/3D seismic survey	500	1,000
Sub-bottom profilers	100	1,000
Pipe driving	100	1,600
VSP	500	2,500
Sheet pile driving	100	2,500
Water jet	15	860

PSO Placement—For the 2D survey, PSOs will be stationed on the source vessel during all seismic operations and geohazard surveys when the sub-bottom profilers are used. Because of the proximity to land, PSOs may also be stationed on land to augment the viewing area. For the 3D survey, PSOs will be stationed on at least two of the project vessels, the source vessel and the chase vessel. For the VSP, PSOs will be stationed on the drilling rig. For geohazard surveys, PSOs will be stationed on the survey vessel. The viewing area may be augmented by placing PSOs on a vessel specifically for mitigation purposes.

Seismic and Geohazard Survey Mitigation

Aircraft (Seismic only)—NMFS proposes to require aerial overflights to clear the intended area of seismic survey activity of beluga whales on a daily basis. Hilcorp will fly over the action area searching for belugas prior to ramp up of seismic airguns and ramp up will not commence until the flights have confirmed the area appears free of beluga whales. This measure would only apply to 2D and 3D seismic surveying, not to other sound sources related to geohazard survey or well construction.

Clearing the Exclusion Zone—Prior to the start of daily activities for which take has been requested or if activities have been stopped for longer than a 30-minute period, the PSOs will ensure the EZ is clear of marine mammals for a period of 30 minutes. Clearing the EZ means no marine mammals have been observed within the EZ for that 30-minute period. If any marine mammals have been observed within the EZ, ramp up cannot start until the marine mammal has left the EZ or has not been observed for a 30-minute period prior to the start of the survey.

Power Downs—A power down procedure involves reducing the number of airguns in use, which reduces the SZ radius and was proposed by Hilcorp in their application. In contrast, a shut down procedure occurs when all airgun activity is suspended immediately. During a power down, a mitigation airgun is operated for no longer than three hours. Operation of the mitigation gun allows the size of the SZ to decrease to the size of the EZ for marine mammals other than beluga whales. If a marine mammal is detected outside the original SZ but is likely to enter that zone, the airguns may be powered down before the animal is within the safety radius, as an alternative to a complete shutdown. Likewise, if a marine mammal is already within the original SZ when first detected, the airguns may be powered down if the PSOs determine it is a reasonable alternative to an immediate shutdown. If a marine mammal is already within the EZ when first detected, the airguns will be shut down immediately.

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

- Is visually observed to have left the SZ,
- Has not been seen within the SZ for 15 min in the case of pinnipeds, and porpoises, or
- Has not been seen within the SZ for 30 min in the case of cetaceans.

Shutdowns—A shutdown is defined as suspending all airgun and sub-bottom profiler activities. Shutdowns are not implemented for the other activities in

Hilcorp's petition that are unlikely to result in take as they are not easily turned off instantaneously. The operating airguns or profiler will be shut down completely if a marine mammal is within or enters the EZ. The operations will shut down completely if a beluga whale is sighted within or entering the SZ or EZ. The shutdown procedure must be accomplished within several seconds (of a ''one shot'' period) of the determination that a marine mammal is within or enters the EZ.

Following a shutdown, airgun or sub-bottom profiler activity may be reactivated only after the protected species has been observed exiting the applicable EZ. The animal will be considered to have cleared the EZ if it:

- Is visually observed to have left the EZ, or
- Has not been seen within the EZ for 15 min in the case of pinnipeds and porpoises
- Has not been seen within the EZ for 30 min in the case of cetaceans (except for beluga whales which cannot not be seen in the EZ or SZ).

Ramp up—A ''ramp up'' procedure gradually increases airgun volume at a specified rate. Ramp up is used at the start of airgun operations, including after a power down, shutdown, and after any period greater than 10 minutes in duration without airgun operations. The rate of ramp up will 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 airgun array configurations. During the ramp up, the EZ for the full airgun array will be maintained.

If the complete EZ has not been visible for at least 30 minutes prior to the start of operations, ramp up will not commence unless the mitigation gun has been operating since the power down of seismic survey operations. This means that it will not be permissible to ramp up the 24-gun source from a complete shut down in thick fog or at other times when the outer part of the EZ is not visible. Ramp up of the airguns will not be initiated if a marine mammal is sighted within or entering the EZ at any time.

Speed or Course Alteration—If a marine mammal is detected outside the EZ and, based on its position and relative motion, is likely to enter the EZ, the vessel's speed and/or direct course may, when practical and safe, be changed. This technique also minimizes the effect on the seismic program. This technique can be used in coordination with a power down procedure. 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 enter the EZ. If the mammal appears likely to enter the EZ, further mitigation actions must be taken, *i.e.,* either further course alterations, power down, or shutdown of the airguns.

Pipe and Sheet Pile Driving Mitigation

Soon after the drill rig is positioned on the well head, the conductor pipe will be driven as the first stage of the drilling operation. Two PSOs (one operating at a time) will be stationed aboard the rig during this two to three day operation monitoring the EZ and the SZ. The impact hammer operator will be notified to shut down hammering operations if a marine mammal is sighted within or enters the EZ. A soft start of the hammering will begin at the start of each hammering session. The soft start procedure involves initially starting with three soft strikes, 30 seconds apart. This delayed-strike start alerts marine mammals of the pending hammering activity and provides them time to vacate the area. Monitoring will occur during all hammering sessions.

A dock face will be constructed on the rock causeway in Iniskin Bay. Two PSOs will be stationed either on a vessel or on land during the 14–21 day operation observing an EZ of 4.6 km for beluga whales. PSOs will implement similar monitoring and mitigation strategies as for the pipe installation.

For impact hammering, ''soft-start'' technique must be used at the beginning of each day's pipe/pile driving activities to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy.

- Clear the EZ 30 minutes prior to a soft-start to ensure no marine mammals are within or entering the EZ.
- Begin impact hammering soft-start with an initial set of three strikes from the impact hammer at 40 percent energy, followed by a one minute waiting period, then two subsequent 3-strike sets.
- Immediately shut down all hammers at any time a marine mammal is detected entering or within the EZ.
- Initial hammering starts will not begin during periods of poor visibility (*e.g.,* night, fog, wind).
- Any shutdown due to a marine mammal sighting within the EZ must be followed by a 30-minute all-clear period and then a standard, full ramp-up.
- Any shutdown for other reasons resulting in the cessation of the sound source for a period greater than 30 minutes, must also be followed by full ramp-up procedures.

Water Jet Mitigation

A PSO will be present on the dive support vessel when divers are using the water jet. Prior to in-water use of the water jet, the EZ around the DSV will be established. The water jet will be shut down if marine mammals are observed within the EZ.

