DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 217

[Docket No. 100217096–1312–01]

RIN 0648–AY63

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Operation of Offshore Oil and Gas Facilities in the U.S. Beaufort Sea

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 BP Exploration (Alaska) Inc. (BP) for authorization for the take of marine mammals incidental to operation of offshore oil and gas facilities in the U.S. Beaufort Sea, Alaska, for the period 2011–2016. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is proposing to issue regulations to govern that take and requesting information, suggestions, and comments on these proposed regulations. These regulations, if issued, would include required mitigation measures to ensure the least practicable adverse impact on the affected marine mammal species and stocks.

DATES: Comments and information must be received no later than August 5, 2011.

ADDRESSES: You may submit comments, identified by 0648–AY63, by any one of the following methods:

- Electronic Submissions: Submit all electronic public comments via the Federal eRulemaking Portal *http://www.regulations.gov.*
- Hand delivery or mailing of paper, disk, or CD–ROM comments should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910.

Comments regarding any aspect of the collection of information requirement contained in this proposed rule should be sent to NMFS via one of the means stated here and to the Office of Information and Regulatory Affairs, NEOB–10202, Office of Management and Budget (OMB), Attn: Desk Office, Washington, DC 20503, *OIRA@omb.eop.gov.*

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.regulations.gov* without change. All Personal Identifying Information (for example, name, address, *etc.*) voluntarily submitted by the commenter 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, WordPerfect, or Adobe PDF file formats only.

FOR FURTHER INFORMATION CONTACT: Candace Nachman, Office of Protected Resources, NMFS, (301) 713–2289, ext. 156, or Brad Smith, Alaska Region, NMFS, (907) 271–3023.

SUPPLEMENTARY INFORMATION:

Availability

A copy of BP's application may be obtained by writing to the address specified above (see **ADDRESSES**), calling the contact listed above (see **FOR FURTHER INFORMATION CONTACT**), or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.* To help NMFS process and review comments more efficiently, please use only one method to submit comments.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) during periods of not more than five consecutive years each if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking 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.

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].

Summary of Request

On November 6, 2009, NMFS received an application from BP requesting authorization for the take of six marine mammal species incidental to operation of the Northstar development in the Beaufort Sea, Alaska, over the course of 5 years, which would necessitate the promulgation of new five-year regulations. Construction of Northstar was completed in 2001. The proposed activities for 2011–2016 include a continuation of drilling, production, and emergency training operations but no construction or activities of similar intensity to those conducted between 1999 and 2001. The likely or possible impacts of the planned continuing operations at Northstar on marine mammals involve both non-acoustic and acoustic effects. Potential non-acoustic effects could result from the physical presence of personnel, structures and equipment, construction or maintenance activities, and the occurrence of oil spills. Petroleum development and associated activities in marine waters introduce sound into the environment, produced by island construction, maintenance, and drilling, as well as vehicles operating on the ice, vessels, aircraft, generators, production machinery, gas flaring, and camp operations. BP requests authorization to take individuals of three cetacean and three pinniped species by Level B Harassment. They are: Bowhead, gray, and beluga whales and ringed, bearded, and spotted seals. Further, BP requests authorization to take five individual ringed seals by injury or mortality annually over the course of the 5-year rule.

Description of the Specified Activity

Background on the Northstar Development Facility

BP is currently producing oil from an offshore development in the Northstar Unit (see Figure 1 in BP's application). This development is the first in the Beaufort Sea that makes use of a subsea pipeline to transport oil to shore and then into the Trans-Alaska Pipeline System. The Northstar facility was built in State of Alaska waters on the remnants of Seal Island approximately 6 mi (9.5 km) offshore from Point Storkersen, northwest of the Prudhoe Bay industrial complex, and 3 mi (5 km) seaward of the closest barrier island. It is located approximately 54 mi (87 km) northeast of Nuiqsut, an Inupiat community.

The main facilities associated with Northstar include a gravel island work surface for drilling and oil production facilities and two pipelines connecting the island to the existing infrastructure at Prudhoe Bay. One pipeline transports crude oil to shore, and the second imports gas from Prudhoe Bay for gas injection at Northstar. Permanent living quarters and supporting oil production facilities are also located on the island.

The construction of Northstar began in early 2000 and continued through 2001. BP states that activities with similar intensity to those that occurred during the construction phase between 2000 and 2001 are not planned or expected for any date within the 5-year period that would be governed by the proposed regulations (*i.e.,* 2011–2016). Well drilling began on December 14, 2000, and oil production commenced on October 31, 2001. Construction and maintenance activities occurred annually on the protection barrier around Northstar due to ice and storm impacts. In August 2003, two barges made a total of 52 round-trips to haul 30,000 cubic yards of gravel from West Dock for berm construction. Depending on the actual damage, repair and maintenance in the following years consisted of activities such as creating a moat for diver access, removing concrete blocks in areas that had sustained erosion and/or block damage, and installing a new layer of filter fabric. In 2008, BP installed large boulders at the NE corner of the barrier instead of replacing the lower concrete blocks that were removed during a storm.

The planned well-drilling program for Northstar was completed in May 2004. Drilling activities to drill new wells, conduct well maintenance, and drill well side-tracks continued in 2006 (six wells), 2007 (two wells), and 2008 (two wells). The drill rig was demobilized and removed from the island by barge during the 2010 open water period. Although future drilling is not specifically planned, drilling of additional wells or well work-over may be required at some time in the future. A more detailed description of past construction, drilling, and production activities at Northstar can be found in BP's application (see **ADDRESSES**).

Expected Activities in 2011–2016

During the 5-year period from 2011–2016, BP intends to continue production and emergency training operations. As mentioned previously, drilling is not specifically planned for the 2011–2016 time period but may be required at some point in the future. The activities described next could occur at any time during the 5-year period. Table 2 in BP's application (see **ADDRESSES**) summarizes the vehicles and machinery used during BP's Northstar activities since the development of Northstar Island. Although all these activities are not planned to take place during the 2011–2016 operational phase, some of the equipment may be required to repair or replace existing structures or infrastructure on Northstar in the future.

(1) Transportation of Personnel, Equipment, and Supplies

Transportation needs for the Northstar project include the ability to safely transport personnel, supplies, and equipment to and from the site during repairs or maintenance, drilling, and operations in an offshore environment. During proposed island renewal construction that may take place during the requested time period, quantities of pipes, vertical support members (*i.e.,* posts that hold up terrestrial pipelines), gravel, and a heavy module will be transported to the site. Drilling operations require movement of pipe materials, chemicals, and other supplies to the island. During ongoing field operations, equipment and supplies will need to be transported to the site. All phases of construction, drilling, and operation require movement of personnel to and from the Northstar area.

During the operations phase from 2002–2009, fewer ice roads were required compared to the construction phase (2000–2001). The future scope of ice road construction activities during ongoing production is expected to be similar to the post-construction period of 2002–2009. The locations, dimensions, and construction techniques of these ice roads are described in the multi-year final comprehensive report (Richardson [ed.], 2008). The presence of ice roads allows the use of standard vehicles such as pick-ups, SUVs, buses and trucks for transport of personnel and equipment to and from Northstar during the ice-covered period. Ice roads are planned to be constructed and used as a means of winter transportation for the duration of Northstar operations. The orientation of future ice roads is undetermined, but will not exceed the number of ice roads created during the winter of 2000/2001.

Barges and Alaska Clean Seas (ACS) vessels are used to transport personnel and equipment from the Prudhoe Bay area to Northstar during the open-water season, which extends from approximately mid- to late-July through early to mid-October. Seagoing barges are used to transport large modules and other supplies and equipment during the construction period.

Helicopter access to Northstar Island continues to be an important transportation option during break-up and freeze-up of the sea ice when wind, ice conditions, or other operational considerations prevent or limit hovercraft travel. Helicopters will be used for movement of personnel and supplies in the fall after freeze-up begins and vessel traffic is not possible but before ice roads have been constructed. Helicopters will also be used in the spring after ice roads are no longer safe for all-terrain vehicles (ATVs) but before enough open water is available for vessel traffic. Helicopters are also available for use at other times of year in emergency situations. Helicopters fly at an altitude of at least 1,000 ft (305 m), except for take-off, landing, and as dictated for safe aircraft operations. Designated flight paths are assigned to minimize potential disturbance to wildlife and subsistence users.

The hovercraft is used to transport personnel and supplies during break-up and freeze-up periods to reduce helicopter use. BP intends to continue the use of the hovercraft in future years. Specifications of the hovercraft and sound characteristics are described in Richardson ([ed.] 2008) and Blackwell and Greene (2005).

(2) Production Operations

The process facilities for the Northstar project are primarily prefabricated sealift modules that were shipped to the island and installed in 2001. The operational aspects of the Northstar production facility include the following: Two diesel generators (designated emergency generators); three turbine generators for the power plant, operating at 50 percent duty cycle (*i.e.,* only two will be operating at any one time); two high pressure turbine compressors; one low pressure flare; and one high pressure flare. Both flares are located on the 215 ft (66 m) flare tower. Modules for the facility include permanent living quarters (*i.e.,* housing, kitchen/dining, lavatories, medical, recreation, office, and laundry space), utility module (*i.e.,* desalinization plant, emergency power, and wastewater treatment plant), warehouse/shop module, communications module, diesel and potable water storage, and chemical storage. Operations have been continuing since oil production began on October 31, 2001 and are expected to continue beyond 2016.

(3) Drilling Operations

The drilling rig and associated equipment was moved by barge to Northstar Island from Prudhoe Bay during the open-water season in 2000. Drilling began in December 2000 using power supplied by the installed gas line. The first well drilled was the Underground Injection Control well, which was commissioned for disposal of permitted muds and cuttings on January 26, 2001. After Northstar facilities were commissioned, drilling above reservoir depth resumed, while drilling below that depth is allowed only during the ice covered period. Although future drilling is not specifically planned during the requested time period for this proposed rule, drilling of additional wells or well work-over may be required at some time during 2011–2016.

(4) Pipeline Design, Inspection, and Maintenance

The Northstar pipelines have been designed, installed, and monitored to assure safety and leak prevention. Pipeline monitoring and surveillance activities have been conducted since oil production began, and BP will conduct long-term monitoring of the pipeline system to assure design integrity and to detect any potential problems through the life of the Northstar development. The program will include visual inspections/aerial surveillance and pig (a gauging/cleaning device) inspections.

The Northstar pipelines include the following measures to assure safety and leak prevention:

- Under the pipeline design specifications, the tops of the pipes are 6–8 ft (1.8–2.4 m) below the original seabed (this is 2 times the deepest measured ice gouge);
- The oil pipeline uses higher yield steel than required by design codes as applied to internal pressure (by a factor of over 2.5 times). This adds weight and makes the pipe stronger. The 10-in (25.4-cm) diameter Northstar oil pipeline has thicker walls than the 48-in (122-cm) diameter Trans-Alaska Pipeline;
- The pipelines are designed to bend without leaking in the event of ice keel impingement or the maximum predicted subsidence from permafrost thaw;
- The pipelines are coated on the outside and protected with anodes to prevent corrosion; and
- The shore transition is buried to protect against storms, ice pile-up, and coastal erosion. The shore transition valve pad is elevated and set back from the shoreline.

A best-available-technology leak detection system is being used during operations to monitor for any potential leaks. The Northstar pipeline incorporates two independent, computational leak detection systems: (1) The Pressure Point Analysis (PPA) system, which detects a sudden loss of pressure in the pipeline; and (2) the mass balance leak detection system, which supplements the PPA. Furthermore, an independent hydrocarbon sensor, the LEOS leak detection system, located between the two pipelines, can detect hydrocarbon vapors and further supplements the other systems.

- Intelligent inspection pigs are used during operations to monitor pipe conditions and measure any changes.
- The line is constructed with no flanges, valves, or fittings in the subsea section to reduce the likelihood of equipment failure.

During operations, BP conducts aerial forward looking infrared (FLIR) surveillance of the offshore and onshore pipeline corridors at least once per week (when conditions allow), to detect pipeline leaks. Pipeline isolation valves are inspected on a regular basis. In addition to FLIR observations/inspections, BP conducts a regular oil pipeline pig inspection program to assess continuing pipeline integrity. The LEOS Leak Detection System is used continuously to detect under-ice releases during the ice covered period.

The pipelines are also monitored annually to determine any potential sources of damage along the pipeline route. The monitoring work has been conducted in two phases: (1) A helicopter-based reconnaissance of strudel drainage features in early June; and (2) a vessel-based survey program in late July and early August. During the vessel-based surveys, multi-beam, single-beam, and side scan sonar are used. These determine the locations and characteristics of ice gouges and strudel scour depressions in the sea bottom along the pipeline route and at additional selected sites where strudel drainage features have been observed. If strudel scour depressions are identified, additional gravel fill is placed in the open water season to maintain the sea bottom to original pipeline construction depth.

(5) Routine Repair and Maintenance

Various routine repair and maintenance activities have occurred since the construction of Northstar. Examples of some of these activities include completion and repair of the island slope protection berm and well cellar retrofit repairs. Activities associated with these repairs or modifications are reported in the 1999–2004 final comprehensive report (Rodrigues and Williams, 2006) and since 2005 in the various Annual Reports (Rodrigues *et al.,* 2006; Rodrigues and Richardson, 2007; Aerts and Rodrigues, 2008; Aerts, 2009). Some of these activities, such as repair of the island slope protection berm, were major repairs that involved the use of barges and heavy equipment, while others were smaller-scale repairs involving small pieces of equipment and hand operated tools. The berm surrounding the island is designed to break waves and ice movement before they contact the island work surface and is subjected to regular eroding action from these forces. The berm and sheet pile walls will require regular surveying and maintenance in the future. Potential repair and maintenance activities that are expected to occur at Northstar during the period 2011–2016 include pile driving, traffic, gravel transport, dock construction and maintenance, diving and other activities similar to those that have occurred in the past.

(6) Emergency and Oil Spill Response Training

Emergency and oil spill response training activities are conducted at various times throughout the year at Northstar. Oil spill drill exercises are conducted by ACS during both the ice-covered and open-water periods. During the ice-covered periods, exercises are conducted for containment of oil in water and for detection of oil under ice. These spill drills have been conducted on mostly bottom-fast ice in an area 200 ft × 200 ft (61 m × 61 m) located just west of the island, using snow machines and ATVs. The spill drill includes the use of various types of equipment to cut ice slots or drill holes through the floating sea ice. Typically, the snow is cleared from the ice surface with a Bobcat loader and snow blower to allow access to the ice. Two portable generators are used to power light plants at the drill site. The locations and frequency of future spill drills or exercises will vary depending on the condition of the sea ice and training needs.

ACS conducts spill response training activities during the open-water season during late July through early October. Vessels used as part of the training typically include Zodiacs, Kiwi Noreens, and Bay-class boats that range in length from 12–45 ft (3.7–13.7 m). Future exercises could include other vessels and equipment.

ARKTOS amphibious emergency escape vehicles are stationed on Northstar Island. Each ARKTOS is capable of carrying 52 people. Training exercises with the ARKTOS are conducted monthly during the ice-covered period. ARKTOS training exercises are not conducted during the summer. Equipment and techniques used during oil spill response exercises are continually updated, and some variations relative to the activities described here are to be expected.

(7) Northstar Abandonment

Detailed plans for the decommissioning of Northstar will be prepared near the end of field life, which will not occur during the period requested for these proposed regulations. For additional information on abandonment and decommissioning of the Northstar facility, refer to BP's application (see **ADDRESSES**).

Northstar Sound Characteristics

During continuing production activities at Northstar, sounds and non-acoustic stimuli will be generated by vehicle traffic, vessel operations, helicopter operations, drilling, and general operations of oil and gas facilities (*e.g.,* generator sounds and gas flaring). The sounds generated from transportation activities will be detectable underwater and/or in air some distance away from the area of activity. The distance will depend on the nature of the sound source, ambient noise conditions, and the sensitivity of the receptor. Take of marine mammals by Level B harassment incidental to the activities mentioned in this document could occur for the duration of these proposed regulations. The type and significance of the harassment is likely to depend on the species and activity of the animal at the time of reception of the stimulus, as well as the distance from the sound source and the level of the sound relative to ambient conditions.

(1) Construction Sounds

Sounds associated with construction of Seal Island in 1982 were studied and described by Greene (1983a) and summarized in the previous petition for regulations submitted by BP (BPXA, 1999). Underwater and in-air sounds and iceborne vibrations of various activities associated with the final construction phases of Northstar were recorded in the winter of 2000–2002 (Greene *et al.,* 2008). The main purpose of these measurements was to characterize the properties of island construction sounds and to use this information in assessing their possible impacts on wildlife. Activities recorded included ice augering, pumping sea water to flood the ice and build an ice road, a bulldozer plowing snow, a Ditchwitch cutting ice, trucks hauling gravel over an ice road to the island site, a backhoe trenching the sea bottom for a pipeline, and both vibratory and impact sheet pile driving (Greene *et al.,* 2008). Table 5 in BP's application presents a summary of the levels of construction sounds and vibrations measured around the Northstar prospect.

Ice road construction is difficult to separate into its individual components, as one or more bulldozers and several rolligons normally work concurrently. Of the construction activities reported, those related to ice road construction (bulldozers, augering and pumping) produced the least amount of sound, in all three media. The distance to median background for the strongest one-third octave bands for bulldozers, augering, and pumping was less than 1.24 mi (2 km) for underwater sounds, less than 0.62 mi (1 km) for in-air sounds, and less than 2.5 mi (4 km) for iceborne vibrations (see Table 5 in BP's application). Vibratory sheet pile driving produced the strongest sounds, with broadband underwater levels of 143 dB re 1 μPa at 328 ft (100 m). Most of the sound energy was in a tone close to 25 Hz. Distances to background levels of underwater sounds (approximately 1.86 mi [3 km]) were somewhat smaller than expected. Shepard *et al.* (2001) recorded sound near Northstar in April 2001 during construction and reported that the noisiest conditions occurred during sheet pile installation with a vibrating hammer. BP's estimates were 8–10 dB higher at 492 ft (150 m) and 5–8 dB lower at 1.24 mi (2 km) than the measurements by Shepard *et al.* (2001). Greene *et al.* (2008) describes sound levels during impact sheet pile driving. However, satisfactory recordings for this activity were only obtained at one station 2,395 ft (730 m) from the sheet pile driven into the island. The maximum peak pressure recorded on the hydrophone was 136.1 dB re 1 μPa and 141.1 dB re 1 μPa on the geophone (Greene *et al.,* 2008).