Beluga Critical Habitat Mitigation

Hilcorp must not operate noise producing activities within 10 miles (16 km) of the mean higher high water (MHHW) line of the Susitna Delta (Beluga River to the Little Susitna River) between April 15 and October 15. The purpose of this mitigation measure is to protect beluga whales in the designated critical habitat in this area that is important for beluga whale feeding and calving during the spring and fall months. The range of the setback required by NMFS was designated to protect this important habitat area and also to create an effective buffer where sound does not encroach on this habitat. This seasonal exclusion is proposed to be in effect from April 15-October 15. Activities can occur within this area from October 16-April 14.

Mitigation for Subsistence Uses of Marine Mammals or Plan of Cooperation

Regulations at 50 CFR 216.104(a)(12) further require Incidental Take Authorization applicants conducting activities that take place in Arctic waters to provide a Plan of Cooperation or information that identifies what measures have been taken and/or will be taken to minimize adverse effects on the availability of marine mammals for subsistence purposes. A plan must include the following:

- A statement that the applicant has notified and provided the affected subsistence community with a draft plan of cooperation;
- 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;
- 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; and
- What plans the applicant has to continue to meet with the affected communities, both prior to and while conducting the activity, to resolve conflicts and to notify the communities of any changes in the operation.

Hilcorp Alaska has developed a Stakeholder Engagement Plan (SEP) and will implement this plan throughout the duration of the Petition. The SEP will help coordinate activities with local stakeholders and thus subsistence users, minimize the risk of interfering with subsistence hunting activities, and keep current as to the timing and status of the subsistence hunts. The Plan is provided in Appendix B of Hilcorp's application.

Presentations will be given at various local forums. Hilcorp Alaska is working with a contractor to update/verify our existing stakeholder list. Meetings and communication will be coordinated with: commercial and sport fishing groups/associations, various Native fisheries and entities as it pertains to subsistence fishing and/or hunting, marine mammal co-management groups, Cook Inlet Regional Citizens Advisory Council, local landowners, government and community organizations, and environmental NGOs.

Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures provide the means effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses.

Proposed Monitoring and Reporting

In order to issue an LOA for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth, requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

The PSOs will observe and collect data on marine mammals in and around the project area for 15 (well activity) or 30 minutes (seismic activity) before, during, and for 30 minutes after all of Hilcorp's activities for which take has been requested.

Protected Species Observer Qualifications

NMFS-approved PSOs must meet the following requirements:

1. Independent observers (*i.e.,* not construction personnel) are required;
2. At least one observer must have prior experience working as an observer;
3. Other observers may substitute education (undergraduate degree in biological science or related field) or training for experience;
4. Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer; and
5. NMFS will require submission and approval of observer CVs.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas);
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and
- Mitigation and monitoring effectiveness.

Proposed Monitoring Measures

Sound Source Verification—When site-specific measurements are not available for noise sources of concern for acoustic exposure, NMFS often requires a sound source verification (SSV) to characterize the sound levels, propagation, and to verify the monitoring zones (EZ and SZ). Hilcorp Alaska plans to perform an SSV for the 3D seismic survey and sub-bottom profiler in lower Cook Inlet. Hilcorp Alaska will work with NMFS to determine if an SSV is needed for other activities occurring in the action area.

Hilcorp will implement a robust monitoring and mitigation program for marine mammals using NMFS-approved PSOs for Petition activities. Much of the activities will use vessel-based PSOs, but land- or platform-based PSOs may also be used to augment project-specific activities. Marine mammal monitoring and mitigation methods have been designed to meet the requirements and objectives which will be specified in the Incidental Take Regulations promulgated by NMFS. Some details of the monitoring and mitigation program may change upon receipt of the individual LOAs issued by NMFS each year.

The main purposes of PSOs are: To conduct visual watches for marine mammals; to serve as the basis for implementation of mitigation measures; to document numbers of marine mammals present; to record any reactions of marine mammals to Hilcorp's activities; and, to identify whether there was any possible effect on accessibility of marine mammals to subsistence hunters in Cook Inlet. These observations will provide the real-time data needed to implement some of the key measures.

PSOs will be on watch during all daylight periods for project-specific activities. Generally, work is conducted 24-hrs a day, depending on the specific activity.

- For 2D seismic surveys, the airgun operations will be conducted during daylight hours.
- For 3D seismic surveys, airgun operations will continue during the waning nighttime hours (ranges from 2230–0600 in early April to 0100–0300 in mid-May) as long as the full array or mitigation gun is operating prior to nightfall and mitigation airgun use cannot be longer than three hours. Night vision and infrared have been suggested for low visibility conditions, but these have not been useful in Cook Inlet or other Alaska-based programs. Passive acoustic monitoring has also been used in Cook Inlet and is typically required for seismic surveys but has not shown to be an effective solution in Cook Inlet's specific environmental conditions. A further discussion of previous passive acoustic monitoring efforts by several entities in Cook Inlet is provided in Section 13 of Hilcorp's application.
- For the sub-bottom profiler, operations will generally be conducted during daylight hours but may continue into the low visibility period as long as the profiler is operating prior to

nightfall. Sub-bottom profiler operations may not begin under low visibility conditions.

• For pipe driving, VSP, and sheet pile driving, operations will generally be conducted during daylight hours.

• Water jet and hydraulic grinder are operated over a 24-hour period as they are limited to low tide conditions. Activities will not start during nighttime but will continue if already started.

Pre-Activity Monitoring—The exclusion zone will be monitored for 30 minutes prior to in-water construction/demolition activities. If a marine mammal is present within the exclusion zone, the activity will be delayed until the animal(s) leave the exclusion zone. Activity will resume only after the PSO has determined that, through sighting or by waiting (15 minutes for pinnipeds and porpoises, 30 minutes for cetaceans) without re-sighting, the animal(s) has moved outside the exclusion zone. If a marine mammal is observed within or entering the exclusion zone, the PSO who sighted that animal will notify all other PSOs and Hilcorp of its presence.

Post-Activity Monitoring—Monitoring of all zones will continue for 30 minutes following the completion of the activity.

For all activities, the PSOs will watch for marine mammals from the best available vantage point on the vessel or station. Ideally this vantage point is an elevated stable platform from which the PSO has an unobstructed 360° view of the water. The PSOs will scan systematically with the naked eye and with binoculars. When a mammal sighting is made, the following information about the sighting will be carefully and accurately recorded:

• Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the PSO, apparent reaction to activities (*e.g.,* none, avoidance, approach, paralleling), closest point of approach, and behavioral pace.

• Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare.

• The positions of other vessel(s) in the vicinity of the PSO location.

• The vessel's position, speed, water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

An electronic database or paper form will be used to record and collate data obtained from visual observations.