(2) Operational Sounds

Drilling operations started in December 2000 and were the first sound-producing activities associated with the operational phase at Northstar. The four principal operations that occur during drilling are drilling itself, tripping (extracting and lowering the drillstring), cleaning, and well-logging (lowering instruments on a cable down the hole). Drilling activities can be categorized as non-continuous sounds, *i.e.,* they contribute to Northstar sounds intermittently. Other non-continuous sounds are those from heavy equipment operation for snow removal, berm maintenance, and island surface maintenance. Sounds from occasional movements of a ''pig'' through the pipeline may also propagate into the marine or nearshore environment.

Sounds from generators, process operations (*e.g.,* flaring, seawater treatment, oil processing, gas injection), and island lighting are more continuous and contribute to the operational sounds from Northstar. Drilling and operational sounds underwater, in air, and of ice-borne vibrations were obtained at Northstar Island and are summarized here and in a bit more detail in BP's application (Blackwell *et al.,* 2004b; Blackwell and Greene, 2006).

Drilling—During the ice covered seasons from 1999 to 2002, drilling sounds were measured and readily identifiable underwater, with a marked increase in received levels at 60–250 Hz and 700–1400 Hz relative to no-drilling times. The higher-frequency peak, which was distinct enough to be used as a drilling ''signature'', was clearly detectible 3.1 mi (5 km) from the drill rig, but had fallen to background values by 5.8 mi (9.4 km). Distances at which background levels were reached were defined as the distance beyond which broadband levels remained constant with increasing distance from the source. Sound pressure levels of island production with and without drilling activities measured at approximately 1,640 ft (500 m) from Northstar are similar, with most of the sound energy below 100 Hz. The broadband (10–10,000 Hz) level was approximately 2 dB higher during drilling than without, but relatively low in both cases (99 vs. 97 dB re 1 μPa; Blackwell and Greene, 2006).

In air, drilling sounds were not distinguishable from overall island sounds based on spectral characteristics or on broadband levels (Blackwell *et al.,* 2004b). A similar result was found for recordings from geophones: broadband levels of iceborne vibrations with or without drilling were indistinguishable (Blackwell *et al.,* 2004b). Thus, airborne sounds and iceborne vibrations were not strong enough during drilling to have much influence on overall Northstar sound, in contrast to underwater sounds, which were higher during drilling (Blackwell and Greene, 2006).

Richardson *et al.* (1995b) summarized then-available data by stating that sounds associated with drilling activities vary considerably, depending on the nature of the ongoing operations and the type of drilling platform (island, ship, etc.). Underwater sound associated with drilling from natural barrier islands or an artificial island built mainly of gravel is generally weak and is inaudible at ranges beyond several kilometers. The results from the Northstar monitoring work in more recent years are generally consistent with the earlier evidence.

Other Operational Sounds: Ice-covered Season—Both with and without drilling, underwater broadband levels recorded north of the island during the ice-covered season were similar with and without production (Blackwell *et al.,* 2004b). Although the broadband underwater levels did not seem to be affected appreciably by production activities, a peak at 125–160 Hz could be related to production. This peak was no longer detectable 3.1 mi (5 km) from the island, either with or without simultaneous drilling (Blackwell *et al.,* 2004b).

Other Operational Sounds: Open-water Season—Underwater and in-air production sounds from Northstar Island were recorded and characterized during nine open-water seasons from 2000 to 2008 (Blackwell and Greene, 2006; Blackwell *et al.,* 2009). Island activity sounds recorded during 2000–2003 included construction of the island, installation of facilities, a large sealift transported by several barges and associated Ocean, River, and Point Class tugs, conversion of power generation from diesel-powered generators to Solar gas turbines, drilling, production, and reconstruction of an underwater berm for protection against ice. From 2003–2008 island activities mainly consisted of production related sounds and maintenance activities of the protection barrier. During the open water season, vessels were the main contributors to the underwater sound field at Northstar (Blackwell and Greene, 2006). Vessel noise is discussed in the next subsection.

During both the construction phase in 2000 and the drilling and production phase, island sounds underwater reached background values at distances of 1.2–2.5 mi (2–4 km; Blackwell and Greene, 2006). For each year, percentile levels of broadband sound (maximum, 95th, 50th, and 5th percentile, and minimum) were computed over the entire field season. The range of broadband levels recorded over 2001–2008 for all percentiles is 80.8–141 dB re 1 μPa. The maximum levels are mainly determined by the presence of vessels and can be governed by one specific event. The 95th percentile represents the sound level generated at Northstar during 95% of the time. From 2004 to 2008 these levels ranged from 110 to 119.5 dB re 1 μPa at approximately 0.3 mi (450 m) from Northstar. Much of the variation in received levels was dependent on sea state, which is correlated with wind speed. The lowest sound levels in the time series are indicative of the quietest times in the water near the island and generally correspond to times with low wind speeds. Conversely, times of high wind speed usually correspond to increased broadband levels in the directional seafloor acoustic recorder (DASAR) record (Blackwell *et al.,* 2009). The short-term variability in broadband sound levels in 2008 was higher than in previous years. This was attributed to the presence of a new type of impulsive sound on the records of the near-island DASARs, referred to as ''pops''. Bearings pointed to the northeastern part of Northstar Island, but to date the source is not known. Pops were broadband in nature, of short duration (approximately 0.05 s), and with received sound pressure levels at the near-island DASAR ranging from 107 to 144 dB re 1 μPa. This sound was also present on the 2009 records, but the source remains unknown.

Airborne sounds were recorded concurrently with the boat-based recordings in 2000–2003 (Blackwell and Greene, 2006). The strongest broadband airborne sounds were recorded approximately 985 ft (300 m) from Northstar Island in the presence of vessels, and reached 61–62 dBA re 20 μPa. These values are expressed as A-weighted levels on the scale normally used for in-air sounds. In-air sounds generally reached a minimum 0.6–2.5 mi (1–4 km) from the island, with or without the presence of boats.

(3) Transportation Sounds

Sounds related to winter construction activities of Seal Island in 1982 were reported by Greene (1983a) and information on this topic can be found in BP's 1999 application (BPXA, 1999). During the construction and operation of Northstar Island from 2000 to 2002, underwater sound from vehicles constructing and traveling along the ice road diminished to background levels at distances ranging from 2.9 to 5.9 mi (4.6 to 9.5 km). In-air sound levels of these activities reached background levels at distances ranging from 328–1,969 ft (100–600 m; see Table 5 in BP's application).

Sounds and vibrations from vehicles traveling along an ice road constructed across the grounded sea ice and along Flaxman Island (a barrier Island east of Prudhoe Bay) were recorded in air and within artificially constructed polar bear dens in March 2002 (MacGillivray *et al.,* 2003). Underwater recordings were not made. Sounds from vehicles traveling along the ice road were attenuated strongly by the snow cover of the artificial dens; broadband vehicle traffic noise was reduced by 30–42 dB. Sound also diminished with increasing distance from the station. Most vehicle noise was indistinguishable from background (ambient) noise at 1,640 ft (500 m), although some vehicles were detectable to more than 1.2 mi (2,000 m). Ground vibrations (measured as velocity) were undetectable for most vehicles at a distance of 328 ft (100 m) but were detectable to 656 ft (200 m) for a Hägglunds tracked vehicle (MacGillivray *et al.,* 2003).

Helicopters were used for personnel and equipment transport to and from Northstar during the unstable ice periods in spring and fall. Helicopters flying to and from Northstar generally maintain straight-line routes at altitudes of 1,000 ft (300 m) ASL, thereby limiting the received levels at and below the surface. Helicopter sounds contain numerous prominent tones at frequencies up to about 350 Hz, with the strongest measured tone at 20–22 Hz. Received peak sound levels of a Bell 212 passing over a hydrophone at an altitude of approximately 1,000 ft (300 m), which is the minimum allowed altitude for the Northstar helicopter under normal operating conditions, varied between 106 and 111 dB re 1 μPa at 30 and 59 ft (9 and 18 m) water depth (Greene, 1982, 1985). Harmonics of the main rotor and tail rotor usually dominate the sound from helicopters; however, many additional tones associated with the engines and other rotating parts are sometimes present (Patenaude *et al.,* 2002).

Under calm conditions, rotor and engine sounds are coupled into the water within a 26° cone beneath the aircraft. Some of the sound transmits beyond the immediate area, and some sound enters the water outside the 26° cone when the sea surface is rough. However, scattering and absorption limit lateral propagation in shallow water. For these reasons, helicopter and fixed-wing aircraft flyovers are not heard underwater for very long, especially when compared to how long they are heard in air as the aircraft approaches, passes and moves away from an observer. Tones from helicopter traffic were detected underwater at a horizontal distance approximately 1,476 ft (450 m) from Northstar, but only during helicopter departures from Northstar (Blackwell *et al.,* 2009). The duration of the detectable tones, when present, was short (20–50 s), and the received sound levels were weak, sometimes barely detectable. The lack of detectable tones during 65% of the investigated helicopter departures and arrivals supports the importance of the aircraft's path in determining whether tones will be detectable underwater. Helicopter tones were not detectable underwater at the most southern DASAR location approximately 4 mi (6.5 km) north of Northstar.

Principally the crew boat, tugs, and self-propelled barges were the main contributors to the underwater sound field at Northstar during the construction and production periods (Blackwell and Greene, 2006). Vessel sounds are a concern due to the potential disturbance to marine mammals (Richardson *et al.,* 1995b). Characteristics of underwater sounds from boats and vessels have been reported extensively, including specific measurements near Northstar (Greene and Moore, 1995; Blackwell and Greene, 2006). Broadband source levels for most small ships (lengths about 180–279 ft [55–85 m]) are approximately 160–180 dB re 1 μPa. Both the crew boat and the tugs produced substantial broadband sound in the 50–2,000 Hz range, which could at least in part be accounted for by propeller cavitation (Ross, 1976). Several tones were also apparent in the vessel sounds, including one at 17.5 Hz, corresponding to the propeller blade rate of Ocean Class tugs. Two tones were identified for the crew boat: one at 52–55 Hz, which corresponds to the blade rate, and one at 22–26 Hz, which corresponds to a harmonic of the shaft rate.

The presence of boats considerably expanded the distances to which Northstar-related sound was detectable. On days with average levels of background sounds, sounds from tug boats were detectable on offshore DASAR recordings to at least 13.4 mi (21.5 km) from Northstar (Blackwell *et al.,* 2009). On other occasions, vessel sounds from crew boat, tugs, and self-propelled barges were often detectable underwater as much as approximately 18.6 mi (30 km) offshore (Blackwell and Greene, 2006). BP therefore looked into options to reduce vessel use. During the summer of 2003, a small, diesel-powered hovercraft (Griffon 2000TD) was tested to transport crew and supplies between the mainland and Northstar Island. Acoustic measurements showed that the hovercraft was considerably quieter underwater than similar-sized conventional vessels (Blackwell and Greene, 2005). Received underwater broadband sound levels at 21.3 ft (6.5 m) from the hovercraft reached 133 and 131 dB re 1 μPa for hydrophone depths 3 ft and 23 ft (1 m and 7 m), respectively. In-air unweighted and A-weighted broadband (10–10,000 Hz) levels reached 104 and 97 dB re 20 μPa, respectively. Use of the hovercraft for Northstar transport resulted in a decreased number of periods of elevated vessel noise in the acoustic records of the near-island DASARs (Blackwell *et al.,* 2009).

Description of Marine Mammals in the Area of the Specified Activity

The Beaufort Sea supports a diverse assemblage of marine mammals, including: Bowhead, gray, beluga, killer, minke, and humpback whales; harbor porpoises; ringed, ribbon, spotted, and bearded seals; narwhals; polar bears; and walruses. The bowhead and humpback whales and polar bear are listed as ''endangered'' under the Endangered Species Act (ESA) and as depleted under the MMPA. Certain stocks or populations of gray, beluga, and killer whales and spotted seals are listed as endangered or are proposed for listing under the ESA; however, none of those stocks or populations occur in the proposed activity area. On December 10, 2010, NMFS published a notice of proposed threatened status for subspecies of the ringed seal (75 FR 77476) and a notice of proposed threatened and not warranted status for subspecies and distinct population segments of the bearded seal (75 FR 77496) in the **Federal Register**. Neither of these two ice seal species is considered depleted under the MMPA. Additionally, the ribbon seal is considered a ''species of concern'' under the ESA. Both the walrus and the polar bear are managed by the U.S. Fish and Wildlife Service (USFWS) and are not considered further in this proposed rulemaking.

Of the species mentioned here, the ones that are most likely to occur near the Northstar facility include: bowhead, gray, and beluga whales and ringed, bearded, and spotted seals. Ringed seals are year-round residents in the Beaufort Sea and are anticipated to be the most frequently encountered species in the proposed project area. Bowhead whales are anticipated to be the most frequently encountered cetacean species in the proposed project area; however, their occurrence is not anticipated to be year-round. The most common time for bowheads to occur near Northstar is during the fall migration westward through the Beaufort Sea, which typically occurs from late August through October each year.

Other marine mammal species that have been observed in the Beaufort Sea but are uncommon or rarely identified in the project area include harbor porpoise, narwhal, killer, minke, and humpback whales, and ribbon seals. These species could occur in the project area, but each of these species is uncommon or rare in the area and relatively few encounters with these species are expected during BP's activities. The narwhal occurs in Canadian waters and occasionally in the Beaufort Sea, but it is rare there and is not expected to be encountered. There are scattered records of narwhal in Alaskan waters, including reports by subsistence hunters, where the species is considered extralimital (Reeves *et al.,* 2002). Point Barrow, Alaska, is the approximate northeastern extent of the harbor porpoise's regular range (Suydam and George, 1992), though there are extralimital records east to the mouth of the Mackenzie River in the Northwest Territories, Canada, and recent sightings in the Beaufort Sea in the vicinity of Prudhoe Bay during surveys in 2007 and 2008 (Christie *et al.,* 2009). Monnett and Treacy (2005) did not report any harbor porpoise sightings during aerial surveys in the Beaufort Sea from 2002 through 2004. Humpback and minke whales have recently been sighted in the Chukchi Sea but very rarely in the Beaufort Sea. Greene *et al.* (2007) reported and photographed a humpback whale cow/calf pair east of Barrow near Smith Bay in 2007, which is the first known occurrence of humpbacks in the Beaufort Sea. Savarese *et al.* (2009) reported one minke whale sighting in the Beaufort Sea in 2007 and 2008. Ribbon seals do not normally occur in the Beaufort Sea; however, two ribbon seal sightings were reported during vessel-based activities near Prudhoe Bay in 2008 (Savarese *et al.,* 2009). Due to the rarity of these species in the proposed project area and the remote chance they would be affected by BP's proposed activities at Northstar, these species are not discussed further in these proposed regulations.

BP's application contains information on the status, distribution, seasonal distribution, and abundance of each of the six species under NMFS jurisdiction likely to be impacted by the proposed activities. When reviewing the application, NMFS determined that the species descriptions provided by BP correctly characterized the status, distribution, seasonal distribution, and abundance of each species. Please refer to the application for that information (see **ADDRESSES**). Additional information can also be found in the NMFS Stock Assessment Reports (SAR). The 2010 Alaska Marine Mammal SAR is available on the Internet at: *http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2010.pdf.*

Brief Background on Marine Mammal Hearing

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms have been derived using auditory evoked potentials, anatomical modeling, and other data, Southall *et al.* (2007) designate ''functional hearing groups'' for marine mammals and estimate the lower and upper frequencies of functional hearing of the groups. The functional groups and the associated frequencies are indicated below (though animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their functional hearing range):

- Low frequency cetaceans (13 species of mysticetes): functional hearing is estimated to occur between approximately 7 Hz and 22 kHz (however, a study by Au *et al.* (2006) of humpback whale songs indicate that the range may extend to at least 24 kHz);
- Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): functional hearing is estimated to occur between approximately 150 Hz and 160 kHz;
- High frequency cetaceans (eight species of true porpoises, six species of river dolphins, Kogia, the franciscana, and four species of cephalorhynchids): functional hearing is estimated to occur between approximately 200 Hz and 180 kHz;
- Pinnipeds in Water: functional hearing is estimated to occur between approximately 75 Hz and 75 kHz, with the greatest sensitivity between approximately 700 Hz and 20 kHz; and
- Pinnipeds in Air: functional hearing is estimated to occur between approximately 75 Hz and 30 kHz.

As mentioned previously in this document, six marine mammal species (three cetacean and three pinniped species) are likely to occur in the Northstar facility area. Of the three cetacean species likely to occur in BP's project area, two are classified as low frequency cetaceans (*i.e.,* bowhead and gray whales) and one is classified as a mid-frequency cetacean (*i.e.,* beluga whales) (Southall *et al.,* 2007).

Underwater audiograms have been obtained using behavioral methods for four species of phocinid seals: the ringed, harbor, harp, and northern elephant seals (reviewed in Richardson *et al.,* 1995b; Kastak and Schusterman, 1998). Below 30–50 kHz, the hearing threshold of phocinids is essentially flat down to at least 1 kHz and ranges between 60 and 85 dB re 1 μPa. There are few published data on in-water hearing sensitivity of phocid seals below 1 kHz. However, measurements for one harbor seal indicated that, below 1 kHz, its thresholds deteriorated gradually to 96 dB re 1 μPa at 100 Hz from 80 dB re 1 μPa at 800 Hz and from 67 dB re 1 μPa at 1,600 Hz (Kastak and Schusterman, 1998). More recent data suggest that harbor seal hearing at low frequencies may be more sensitive than that and that earlier data were confounded by excessive background noise (Kastelein *et al.,* 2009a,b). If so, harbor seals have considerably better underwater hearing sensitivity at low frequencies than do small odontocetes like belugas (for which the threshold at 100 Hz is about 125 dB). In air, the upper frequency limit of phocid seals is lower (about 20 kHz).

Pinniped call characteristics are relevant when assessing potential masking effects of man-made sounds. In addition, for those species whose hearing has not been tested, call characteristics are useful in assessing the frequency range within which hearing is likely to be most sensitive. The three species of seals present in the study area, all of which are in the phocid seal group, are all most vocal during the spring mating season and much less so during late summer. In each species, the calls are at frequencies from several hundred to several thousand hertz—above the frequency range of the dominant noise components from most of the proposed oil production and operational activities.

Cetacean hearing has been studied in relatively few species and individuals. The auditory sensitivity of bowhead, gray, and other baleen whales has not been measured, but relevant anatomical and behavioral evidence is available. These whales appear to be specialized for low frequency hearing, with some directional hearing ability (reviewed in Richardson *et al.,* 1995b; Ketten, 2000). Their optimum hearing overlaps broadly with the low frequency range where BP's production activities and associated vessel traffic emit most of their energy.

The beluga whale is one of the better-studied species in terms of its hearing ability. As mentioned earlier, the auditory bandwidth in mid-frequency odontocetes is believed to range from 150 Hz to 160 kHz (Southall *et al.,* 2007); however, belugas are most sensitive above 10 kHz. They have relatively poor sensitivity at the low frequencies (reviewed in Richardson *et al.,* 1995b) that dominate the sound from industrial activities and associated vessels. Nonetheless, the noise from strong low frequency sources is detectable by belugas many kilometers away (Richardson and Wursig, 1997). Also, beluga hearing at low frequencies in open-water conditions is apparently somewhat better than in the captive situations where most hearing studies were conducted (Ridgway and Carder, 1995; Au, 1997). If so, low frequency sounds emanating from production activities may be detectable somewhat farther away than previously estimated.

Call characteristics of cetaceans provide some limited information on their hearing abilities, although the auditory range often extends beyond the range of frequencies contained in the calls. Also, understanding the frequencies at which different marine mammal species communicate is relevant for the assessment of potential impacts from manmade sounds. A summary of the call characteristics for bowhead, gray, and beluga whales is provided next. More information is available in BP's application (see **ADDRESSES**).

Most bowhead calls are tonal, frequency-modulated sounds at frequencies of 50–400 Hz. These calls overlap broadly in frequency with the underwater sounds emitted by many construction and operational activities (Richardson *et al.,* 1995b). Source levels are quite variable, with the stronger calls having source levels up to about 180 dB re 1 μPa at 1 m. Gray whales make a wide variety of calls at frequencies from < 100–2,000 Hz (Moore and Ljungblad, 1984; Dalheim, 1987).

Beluga calls include trills, whistles, clicks, bangs, chirps and other sounds (Schevill and Lawrence, 1949; Ouellet, 1979; Sjare and Smith, 1986a). Beluga whistles have dominant frequencies in the 2–6 kHz range (Sjare and Smith, 1986a). This is above the frequency range of most of the sound energy produced by the planned Northstar production activities and associated vessels. Other beluga call types reported by Sjare and Smith (1986a,b) included sounds at mean frequencies ranging upward from 1 kHz.

The beluga also has a very well developed high frequency echolocation system, as reviewed by Au (1993). Echolocation signals have peak frequencies from 40–120 kHz and broadband source levels of up to 219 dB re 1 μPa-m (zero-peak). Echolocation calls are far above the frequency range of the sounds from the planned Northstar activities. Therefore, those industrial sounds are not expected to interfere with echolocation.

Potential Effects of the Specified Activity on Marine Mammals

The likely or possible impacts of the planned offshore oil developments at Northstar on marine mammals involve both non-acoustic and acoustic effects. Potential non-acoustic effects could result from the physical presence of personnel, structures and equipment, construction or maintenance activities, and the occurrence of oil spills. In winter, during ice road construction, and in spring, flooding on the sea ice may displace some ringed seals along the ice road corridor. There is a small chance that a seal pup might be injured or killed by on-ice construction or transportation activities. A major oil spill is unlikely and, if it occurred, its effects are difficult to predict. Potential impacts from an oil spill are discussed in more detail later in this section.

Petroleum development and associated activities in marine waters introduce sound into the environment, produced by island construction, maintenance, and drilling, as well as vehicles operating on the ice, vessels, aircraft, generators, production machinery, gas flaring, and camp operations. The potential effects of sound from the proposed activities might include one or more of the following: masking of natural sounds; behavioral disturbance and associated habituation effects; and, at least in theory, temporary or permanent hearing impairment. As outlined in previous NMFS documents, the effects of noise on marine mammals are highly variable, and can be categorized as follows (based on Richardson *et al.,* 1995b):

(1) The noise may be too weak to be heard at the location of the animal (*i.e.,* lower than the prevailing ambient noise level, the hearing threshold of the animal at relevant frequencies, or both);

(2) The noise may be audible but not strong enough to elicit any overt behavioral response;

(3) The noise may elicit reactions of variable conspicuousness and variable relevance to the well being of the marine mammal; these can range from temporary alert responses to active avoidance reactions such as vacating an area at least until the noise event ceases but potentially for longer periods of time;

(4) Upon repeated exposure, a marine mammal may exhibit diminishing responsiveness (habituation), or disturbance effects may persist; the latter is most likely with sounds that are highly variable in characteristics, infrequent, and unpredictable in occurrence, and associated with situations that a marine mammal perceives as a threat;

(5) Any anthropogenic noise that is strong enough to be heard has the potential to reduce (mask) the ability of a marine mammal to hear natural sounds at similar frequencies, including calls from conspecifics, and underwater environmental sounds such as surf noise;

(6) If mammals remain in an area because it is important for feeding, breeding, or some other biologically important purpose even though there is chronic exposure to noise, it is possible that there could be noise-induced physiological stress; this might in turn have negative effects on the well-being or reproduction of the animals involved; and

(7) Very strong sounds have the potential to cause a temporary or permanent reduction in hearing sensitivity. In terrestrial mammals, and presumably marine mammals, received sound levels must far exceed the animal's hearing threshold for there to be any temporary threshold shift (TTS) in its hearing ability. For transient sounds, the sound level necessary to cause TTS is inversely related to the duration of the sound. Received sound levels must be even higher for there to be risk of permanent hearing impairment. In addition, intense acoustic or explosive events may cause trauma to tissues associated with organs vital for hearing, sound production, respiration and other functions. This trauma may include minor to severe hemorrhage.

The characteristics of the various sound sources at Northstar were summarized earlier in this document (see the ''Description of the Specified Activity'' section). Additionally, BP's application contains more details on the Northstar sound characteristics, underwater and in-air sound propagation in and around Northstar, and ambient noise levels in the waters near Prudhoe Bay, Alaska. Please refer to that document for more information (see **ADDRESSES**).

Potential Effects of Sound on Cetaceans

(1) Masking

Masking is the obscuring of sounds of interest by other sounds, often at similar frequencies. Marine mammals are highly dependent on sound, and their ability to recognize sound signals amid other noise is important in communication, predator and prey detection, and, in the case of toothed whales, echolocation. Even in the absence of manmade sounds, the sea is usually noisy. Background ambient noise often interferes with or masks the ability of an animal to detect a sound signal even when that signal is above its absolute hearing threshold. Natural ambient noise includes contributions from wind, waves, precipitation, other animals, and (at frequencies above 30 kHz) thermal noise resulting from molecular agitation (Richardson *et al.,* 1995b). Background noise also can include sounds from human activities. Masking of natural sounds can result when human activities produce high levels of background noise. Conversely, if the background level of underwater noise is high (*e.g.,* on a day with strong wind and high waves), an anthropogenic noise source will not be detectable as far away as would be possible under quieter conditions and will itself be masked.

Although some degree of masking is inevitable when high levels of manmade broadband sounds are introduced into the sea, marine mammals have evolved systems and behavior that function to reduce the impacts of masking. Structured signals, such as the echolocation click sequences of small toothed whales, may be readily detected even in the presence of strong background noise because their frequency content and temporal features usually differ strongly from those of the background noise (Au and Moore, 1988, 1990). The components of background noise that are similar in frequency to the sound signal in question primarily determine the degree of masking of that signal.

Redundancy and context can also facilitate detection of weak signals. These phenomena may help marine mammals detect weak sounds in the presence of natural or manmade noise. Most masking studies in marine mammals present the test signal and the masking noise from the same direction. The sound localization abilities of marine mammals suggest that, if signal and noise come from different directions, masking would not be as severe as the usual types of masking studies might suggest (Richardson *et al.,* 1995b). The dominant background noise may be highly directional if it comes from a particular anthropogenic source such as a ship or industrial site. Directional hearing may significantly reduce the masking effects of these noises by improving the effective signal-to-noise ratio. In the cases of high-frequency hearing by the bottlenose dolphin, beluga whale, and killer whale, empirical evidence confirms that masking depends strongly on the relative directions of arrival of sound signals and the masking noise (Penner *et al.,* 1986; Dubrovskiy, 1990; Bain *et al.,* 1993; Bain and Dahlheim, 1994). Toothed whales, and probably other marine mammals as well, have additional capabilities besides directional hearing that can facilitate detection of sounds in the presence of background noise. There is evidence that some toothed whales can shift the dominant frequencies of their echolocation signals from a frequency range with a lot of ambient noise toward frequencies with less noise (Au *et al.,* 1974, 1985; Moore and Pawloski, 1990; Thomas and Turl, 1990; Romanenko and Kitain, 1992; Lesage *et al.,* 1999). A few marine mammal species are known to increase the source levels or alter the frequency of their calls in the presence of elevated sound levels (Dahlheim, 1987; Au, 1993; Lesage *et al.,* 1993, 1999; Terhune, 1999; Foote *et al.,* 2004; Parks *et al.,* 2007, 2009; Di Iorio and Clark, 2009; Holt *et al.,* 2009).

These data demonstrating adaptations for reduced masking pertain mainly to the very high frequency echolocation signals of toothed whales. There is less information about the existence of corresponding mechanisms at moderate or low frequencies or in other types of marine mammals. For example, Zaitseva *et al.* (1980) found that, for the bottlenose dolphin, the angular separation between a sound source and a masking noise source had little effect on the degree of masking when the sound frequency was 18 kHz, in contrast to the pronounced effect at higher frequencies. Directional hearing has been demonstrated at frequencies as low as 0.5–2 kHz in several marine mammals, including killer whales (Richardson *et al.,* 1995b). This ability may be useful in reducing masking at these frequencies. In summary, high levels of noise generated by anthropogenic activities may act to mask the detection of weaker biologically important sounds by some marine mammals. This masking may be more prominent for lower frequencies. For higher frequencies, such as that used in echolocation by toothed whales, several mechanisms are available that may allow them to reduce the effects of such masking.

There would be no masking effects on cetaceans from BP's proposed activities during the ice-covered season because cetaceans will not occur near Northstar at that time. The sounds from oil production and any drilling activities are not expected to be detectable beyond several kilometers from the source (Greene, 1983; Blackwell *et al.,* 2004b; Blackwell and Greene, 2005, 2006). Sounds from vessel activity, however, were detectable to distances as far as approximately 18.6 mi (30 km) from Northstar (Blackwell and Greene, 2006). Vessels under power to maintain position can be a source of continuous noise in the marine environment (Blackwell *et al.,* 2004b; Blackwell and Greene, 2006) and therefore have the potential to cause some degree of masking.

Small numbers of bowheads, belugas and (rarely) gray whales could be present near Northstar during the open-water season. Almost all energy in the sounds emitted by drilling and other operational activities is at low frequencies, predominantly below 250 Hz with another peak centered around 1,000 Hz. Most energy in the sounds from the vessels and aircraft to be used during this project is below 1 kHz (Moore *et al.,* 1984; Greene and Moore, 1995; Blackwell *et al.,* 2004b; Blackwell and Greene, 2006). These frequencies are mainly used by mysticetes but not by odontocetes. Therefore, masking effects would potentially be more pronounced in the bowhead and gray whales that might occur in the proposed project area.

Because of the relatively low effective source levels and rapid attenuation of drilling and production sounds from artificial islands in shallow water, masking effects are unlikely even for mysticetes that are within several kilometers of Northstar Island. Vessels that are docking or under power to maintain position could cause some degree of masking. However, the adaptation of some cetaceans to alter the source level or frequency of their calls, along with directional hearing, pre-adaptation to tolerate some masking by natural sounds, and the brief periods when most individual whales occur near Northstar, would all reduce the potential impacts of masking from BP's proposed activities. Therefore, impacts from masking on cetaceans are anticipated to be minor.

(2) Behavioral Disturbance

Disturbance can induce a variety of effects, such as subtle changes in behavior, more conspicuous dramatic changes in activities, and displacement. A main concern about the impacts of manmade noise on marine mammals is the potential for disturbance. Behavioral reactions of marine mammals to sound are difficult to predict because they are dependent on numerous factors, including species, state of maturity, experience, current activity, reproductive state, time of day, and weather.

When the received level of noise exceeds some behavioral reaction threshold, it is possible that some cetaceans could exhibit disturbance reactions. The levels, frequencies and types of noise that elicit a response vary among and within species, individuals, locations, and seasons. Behavioral changes may be subtle alterations in surface-respiration-dive cycles, changes in activity or aerial displays, movement away from the sound source, or complete avoidance of the area. The reaction threshold and degree of response are related to the activity of the animal at the time of the disturbance. Whales engaged in active behaviors such as feeding, socializing, or mating are less likely than resting animals to show overt behavioral reactions. However, they may do so if the received noise level is high or the source of disturbance is directly threatening.

Some researchers have noted that behavioral reactions do not occur throughout the entire zone ensonified by industrial activity. In most cases that have been studied, including work on bowhead, gray, and beluga whales, the actual radius of effect is smaller than the radius of detectability (reviewed in Richardson and Malme, 1993; Richardson *et al.,* 1995b; Nowacek *et al.,* 2007; Southall *et al.,* 2007).

Effects of Construction, Drilling, and Production Activity—Spring migration of bowheads and belugas through the western and central Beaufort Sea occurs from April to June. Their spring migration corridors are far north of the barrier islands and of the Northstar project area. Whales, including bowhead, beluga, and gray, will not be within the Northstar project area during winter or spring. In addition, industrial sounds from Northstar are unlikely to be detectable far enough offshore to be heard by spring-migrating whales. In rare cases where these sounds might be audible to cetaceans in spring, the received levels would be weak and unlikely to elicit behavioral reactions. Consequently, noise from construction and operational activities at Northstar during the ice-covered season would have minimal, if any, effect on whales.

During the open-water season, sound propagation from sources on the island is reduced because of poor coupling of sound through the gravel island into the shallow waters. In the absence of boats, underwater sounds from Northstar Island during construction, drilling, and production reached background values 1.2–2.5 mi (2–4 km) away in quiet conditions (Blackwell and Greene, 2006). However, when Northstar-related vessels were present, levels were higher and faint vessel sound was often still evident 12.4–18.6 mi (20–30 km) away.

Information about the reactions of cetaceans to construction or heavy equipment activity on artificial (or natural) islands is limited (Richardson *et al.,* 1995b). During the construction of artificial islands and other oil-industry facilities in the Canadian Beaufort Sea during late summers of 1980–1984, bowheads were at times observed as close as 0.5 mi (0.8 km) from the construction sites (Richardson *et al.,* 1985, 1990). Richardson *et al.* (1990) showed that, at least in summer, bowheads generally tolerated playbacks of low-frequency construction and dredging noise at received broadband levels up to about 115 dB re 1 μPa. At received levels higher than about 115 dB, some avoidance reactions were observed. Bowheads apparently reacted in only a limited and localized way (if at all) to construction of Seal Island, the precursor of Northstar (Hickie and Davis, 1983).

There are no specific data on reactions of bowhead or gray whales to noise from drilling on an artificial island. However, playback studies have shown that both species begin to display overt behavioral responses to various low-frequency industrial sounds when received levels exceed 110–120 dB re 1 μPa (Malme *et al.,* 1984; Richardson *et al.,* 1990, 1995a, 1995b). The overall received level of drilling sound from Northstar Island generally diminished to 115 dB within 0.62 mi (1 km; Blackwell *et al.,* 2004b). Therefore, any reactions by bowhead or gray whales to drilling at Northstar were expected to be highly localized, involving few whales.

Prior to construction of Northstar, it was expected (based on early data mentioned earlier) that some bowheads would avoid areas where noise levels exceeded 115 dB re 1 μPa (Richardson *et al.,* 1990). On their summer range in the Beaufort Sea, bowhead whales were observed reacting to drillship noises within 2.5–5 mi (4–8 km) of the drillship at received levels 20 dB above ambient (Richardson *et al.,* 1990). It was expected that, during most autumn migration seasons, few bowheads would come close enough to shore to receive sound levels that high from Northstar. Thus disturbance effects from continuous construction and operational noise were expected to be limited to the closest whales and the times with highest sound emissions.

In 2000–2004, bowhead whales were monitored acoustically to determine the number of whales that might have been exposed to Northstar-related sounds. Data from 2001–2004 were useable for this purpose. The results showed that, during late summer and early autumn of 2001, a small number of bowhead whales in the southern part of the migration corridor (closest to Northstar) were apparently affected by vessel or Northstar operations. At these times, most ''Northstar sound'' was from maneuvering vessels, not the island itself. The distribution of calling whales was analyzed, and the results indicated that the apparent southern (proximal) edge of the call distribution was significantly associated with the level of industrial sound output each year, with the southern edge of the call distribution varying by 0.47 mi to 1.46 mi (0.76 km to 2.35 km; depending on year) farther offshore when underwater sound levels from Northstar and associated vessels were above average (Richardson *et al.,* 2008a). It is possible that the apparent deflection effect was, at least in part, attributable to a change in calling behavior rather than actual deflection. In either case, there was a change in the behavior of some bowhead whales.

Nowacek *et al.* (2004) used controlled exposures to demonstrate behavioral reactions of North Atlantic right whales (a species closely related to the bowhead whale) to various non-pulse sounds. Playback stimuli included ship noise, social sounds of conspecifics, and a complex, 18-min ''alert'' sound consisting of repetitions of three different artificial signals. Ten whales were tagged with calibrated instruments that measured received sound characteristics and concurrent animal movements in three dimensions. Five out of six exposed whales reacted strongly to alert signals at measured received levels between 130 and 150 dB (*i.e.,* ceased foraging and swam rapidly to the surface). Two of these individuals were not exposed to ship noise, and the other four were exposed to both stimuli. These whales reacted mildly to conspecific signals. Seven whales, including the four exposed to the alert stimulus, had no measurable response to either ship sounds or actual vessel noise.

There are no data on the reactions of gray whales to production activities similar to those in operation at Northstar. Oil production platforms of a very different type have been in place off California for many years. Gray whales regularly migrate through that area (Brownell, 1971), but no detailed data on distances of closest approach or possible noise disturbance have been published. Oil industry personnel have reported seeing whales near platforms, and that the animals approach more closely during low-noise periods (Gales, 1982; McCarty, 1982). Playbacks of recorded production platform noise indicate that gray whales react if received levels exceed approximately 123 dB re 1 μPa—similar to the levels of drilling noise that elicit avoidance (Malme *et al.,* 1984).