The results of the PSO monitoring, including estimates of exposure to key sound levels, will be presented in weekly, monthly, and 90-day reports. Reporting will address the requirements established by NMFS in the LOAs. The technical report(s) will include the list below.

• Summaries of monitoring effort: Total hours, total distances, and distribution of marine mammals throughout the study period compared to sea state, and other factors affecting visibility and detectability of marine mammals;

• Analyses of the effects of various factors influencing detectability of marine mammals: sea state, number of observers, and fog/glare;

• Species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers, age/size/gender categories (when discernable), group sizes, and ice cover; and

• Analyses of the effects of seismic program:

○ Sighting rates of marine mammals during periods with and without project activities (and other variables that could affect detectability);

○ Initial sighting distances versus project activity;

○ Closest point of approach versus project activity;

○ Observed behaviors and types of movements versus project activity;

○ Numbers of sightings/individuals seen versus project activity;

○ Distribution around the vessels versus project activity;

○ Summary of implemented mitigation measures; and

○ Estimates of ''take by harassment.''

Proposed Reporting Measures

Immediate reports will be submitted to NMFS if 30 or more belugas are detected over the course of annual operations in the safety and exclusion zones during operation of sound sources to evaluate and make necessary adjustments to monitoring and mitigation. If the number of detected takes for any marine mammal species is met or exceeded, Hilcorp will immediately cease survey operations involving the use of active sound sources (*e.g.,* airguns and pingers) and notify NMFS Office of Protected Resources (OPR).

1. Weekly Reports (during years with seismic surveying only)—Hilcorp would submit a weekly field report to NMFS Headquarters as well as the Alaska Regional Office, no later than close of business each Thursday during the weeks when in-water seismic survey activities take place. The weekly field reports would summarize species detected (number, location, distance from seismic vessel, behavior), in-water activity occurring at the time of the sighting (discharge volume of array at time of sighting, seismic activity at time of sighting, visual plots of sightings, and number of power downs and shutdowns), behavioral reactions to in-water activities, and the number of marine mammals exposed.

2. Monthly Reports- Monthly reports will be submitted to NMFS for all months during which in-water seismic activities take place. The monthly report will contain and summarize the following information:

• Dates, times, locations, heading, speed, weather, sea conditions (including Beaufort sea state and wind force), and associated activities during all seismic operations and marine mammal sightings.

• Species, number, location, distance from the vessel, and behavior of any sighted marine mammals, as well as associated seismic activity (number of power-downs and shutdowns), observed throughout all monitoring activities.

• An estimate of the number (by species) exposed to the seismic activity (based on visual observation) at received levels greater than or equal to the NMFS thresholds discussed above with a discussion of any specific behaviors those individuals exhibited.

• A description of the implementation and effectiveness of the: (i) Terms and conditions of the Biological Opinion's Incidental Take Statement (ITS); and (ii) mitigation measures of the LOA. For the Biological Opinion, the report must confirm the implementation of each Term and Condition, as well as any conservation recommendations, and describe their effectiveness for minimizing the adverse effects of the action on ESA-listed marine mammals.

3. Annual Reports—Hilcorp must submit an annual report within 90 days after each activity year, starting from the date when the LOA is issued (for the first annual report) or from the date when the previous annual report ended. The annual report would include:

• Summaries of monitoring effort (*e.g.,* total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals).

• Analyses of the effects of various factors influencing detectability of marine mammals (*e.g.,* sea state, number of observers, and fog/glare).

• Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover.

• Analyses of the effects of survey operations.

• Sighting rates of marine mammals during periods with and without seismic survey activities (and other variables that could affect detectability), such as: (i) Initial sighting distances versus survey activity state; (ii) closest point of approach versus survey activity state; (iii) observed behaviors and types of movements versus survey activity state; (iv) numbers of sightings/individuals seen versus survey activity state; (v) distribution around the source vessels versus survey activity state; and (vi) numbers of animals detected in the harassment/safety zone.

NMFS would review the draft annual reports. Hilcorp must then submit a final annual report to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, within 30 days after receiving comments from NMFS on the draft annual report. If NMFS decides that the draft annual report needs no comments, the draft report will be considered to be the final report.

3. Discovery of Injured or Dead Marine Mammals—In the event that personnel involved in the survey activities covered by the authorization discover an injured or dead marine mammal, Hilcorp must report the incident to the Office of Protected Resources (OPR), NMFS and to the Alaska Regional stranding coordinator as soon as feasible. The report must include the following information:

• Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

• Species identification (if known) or description of the animal(s) involved;

• Condition of the animal(s) (including carcass condition if the animal is dead);

• Observed behaviors of the animal(s), if alive;

• If available, photographs or video footage of the animal(s); and

• General circumstances under which the animal was discovered.

Vessel Strike—In the event of a ship strike of a marine mammal by any vessel involved in the activities covered by the authorization, Hilcorp must report the incident to OPR, NMFS and to regional stranding coordinator as soon as feasible. The report must include the following information:

• Time, date, and location (latitude/longitude) of the incident;

• Species identification (if known) or description of the animal(s) involved;

• Vessel's speed during and leading up to the incident;

• Vessel's course/heading and what operations were being conducted (if applicable);

• Status of all sound sources in use;

• Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;

• Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;

• Estimated size and length of animal that was struck;

• Description of the behavior of the marine mammal immediately preceding and following the strike;

• If available, description of the presence and behavior of any other marine mammals immediately preceding the strike;

• Estimated fate of the animal (*e.g.,* dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and

• To the extent practicable, photographs or video footage of the animal(s).

Actions to Minimize Additional Harm to Live-Stranded (or Milling) Marine Mammals—In the event of a live stranding (or near-shore atypical milling) event within 50 km of the survey operations, where the NMFS stranding network is engaged in herding or other interventions to return animals to the water, the Director of OPR, NMFS (or designee) will advise the Hilcorp of the need to implement shutdown procedures for all active acoustic sources operating within 50 km of the stranding. Shutdown procedures for live stranding or milling marine mammals include the following:

• If at any time, the marine mammals die or are euthanized, or if herding/intervention efforts are stopped, the Director of OPR, NMFS (or designee) will advise Hilcorp that the shutdown around the animals' location is no longer needed.

• Otherwise, shutdown procedures will remain in effect until the Director of OPR, NMFS (or designee) determines and advises Hilcorp that all live animals involved have left the area (either of their own volition or following an intervention).

• If further observations of the marine mammals indicate the potential for re-stranding, additional coordination with Hilcorp will be required to determine what measures are necessary to minimize that likelihood (*e.g.,* extending the shutdown or moving operations farther away) and to implement those measures as appropriate.