A typical migrating gray whale tolerates steady, low-frequency industrial sounds at received levels up to about 120 dB re 1 μPa (Malme *et al.,* 1984). Gray whales may tolerate higher-level sounds if the sound source is offset to the side of the migration path (Tyack and Clark, 1998). Also, gray whales generally tolerate repeated low-frequency seismic pulses at received levels up to about 163–170 dB re 1 μPa measured on an (approximate) rms basis. Above those levels, avoidance is common. Because the reaction thresholds to both steady and pulsed sounds are slightly higher than corresponding values for bowheads, reaction distances for gray whales would be slightly less than those for bowheads.

In the Canadian Beaufort Sea, beluga whales were seen within several feet of an artificial island. During the island's construction, belugas were displaced from the immediate vicinity of the island but not from the general area (Fraker, 1977a). Belugas in the Mackenzie River estuary showed less response to a stationary dredge than to moving tug/barge traffic. They approached as close as 1,312 ft (400 m) from stationary dredges. Underwater sounds from Northstar Island are weaker than those from the dredge. In addition, belugas occur only infrequently in nearshore waters in the Prudhoe Bay region. They also have relatively poor hearing sensitivity at the low frequencies of most construction noises. Therefore, effects of construction and related sounds on belugas would be expected to be minimal.

Responses of beluga whales to drilling operations are described in Richardson *et al.* (1995a) and summarized here. In the Mackenzie Estuary during summer, belugas have been seen regularly within 328 to 492 ft (100 to 150 m) of artificial islands (Fraker 1977a,b; Fraker and Fraker, 1979). However, in the Northstar area, belugas are present only during late summer and autumn, and almost all of them are migrating through offshore waters far seaward of Northstar. Only a very small proportion of the population enters nearshore waters. In spring, migrating belugas showed no overt reactions to recorded drilling noise (<350 Hz) until within 656 to 1,312 ft (200 to 400 m) of the source, even though the sounds were measurable up to 3.1 mi away (5 km; Richardson *et al.,* 1991). During another drilling noise playback study, overt reactions by belugas within 164 to 984 ft (50 to 300 m) involved increased swimming speed or reversal of direction of travel (Stewart *et al.,* 1983). The short reaction distances are probably partly a consequence of the poor hearing sensitivity of belugas at low frequencies (Richardson *et al.,* 1995b). In general, very few belugas are expected to approach Northstar Island, and any such occurrences would be restricted to the late summer/autumn period.

There are no specific data on the reactions of beluga whales to production operations similar to those at Northstar. Personnel from production platforms in Cook Inlet, Alaska, report that belugas are seen within 30 ft (9 m) of some rigs, and that steady noise is non-disturbing to belugas (Gales, 1982; McCarty, 1982). Beluga whales are regularly observed near the Port of Anchorage and the extensive dredging/maintenance activities that operate there (NMFS, 2003). Pilot whales, killer whales, and unidentified dolphins were also reported near Cook Inlet platforms. In that area, flare booms might attract belugas, possibly because the flares attract salmon in that area. Attraction of belugas to prey concentrations is not likely to occur at Northstar because belugas are predominantly migrating rather than feeding when in that area and because only a very small proportion of the beluga population occurs in nearshore waters. Overall, effects of routine production activities on belugas are expected to be minimal.

Effects of Aircraft Activity—Helicopters are the only aircraft associated with Northstar drilling and oil production operations for crew transfer and supply and support. Helicopter traffic occurs during late spring/summer and fall/early winter when travel by ice roads, hovercraft, or vessels is not possible. Twin Otters are used for routine pipeline inspections.

Potential effects to cetaceans from aircraft activity could involve both acoustic and non-acoustic effects. It is uncertain if the animals react to the sound of the aircraft or to its physical presence flying overhead. Low passes by aircraft over a cetacean, including a bowhead, gray, or beluga whale, can result in short-term responses or no discernible reaction. Responses can include sudden dives, breaching, churning the water with the flippers and/or flukes, or rapidly swimming away from the aircraft track (reviewed in Richardson *et al.,* 1995b; updated review in Luksenburg and Parsons, 2009). These studies have found that various factors affect cetacean responses to aircraft noise. Some of these factors include species, behavioral state at the time of the exposure, and altitude and lateral distance of the aircraft to the animal. For example, Wursig *et al.* (1998) found that resting individuals appeared to be more sensitive to the disturbance.

Patenaude *et al.* (2002) recorded reactions of bowhead and beluga whales to a Bell 212 helicopter and Twin Otter fixed-wing aircraft during four spring seasons (1989–1991 and 1994) in the western Beaufort Sea. Responses were more common to the helicopter than to the fixed-wing aircraft. The authors noted responses by 38% of belugas (n = 40) and 14% of bowheads (n = 63) to the helicopter, whereas only 3.2% of belugas (n = 760) and 2.2% of bowheads (n = 507) reacted to the Twin Otter. Common responses to the helicopter included immediate dives, changes in heading, changes in behavioral state, and apparent displacement for belugas and abrupt dives and breaching for bowheads (Patenaude *et al.,* 2002). Similar reactions were observed by the authors from the fixed-wing aircraft: Immediate dives with a tail thrash, turns or changes in heading, and twists to look upwards for belugas and unusually short surfacing for bowheads. For both species, the authors noted that responses were seen more often when the helicopter was below 492 ft (150 m) altitude and at a lateral distance of less than 820 ft (250 m) and when the Twin Otter was below 597 ft (182 m) altitude and at a lateral distance of less than 820 ft (250 m).

During their study, Patenaude *et al.* (2002) observed one bowhead whale cow-calf pair during four passes totaling 2.8 hours of the helicopter and two pairs during Twin Otter overflights. All of the helicopter passes were at altitudes of 49–98 ft (15–30 m). The mother dove both times she was at the surface, and the calf dove once out of the four times it was at the surface. For the cow-calf pair sightings during Twin Otter overflights, the authors did not note any behaviors specific to those pairs. Rather, the reactions of the cow-calf pairs were lumped with the reactions of other groups that did not consist of calves.

Richardson *et al.* (1995b) and Moore and Clarke (2002) reviewed a few studies that observed responses of gray whales to aircraft. Cow-calf pairs were quite sensitive to a turboprop survey flown at 1,000 ft (305 m) altitude on the Alaskan summering grounds. In that survey, adults were seen swimming over the calf, or the calf swam under the adult (Ljungblad *et al.,* 1983, cited in Richardson *et al.,* 1995b and Moore and Clarke, 2002). However, when the same aircraft circled for more than 10 minutes at 1,050 ft (320 m) altitude over a group of mating gray whales, no reactions were observed (Ljungblad *et al.,* 1987, cited in Moore and Clarke, 2002). Malme *et al.* (1984, cited in Richardson *et al.,* 1995b and Moore and Clarke, 2002) conducted playback experiments on migrating gray whales. They exposed the animals to underwater noise recorded from a Bell 212 helicopter (estimated altitude = 328 ft [100 m]), at an average of three simulated passes per minute. The authors observed that whales changed their swimming course and sometimes slowed down in response to the playback sound but proceeded to migrate past the transducer. Migrating gray whales did not react overtly to a Bell 212 helicopter at greater than 1,394 ft (425 m) altitude, occasionally reacted when the helicopter was at 1,000–1,198 ft (305–365 m), and usually reacted when it was below 825 ft (250 m; Southwest Research Associates, 1988, cited in Richardson *et al.,* 1995b and Moore and Clarke, 2002). Reactions noted in that study included abrupt turns or dives or both. Green *et al.* (1992, cited in Richardson *et al.,* 1995b) observed that migrating gray whales rarely exhibited noticeable reactions to a straight-line overflight by a Twin Otter at 197 ft (60 m) altitude.

There is little likelihood of project-related helicopter and aircraft traffic over bowheads during their westward fall migration through the Beaufort Sea. Helicopter and aircraft traffic is between the shore and Northstar Island. Most bowhead whales migrate west in waters farther north than the island. Helicopters maintain an altitude of 1,000 ft (305 m) above sea level while traveling over water to and from Northstar whenever weather conditions allow. It is unlikely that there will be any need for helicopters or aircraft to circle or hover over the open water other than when landing or taking off. Gray whales are uncommon in the area, and there is little likelihood that any will be overflown by a helicopter or aircraft. The planned flight altitude will minimize any disturbance that might occur if a gray whale is encountered. Likewise, there is little likelihood of helicopter disturbance to belugas.

Because of the predominantly offshore migration route of belugas, very few (if any) will be overflown during flights over nearshore waters. Any overflights are most likely to be at an altitude of 1,000 ft (305 m) or more, weather permitting. This is greater than the altitude at which belugas and bowheads typically react to aircraft (Patenaude *et al.,* 2002). Therefore, few belugas or bowheads are expected to react to aircraft overflights near the Northstar facility. Additionally, reactions are expected to be brief.

Effects of Vessel Activity—Reactions of cetaceans to vessels often include changes in general activity (*e.g.,* from resting or feeding to active avoidance), changes in surfacing-respiration-dive cycles, and changes in speed and direction of movement. As with aircraft, responses to vessel approaches tend to be reduced if the animals are actively involved in a specific activity such as feeding or socializing (reviewed in Richardson *et al.,* 1995b). Past experiences of the animals with vessels are important in determining the degree and type of response elicited from a whale-vessel encounter.

Whales react most noticeably to erratically moving vessels with varying engine speeds and gear changes and to vessels in active pursuit. Avoidance reactions by bowheads sometimes begin as subtle alterations in whale activity, speed and heading as far as 2.5 mi (4 km) from the vessel. Consequently, the closest point of approach is farther from the vessel than if the cetacean had not altered course. Bowheads sometimes begin to swim actively away from approaching vessels when they come within 1.2–2.5 mi (2–4 km). If the vessel approaches to within several hundred meters, the response becomes more noticeable, and whales sometimes change direction to swim perpendicularly away from the vessel path (Richardson *et al.,* 1985, 1995b; Richardson and Malme, 1993).

North Atlantic right whales (a species closely related to the bowhead whale) also display variable responses to boats. There may be an initial orientation away from a boat, followed by a lack of observable reaction (Atkins and Swartz, 1989). A slowly moving boat can approach a right whale, but an abrupt change in course or engine speed usually elicits a reaction (Goodyear, 1989; Mayo and Marx, 1990; Gaskin, 1991). When approached by a boat, right whale mothers will interpose themselves between the vessel and calf and will maintain a low profile (Richardson *et al.,* 1995b). In a long-term study of baleen whale reactions to boats, while other baleen whale species appeared to habituate to boat presence over the 25-year period, right whales continued to show either uninterested or negative reactions to boats with no change over time (Watkins, 1986).

Beluga whales are generally quite responsive to vessels. Belugas in Lancaster Sound in the Canadian Arctic showed dramatic reactions in response to icebreaking ships, with received levels of sound ranging from 101 dB to 136 dB re 1 μPa in the 20 to 1,000-Hz band at a depth of 66 ft (20 m; Finley *et al.,* 1990). Responses included emitting distinctive pulsive calls that were suggestive of excitement or alarm and rapid movement in what seemed to be a flight response. Reactions occurred out to 50 mi (80 km) from the ship. Another study found belugas use higher-frequency calls, a greater redundancy in their calls (more calls emitted in a series), and a lower calling rate in the presence of vessels (Lesage *et al.,* 1999). The level of response of belugas to vessels is thought to be partly a function of habituation.

During the drilling and oil production phase of the Northstar development, most vessel traffic involves slow-moving tugs and barges and smaller faster-moving vessels providing local transport of equipment, supplies, and personnel. Much of this traffic will occur during August and early September before many whales are in the area. Some vessel traffic during the broken ice periods in the spring and fall may also occur. Alternatively, small hovercraft may be used during the spring and fall when the ice is too thin to allow safe passage by large vehicles over the ice road.

Whale reactions to slow-moving vessels are less dramatic than their reactions to faster and/or erratic vessel movements. Bowhead, gray, and beluga whales often tolerate the approach of slow-moving vessels within several hundred meters. This is especially so when the vessel is not directed toward the whale and when there are no sudden changes in direction or engine speed (Wartzok *et al.,* 1989; Richardson *et al.,* 1995b; Heide-Jorgensen *et al.,* 2003).

Most vessel traffic associated with Northstar will be inshore of the bowhead and beluga migration corridor and/or prior to the migration season of bowhead and beluga whales. Underwater sounds from hovercraft are generally lower than for standard vessels since the sound is generated in air, rather than underwater. If vessels or hovercraft do approach whales, a small number of individuals may show short-term avoidance reactions.

The highest levels of underwater sound produced by routine Northstar operations are generally associated with Northstar-related vessel operations. These vessel operations around Northstar sometimes result in sound levels high enough that a small number of the bowheads in the southern part of the migration corridor appear to be deflected slightly offshore. To the extent that offshore deflection occurs as a result of Northstar, it is mainly attributable to Northstar-related vessel operations. As previously described, this deflection is expected to involve few whales and generally small deflections.

(3) Hearing Impairment and Other Physiological Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds. Non-auditory physiological effects might also occur in marine mammals exposed to strong underwater sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. It is possible that some marine mammal species (*i.e.,* beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong sounds, particularly at higher frequencies. There are no beaked whale species found in the proposed project area. Cetaceans are not anticipated to experience non-auditory physiological effects as a result of operation of the Northstar facility, as none of the activities associated with the facility will generate sounds loud enough to cause such effects.

Temporary Threshold Shift (TTS)—TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises, and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound.

Human non-impulsive noise exposure guidelines are based on exposures of equal energy (the same sound exposure level [SEL]) producing equal amounts of hearing impairment regardless of how the sound energy is distributed in time (NIOSH, 1998). Until recently, previous marine mammal TTS studies have also generally supported this equal energy relationship (Southall *et al.,* 2007). Three newer studies, two by Mooney *et al.* (2009a, b) on a single bottlenose dolphin either exposed to playbacks of U.S. Navy mid-frequency active sonar or octave-band noise (4–8 kHz) and one by Kastak *et al.* (2007) on a single California sea lion exposed to airborne octave-band noise (centered at 2.5 kHz), concluded that for all noise exposure situations, the equal energy relationship may not be the best indicator to predict TTS onset levels. Generally, with sound exposures of equal energy, those that were quieter (lower sound pressure level [SPL]) with longer duration were found to induce TTS onset more than those of louder (higher SPL) and shorter duration. Given the available data, the received level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB re 1 μPa · 2. s (*i.e.,* 186 dB SEL) in order to produce brief, mild TTS. NMFS considers TTS to be a form of Level B harassment, which temporarily causes a shift in an animal's hearing, and the animal is able to recover. Data on TTS from continuous sound (such as that produced by many of BP's Northstar activities) are limited, so available data from seismic activities are used as a proxy. Exposure to several strong seismic pulses that each have received levels near 175–180 dB SEL might result in slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy. Given that the SPL is approximately 10–15 dB higher than the SEL value for the same pulse, an odontocete would need to be exposed to a sound level of 190 dB re 1 μPa (rms) in order to incur TTS.

TTS was measured in a single, captive bottlenose dolphin after exposure to a continuous tone with maximum SPLs at frequencies ranging from 4 to 11 kHz that were gradually increased in intensity to 179 dB re 1 μPa and in duration to 55 minutes (Nachtigall *et al.,* 2003). No threshold shifts were measured at SPLs of 165 or 171 dB re 1 μPa. However, at 179 dB re 1 μPa, TTSs greater than 10 dB were measured during different trials with exposures ranging from 47 to 54 minutes. Hearing sensitivity apparently recovered within 45 minutes after noise exposure.

Schlundt *et al.* (2000) measure masked TTS (*i.e.,* band-limited white noise, masking noise, was introduced into the testing environment to keep thresholds consistent despite variations in ambient noise levels) in five bottlenose dolphins and two beluga whales during eight experiments conducted over 2.3 years. The test subjects were exposed to 1-s pure tones at frequencies of 0.4, 3, 10, 20, and 75 kHz. Over the course of the eight experiments, Schlundt *et al.* (2000) conducted a total of 195 masked TTS sessions, and 11 of those sessions produced masked TTSs. The authors found that the levels needed to induce a 6 dB or larger masked TTS were generally between 192 and 201 dB re 1 μPa. No subjects exhibited shifts at levels up to 193 dB re 1 μPa for tones played at 0.4 kHz (Schlundt *et al.,* 2000). The authors found that at the conclusion of each experiment, all thresholds were within 3 dB of baseline values. Additionally, they did not note any permanent shifts in hearing thresholds (Schlundt *et al.,* 2000).

For baleen whales, there are no data, direct or indirect, on levels or properties of sound that are required to induce TTS. The frequencies to which baleen whales are most sensitive are lower than those to which odontocetes are most sensitive, and natural background noise levels at those low frequencies tend to be higher. Marine mammals can hear sounds at varying frequency levels. However, sounds that are produced in the frequency range at which an animal hears the best do not need to be as loud as sounds in less functional frequencies to be detected by the animal. As a result, auditory thresholds of baleen whales within their frequency band of best hearing are believed to be higher (less sensitive) than are those of odontocetes at their best frequencies (Clark and Ellison, 2004). Therefore, for a sound to be audible, baleen whales require sounds to be louder (*i.e.,* higher dB levels) than odontocetes in the frequency ranges at which each group hears the best. Based on this information, it is suspected that received levels causing TTS onset may also be higher in baleen whales. Since current NMFS practice assumes the same thresholds for the onset of hearing impairment in both odontocetes and mysticetes, NMFS' onset of TTS threshold is likely conservative for mysticetes.

NMFS (1995, 2000) concluded that cetaceans should not be exposed to pulsed underwater noise at received levels exceeding 180 dB re 1 μPa (rms). The established 180-dB re 1 μPa (rms) criterion is not considered to be the level above which TTS might occur in cetaceans. Rather, it is the received level above which, in the view of a panel of bioacoustics specialists convened by NMFS before TTS measurements for marine mammals started to become available, one could not be certain that there would be no injurious effects, auditory or otherwise, to cetaceans. Levels of underwater sound from production and drilling activities that occur continuously over extended periods at Northstar are not very high (Blackwell and Greene, 2006). For example, received levels of prolonged drilling sounds are expected to diminish below 140 dB re 1 μPa at a distance of about 131 ft (40 m) from the center of activity. Sound levels during production activities other than drilling usually would diminish below 140 dB re 1 μPa at a closer distance. The 140 dB re 1 μPa radius for drilling noise is within the island and drilling sounds are attenuated to levels below 140 dB re 1 μPa in the water near Northstar. Additionally, cetaceans are not commonly found in the area during the ice-covered season. Based on this information and the available data, TTS of cetaceans is not expected from the operations at Northstar.

Permanent Threshold Shift (PTS)—When PTS occurs, there is physical damage to the sound receptors in the ear. In some cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges.