Shutdown procedures are not related to the investigation of the cause of the stranding and their implementation is not intended to imply that the specified activity is the cause of the stranding. Rather, shutdown procedures are intended to protect marine mammals exhibiting indicators of distress by minimizing their exposure to possible additional stressors, regardless of the factors that contributed to the stranding.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration), the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Given the nature of activities, proposed mitigation and related monitoring, no serious injuries or mortalities are anticipated to occur as a result of Hilcorp's proposed oil and gas activities in Cook Inlet, and none are proposed to be authorized. The number of takes that are anticipated and proposed to be authorized are expected to be limited mostly to short-term Level B harassment, although some PTS may occur. The seismic airguns and other sound sources do not operate continuously over a 24-hour period. Rather the airguns are operational for a few hours at a time with breaks in between, as surveys can only be conducted during slack tides, totaling a maximum of 12 hours a day for the most frequently used equipment. Sources other than airguns are likely to be used for much shorter durations daily than the 12 potential hours of airgun use.

Cook Inlet beluga whales, the Mexico DPS of humpback whales, fin whales, and the western stock of Steller sea lions are listed as endangered under the ESA. These stocks are also considered depleted under the MMPA. Beluga-specific mitigation measures, such as shutting down whenever beluga whales are sighted by PSOs and an exclusion zone at the Susitna River Delta months of high beluga concentrations, aim to minimize the effects of this activity on the population. Zerbini *et al.* (2006) estimated rates of increase of fin whales in coastal waters south of the Alaska, and data from Calambokidis *et al.* (2008) suggest the population of humpback whales by also be increasing. Steller sea lion trends for the western stock are variable throughout the region with some decreasing and others remaining stable or even indicating slight increases. The other species that may be taken by harassment during Hilcorp's proposed oil and gas program are not listed as threatened or endangered under the ESA nor as depleted under the MMPA.

Odontocete (including Cook Inlet beluga whales, killer whales, and harbor porpoises) reactions to seismic energy pulses are usually assumed to be limited to shorter distances from the airgun(s) than are those of mysticetes, in part because odontocete low-frequency hearing is assumed to be less sensitive than that of mysticetes. When in the Canadian Beaufort Sea in summer, belugas appear to be fairly responsive to seismic energy, with few being sighted within 10–20 km (6–12 mi) of seismic vessels during aerial surveys (Miller *et al.,* 2005). However, as noted above, Cook Inlet belugas are more accustomed to anthropogenic sound than beluga whales in the Beaufort Sea. Therefore, the results from the Beaufort Sea surveys may be less applicable to potential reactions of Cook Inlet beluga whales. Also, due to the dispersed distribution of beluga whales in Cook Inlet during winter and the concentration of beluga whales in upper Cook Inlet from late April through early fall (*i.e.,* far north of the proposed seismic surveys), belugas would likely occur in small numbers in the majority of Hilcorp's proposed survey area during the majority of Hilcorp's annual operational timeframe.

Taking into account the mitigation measures that are planned, effects on cetaceans are generally expected to be restricted to avoidance of a limited area around the survey operation and short-term changes in behavior, falling within the MMPA definition of ''Level B harassment.'' It is possible that Level A take of marine mammals from sound sources such as seismic airguns may also occur. Due to the short term duration of activities in any given area and the small geographic area in which Hilcorp's activities would be occurring at any one time, it is unlikely that these activities would affect reproduction or survival of cetaceans in Cook Inlet. Animals are not expected to permanently abandon any area that is surveyed, and any behaviors that are interrupted during the activity are expected to resume once the activity ceases. Only a small portion of marine mammal habitat will be affected at any time, and other areas within Cook Inlet will be available for necessary biological functions including breeding, foraging, and mating. In addition, NMFS proposes to seasonally restrict seismic survey operations in locations known to be important for beluga whale feeding, calving, or nursing. One of the primary locations for these biological life functions occur in the Susitna Delta region of upper Cook Inlet. NMFS proposes to implement a 16 km (10 mi) seasonal exclusion from activities for which take has been requested in this region from April 15 to October 15 annually. The highest concentrations of belugas are typically found in this area from early May through September each year. NMFS has incorporated a 2-week buffer on each end of this seasonal use timeframe to account for any anomalies in distribution and marine mammal usage.

Mitigation measures, such as dedicated marine mammal observers, and shutdowns or power downs when marine mammals are seen within defined ranges, are designed both to further reduce short-term reactions and minimize any effects on hearing sensitivity. In all cases, the effects of these activities are expected to be short-term, with no lasting biological consequence. Therefore, the exposure of cetaceans to sounds produced by Hilcorp's proposed oil and gas activities is not anticipated to have an effect on annual rates of recruitment or survival of the affected species or stocks.

Some individual pinnipeds may be exposed to sound from the proposed activities more than once during the timeframe of the project. Taking into account the mitigation measures that are planned, effects on pinnipeds are generally expected to be restricted to avoidance of a limited area around the survey operation and short-term changes in behavior, falling within the MMPA definition of ''Level B harassment,'' although some pinnipeds may approach close enough to sound sources undetected and incur PTS. Due to the solitary nature of pinnipeds in water, this is expected to be a small number of individuals and the calculated distances to the PTS thresholds incorporate a relatively long duration, making them conservative. Animals are not expected to permanently abandon any area that is surveyed, and any behaviors that are interrupted during the activity are expected to resume once the activity ceases. Only a small portion of pinniped habitat will be affected at any time, and other areas within Cook Inlet will be available for necessary biological functions. In addition, the areas where the activities will take place are largely offshore and not known to be biologically important areas for pinniped populations. Therefore, the exposure of pinnipeds to sounds produced by this phase of Hilcorps's proposed activity is not anticipated to have an effect on annual rates of recruitment or survival on those species or stocks.

The addition of multiple source and supply vessels, and noise due to vessel operations associated with the activities, would not be outside the present experience of marine mammals in Cook Inlet, although levels may increase locally. Given the large number of vessels in Cook Inlet and the apparent habituation to vessels by Cook Inlet beluga whales and the other marine mammals that may occur in the area, vessel activity and its associated noise is not expected to have effects that could cause significant or long-term consequences for individual marine mammals or their populations.