There is no specific evidence that exposure to underwater industrial sounds can cause PTS in any marine mammal (see Southall *et al.,* 2007). However, given the possibility that marine mammals might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to industrial activities might incur PTS. Richardson *et al.* (1995b) hypothesized that PTS caused by prolonged exposure to continuous anthropogenic sound is unlikely to occur in marine mammals, at least for sounds with source levels up to approximately 200 dB re 1 μPa at 1 m (rms). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage in terrestrial mammals. Relationships between TTS and PTS thresholds have not been studied in marine mammals but are assumed to be similar to those in humans and other terrestrial mammals. PTS might occur at a received sound level at least several decibels above that inducing mild TTS.

It is highly unlikely that cetaceans could receive sounds strong enough (and over a sufficient duration) to cause PTS (or even TTS) during the proposed operation of the Northstar facility. Source levels for much of the equipment used at Northstar do not reach the threshold of 180 dB (rms) currently used for cetaceans. Based on this conclusion, it is highly unlikely that any type of hearing impairment, temporary or permanent, would occur as a result of BP's proposed activities. Additionally, Southall *et al.* (2007) proposed that the thresholds for injury of marine mammals exposed to ''discrete'' noise events (either single or multiple exposures over a 24-hr period) are higher than the 180-dB re 1 μPa (rms) in-water threshold currently used by NMFS. Table 1 in this document summarizes the SPL and SEL levels thought to cause auditory injury to cetaceans. For more information, please refer to Southall *et al.* (2007).

TABLE 1—PROPOSED INJURY CRITERIA FOR LOW- AND MID-FREQUENCY CETACEANS EXPOSED TO ''DISCRETE'' NOISE EVENTS (EITHER SINGLE PULSES, MULTIPLE PULSES, OR NON-PULSES WITHIN A 24-HR PERIOD; SOUTHALL ET AL., 2007)

	Single pulses	Multiple pulses	Non pulses
Low-frequency cetaceans			
Sound pressure level	230 dB re 1 μPa (peak) (flat)	230 dB re 1 μPa (peak) (flat)	230 dB re 1 μPa (peak) (flat)
Sound exposure level	198 dB re 1 μPa^2-s (M_{lf})	198 dB re 1 μPa^2-s (M_{lf})	215 dB re 1 μPa^2-s (M_{lf})
Mid-frequency cetaceans			
Sound pressure level	230 dB re 1 μPa (peak) (flat)	230 dB re 1 μPa (peak) (flat)	230 dB re 1 μPa (peak) (flat)
Sound exposure level	198 dB re 1 μPa^2-s (M_{lf})	198 dB re 1 μPa^2-s (M_{lf})	215 dB re 1 μPa^2-s (M_{lf})

Potential Effects of Sound on Pinnipeds

(1) Masking

As stated previously in this document, masking is the obscuring of sounds of interest by other sounds, often at similar frequencies. There are fewer data available regarding the potential impacts of masking on pinnipeds than on cetaceans. Cummings *et al.* (1984) subjected breeding ringed seals to recordings of industrial sounds. The authors did not document any impacts to ringed seal vocalizations as a result of exposure to the recordings.

During the ice-covered season, only ringed seals and small numbers of bearded seals are found near Northstar. Therefore, there would be no masking effects on spotted seals, as they do not occur in the area during that time. All three pinniped species can be found in and around Northstar during the summer open-water season. As stated previously in this document, sounds from oil production and any drilling activities are not expected to be detectable beyond several kilometers from the source; however, sounds from vessels were detectable to distances as far as approximately 18.6 mi (30 km) from Northstar. There is the potential for vessels to cause some degree of masking.

It is expected that masking of calls or other natural sounds would not extend beyond the maximum distance where the construction or operational sounds are detectable, and, at that distance, only the weakest sounds would be masked. The maximum distances for masking will vary greatly depending on ambient noise and sound propagation conditions but will typically be about 1.2–3.1 mi (2–5 km) in air and 1.9–6.2 mi (3–10 km) underwater. Also, some types of Northstar sounds (especially the stronger ones) vary over time, and, at quieter times, masking would be absent or limited to closer distances. While some masking is possible, it is usually more prominent for lower frequencies. Although the functional hearing range for pinnipeds is estimated to occur between approximately 75 Hz and 75 kHz, the range with the greatest sensitivity is estimated to occur between approximately 700 Hz and 20 kHz. Therefore, BP's proposed activities are expected to have minor masking effects on pinnipeds.

(2) Behavioral Disturbance

As stated earlier in this document, disturbance can induce a variety of effects, such as subtle changes in behavior, more conspicuous dramatic changes in activities, and displacement. When the received level of noise exceeds some behavioral reaction threshold, it is possible that some pinnipeds could exhibit disturbance reactions. The levels, frequencies and types of noise that elicit a response vary among and within species, individuals, locations, and seasons. Behavioral changes may be an upright posture for hauled out seals, movement away from the sound source, or complete avoidance of the area. The reaction threshold and degree of response are related to the activity of the animal at the time of the disturbance. Some researchers have noted that behavioral reactions do not occur throughout the entire zone ensonified by industrial activity. In most cases that have been studied, including recent work on ringed seals, the actual radius of effect is smaller than the radius of detectability (reviewed in Richardson *et al.,* 1995b; Moulton *et al.,* 2003a, 2005; Blackwell *et al.,* 2004a).

Effects of Construction, Drilling, and Production Activity—Systematic aerial surveys to assess ringed seal responses to the construction of Seal Island were done both for Shell Oil (Green and Johnson, 1983) and for the Minerals Management Service, now the Bureau of Ocean Energy Management, Regulation and Enforcement (Frost and Burns, 1989; Kelly *et al.,* 1988). Green and Johnson (1983) found that some seals within several kilometers of Seal Island were apparently displaced by construction of the island during the winter of 1981–82. Similarly, Frost and Lowry (1988) found lower densities of seals within 2.3 mi (3.7 km) of artificial islands than in a zone 2.3–4.6 mi (3.7–7.4 km) away when exploration activity was high. During years with construction or drilling activities, there was a 38–40% reduction in seal densities near the islands (Frost and Lowry, 1988). However, these early analyses did not account for non-industrial factors known to influence basking activity of seals (Moulton *et al.,* 2002, 2005). Also, the numbers of sightings were small relative to the variation in the data.

Kelly *et al.* (1988) used trained dogs to study the use by seals of breathing holes and lairs in relation to exposure to industrial activities. They reported that the proportion of structures abandoned within 5 mi (8 km) of Seal Island was similar to that within 492 ft (150 m) of on-ice seismic lines. There were no differences in abandonment rate within or beyond 492 ft (150 m) from Seal Island. Kelly *et al.* (1988) indicated that the data were not adequate to evaluate at what distances from the island abandonment of structures began to decrease. In a final analysis of those data, Frost and Burns (1989) reported that the proportion of abandoned structures was significantly higher within 1.2 mi (2 km) of Seal Island than 1.2–6.2 mi (2–10 km) away. Complicating the interpretation is that dog-based searches were conducted where structures were expected to be found, rather than over the entire study area, and multiple searches over a given area were not conducted. Hammill and Smith (1990) found that dogs missed as many as 73% of the structures during the first search of an area. Frost and Burns (1989) also noted that the analyses of disturbance and abandonment as a result of Seal Island construction were complicated by other noise sources that were active at the same time. These included on-ice seismic exploration, excavation of structures by their investigations, and snow machine traffic. Frost and Burns (1989) suspected that, overall, there was no area-wide increase in abandonment of structures. Finally, it is unknown whether there are differences in detection rates by dogs for open versus abandoned structures or for areas of different structure density. This detection bias potentially confounds interpretation of the data.

Utilizing radio telemetry to examine the short-term behavioral responses of ringed seals to human activities, Kelly *et al.* (1988) found that some ringed seals temporarily departed from lairs when various sources of noise were within 97–3,000 m (0.06–1.9 mi) of an occupied structure. Radio-tagged ringed seals did return to re-occupy those lairs. However, the authors did not note the amount of time it took the ringed seals to re-occupy the lairs. The durations of haul-out bouts during periods with and without disturbance were not significantly different. Also, the time ringed seals spent in the water after disturbance did not differ significantly from that during periods of no disturbance (Kelly *et al.,* 1988). Kelly *et al.* (1988) observed that rates of ringed seal abandonment of lairs were three times higher in areas with noise disturbance than in areas without noise disturbance. However, the abandonment rates in areas with noise disturbance were similar to rates of disturbance in areas of frequent predator activity (*e.g.,* polar bears trying to break into lairs).

Moulton *et al.* (2003a, 2005) conducted intensive and replicated aerial surveys during the springs of 1997–1999 (prior to the construction of Northstar) and 2000–2002 (with Northstar activities) to study the distribution and abundance of ringed seals within an approximately 1,598 mi^2 (4,140 km^2) area around the Northstar Development. The main objective was to determine whether, and to what extent, oil development affected the local distribution and abundance of ringed seals. The 1997–1999 surveys were conducted coincidentally with aerial surveys over a larger area of the central Beaufort Sea (Frost *et al.,* 2004). Moulton *et al.* (2003a, 2005) determined that the raw density of ringed seals over their study area ranged from 0.39 to 0.83 seals/km^2, while Frost *et al.* (2004) obtained raw densities of 0.64 to 0.87 seals/km^2 in a similar area at about the same times. There was no evidence that construction, drilling, and production activities at Northstar in 2000–2002 significantly affected local ringed seal distribution and abundance relative to the baseline years (1997–1999). Additionally, after natural variables that affect haul-out behavior were considered (Moulton *et al.,* 2003a, 2005), there was no significant evidence of reduced seal densities close to Northstar as compared with farther away during the springs of 2000, 2001, and 2002. The survey methods and associated analyses were shown to have high statistical power to detect such changes if they occurred. Environmental factors such as date, water depth, degree of ice deformation, presence of meltwater, and percent cloud cover had more conspicuous and statistically-significant effects on seal sighting rates than did any human-related factors (Moulton *et al.,* 2003a, 2005).

To complement the aerial survey program on a finer scale, specially-trained dogs were used to find seal structures and to monitor the fate of structures in relation to distance from industrial activities (Williams *et al.,* 2006c). In late 2000, surveys began before construction of ice roads but concurrent with drilling and other island activities. In the winter of 2000–2001, a total of 181 structures were located, of which 118 (65%) were actively used by late May 2001. However, there was no relationship between structure survival or the proportion of structures abandoned and distance to Northstar-related activities. The most important factors predicting structure survival were time of year when found and ice deformation. The covariate distance to the ice road improved the fit of the model, but the relationship indicated that structure survival was lower farther away from the ice road, contrary to expectation. However, new structures found after the ice road was constructed were, on average, farther from the ice road than were structures found before construction (though this was marginally statistically significant). This may have been related to the active flooding of the ice road, which effectively removed some of the ice as potential ringed seal habitat.

Blackwell *et al.* (2004a) investigated the effects of noise from pipe-driving and other construction activities on Northstar to ringed seals in June and July 2000, during and just after break-up of the landfast ice. None of the ringed seals seen during monitoring showed any strong reactions to the pipe-driving or other construction activities on Northstar. Eleven of the seals (48%) appeared either indifferent or curious when exposed to construction or pipe-driving sounds. One seal approached within 9.8 ft (3 m) of the island's edge during pipe-driving and others swam in the 9.8–49.2 ft (3–15 m) moat around the island. Seals in the moat may have been exposed to sound levels up to 153–160 dB re 1 μPa (rms) when they dove close to the bottom.

Consistent with Blackwell *et al.* (2004a), seals are often very tolerant of exposure to other types of pulsed sounds. For example, seals tolerate high received levels of sounds from airgun arrays (Arnold, 1996; Harris *et al.,* 2001; Moulton and Lawson, 2002). Monitoring work in the Alaskan Beaufort Sea during 1996–2001 provided considerable information regarding the behavior of seals exposed to seismic pulses (Harris *et al.,* 2001; Moulton and Lawson, 2002). These seismic projects usually involved arrays of 6 to 16 airguns with total volumes of 560 to 1,500 in^3 (0.01 to 0.03 m^3). The combined results suggest that some seals avoid the immediate area around seismic vessels. In most survey years, ringed seal sightings tended to be farther away from the seismic vessel when the airguns were operating than when they were not (Moulton and Lawson, 2002). However, these avoidance movements were relatively small, on the order of 328 ft (100 m) to a few hundreds of meters, and many seals remained within 328–656 ft (100–200 m) of the trackline as the operating airgun array passed by. Seal sighting rates at the water surface were lower during airgun array operations than during no-airgun periods in each survey year except 1997. Similarly, seals are often very tolerant of pulsed sounds from seal-scaring devices (Mate and Harvey, 1987; Jefferson and Curry, 1994; Richardson *et al.,* 1995b). Therefore, the short distance for avoidance reactions to impulsive pile driving sounds from the pile driving operations on Northstar is consistent with these other data.

Effects of Aircraft Activity—Helicopters are the only aircraft associated with Northstar oil production activities. Helicopter traffic occurs primarily during late spring and autumn when travel by ice road, hovercraft, or vessel is not possible.

Potential effects to pinnipeds from aircraft activity could involve both acoustic and non-acoustic effects. It is uncertain if the seals react to the sound of the helicopter or to its physical presence flying overhead. Typical reactions of hauled out pinnipeds to aircraft that have been observed include looking up at the aircraft, moving on the ice or land, entering a breathing hole or crack in the ice, or entering the water. Ice seals hauled out on the ice have been observed diving into the water when approached by a low-flying aircraft or helicopter (Burns and Harbo, 1972, cited in Richardson *et al.,* 1995b; Burns and Frost, 1979, cited in Richardson *et al.,* 1995b). Richardson *et al.* (1995b) note that responses can vary based on differences in aircraft type, altitude, and flight pattern. Additionally, a study conducted by Born *et al.* (1999) found that wind chill was also a factor in level of response of ringed seals hauled out on ice, as well as time of day and relative wind direction.

Blackwell *et al.* (2004a) observed 12 ringed seals during low-altitude overflights of a Bell 212 helicopter at Northstar in June and July 2000 (9 observations took place concurrent with pipe-driving activities). One seal showed no reaction to the aircraft while the remaining 11 (92%) reacted, either by looking at the helicopter (n=10) or by departing from their basking site (n=1). Blackwell *et al.* (2004a) concluded that none of the reactions to helicopters were strong or long lasting, and that seals near Northstar in June and July 2000 probably had habituated to industrial sounds and visible activities that had occurred often during the preceding winter and spring. There have been few systematic studies of pinniped reactions to aircraft overflights, and most of the available data concern pinnipeds hauled out on land or ice rather than pinnipeds in the water (Richardson *et al.,* 1995b; Born *et al.,* 1999).

Born *et al.* (1999) determined that 49% of ringed seals escaped (*i.e.,* left the ice) as a response to a helicopter flying at 492 ft (150 m) altitude. Seals entered the water when the helicopter was 4,101 ft (1,250 m) away if the seal was in front of the helicopter and at 1,640 ft (500 m) away if the seal was to the side of the helicopter. The authors noted that more seals reacted to helicopters than to fixed-wing aircraft. The study concluded that the risk of scaring ringed seals by small-type helicopters could be substantially reduced if they do not approach closer than 4,921 ft (1,500 m).

Spotted seals hauled out on land in summer are unusually sensitive to aircraft overflights compared to other species. They often rush into the water when an aircraft flies by at altitudes up to 984–2,461 ft (300–750 m). They occasionally react to aircraft flying as high as 4,495 ft (1,370 m) and at lateral distances as far as 1.2 mi (2 km) or more (Frost and Lowry, 1990; Rugh *et al.,* 1997). However, no spotted seal haul-outs are located near Northstar.

Effects of Vessel Activity—Few authors have specifically described the responses of pinnipeds to boats, and most of the available information on reactions to boats concerns pinnipeds hauled out on land or ice. Ringed seals hauled out on ice pans often showed short-term escape reactions when a ship approached the animal within 0.16 to 0.31 mi (0.25 to 0.5 km; Brueggeman *et al.,* 1992). Jansen *et al.* (2006) reported that harbor seals approached by vessels within 328 ft (100 m) were 25 times more likely to enter the water than were seals approached at 1,640 ft (500 m). However, during the open water season in the Beaufort Sea, ringed and bearded seals are commonly observed close to vessels (Harris *et al.,* 2001; Moulton and Lawson, 2002).

In places where boat traffic is heavy, there have been cases where seals have habituated to vessel disturbance. In England, harbor and gray seals at specific haul-outs appear to have habituated to close approaches by tour boats (Bonner, 1982). Jansen *et al.* (2006) found that harbor seals in Disenchantment Bay, Alaska, increased in abundance during the summer as ship traffic also increased. In Maine, Lelli and Harris (2001) found that boat traffic was the best predictor of variability in harbor seal haulout behavior, followed by wave height and percent sunshine, utilizing multiple regressions. Lelli and Harris (2001) reported that increasing boat traffic reduced the number of seals counted on the haul-out. Suryan and Harvey (1999) reported that Pacific harbor seals commonly left the shore when powerboat operators approached to observe the seals. Those seals detected a powerboat at a mean distance of 866 ft (264 m), and seals left the haul-out site when boats approached to within 472 ft (144 m). Southall *et al.* (2007) report that pinnipeds exposed to sounds at approximately 110 to 120 dB re 20 μPa in-air tended to respond by leaving their haul-outs and seeking refuge in the water, while animals exposed to in-air sounds of approximately 60 to 70 dB re 20 μPa often did not respond at all.

(3) Hearing Impairment and Other Physiological Effects

Pinnipeds are able to hear both in-water and in-air sounds. However, they have significantly different hearing capabilities in the two media. Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds. Non-auditory physiological effects might also occur in marine mammals exposed to strong underwater sound. Possible types of non-auditory physiological effects or injuries that theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. Pinnipeds are not anticipated to experience non-auditory physiological effects as a result of operation of the Northstar facility, as none of the activities associated with the facility will generate sounds loud enough to cause such effects.

TTS—As stated earlier in this document, TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). For additional background about TTS, please refer to the discussion on impacts to cetaceans from sound found earlier in this section of the document.