Potential impacts to marine mammal habitat were discussed previously in this document (see the ''Anticipated Effects on Habitat'' section). Although some disturbance is possible to food sources of marine mammals, the impacts are anticipated to be minor enough as to not affect annual rates of recruitment or survival of marine mammals in the area. Based on the size of Cook Inlet where feeding by marine mammals occurs versus the localized area of the marine survey activities, any missed feeding opportunities in the direct project area would be minor based on the fact that other feeding areas exist elsewhere. Additionally, operations will not occur in the primary beluga feeding and calving habitat during times of high use by those animals. The proposed mitigation measure of limiting activities around the Susistna Delta would also protect beluga whale prey and their foraging habitat.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No mortality is anticipated or authorized;
- Increased mitigation for beluga whales, including shutdowns at any distance and exclusion zones and avoiding exposure during critical foraging periods around the Susitna Delta;
- Location of activities offshore which minimizes effects of activity on resident pinnipeds at haulouts,
- Concentration of seismic surveying in the lower portions of Cook Inlet going into open water where densities of marine mammals are less than other parts of the Inlet; and
- Comprehensive land, sea, and aerial-based monitoring maximizing marine mammal detection rates as well as acoustic SSV to verify exposure levels.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under section 101(a)(5)(A) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, NMFS compares the number of individuals taken within a year to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

As described above in Table 18, the takes proposed to be authorized represent less than 25 percent of any stock of population in the year of maximum activity. Further, takes are expected to be significantly lower in the years without 3D seismic activities. For species listed as endangered under the ESA, takes proposed to be authorized represent no more than nine percent of the stock of humpback whales, ten percent of the stock of Cook Inlet beluga whales, and less than one percent of the Northeastern Pacific stock of fin whales and Western DPS of Steller sea lions.

NMFS finds that any incidental take reasonably likely to result annually from the effects of the proposed activities, as proposed to be mitigated through this rulemaking and LOA process, will be limited to small numbers of the affected species or stock. In addition to the quantitative methods used to estimate take, NMFS also considered qualitative factors that further support the ''small numbers'' determination, including: (1) The seasonal distribution and habitat use patterns of Cook Inlet beluga whales, which suggest that for much of the time only a small portion of the population would be accessible to impacts from Hilcorp's activity, as most animals are found in the Susitna Delta region of Upper Cook Inlet from early May through September; (2) other cetacean species and Steller sea lions are not common in the action area; (3) the proposed mitigation requirements, which provide spatio-temporal limitations that avoid impacts to large numbers of belugas feeding and calving in the Susitna Delta and limit exposures to sound levels associated with Level B harassment; (4) the proposed monitoring requirements and mitigation measures described earlier in this document for all marine mammal species that will further reduce impacts and the amount of takes; and (5) monitoring results from previous activities that indicated low numbers of beluga whale sightings within the Level B disturbance exclusion zone and low levels of Level B harassment takes of other marine mammals. Additionally, the rationale provided in the Estimated Take section above, estimates that the number of individual harbor seals like to be exposed to noise that may cause harassment is significantly less than the number of calculated exposure due to the resident nature of harbor seals, offshore locations of the sound sources, and likelihood of harbor seals to be hauled out on land at the time sound sources are deployed.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

In order to issue an ITA, NMFS must find that the specified activity will not have an ''unmitigable adverse impact'' on the subsistence uses of the affected marine mammal species or stocks by Alaskan Natives. NMFS has defined ''unmitigable adverse impact'' in 50 CFR 216.103 as an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) placing physical barriers between the marine mammals and the subsistence hunters; and (2) that cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

The project is unlikely to affect beluga whale harvests because no beluga harvest will take place in 2019, nor is one likely to occur in the other years that would be covered by the 5-year regulations and associated LOAs. Additionally, the proposed action area is not an important native subsistence site for other subsistence species of marine mammals. Also, because of the relatively small number of marine mammals harvested in Cook Inlet, the number affected by the proposed action is expected to be extremely low. Therefore, because the proposed action would result in only temporary disturbances, the proposed action would not impact the availability of these other marine mammal species for subsistence uses.

The timing and location of subsistence harvest of Cook Inlet harbor seals may coincide with Hilcorp's project but, because this subsistence hunt is conducted opportunistically and at such a low level (NMFS, 2013c), Hilcorp's program is not expected to have an impact on the subsistence use of harbor seals.

NMFS anticipates that any effects from Hilcorp's proposed activities on marine mammals, especially harbor seals and Cook Inlet beluga whales, which are or have been taken for subsistence uses, would be short-term, site specific, and limited to inconsequential changes in behavior and mild stress responses. NMFS does not anticipate that the authorized taking of affected species or stocks will reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (1) Causing the marine mammals to abandon or avoid hunting areas; (2) directly displacing subsistence users; or (3) placing physical barriers between the marine mammals and the subsistence hunters. And any such potential reductions could be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met. Based on the description of the specified activity, the measures described to minimize adverse effects on the availability of marine mammals for subsistence purposes, and the proposed mitigation and monitoring measures, NMFS has preliminarily determined that there will not be an unmitigable adverse impact on subsistence uses from Hilcorp's proposed activities.

Adaptive Management

The regulations governing the take of marine mammals incidental to Hilcorp's proposed oil and gas activities would contain an adaptive management component.

The reporting requirements associated with this proposed rule are designed to provide NMFS with monitoring data from the previous year to allow consideration of whether any changes are appropriate. The use of adaptive management allows NMFS to consider new information from different sources to determine (with input from Hilcorp regarding practicability) on an annual basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation or monitoring measures could be modified if new data suggests that such modifications would have a reasonable likelihood more effectively achieving the goals of the mitigation and monitoring and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) Results from monitoring reports, as required by MMPA authorizations; (2) Results from general marine mammal and sound research; and (3) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of ITAs, NMFS consults internally, in this case with the Alaska Protected Resources Division Office, whenever we propose to authorize take for endangered or threatened species.

NMFS is proposing to authorize take of Cook Inlet beluga whale, Northeastern Pacific stock of fin whales, Western North Pacific, Hawaii, and Mexico DPS of humpback whales, and western DPS of Steller sea lions, which are listed under the ESA.

The Permit and Conservation Division has requested initiation of section 7 consultation with the Alaska Region for the promulgation of 5-year regulations and the subsequent issuance of annual LOAs. NMFS will conclude the ESA consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Classification

Pursuant to the procedures established to implement Executive Order 12866, the Office of Management and Budget has determined that this proposed rule is not significant.

Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. Hilcorp Alaska LLC is the only entity that would be subject to the requirements in these proposed regulations. Hilcorp employs thousands of people worldwide, and has a market value in the billions of dollars. Therefore, Hilcorp is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Because of this certification, a regulatory flexibility analysis is not required and none has been prepared.

Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid OMB control number. This proposed rule contains collection-of-information requirements subject to the provisions of the PRA. These requirements have been approved by OMB under control number 0648–0151 and include applications for regulations, subsequent LOAs, and reports.

List of Subjects in 50 CFR Part 217

Penalties, Reporting and recordkeeping requirements, Seafood, Transportation.

Dated: March 21, 2019.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 217 is proposed to be amended as follows:

PART 217—REGULATIONS GOVERNING THE TAKE OF MARINE MAMMALS INCIDENTAL TO SPECIFIED ACTIVITIES

■ 1. The authority citation for part 217 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*

■ 2. Add subpart Q to part 217 to read as follows:

Subpart Q—Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Oil and Gas Activities in Cook Inlet, Alaska

Subpart Q—Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Oil and Gas Activities in Cook Inlet, Alaska

§ 217.160 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to Hilcorp Alaska LLC (Hilcorp) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the area outlined in paragraph (b) of this section and that occurs incidental to the activities described in paragraph (c) of this section.

(b) The taking of marine mammals by Hilcorp may be authorized in Letters of Authorization (LOAs) only if it occurs within the action area defined in Cook Inlet, Alaska.

(c) The taking of marine mammals by Hilcorp is only authorized if it occurs incidental to Hilcorp's oil and gas activities including use of seismic airguns, sub-bottom profiler, vertical seismic profiling, pile driving, conductor pipe driving, and water jets.

§ 217.161 Effective dates and definitions.

Regulations in this subpart are effective [EFFECTIVE DATE OF FINAL RULE] through [DATE 5 YEARS AFTER EFFECTIVE DATE OF FINAL RULE].

§ 217.162 Permissible methods of taking.

Under LOAs issued pursuant to § 216.106 of this chapter and § 217.166, the Holder of the LOAs (hereinafter ''Hilcorp'') may incidentally, but not intentionally, take marine mammals within the area described in § 217.160(b) by Level A harassment and Level B harassment associated with oil and gas activities, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the applicable LOAs.

§ 217.163 Prohibitions.

Notwithstanding takings contemplated in § 217.162 and authorized by LOAs issued under §§ 216.106 of this chapter and 217.166, no person in connection with the activities described in § 217.160 may:

(a) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under §§ 216.106 of this chapter and 217.166;

(b) Take any marine mammal not specified in such LOAs;

(c) Take any marine mammal specified in such LOAs in any manner other than as specified;

(d) Take a marine mammal specified in such LOAs if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal; or

(e) Take a marine mammal specified in such LOAs if NMFS determines such taking results in an unmitigable adverse impact on the availability of such species or stock of marine mammal for taking for subsistence uses.

§ 217.164 Mitigation requirements.

When conducting the activities identified in § 217.160(c), the mitigation measures contained in any LOAs issued under §§ 216.106 of this chapter and 217.166 must be implemented. These mitigation measures must include but are not limited to:

(a) If any marine mammal species for which take is not authorized are sighted within or entering the relevant zones within which they would be exposed to sound above the 120 dB re 1 μPa (rms) threshold for continuous (*e.g.,* vibratory pile-driving, drilling) sources or the 160 dB re 1 μPa (rms) threshold for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources, Hilcorp must take appropriate action to avoid such exposure (*e.g.,* by altering speed or course or by power down or shutdown of the sound source).

(b) If the allowable number of takes in an LOA listed for any marine mammal species is met or exceeded, Hilcorp must immediately cease survey operations involving the use of active sound source(s), record the observation, and notify NMFS Office of Protected Resources.

(c) Hilcorp must notify NMFS Office of Protected Resources at least 48 hours prior to the start of oil and gas activities each year.

(d) Hilcorp must conduct briefings as necessary between vessel crews, marine mammal monitoring team, and other relevant personnel prior to the start of all survey activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

(e) *Establishment of monitoring and exclusion zones.* (1) For all relevant in-water construction and demolition activity, Hilcorp must implement shutdown zones/exclusion zones (EZs) with radial distances as identified in any LOA issued under §§ 216.106 of this chapter and 217.166. If a marine mammal is sighted within or entering the EZ, such operations must cease.

(2) For all relevant in-water construction and demolition activity, Hilcorp must designate safety zones for monitoring (SZ)with radial distances as identified in any LOA issued under §§ 216.106 of this chapter and 217.166 and record and report occurrence of marine mammals within these zones.

(3) For all in-water construction and demolition activity, Hilcorp must implement a minimum EZ of a 10 m radius around the source.

(f) *Shutdown measures.* (1) Hilcorp must deploy protected species observers (PSOs) and PSOs must be posted to monitor marine mammals within the monitoring zones during use of active acoustic sources and pile driving in water.

(2) Monitoring must begin 15 minutes prior to initiation of stationary source activity and 30 minutes prior to initiation of mobile source activity, occur throughout the time required to complete the activity, and continue through 30 minutes post-completion of the activity. Pre-activity monitoring must be conducted to ensure that the EZ is clear of marine mammals, and activities may only commence once observers have declared the EZ clear of marine mammals. In the event of a delay or shutdown of activity resulting from marine mammals in the EZ, the marine mammals' behavior must be monitored and documented.

(3) A determination that the EZ is clear must be made during a period of good visibility (*i.e.,* the entire EZ must be visible to the naked eye).

(4) If a marine mammal is observed within or entering the EZ, Hilcorp must halt all noise producing activities for which take is authorized at that location. If activity is delayed due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily left and been visually confirmed outside the EZ or the required amount of time (15 for porpoises and pinnipeds, 30 minutes for cetaceans) have passed without re-detection of the animal.

(5) Monitoring must be conducted by trained observers, who must have no other assigned tasks during monitoring periods. Trained observers must be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown or delay procedures when applicable through communication with the equipment operator. Hilcorp must adhere to the following additional observer qualifications:

(i) Hilcorp must use independent, dedicated, trained visual PSOs, meaning that the PSOs must be employed by a third-party observer provider, must not have tasks other than to conduct observational effort, collect data, and communicate with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards), and must have successfully completed an approved PSO training course appropriate for their designated task.

(ii) Hilcorp must submit PSO resumes for NMFS review and approval. Resumes must be accompanied by a relevant training course information packet that includes the name and qualifications (*i.e.,* experience, training completed, or educational background) of the instructor(s), the course outline or syllabus, and course reference material as well as a document stating successful completion of the course. NMFS is allowed one week to approve PSOs from the time that the necessary information is received by NMFS, after which PSOs meeting the minimum requirements will automatically be considered approved.

(iii) To the maximum extent practicable, the lead PSO must devise the duty schedule such that experienced PSOs are on duty with those PSOs with appropriate training but who have not yet gained relevant experience.

(6) Hilcorp must implement shutdown measures if the number of

authorized takes for any particular species reaches the limit under the applicable LOA and if such marine mammals are sighted within the vicinity of the project area and are entering the SZ during activities.

(7) Hilcorp must implement a shutdown if a beluga whale is seen within or entering the EZ or SZ.

(g) *Impact driving soft start.* (1) Hilcorp must implement soft start techniques for impact pile driving. Hilcorp must conduct an initial set of three strikes from the impact hammer 30 seconds apart, at 40 percent energy, followed by a 1-minute waiting period, then two subsequent three strike sets.