As stated earlier in this document, the functional hearing range for pinnipeds in-air is 75 Hz to 30 kHz (Southall *et al.,* 2007). Richardson *et al.* (1995b) note that dominant tones in noise spectra from both helicopters and fixed-wing aircraft are generally below 500 Hz. Kastak and Schustermann (1995) state that the in-air hearing sensitivity is less than the in-water hearing sensitivity for pinnipeds. In-air hearing sensitivity deteriorates as frequency decreases below 2 kHz, and generally pinnipeds appear to be considerably less sensitive to airborne sounds below 10 kHz than humans. There is a dearth of information on the acoustic effects of helicopter overflights on pinniped hearing and communication (Richardson *et al.,* 1995b), and, to NMFS' knowledge, there has been no specific documentation of TTS in free-ranging pinnipeds exposed to helicopter operations during realistic field conditions.

In free-ranging pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. However, systematic TTS studies on captive pinnipeds have been conducted (Bowles *et al.,* 1999; Kastak *et al.,* 1999, 2005, 2007; Schusterman *et al.,* 2000; Finneran *et al.,* 2003; Southall *et al.,* 2007). Kastak *et al.* (1999) reported TTS of approximately 4–5 dB in three species of pinnipeds (harbor seal, California sea lion, and northern elephant seal) after underwater exposure for approximately 20 minutes to noise with frequencies ranging from 100–2,000 Hz at received levels 60–75 dB above hearing threshold. This approach allowed similar effective exposure conditions to each of the subjects, but resulted in variable absolute exposure values depending on subject and test frequency. Recovery to near baseline levels was reported within 24 hours of noise exposure (Kastak *et al.,* 1999). Kastak *et al.* (2005) followed up on their previous work using higher sensitivity levels and longer exposure times (up to 50 min) and corroborated their previous findings. The sound exposures necessary to cause slight threshold shifts were also determined for two California sea lions and a juvenile elephant seal exposed to underwater sound for a similar duration. The sound level necessary to cause TTS in pinnipeds depends on exposure duration, as in other mammals; with longer exposure, the level necessary to elicit TTS is reduced (Schusterman *et al.,* 2000; Kastak *et al.,* 2005, 2007). For very short exposures (*e.g.,* to a single sound pulse), the level necessary to cause TTS is very high (Finneran *et al.,* 2003). For pinnipeds exposed to in-air sounds, auditory fatigue has been measured in response to single pulses and to non-pulse noise (Southall *et al.,* 2007), although high exposure levels were required to induce TTS-onset (SEL: 129 dB re: 20 μPa^2·s; Bowles *et al.,* unpub. data).

NMFS (1995, 2000) concluded that pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding 190 dB re 1 μPa (rms). The established 190-dB re 1 μPa (rms) criterion is not considered to be the level above which TTS might occur in pinnipeds. Rather, it is the received level above which, in the view of a panel of bioacoustics specialists convened by NMFS before TTS measurements for marine mammals started to become available, one could not be certain that there would be no injurious effects, auditory or otherwise, to pinnipeds. Levels of underwater sound from production and drilling activities that occur continuously over extended periods at Northstar are not very high (Blackwell and Greene, 2006). For example, received levels of prolonged drilling sounds are expected to diminish below 140 dB re 1 μPa at a distance of about 131 ft (40 m) from the center of activity. Sound levels during other production activities aside from drilling usually would diminish below 140 dB re 1 μPa at a closer distance. The 140 dB re 1 μPa radius for drilling noise is within the island and drilling sounds are attenuated to levels below 140 dB re 1 μPa in the water near Northstar. Therefore, TTS is not expected from the operations at Northstar.

PTS—As stated earlier in this document, when PTS occurs, there is physical damage to the sound receptors in the ear. For additional background about PTS, please refer to the discussion with respect to impacts from sound on cetaceans found earlier in this section of the document.

It is highly unlikely that pinnipeds could receive sounds strong enough (and over a sufficient duration) to cause PTS (or even TTS) during the proposed operation of the Northstar facility. Source levels for much of the equipment used at Northstar do not reach the threshold of 190 dB currently used for pinnipeds. Based on this conclusion, it is highly unlikely that any type of hearing impairment, temporary or permanent, would occur as a result of BP's proposed activities. Additionally, Southall *et al.* (2007) proposed that the thresholds for injury of marine mammals exposed to ''discrete'' noise events (either single or multiple exposures over a 24-hr period) are higher than the 190-dB re 1 μPa (rms) in-water threshold currently used by NMFS. Table 2 in this document summarizes the SPL and SEL levels thought to cause auditory injury to pinnipeds both in-water and in-air. For more information, please refer to Southall *et al.* (2007).

TABLE 2—PROPOSED INJURY CRITERIA FOR PINNIPEDS EXPOSED TO ''DISCRETE'' NOISE EVENTS (EITHER SINGLE PULSES, MULTIPLE PULSES, OR NON-PULSES WITHIN A 24-HR PERIOD; SOUTHALL ET AL., 2007)

	Single pulses	Multiple pulses	Non pulses
Pinnipeds (in water)			
Sound pressure level	218 dB re 1 μPa (peak) (flat)	218 dB re 1 μPa (peak) (flat)	218 dB re 1 μPa (peak) (flat)
Sound exposure level	186 dB re 1 μPa^2-s (M_{pw})	186 dB re 1 μPa^2-s (M_{pw})	203 dB re 1 μPa^2-s (M_{pw})
Pinnipeds (in air)			
Sound pressure level	149 dB re 20 μPa (peak) (flat)	149 dB re 20 μPa (peak) (flat)	149 dB re 20 μPa (peak) (flat)
Sound exposure level	144 dB re (20 μPa)^2-s (M_{pa})	144 dB re (20 μPa)^2-s (M_{pa})	144.5 dB re (20 μPa)^2-s (M_{pa})

Potential Effects of Oil on Cetaceans

The specific effects an oil spill would have on bowhead, gray, or beluga whales are not well known. While direct mortality is unlikely, exposure to spilled oil could lead to skin irritation, baleen fouling (which might reduce feeding efficiency), respiratory distress from inhalation of hydrocarbon vapors, consumption of some contaminated prey items, and temporary displacement from contaminated feeding areas. Geraci and St. Aubin (1990) summarize effects of oil on marine mammals, and Bratton *et al.* (1993) provides a synthesis of knowledge of oil effects on bowhead whales. The number of whales that might be contacted by a spill would depend on the size, timing, and duration of the spill. Whales may not avoid oil spills, and some have been observed feeding within oil slicks (Goodale *et al.,* 1981). These topics are discussed in more detail next.

In the case of an oil spill occurring during migration periods, disturbance of the migrating cetaceans from cleanup activities may have more of an impact than the oil itself. Human activity associated with cleanup efforts could deflect whales away from the path of the oil. However, noise created from cleanup activities likely will be short term and localized. In fact, whale avoidance of clean-up activities may benefit whales by displacing them from the oil spill area.

There is no concrete evidence that oil spills, including the much studied Santa Barbara Channel and Exxon Valdez spills, have caused any deaths of cetaceans (Geraci, 1990; Brownell, 1971;

Harvey and Dahlheim, 1994). It is suspected that some individually identified killer whales that disappeared from Prince William Sound during the time of the Exxon Valdez spill were casualties of that spill. However, no clear cause and effect relationship between the spill and the disappearance could be established (Dahlheim and Matkin, 1994). The AT–1 pod of transient killer whales that sometimes inhabits Prince William Sound has continued to decline after the Exxon Valdez oil spill (EVOS). Matkin *et al.* (2008) tracked the AB resident pod and the AT–1 transient group of killer whales from 1984 to 2005. The results of their photographic surveillance indicate a much higher than usual mortality rate for both populations the year following the spill (33% for AB Pod and 41% for AT–1 Group) and lower than average rates of increase in the 16 years after the spill (annual increase of about 1.6% for AB Pod compared to an annual increase of about 3.2% for other Alaska killer whale pods). In killer whale pods, mortality rates are usually higher for non-reproductive animals and very low for reproductive animals and adolescents (Olesiuk *et al.,* 1990, 2005; Matkin *et al.,* 2005). No effects on humpback whales in Prince William Sound were evident after the Exxon Valdez spill (von Ziegesar *et al.,* 1994). There was some temporary displacement of humpback whales out of Prince William Sound, but this could have been caused by oil contamination, boat and aircraft disturbance, displacement of food sources, or other causes.

Migrating gray whales were apparently not greatly affected by the Santa Barbara spill of 1969. There appeared to be no relationship between the spill and mortality of marine mammals. The higher than usual counts of dead marine mammals recorded after the spill represented increased survey effort and therefore cannot be conclusively linked to the spill itself (Brownell, 1971; Geraci, 1990). The conclusion was that whales were either able to detect the oil and avoid it or were unaffected by it (Geraci, 1990).

(1) Oiling of External Surfaces

Whales rely on a layer of blubber for insulation, so oil would have little if any effect on thermoregulation by whales. Effects of oiling on cetacean skin appear to be minor and of little significance to the animal's health (Geraci, 1990). Histological data and ultrastructural studies by Geraci and St. Aubin (1990) showed that exposures of skin to crude oil for up to 45 minutes in four species of toothed whales had no effect. They switched to gasoline and applied the sponge up to 75 minutes. This produced transient damage to epidermal cells in whales. Subtle changes were evident only at the cell level. In each case, the skin damage healed within a week. They concluded that a cetacean's skin is an effective barrier to the noxious substances in petroleum. These substances normally damage skin by getting between cells and dissolving protective lipids. In cetacean skin, however, tight intercellular bridges, vital surface cells, and the extraordinary thickness of the epidermis impeded the damage. The authors could not detect a change in lipid concentration between and within cells after exposing skin from a white-sided dolphin to gasoline for 16 hours in vitro.

Bratton *et al.* (1993) synthesized studies on the potential effects of contaminants on bowhead whales. They concluded that no published data proved oil fouling of the skin of any free-living whales, and conclude that bowhead whales contacting fresh or weathered petroleum are unlikely to suffer harm. Although oil is unlikely to adhere to smooth skin, it may stick to rough areas on the surface (Henk and Mullan, 1997). Haldiman *et al.* (1985) found the epidermal layer to be as much as seven to eight times thicker than that found on most whales. They also found that little or no crude oil adhered to preserved bowhead skin that was dipped into oil up to three times, as long as a water film stayed on the skin's surface. Oil adhered in small patches to the surface and vibrissae (stiff, hairlike structures), once it made enough contact with the skin. The amount of oil sticking to the surrounding skin and epidermal depression appeared to be in proportion to the number of exposures and the roughness of the skin's surface. It can be assumed that if oil contacted the eyes, effects would be similar to those observed in ringed seals; continued exposure of the eyes to oil could cause permanent damage (St. Aubin, 1990).

(2) Ingestion

Whales could ingest oil if their food is contaminated, or oil could also be absorbed through the respiratory tract. Some of the ingested oil is voided in vomit or feces but some is absorbed and could cause toxic effects (Geraci, 1990). When returned to clean water, contaminated animals can depurate this internal oil (Engelhardt, 1978, 1982). Oil ingestion can decrease food assimilation of prey eaten (St. Aubin, 1988). Cetaceans may swallow some oil-contaminated prey, but it likely would be only a small part of their food. It is not known if whales would leave a feeding area where prey was abundant following a spill. Some zooplankton eaten by bowheads and gray whales consume oil particles and bioaccumulation can result. Tissue studies by Geraci and St. Aubin (1990) revealed low levels of naphthalene in the livers and blubber of baleen whales. This result suggests that prey have low concentrations in their tissues, or that baleen whales may be able to metabolize and excrete certain petroleum hydrocarbons. Whales exposed to an oil spill are unlikely to ingest enough oil to cause serious internal damage (Geraci and St. Aubin, 1980, 1982) and this kind of damage has not been reported (Geraci, 1990).

(3) Fouling of Baleen

Baleen itself is not damaged by exposure to oil and is resistant to effects of oil (St. Aubin *et al.,* 1984). Crude oil could coat the baleen and reduce filtration efficiency; however, effects may be temporary (Braithwaite, 1983; St. Aubin *et al.,* 1984). If baleen is coated in oil for long periods, it could cause the animal to be unable to feed, which could lead to malnutrition or even death. Most of the oil that would coat the baleen is removed after 30 min, and less than 5% would remain after 24 h (Bratton *et al.,* 1993). Effects of oiling of the baleen on feeding efficiency appear to be minor (Geraci, 1990). However, a study conducted by Lambertsen *et al.* (2005) concluded that their results highlight the uncertainty about how rapidly oil would depurate at the near zero temperatures in arctic waters and whether baleen function would be restored after oiling.

(4) Avoidance

Some cetaceans can detect oil and sometimes avoid it, but others enter and swim through slicks without apparent effects (Geraci, 1990; Harvey and Dahlheim, 1994). Bottlenose dolphins apparently could detect and avoid slicks and mousse but did not avoid light sheens on the surface (Smultea and Wursig, 1995). After the Regal Sword spill in 1979, various species of baleen and toothed whales were observed swimming and feeding in areas containing spilled oil southeast of Cape Cod, MA (Goodale *et al.,* 1981). For months following EVOS, there were numerous observations of gray whales, harbor porpoises, Dall's porpoises, and killer whales swimming through light-to-heavy crude-oil sheens (Harvey and Dalheim, 1994, cited in Matkin *et al.,* 2008). However, if some of the animals avoid the area because of the oil, then the effects of the oiling would be less severe on those individuals.

(5) Factors Affecting the Severity of Effects

Effects of oil on whales in open water are likely to be minimal, but there could be effects on whales where both the oil and the whales are at least partly confined in leads or at ice edges (Geraci, 1990). In spring, bowhead and beluga whales migrate through leads in the ice. At this time, the migration can be concentrated in narrow corridors defined by the leads, thereby creating a greater risk to animals caught in the spring lead system should oil enter the leads. However, given the probable alongshore trajectory of oil spilled from Northstar in relation to the whale migration route through offshore waters, interactions between oil slicks and whales are unlikely in spring, as any spilled oil would likely remain closer to shore.

In fall, the migration route of bowheads can be close to shore (Blackwell *et al.,* 2009). If fall migrants were moving through leads in the pack ice or were concentrated in nearshore waters, some bowhead whales might not be able to avoid oil slicks and could be subject to prolonged contamination. However, the autumn migration past the Northstar area extends over several weeks, and many of the whales travel along routes well north of Northstar. Thus, only a small portion of the whales are likely to approach patches of spilled oil. Additionally, vessel activity associated with spill cleanup efforts may deflect the small number of whales traveling nearshore farther offshore, thereby reducing the likelihood of contact with spilled oil. Also, during years when movements of oil and whales might be partially confined by ice, the bowhead migration corridor tends to be farther offshore (Treacy, 1997; LGL and Greeneridge, 1996a; Moore, 2000).

Bowhead and beluga whales overwinter in the Bering Sea (mainly from November to March). In the summer, the majority of the bowhead whales are found in the Canadian Beaufort Sea, although some have recently been observed in the U.S. Beaufort and Chukchi Seas during the summer months (June to August). Data from the Barrow-based boat surveys in 2009 (George and Sheffield, 2009) showed that bowheads were observed almost continuously in the waters near Barrow, including feeding groups in the Chukchi Sea at the beginning of July. The majority of belugas in the Beaufort stock migrate into the Beaufort Sea in April or May, although some whales may pass Point Barrow as early as late March and as late as July (Braham *et al.,* 1984; Ljungblad *et al.,* 1984; Richardson *et al.,* 1995b). Therefore, a spill in winter or summer would not be expected to have major impacts on these species. Additionally, while gray whales have commonly been sighted near Point Barrow, they are much less frequently found in the Prudhoe Bay area. Therefore, an oil spill is not expected to have major impacts to gray whales.

(6) Effects of Oil-Spill Cleanup Activities

Oil spill cleanup activities could increase disturbance effects on either whales or seals, causing temporary disruption and possible displacement (MMS, 1996). The Northstar Oil Discharge Prevention and Contingency Plan (ODPCP; BPXA, 1998a, b) includes a scenario of a production well blowout to the open-water in August. In this scenario, approximately 177,900 barrels of North Slope crude oil will reach the open-water. It is estimated that response activities would require 186 staff (93 per shift) using 33 vessels (see Table 1.6.1–3 in BPXA, 1998b) for about 15 days to recover oil in open-water. Shoreline cleanup would occur for approximately 45 days employing low pressure, cold water deluge on the soiled shorelines. In a similar scenario during solid ice conditions, it is estimated that 97 pieces of equipment along with 246 staff (123 per shift) would be required for response activities (BPXA, 1998a).

The potential effects on cetaceans are expected to be less than those on seals (described later in this section of the document). Cetaceans tend to occur well offshore where cleanup activities (in the open-water season) are unlikely to be as concentrated. Also, cetaceans are transient and, during the majority of the year, absent from the area. However, if intensive cleanup activities were necessary during the autumn whale hunt, this could affect subsistence hunting. Impacts to subsistence uses of marine mammals are discussed later in this document (see the ‘‘Impact on Availability of Affected Species or Stock for Taking for Subsistence Uses’’ section).

Potential Effects of Oil on Pinnipeds

Ringed, bearded, and spotted seals are present in open-water areas during summer and early autumn, and ringed seals remain in the area through the ice-covered season. During the spring periods in 1997–2002, the observed densities of ringed seals on the fast-ice in areas greater than 9.8 ft (3 m) deep ranged from 0.35 to 0.72 seals/km^2. After allowance for seals not seen by aerial surveyors, actual densities may have been about 2.84 times higher (Moulton *et al.,* 2003a). Therefore, an oil spill from the Northstar development or its pipeline could affect seals. Any oil spilled under the ice also has the potential to directly contact seals.

Externally oiled phocid seals often survive and become clean, but heavily oiled seal pups and adults may die, depending on the extent of oiling and characteristics of the oil. Prolonged exposure could occur if fuel or crude oil was spilled in or reached nearshore waters, was spilled in a lead used by seals, or was spilled under the ice when seals have limited mobility (NMFS, 2000). Adult seals may suffer some temporary adverse effects, such as eye and skin irritation, with possible infection (MMS, 1996). Such effects may increase stress, which could contribute to the death of some individuals. Ringed seals may ingest oil-contaminated foods, but there is little evidence that oiled seals will ingest enough oil to cause lethal internal effects. There is a likelihood that newborn seal pups, if contacted by oil, would die from oiling through loss of insulation and resulting hypothermia. These potential effects are addressed in more detail in subsequent paragraphs.

Reports of the effects of oil spills have shown that some mortality of seals may have occurred as a result of oil fouling; however, large scale mortality had not been observed prior to the EVOS (St. Aubin, 1990). Effects of oil on marine mammals were not well studied at most spills because of lack of baseline data and/or the brevity of the post-spill surveys. The largest documented impact of a spill, prior to EVOS, was on young seals in January in the Gulf of St. Lawrence (St. Aubin, 1990). Brownell and Le Boeuf (1971) found no marked effects of oil from the Santa Barbara oil spill on California sea lions or on the mortality rates of newborn pups.

Intensive and long-term studies were conducted after the EVOS in Alaska. There may have been a long-term decline of 36% in numbers of molting harbor seals at oiled haul-out sites in Prince William Sound following EVOS (Frost *et al.,* 1994a). However, in a reanalysis of those data and additional years of surveys, along with an examination of assumptions and biases associated with the original data, Hoover-Miller *et al.* (2001) concluded that the EVOS effect had been overestimated. The decline in attendance at some oiled sites was more likely a continuation of the general decline in harbor seal abundance in Prince William Sound documented since 1984 (Frost *et al.,* 1999) than a result of EVOS. The results from Hoover-Miller *et al.* (2001) indicate that the effects of EVOS were largely indistinguishable from natural decline by 1992. However, while Frost *et al.* (2004) concluded that there was no evidence that seals were displaced from oiled sites, they did find that aerial counts indicated 26% less pups were produced at oiled locations in 1989 than would have been expected without the oil spill. Harbor seal pup mortality at oiled beaches was 23% to 26%, which may have been higher than natural mortality, although no baseline data for pup mortality existed prior to EVOS (Frost *et al.,* 1994a). There was no conclusive evidence of spill effects on Steller sea lions (Calkins *et al.,* 1994). Oil did not persist on sea lions themselves (as it did on harbor seals), nor did it persist on sea lion haul-out sites and rookeries (Calkins *et al.,* 1994). Sea lion rookeries and haul out sites, unlike those used by harbor seals, have steep sides and are subject to high wave energy (Calkins *et al.,* 1994).

(1) Oiling of External Surfaces

Adult seals rely on a layer of blubber for insulation, and oiling of the external surface does not appear to have adverse thermoregulatory effects (Kooyman *et al.,* 1976, 1977; St. Aubin, 1990). Contact with oil on the external surfaces can potentially cause increased stress and irritation of the eyes of ringed seals (Geraci and Smith, 1976; St. Aubin, 1990). These effects seemed to be temporary and reversible, but continued exposure of eyes to oil could cause permanent damage (St. Aubin, 1990). Corneal ulcers and abrasions, conjunctivitis, and swollen nictitating membranes were observed in captive ringed seals placed in crude oil-covered water (Geraci and Smith, 1976), and in seals in the Antarctic after an oil spill (Lillie, 1954).

Newborn seal pups rely on their fur for insulation. Newborn ringed seal pups in lairs on the ice could be contaminated through contact with oiled mothers. There is the potential that newborn ringed seal pups that were contaminated with oil could die from hypothermia.

(2) Ingestion

Marine mammals can ingest oil if their food is contaminated. Oil can also be absorbed through the respiratory tract (Geraci and Smith, 1976; Engelhardt *et al.,* 1977). Some of the ingested oil is voided in vomit or feces but some is absorbed and could cause toxic effects (Engelhardt, 1981). When returned to clean water, contaminated animals can depurate this internal oil (Engelhardt, 1978, 1982, 1985). In addition, seals exposed to an oil spill are unlikely to ingest enough oil to cause serious internal damage (Geraci and St. Aubin, 1980, 1982).

(3) Avoidance and Behavioral Effects

Although seals may have the capability to detect and avoid oil, they apparently do so only to a limited extent (St. Aubin, 1990). Seals may abandon the area of an oil spill because of human disturbance associated with cleanup efforts, but they are most likely to remain in the area of the spill. One notable behavioral reaction to oiling is that oiled seals are reluctant to enter the water, even when intense cleanup activities are conducted nearby (St. Aubin, 1990; Frost *et al.,* 1994b, 2004).

(4) Factors Affecting the Severity of Effects

Seals that are under natural stress, such as lack of food or a heavy infestation by parasites, could potentially die because of the additional stress of oiling (Geraci and Smith, 1976; St. Aubin, 1990; Spraker *et al.,* 1994). Female seals that are nursing young would be under natural stress, as would molting seals. In both cases, the seals would have reduced food stores and may be less resistant to effects of oil than seals that are not under some type of natural stress. Seals that are not under natural stress (*e.g.,* fasting, molting) would be more likely to survive oiling. In general, seals do not exhibit large behavioral or physiological reactions to limited surface oiling or incidental exposure to contaminated food or vapors (St. Aubin, 1990; Williams *et al.,* 1994). Effects could be severe if seals surface in heavy oil slicks in leads or if oil accumulates near haul-out sites (St. Aubin, 1990). An oil spill in open-water is less likely to impact seals.

Seals exposed to heavy doses of oil for prolonged periods could die. This type of prolonged exposure could occur if fuel or crude oil was spilled in or reached nearshore waters, was spilled in a lead used by seals, or was spilled under the ice in winter when seals have limited mobility. Seals residing in these habitats may not be able to avoid prolonged contamination and some could die. Impacts on regional populations of seals would be expected to be minor.

Since ringed seals are found year-round in the U.S. Beaufort Sea and more specifically in the project area, an oil spill at any time of year could potentially have effects on ringed seals. However, they are more widely dispersed during the open-water season. Spotted seals are unlikely to be found in the project area during late winter and spring. Therefore, they are more likely to be affected by a spill in the summer or fall seasons. Bearded seals typically overwinter south of the Beaufort Sea. However, some have been reported around Northstar during early spring (Moulton *et al.,* 2003b). Oil spills during the open-water period and fall are the most likely to impact bearded seals.

(5) Effects of Oil-Spill Cleanup Activities

Oil spill cleanup activities could increase disturbance effects on either whales or seals, causing temporary disruption and possible displacement (MMS, 1996). General issues related to oil spill cleanup activities are discussed earlier in this section for cetaceans. In the event of a large spill contacting and extensively oiling coastal habitats, the presence of response staff, equipment, and the many aircraft involved in the cleanup could (depending on the time of the spill and the cleanup) potentially displace seals. If extensive cleanup operations occur in the spring, they could cause increased stress and reduced pup survival of ringed seals. Oil spill cleanup activity could exacerbate and increase disturbance effects on subsistence species, cause localized displacement of subsistence species, and alter or reduce access to those species by hunters. On the other hand, the displacement of marine mammals away from oil-contaminated areas by cleanup activities would reduce the likelihood of direct contact with oil. Impacts to subsistence uses of marine mammals are discussed later in this document (see the ''Impact on Availability of Affected Species or Stock for Taking for Subsistence Uses'' section).

Summary of Potential Effects on Marine Mammals

The likely or possible impacts of the planned offshore oil developments at Northstar on marine mammals involve both non-acoustic and acoustic effects. Potential non-acoustic effects are most likely to impact pinnipeds in the area through temporary displacement from haul-out areas near the Northstar facility. There is a small chance that a seal pup might be injured or killed by on-ice construction or transportation activities. A major oil spill is unlikely and, if it occurred, its effects are difficult to predict. A major oil spill might cause serious injury or mortality to small numbers of marine mammals by impacting the animals' ability to eat or find uncontaminated prey or by causing respiratory distress from inhalation of hydrocarbon vapors. Oiled newborn seal pups could also die from hypothermia. However, BP has an oil spill contingency and prevention plan (discussed later in this document) in place that will help avoid the occurrence of a spill and the impacts to the environment (including marine mammals) should one occur.

BP's activities at Northstar will also introduce sound into the environment. The potential effects of sound from the proposed activities might include one or more of the following: Masking of natural sounds; behavioral disturbance and associated habituation effects; and, at least in theory, temporary or permanent hearing impairment. Because of the low source levels for the majority of equipment used at Northstar, no hearing impairment is expected in any pinnipeds or cetaceans. Other types of effects are expected to be less for cetaceans, as the higher sound levels are found close to shore, usually further inshore than the migration paths of cetaceans. Additionally, cetaceans are not found in the Northstar area during the ice-covered season; therefore, they would only be potentially impacted during certain times of the year. As discussed earlier in the document, cetaceans often avoid sound sources, which would further reduce impacts from sound. Pinnipeds may exhibit some behavioral disturbance reactions, but they are anticipated to be minor. In summary, impacts to marine mammals that may occur in the Northstar area are expected to be minor, as source levels are low and many of the species are found farther out to sea.

Moreover, the potential effects to marine mammals described in this section of the document do not take into consideration the proposed monitoring and mitigation measures described later in this document (see the ''Proposed Mitigation'' and ''Proposed Monitoring and Reporting'' sections).

Anticipated Effects on Habitat

Potential impacts to marine mammals and their habitat as a result of operation of the Northstar facility are mainly associated with elevated sound levels. However, potential impacts are also possible from ice road construction and an oil spill (should one occur).

Common Marine Mammal Prey in the Project Area

All six of the marine mammal species that may occur in the proposed project area prey on either marine fish or invertebrates. The ringed seal feeds on fish and a variety of benthic species, including crabs and shrimp. Bearded seals feed mainly on benthic organisms, primarily crabs, shrimp, and clams. Spotted seals feed on pelagic and demersal fish, as well as shrimp and cephalopods. They are known to feed on a variety of fish including herring, capelin, sand lance, Arctic cod, saffron cod, and sculpins.

Bowhead whales feed in the eastern Beaufort Sea during summer and early autumn, but continue feeding to varying degrees while on their migration through the central and western Beaufort Sea in the late summer and fall (Richardson and Thomson [eds.], 2002). Aerial surveys in recent years have sighted bowhead whales feeding in Camden Bay on their westward migration through the Beaufort Sea. [Camden Bay is more than 62 mi (100 km) east of Northstar.] When feeding in relatively shallow areas, bowheads feed throughout the water column. However, feeding is concentrated at depths where zooplankton is concentrated (Wursig *et al.,* 1984, 1989; Richardson [ed.], 1987; Griffiths *et al.,* 2002). Lowry and Sheffield (2002) found that copepods and euphausiids were the most common prey found in stomach samples from bowhead whales harvested in the Kaktovik area from 1979 to 2000. Areas to the east of Barter Island (which is approximately 110 mi [177 km] east of Northstar) appear to be used regularly for feeding as bowhead whales migrate slowly westward across the Beaufort Sea (Thomson and Richardson, 1987; Richardson and Thomson [eds.], 2002). However, in some years, sizable groups of bowhead whales have been seen feeding as far west as the waters just east of Point Barrow (which is more than 155 mi [250 km] west of Northstar) near the Plover Islands (Braham *et al.,* 1984; Ljungblad *et al.,* 1985; Landino *et al.,* 1994). The situation in September–October 1997 was unusual in that bowheads fed widely across the Alaskan Beaufort Sea, including higher numbers in the area east of Barrow than reported in any previous year (S. Treacy and D. Hansen, MMS, pers. comm.).

Beluga whales feed on a variety of fish, shrimp, squid and octopus (Burns and Seaman, 1985). Very few beluga whales occur near Northstar; their main migration route is much further offshore.

Gray whales are primarily bottom feeders, and benthic amphipods and isopods form the majority of their summer diet, at least in the main summering areas west of Alaska (Oliver *et al.,* 1983; Oliver and Slattery, 1985). Farther south, gray whales have also been observed feeding around kelp beds, presumably on mysid crustaceans, and on pelagic prey such as small schooling fish and crab larvae (Hatler and Darling, 1974).

Two kinds of fish inhabit marine waters in the study area: (1) True marine fish that spend all of their lives in salt water, and (2) anadromous species that reproduce in fresh water and spend parts of their life cycles in salt water.

Most arctic marine fish species are small, benthic forms that do not feed high in the water column. The majority of these species are circumpolar and are found in habitats ranging from deep offshore water to water as shallow as 16.4–33 ft (5–10 m; Fechhelm *et al.,* 1995). The most important pelagic species, and the only abundant pelagic species, is the Arctic cod. The Arctic cod is a major vector for the transfer of energy from lower to higher trophic levels (Bradstreet *et al.,* 1986). In summer, Arctic cod can form very large schools in both nearshore and offshore waters (Craig *et al.,* 1982; Bradstreet *et al.,* 1986). Locations and areas frequented by large schools of Arctic cod cannot be predicted, but can be almost anywhere. The Arctic cod is a major food source for beluga whales, ringed seals, and numerous species of seabirds (Frost and Lowry, 1984; Bradstreet *et al.,* 1986).

Anadromous Dolly Varden char and some species of whitefish winter in rivers and lakes, migrate to the sea in spring and summer, and return to fresh water in autumn. Anadromous fish form the basis of subsistence, commercial, and small regional sport fisheries. Dolly Varden char migrate to the sea from May through mid-June (Johnson, 1980) and spend about 1.5 to 2.5 months there (Craig, 1989). They return to rivers beginning in late July or early August with the peak return migration occurring between mid-August and early September (Johnson, 1980). At sea, most anadromous corregonids (whitefish) remain in nearshore waters within several kilometers of shore (Craig, 1984, 1989). They are often termed ''amphidromous'' fish in that they make repeated annual migrations into marine waters to feed, returning each fall to overwinter in fresh water.

Benthic organisms are defined as bottom dwelling creatures. Infaunal organisms are benthic organisms that live within the substrate and are often sedentary or sessile (bivalves, polychaetes). Epibenthic organisms live on or near the bottom surface sediments and are mobile (amphipods, isopods, mysids, and some polychaetes). Epifauna, which live attached to hard substrates, are rare in the Beaufort Sea because hard substrates are scarce there. A small community of epifauna, the

Boulder Patch, occurs in Stefansson Sound.

The benthic environment near Northstar appears similar to that reported in various other parts of the Arctic (Ellis, 1960, 1962, 1966; Dunbar, 1968; Wacasey, 1975). Many of the nearshore benthic marine invertebrates of the Arctic are circumpolar and are found over a wide range of water depths (Carey *et al.,* 1975). Species identified include polychaetes (*Spio filicornis, Chaetozone setosa, Eteone longa*), bivalves (*Cryrtodaria kurriana, Nucula tenuis, Liocyma fluctuosa*), an isopod (*Saduria entomon*), and amphipods (*Pontoporeia femorata, P. affinis*).

Nearshore benthic fauna have been studied in lagoons west of Northstar and near the mouth of the Colville River (Kinney *et al.,* 1971, 1972; Crane and Cooney, 1975). The waters of Simpson Lagoon, Harrison Bay, and the nearshore region support a number of infaunal species including crustaceans, mollusks, and polychaetes. In areas influenced by river discharge, seasonal changes in salinity can greatly influence the distribution and abundance of benthic organisms. Large fluctuations in salinity and temperature that occur over a very short time period, or on a seasonal basis, allow only very adaptable, opportunistic species to survive (Alexander *et al.,* 1974). Since shorefast ice is present for many months, the distribution and abundance of most species depends on annual (or more frequent) recolonization from deeper offshore waters (Woodward Clyde Consultants, 1995). Due to ice scouring, particularly in water depths of less than 8 ft (2.4 m), infaunal communities tend to be patchily distributed. Diversity increases with water depth until the shear zone is reached at 49–82 ft (15–25 m; Carey, 1978). Biodiversity then declines due to ice gouging between the landfast ice and the polar pack ice (Woodward Clyde Consultants, 1995).

Potential Impacts From Sound Generation

Fish are known to hear and react to sounds and to use sound to communicate (Tavolga *et al.,* 1981) and possibly avoid predators (Wilson and Dill, 2002). Experiments have shown that fish can sense both the strength and direction of sound (Hawkins, 1981). Primary factors determining whether a fish can sense a sound signal, and potentially react to it, are the frequency of the signal and the strength of the signal in relation to the natural background noise level.

Fishes produce sounds that are associated with behaviors that include territoriality, mate search, courtship, and aggression. It has also been speculated that sound production may provide the means for long distance communication and communication under poor underwater visibility conditions (Zelick *et al.,* 1999), although the fact that fish communicate at low-frequency sound levels where the masking effects of ambient noise are naturally highest suggests that very long distance communication would rarely be possible. Fishes have evolved a diversity of sound generating organs and acoustic signals of various temporal and spectral contents. Fish sounds vary in structure, depending on the mechanism used to produce them (Hawkins, 1993). Generally, fish sounds are predominantly composed of low frequencies (less than 3 kHz).

Since objects in the water scatter sound, fish are able to detect these objects through monitoring the ambient noise. Therefore, fish are probably able to detect prey, predators, conspecifics, and physical features by listening to environmental sounds (Hawkins, 1981). There are two sensory systems that enable fish to monitor the vibration-based information of their surroundings. The two sensory systems, the inner ear and the lateral line, constitute the acoustico-lateralis system.

Although the hearing sensitivities of very few fish species have been studied to date, it is becoming obvious that the intra- and inter-specific variability is considerable (Coombs, 1981). Nedwell *et al.* (2004) compiled and published available fish audiogram information. A noninvasive electrophysiological recording method known as auditory brainstem response is now commonly used in the production of fish audiograms (Yan, 2004). Generally, most fish have their best hearing in the low-frequency range (*i.e.,* less than 1 kHz). Even though some fish are able to detect sounds in the ultrasonic frequency range, the thresholds at these higher frequencies tend to be considerably higher than those at the lower end of the auditory frequency range.

Literature relating to the impacts of sound on marine fish species can be divided into the following categories: (1) Pathological effects; (2) physiological effects; and (3) behavioral effects. Pathological effects include lethal and sub-lethal physical damage to fish; physiological effects include primary and secondary stress responses; and behavioral effects include changes in exhibited behaviors of fish. Behavioral changes might be a direct reaction to a detected sound or a result of the anthropogenic sound masking natural sounds that the fish normally detect and to which they respond. The three types of effects are often interrelated in complex ways. For example, some physiological and behavioral effects could potentially lead to the ultimate pathological effect of mortality. Hastings and Popper (2005) reviewed what is known about the effects of sound on fishes and identified studies needed to address areas of uncertainty relative to measurement of sound and the responses of fishes. Popper *et al.* (2003/2004) also published a paper that reviews the effects of anthropogenic sound on the behavior and physiology of fishes.

The following discussions of the three primary types of potential effects on fish from exposure to sound mostly consider continuous sound sources since the majority of sounds that will be generated by the proposed activities associated with Northstar are of a continuous nature; however, most research reported in the literature focuses on the effects of airguns, which produce pulsed sounds.

Potential effects of exposure to continuous sound on marine fish include TTS, physical damage to the ear region, physiological stress responses, and behavioral responses such as startle response, alarm response, avoidance, and perhaps lack of response due to masking of acoustic cues. Most of these effects appear to be either temporary or intermittent and therefore probably do not significantly impact the fish at a population level. The studies that resulted in physical damage to the fish ears used noise exposure levels and durations that were far more extreme than would be encountered under conditions similar to those expected at Northstar.