(2) Soft start is required for any impact driving, including at the beginning of the day, after 30 minutes of pre-activity monitoring, and at any time following a cessation of impact pile driving of 30 minutes or longer.

(h) *Airgun ramp up.* (1) Ramp up must be used at the start of airgun operations, including after a power down, shutdown, and after any period greater than 10 minutes in duration without airgun operations.

(2) The rate of ramp up must be no more than 6 dB per 5-minute period.

(3) Ramp up must begin with the smallest gun in the array that is being used for all airgun array configurations.

(4) During the ramp up, the EZ for the full airgun array must be implemented.

(5) If the complete EZ has not been visible for at least 30 minutes prior to the start of operations, ramp up must not commence.

(6) Ramp up of the airguns must not be initiated if a marine mammal is sighted within or entering the EZ at any time.

(i) *Airgun power down.* (1) If a marine mammal, other than a beluga whale, is detected outside the safety zone (SZ) but is likely to enter that zone, the airguns may be powered down before the animal is within the safety zone, as an alternative to a complete shutdown. Likewise, if a marine mammal is already within the SZ when first detected, the airguns may be powered down if the PSOs determine it is a reasonable alternative to an immediate shutdown. If a marine mammal is already within the EZ when first detected, the airguns must be shut down immediately.

(2) Following a power down, airgun activity must not resume until the marine mammal has cleared the SZ. The animal will be considered to have cleared the SZ if it:

(i) Is visually observed to have left the SZ; or

(ii) Has not been seen within the SZ for 15 min in the case of pinnipeds and porpoises; or

(iii) Has not been seen within the SZ for 30 min in the case of cetaceans.

(3) A mitigation airgun must not operate for longer than three hours.

(j) *Aircraft mitigation.* (1) Hilcorp must use aircraft daily to survey the planned seismic survey area prior to the start of seismic surveying. Surveying must not begin unless the aerial flights confirm the proposed survey area for that day is clear of beluga whales.

(2) If beluga whales are sighted during flights, start of seismic surveying must be delayed until it is confirmed the area is free of beluga whales.

(k) *Beluga exclusion zone.* Hilcorp must not operate with noise producing activity within 10 miles (16 km) of the mean higher high water (MHHW) line of the Susitna Delta (Beluga River to the Little Susitna River) between April 15 and October 15.

§ 217.165 Requirements for monitoring and reporting.

(a) *Marine Mammal Monitoring Protocols.* Hilcorp must conduct briefings between construction supervisors and crews and the observer team prior to the start of all pile driving and removal activities, and when new personnel join the work. Trained observers must receive a general environmental awareness briefing conducted by Hilcorp staff. At minimum, training must include identification of marine mammals that may occur in the project vicinity and relevant mitigation and monitoring requirements. All observers must have no other construction-related tasks while conducting monitoring.

(b) Activities must only commence when the entire exclusion zone (EZ) is visible to the naked eye and can be adequately monitored. If conditions (*e.g.,* fog) prevent the visual detection of marine mammals, activities must not be initiated. For activities other than seismic surveying, activity would be halted in low visibility but vibratory pile driving or removal would be allowed to continue if started in good visibility.

(c) Monitoring must begin 15 minutes prior to initiation of stationary source activity and 30 minutes prior to initiation of mobile source activity, occur throughout the time required to complete the activity, and continue through 30 minutes post-completion of the activity. Pre-activity monitoring must be conducted to ensure that the EZ is clear of marine mammals, and activities may only commence once observers have declared the EZ clear of marine mammals. In the event of a delay or shutdown of activity resulting from marine mammals in the EZ, the animals' behavior must be monitored and documented.

(d) *Reporting Measures.* (1) *Weekly reports.* Hilcorp must submit weekly reports during the weeks when in-water seismic survey activities take place. The weekly field reports would summarize species detected (number, location, distance from seismic vessel, behavior), in-water activity occurring at the time of the sighting (discharge volume of array at time of sighting, seismic activity at time of sighting, visual plots of sightings, and number of power downs and shutdowns), behavioral reactions to in-water activities, and the number of marine mammals exposed.

(2) *Monthly reports.* Monthly reports must be submitted to NMFS for all months during which in-water seismic activities take place. The monthly report must contain and summarize the following information: Dates, times, locations, heading, speed, weather, sea conditions (including Beaufort sea state and wind force), and associated activities during all seismic operations and marine mammal sightings; Species, number, location, distance from the vessel, and behavior of any sighted marine mammals, as well as associated seismic activity (number of power-downs and shutdowns), observed throughout all monitoring activities; An estimate of the number (by species) exposed to the seismic activity (based on visual observation) at received levels greater than or equal to the NMFS thresholds discussed above with a discussion of any specific behaviors those individuals exhibited; A description of the implementation and effectiveness of the terms and conditions of the Biological Opinion's Incidental Take Statement (ITS) and mitigation measures of the LOA.

(3) *Annual Report*s. (i) Hilcorp must submit an annual report within 90 days after each activity year, starting from the date when the LOA is issued (for the first annual report) or from the date when the previous annual report ended.

(ii) Annual reports would detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed during the period of the report.

(iii) NMFS would provide comments within 30 days after receiving annual reports, and Hilcorp must address the comments and submit revisions within 30 days after receiving NMFS comments. If no comment is received from the NMFS within 30 days, the annual report will be considered completed.

(4) *Final report.* (i) Hilcorp must submit a comprehensive summary

report to NMFS not later than 90 days following the conclusion of marine mammal monitoring efforts described in this subpart.

(ii) The final report must synthesize all data recorded during marine mammal monitoring, and estimate the number of marine mammals that may have been harassed through the entire project.

(iii) NMFS would provide comments within 30 days after receiving this report, and Hilcorp must address the comments and submit revisions within 30 days after receiving NMFS comments. If no comment is received from the NMFS within 30 days, the final report will be considered as final.

(5) *Reporting of injured or dead marine mammals.* (i) In the event that personnel involved in the survey activities discover an injured or dead marine mammal, Hilcorp must report the incident to the Office of Protected Resources (OPR), NMFS (301–427–8401) and to regional stranding network (877–925–7773) as soon as feasible. The report must include the following information:

(A) Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

(B) Species identification (if known) or description of the animal(s) involved;

(C) Condition of the animal(s) (including carcass condition if the animal is dead);

(D) Observed behaviors of the animal(s), if alive;

(E) If available, photographs or video footage of the animal(s); and

(F) General circumstances under which the animal was discovered.

(ii) In the event of a ship strike of a marine mammal by any vessel involved in the survey activities, Hilcorp must report the incident to OPR, NMFS and to regional stranding networks as soon as feasible. The report must include the following information:

(A) Time, date, and location (latitude/longitude) of the incident;

(B) Species identification (if known) or description of the animal(s) involved;

(C) Vessel's speed during and leading up to the incident;

(D) Vessel's course/heading and what operations were being conducted (if applicable);

(E) Status of all sound sources in use;

(F) Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;

(G) Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;

(H) Estimated size and length of animal that was struck;

(I) Description of the behavior of the marine mammal immediately preceding and following the strike;

(J) If available, description of the presence and behavior of any other marine mammals immediately preceding the strike;

(K) Estimated fate of the animal (*e.g.,* dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and

(L) To the extent practicable, photographs or video footage of the animal(s).

(iii) In the event of a live stranding (or near-shore atypical milling) event within 50 km of the survey operations, where the NMFS stranding network is engaged in herding or other interventions to return animals to the water, the Director of OPR, NMFS (or designee) will advise Hilcorp of the need to implement shutdown procedures for all active acoustic sources operating within 50 km of the stranding. Shutdown procedures for live stranding or milling marine mammals include the following:

(A) If at any time, the marine mammal(s) die or are euthanized, or if herding/intervention efforts are stopped, the Director of OPR, NMFS (or designee) will advise Hilcorp that the shutdown around the animals' location is no longer needed.

(B) Otherwise, shutdown procedures must remain in effect until the Director of OPR, NMFS (or designee) determines and advises Hilcorp that all live animals involved have left the area (either of their own volition or following an intervention).

(C) If further observations of the marine mammals indicate the potential for re-stranding, additional coordination with Hilcorp must occur to determine what measures are necessary to minimize that likelihood (*e.g.,* extending the shutdown or moving operations farther away) and Hilcorp must implement those measures as appropriate.

(iv) If NMFS determines that the circumstances of any marine mammal stranding found in the vicinity of the activity suggest investigation of the association with survey activities is warranted, and an investigation into the stranding is being pursued, NMFS will submit a written request to Hilcorp indicating that the following initial available information must be provided as soon as possible, but no later than 7 business days after the request for information.

(A) Status of all sound source use in the 48 hours preceding the estimated time of stranding and within 50 km of the discovery/notification of the stranding by NMFS; and

(B) If available, description of the behavior of any marine mammal(s) observed preceding (*i.e.,* within 48 hours and 50 km) and immediately after the discovery of the stranding.

(C) In the event that the investigation is still inconclusive, the investigation of the association of the survey activities is still warranted, and the investigation is still being pursued, NMFS may provide additional information requests, in writing, regarding the nature and location of survey operations prior to the time period above.

§ 217.166 Letters of authorization.

(a) To incidentally take marine mammals pursuant to these regulations, Hilcorp must apply for and obtain (LOAs) in accordance with § 216.106 of this chapter for conducting the activity identified in § 217.160(c).

(b) LOAs, unless suspended or revoked, may be effective for a period of time not to extend beyond the expiration date of these regulations.

(c) An LOA application must be submitted to the Director, Office of Protected Resources, NMFS, by December 31st of the year preceding the desired start date.

(d) An LOA application must include the following information:

(1) The date(s), duration, and the area(s) where the activity will occur;

(2) The species and/or stock(s) of marine mammals likely to be found within each area;

(3) The estimated number of takes for each marine mammal stock potentially affected in each area for the period of effectiveness of the Letter of Authorization.

(4) If an application is for an LOA renewal, it must meet the requirements set forth in § 217.167.

(e) In the event of projected changes to the activity or to mitigation, monitoring, reporting (excluding changes made pursuant to the adaptive management provision of § 217.97(c)(1)) required by an LOA, Hilcorp must apply for and obtain a modification of LOAs as described in § 217.167.

(f) Each LOA must set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species, their habitat, and the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(g) Issuance of the LOA(s) must be based on a determination that the level of taking must be consistent with the findings made for the total taking allowable under these regulations.

(h) If NMFS determines that the level of taking is resulting or may result in more than a negligible impact on the species or stocks of such marine mammal, the LOA may be modified or suspended after notice and a public comment period.

(i) Notice of issuance or denial of the LOA(s) must be published in the **Federal Register** within 30 days of a determination.

§ 217.167 Renewals and modifications of letters of authorization and adaptive management.

(a) An LOA issued under §§ 216.106 of this chapter and 217.166 for the activity identified in § 217.160(c) may be renewed or modified upon request by the applicant, provided that the following are met:

(1) Notification to NMFS that the activity described in the application submitted under § 217.160(a) will be undertaken and that there will not be a substantial modification to the described work, mitigation or monitoring undertaken during the upcoming or remaining LOA period;

(2) Timely receipt (by the dates indicated) of monitoring reports, as required under § 217.165(C)(3);

(3) A determination by the NMFS that the mitigation, monitoring and reporting measures required under § 217.165(c) and the LOA issued under §§ 216.106 of this chapter and 217.166, were undertaken and are expected to be undertaken during the period of validity of the LOA.

(b) If a request for a renewal of a Letter of Authorization indicates that a substantial modification, as determined by NMFS, to the described work, mitigation or monitoring undertaken during the upcoming season will occur, NMFS will provide the public a period of 30 days for review and comment on the request as well as the proposed modification to the LOA. Review and comment on renewals of Letters of Authorization are restricted to:

(1) New cited information and data indicating that the original determinations made for the regulations are in need of reconsideration; and

(2) Proposed changes to the mitigation and monitoring requirements contained in these regulations or in the current Letter of Authorization.

(c) A notice of issuance or denial of a renewal of a Letter of Authorization will be published in the **Federal Register** within 30 days of a determination.

(d) An LOA issued under §§ 216.16 of this chapter and 217.166 for the activity identified in § 217.160 may be modified by NMFS under the following circumstances:

(1) *Adaptive management.* NMFS, in response to new information and in consultation with Hilcorp, may modify the mitigation or monitoring measures in subsequent LOAs if doing so creates a reasonable likelihood of more effectively accomplishing the goals of mitigation and monitoring set forth in the preamble of these regulations.

(i) Possible sources of new data that could contribute to the decision to modify the mitigation or monitoring measures include:

(A) Results from Hilcorp's monitoring from the previous year(s).

(B) Results from marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by these regulations or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS will publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) NMFS will withdraw or suspend an LOA if, after notice and opportunity for public comment, NMFS determines these regulations are not being substantially complied with or that the taking allowed is or may be having more than a negligible impact on an affected species or stock specified in § 217.162(b) or an unmitigable adverse impact on the availability of the species or stock for subsistence uses. The requirement for notice and comment will not apply if NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals. Notice would be published in the **Federal Register** within 30 days of such action.

§§ 217.168—217.169 [Reserved]

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