The situation for disturbance responses is less clear. Fish do react to underwater noise from vessels and move out of the way, move to deeper depths, or change their schooling behavior. The received levels at which fish react are not known and in fact are somewhat variable depending upon circumstances and species. In order to assess the possible effects of underwater project noise, it is best to examine project noise in relation to continuous noises routinely produced by other projects and activities such as shipping, fishing, *etc.*

Construction activities at Northstar produced both impulsive sounds (*e.g.,* pile driving) and longer-duration sounds. Short, sharp sounds can cause overt or subtle changes in fish behavior. Chapman and Hawkins (1969) tested the reactions of whiting (hake) in the field to an airgun. When the airgun was fired, the fish dove from 82 to 180 ft (25 to 55 m) depth and formed a compact layer.

The whiting dove when received sound levels were higher than 178 dB re 1 μPa (Pearson *et al.,* 1992).

Pearson *et al.* (1992) conducted a controlled experiment to determine effects of strong noise pulses on several species of rockfish off the California coast. They used an airgun with a source level of 223 dB re 1 μPa. They noted:

- Startle responses at received levels of 200–205 dB re 1 μPa and above for two sensitive species, but not for two other species exposed to levels up to 207 dB;
- Alarm responses at 177–180 dB for the two sensitive species, and at 186 to 199 dB for other species;
- An overall threshold for the above behavioral response at about 180 dB;
- An extrapolated threshold of about 161 dB for subtle changes in the behavior of rockfish; and
- A return to pre-exposure behaviors within the 20–60 minute exposure period.

In summary, fish often react to sounds, especially strong and/or intermittent sounds of low frequency. Sound pulses at received levels of 160 dB re 1 μPa may cause subtle changes in behavior. Pulses at levels of 180 dB may cause noticeable changes in behavior (Chapman and Hawkins, 1969; Pearson *et al.,* 1992; Skalski *et al.,* 1992). It also appears that fish often habituate to repeated strong sounds rather rapidly, on time scales of minutes to an hour. However, the habituation does not endure, and resumption of the strong sound source may again elicit disturbance responses from the same fish. Underwater sound levels from Northstar, even during construction, were lower than the response threshold reported by Pearson *et al.* (1992), and are not likely to result in major effects to fish near Northstar.

The reactions of fish to research vessel sounds have been measured in the field with forward-looking echosounders. Sound produced by a ship varies with aspect and is lowest directly ahead of the ship and highest within butterfly-shaped lobes to the side of the ship (Misund *et al.,* 1996). Because of this directivity, fish that react to ship sounds by swimming in the same direction as the ship may be guided ahead of it (Misund, 1997). Fish in front of a ship that show avoidance reactions may do so at ranges of 164 to 1,148 ft (50 to 350 m; Misund, 1997), though reactions probably will depend on the species of fish. In some instances, fish will likely avoid the ship by swimming away from the path and become relatively concentrated to the side of the ship (Misund, 1997). Most schools of fish are likely to show avoidance if they are not in the path of the vessel. When the vessel passes over fish, some species, in some cases, show sudden escape responses that include lateral avoidance and/or downward compression of the school (Misund, 1997). Some fish show no reaction. Avoidance reactions are quite variable and depend on species, life history stage, behavior, time of day, whether the fish have fed, and sound propagation characteristics of the water (Misund, 1997).

Some of the fish species found in the Arctic are prey sources for odontocetes and pinnipeds. A reaction by fish to sounds produced by the operations at Northstar would only be relevant to marine mammals if it caused concentrations of fish to vacate the area. Pressure changes of sufficient magnitude to cause that type of reaction would probably occur only very close to the sound source, if any would occur at all due to the low energy sounds produced by the majority of equipment at Northstar. Impacts on fish behavior are predicted to be inconsequential. Thus, feeding odontocetes and pinnipeds would not be adversely affected by this minimal loss or scattering, if any, of reduced prey abundance.

Reactions of zooplankton to sound are, for the most part, not known. Their ability to move significant distances is limited or nil, depending on the type of zooplankton. Behavior of zooplankters is not expected to be affected by drilling and production operations at Northstar. These animals have exoskeletons and no air bladders. Many crustaceans can make sounds, and some crustacea and other invertebrates have some type of sound receptor. Some mysticetes, including bowhead whales, feed on concentrations of zooplankton. Some feeding bowhead whales may occur in the Alaskan Beaufort Sea in July and August, and others feed intermittently during their westward migration in September and October (Richardson and Thomson [eds.], 2002; Lowry *et al.,* 2004). A reaction by zooplankton to sounds produced by the operations at Northstar would only be relevant to whales if it caused concentrations of zooplankton to scatter. Pressure changes of sufficient magnitude to cause that type of reaction would probably occur only very close to the sound source, if any would occur at all due to the low energy sounds produced by the majority of equipment at Northstar. Impacts on zooplankton behavior are predicted to be inconsequential. Thus, feeding mysticetes would not be adversely affected by this minimal loss or scattering, if any, of reduced zooplankton abundance.

Potential Impacts From Ice Road Construction

Ringed seals dig lairs in the sea ice near and around Northstar during the pupping season. There is the potential for ice road construction to impact areas of the ice used by ringed seals to create these lairs and breathing holes. Ice habitat for ringed seal breathing holes and lairs (especially for mothers and pups) is normally associated with pressure ridges or cracks (Smith and Stirling, 1975). The amount of habitat altered by Northstar ice road construction is minimal compared to the overall habitat available in the region. Densities of ringed seals on the ice near Northstar during late spring are similar to densities seen elsewhere in the region (Miller *et al.,* 1998b; Link *et al.,* 1999; Moulton *et al.,* 2002, 2005). Ringed seals use multiple breathing holes (Smith and Stirling, 1975; Kelly and Quakenbush, 1990) and are not expected to be adversely affected by the loss of one to two breathing holes within the thickened ice road. Ringed seals near Northstar appear to have the ability to open new holes and create new structures throughout the winter, and ringed seal use of landfast ice near Northstar did not appear to be much different than that of ice 1.2–2.2 mi away (2–3.5 km; Williams *et al.,* 2002). Active seal structures were found within tens of meters of thickened ice (Williams *et al.,* 2006b,c). A few ringed seals occur within areas of artificially thickened ice if cracks that can be exploited by seals form in that thickened ice. Therefore, ice road construction activities are not anticipated to have a major impact on the availability of ice for lairs and breathing holes for ringed seals in the vicinity of Northstar.

Potential Impacts From an Oil Spill

Oil spill probabilities for the Northstar project have been calculated based on historic oil spill data. Probabilities vary depending on assumptions and method of calculation. A reanalysis of worldwide oil spill data indicates the probability of a large oil spill (≤1,000 barrels) during the lifetime of Northstar is low (S.L. Ross Environmental Research Ltd., 1998). That report uses standardized units such as well-years and pipeline mile-years to develop oil spill probabilities for the Northstar project. Well-years represent the summed number of years that the various wells will be producing, and mile-years represent the length of pipeline times the amount of time the pipeline is in service. The calculated probability of a large oil spill takes into account the state-of-the-art engineering and procedures used at Northstar. That probability is far lower than previously-estimated probabilities (23–26%), which were based on Minerals Management Service (MMS, now the Bureau of Ocean Energy Management [BOEM]), studies of offshore oil field experience in the Gulf of Mexico and California (USACE, 1998a).

Based on the MMS exposure variable and an estimated production of 158 million barrels of oil, the probability of one or more well blowouts or tank spills >1,000 barrels on Seal Island is 7% throughout the life of the project (approximately 15–20 years; USACE, 1998a). The chance of the maximum estimated well blowout volume (225,000 barrels) being released is very low. Tank spills would likely be contained to the island itself. Based on the MMS exposure variable, there is an estimated 19% probability of one or more offshore pipeline ruptures or leaks releasing 1,000 barrels or more. However, of the 12 pipeline spills in OCS areas of >1,000 barrels from 1964–1992, anchor damage to the pipeline caused 7 spills, hurricane damage caused 2, trawl damage caused 2, and pipeline corrosion caused 1. The Northstar pipeline is buried, and there is minimal boat traffic in the area, therefore eliminating damage from anchors or trawls. With these two events eliminated, the risk of an offshore pipeline spill is reduced to 5%. A second exposure variable, based on the CONCAWE exposure variable (which is a European organization that maintains a database relevant to environment, health, and safety activities associated with the oil industry), indicates there is a 1.6 to 2.4% probability for one or more offshore pipeline ruptures or leaks releasing >1,000 barrels (USACE, 1998a). It should also be noted that production at BP's Northstar facility has declined significantly since it originally began operating nearly 10 years ago. The oil spill assessment conducted in the late 1990s was based on original peak production levels (which was approximately 80,000 barrels/day), not current production levels (which is approximately 18,000 barrels/day; B. Streever, BP Senior Environmental Studies Advisor, 2011, pers. comm.).

In the unlikely event of an oil spill from the Northstar pipeline, flow through the line can be stopped. There are automated isolation valves at each terminus of pipeline and at the mainland landfall, including along the sales line at Northstar Island, where the pipeline comes onshore, and at Pump Station 1. These would allow isolation of the marine portion of the line at the island and at the shore landing south of the island.

The Northstar pipe wall thickness is approximately 2.8 × greater than that required to contain the maximum operating gas pressure. Therefore, the probability of a gas pipeline leak is considered to be low. Also, a gas pipeline leak is not considered to be a potential source of an oil spill.

(1) Oil Effects on Seal and Whale Prey

Arctic cod and other fishes are a principal food item for beluga whales and seals in the Beaufort Sea. Anadromous fish are more sensitive to oil when in the marine environment than when in the fresh water environment (Moles *et al.,* 1979). Generally, arctic fish are more sensitive to oil than are temperate species (Rice *et al.,* 1983). However, fish in the open sea are unlikely to be affected by an oil spill. Fish in shallow nearshore waters could sustain heavy mortality if an oil slick were to remain in the area for several days or longer. Fish concentrations in shallow nearshore areas that are used as feeding habitat for seals and whales could be unavailable as prey. Because the animals are mobile, effects would be minor during the ice-free period when whales and seals could go to unaffected areas to feed.

Effects of oil on zooplankton as food for bowhead whales were discussed by Richardson ([ed.] 1987). Zooplankton populations in the open sea are unlikely to be depleted by the effects of an oil spill. Oil concentrations in water under a slick are low and unlikely to have anything but very minor effects on zooplankton. Zooplankton populations in near surface waters could be depleted; however, concentrations of zooplankton in near-surface waters generally are low compared to those in deeper water (Bradstreet *et al.,* 1987; Griffiths *et al.,* 2002).

Some bowheads feed in shallow nearshore waters (Bradstreet *et al.,* 1987; Richardson and Thomson [eds.], 2002). Wave action in nearshore waters could cause high concentrations of oil to be found throughout the water column. Oil slicks in nearshore feeding areas could contaminate food and render the site unusable as a feeding area. However, bowhead feeding is uncommon along the coast near the Northstar Development area, and contamination of certain areas would have only a minor impact on bowhead feeding. In the Beaufort Sea, Camden Bay and Point Barrow are more common feeding grounds for bowhead whales. Additionally, gray whales do not commonly feed in the Beaufort Sea and are rarely seen near the Northstar Development area.

Effects of oil spills on zooplankton as food for seals would be similar to those described above for bowhead whales. Effects would be restricted to nearshore waters. During the ice-free period, effects on seal feeding would be minor.

Bearded seals consume benthic animals. Wave action in nearshore waters could cause oil to reach the bottom through adherence to suspended sediments (Sanders *et al.,* 1990). There could be mortality of benthic animals and elimination of some benthic feeding habitat. During the ice-free period, effects on seal feeding would be minor.

Effects on availability of feeding habitat would be restricted to shallow nearshore waters. During the ice-free period, seals and whales could find alternate feeding habitats.

The ringed seal is the only marine mammal present near Northstar in significant numbers during the winter. An oil spill in shallow waters could affect habitat availability for ringed seals during winter. The oil could kill ringed seal food and/or drive away mobile species such as the arctic cod. Effects of an oil spill on food supply and habitat would be locally significant for ringed seals in shallow nearshore waters in the immediate vicinity of the spill and oil slick in winter. Effects of an oil spill on marine mammal foods and habitat under other circumstances are expected to be minor.

(2) Oil Effects on Habitat Availability

The subtidal marine plants and animals associated with the Boulder Patch community of Stefansson Sound are not likely to be affected directly by an oil spill from Northstar Island, seaward of the barrier islands and farther west. The only type of oil that could reach the subtidal organisms (located in 16 to 33 ft [5 to 10 m] of water) would be highly dispersed oil created by heavy wave action and vertical mixing. Such oil has no measurable toxicity (MMS, 1996). The amount and toxicity of oil reaching the subtidal marine community is expected to be so low as to have no measurable effect. However, oil spilled under the ice during winter, if it reached the relevant habitat, could act to reduce the amount of light available to the kelp species and other organisms directly beneath the spill. This could be an indirect effect of a spill. Due to the highly variable winter lighting conditions, any reduction in light penetration resulting from an oil spill would not be expected to have a significant impact on the growth of the kelp communities.

Depending on the timing of a spill, planktonic larval forms of organisms in arctic kelp communities such as annelids, mollusks, and crustaceans may be affected by floating oil. The contact may occur anywhere near the surface of the water column (MMS, 1996). Due to their wide distribution, large numbers, and rapid rate of regeneration, the recovery of marine invertebrate populations is expected to occur soon after the surface oil passes. Spill response activities are not likely to disturb the prey items of whales or seals sufficiently to cause more than minor effects. Additionally, the likelihood of an oil spill is expected to be very low.

In conclusion, NMFS has preliminarily determined that BP's proposed operation of the Northstar Development area is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or on the food sources that they utilize.

Proposed Mitigation

In order to issue an incidental take authorization (ITA) under section 101(a)(5)(A) of the MMPA, NMFS must, where applicable, set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse 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 subsistence uses (where relevant).

As part of its application, BP proposed several mitigation measures in order to ensure the least practicable adverse impact on marine mammal species that may occur in the proposed project area. BP proposed different mitigation measures for the ice-covered season and for the open-water season. The proposed mitigation measures are described fully in BP's application (see **ADDRESSES**) and summarized here.

Ice-Covered Season Proposed Mitigation Measures

In order to reduce impacts to ringed seal construction of birth lairs, BP must begin winter construction activities (*e.g.,* ice road construction) on the sea ice as early as possible once weather and ice conditions permit such activities. Any ice road or other construction activities that are initiated after March 1 in previously undisturbed areas in waters deeper than 10 ft (3 m) must be surveyed, using trained dogs, in order to identify and avoid ringed seal structures by a minimum of 492 ft (150 m). If dog surveys are conducted, trained dogs shall search all floating sea ice for any ringed seal structures. Those surveys shall be done prior to the new proposed activity on the floating sea ice to provide information needed to prevent injury or mortality of young seals. Additionally, after March 1 of each year, activities should avoid, to the greatest extent practicable, disturbance of any located seal structure. It should be noted that since 2001, none of BP's activities took place after March 1 in previously undisturbed areas during late winter, so no on-ice searches were conducted.

Open-Water Season Proposed Mitigation Measures

All non-essential boat, hovercraft, barge, and air traffic shall be scheduled to avoid periods when whales (especially bowhead whales) are migrating through the area. Helicopter flights to support Northstar activities shall be limited to a corridor from Seal Island to the mainland, and, except when limited by weather or personnel safety, shall maintain a minimum altitude of 1,000 ft (305 m), except during takeoff and landing.

Impact hammering activities may occur at any time of year to repair sheet pile or dock damage due to ice impingement. Impact hammering is most likely to occur during the ice-covered season or break-up period and would not be scheduled during the fall bowhead migration. However, if such activities were to occur during the open-water or broken ice season, certain mitigation measures that are described here are proposed to be required of BP. Based on studies by Blackwell *et al.* (2004a), it is predicted that only impact driving of sheet piles or pipes that are in the water (*i.e.,* those on the dock) could produce received levels of 190 dB re 1 μPa (rms) and then only in immediate proximity to the pile. The impact pipe driving in June and July 2000 did not produce received levels as high as 180 dB re 1 μPa (rms) at any location in the water. This was attributable to attenuation by the gravel and sheet pile walls (Blackwell *et al.,* 2004a). BP anticipates that received levels for any pile driving that might occur within the sheet pile walls of the island in the future would also be less than 180 dB (rms) at all locations in the water around the island. If impact pile driving were planned in areas outside the sheet pile walls, it is possible that received levels underwater might exceed the 180 dB re 1 μPa (rms) level.

NMFS has established acoustic thresholds that identify the received sound levels above which hearing impairment or other injury could potentially occur, which are 180 and 190 dB re 1 μPa (rms) for cetaceans and pinnipeds, respectively (NMFS, 1995, 2000). The established 180- and 190-dB re 1 μPa (rms) criteria are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS before additional TTS measurements for marine mammals became available, one could not be certain that there would be no injurious effects, auditory or otherwise, to marine mammals. To prevent or at least minimize exposure to sound levels that might cause hearing impairment, a safety zone shall be established and monitored for the presence of seals and whales. Establishment of the safety zone of any source predicted to result in received levels underwater above 180 dB (rms) will be analyzed using existing data collected in the waters of the Northstar facility (see the ''Proposed Monitoring and Reporting'' section later in this document or BP's application).

If observations and mitigation are required, a protected species observer stationed at an appropriate viewing location on the island will conduct watches commencing 30 minutes prior to the onset of impact hammering or other identified activity. The ''Proposed Monitoring and Reporting'' section later in this document contains a description of the observer program. If pinnipeds are seen within the 190 dB re 1 μPa radius (the ''safety zone''), then operations shall shut down or reduce SPLs sufficiently to ensure that received SPLs do not exceed those prescribed here. If whales are observed within the 180 dB re 1 μPa (rms) radius, operations shall shut down or reduce SPLs sufficiently to ensure that received SPLs do not exceed those prescribed here. The shutdown or reduced SPL shall be maintained until such time as the observed marine mammal(s) has been seen to have left the applicable safety zone or until 15 minutes have elapsed in the case of a pinniped or odontocete or 30 minutes in the case of a mysticete without resighting, whichever occurs sooner.

Should any new drilling into oil-bearing strata be required during the effective period of these regulations, the drilling shall not take place during either open-water or spring-time broken ice conditions.

Oil Spill Contingency Plan

The taking by harassment, injury, or mortality of any marine mammal species incidental to an oil spill is prohibited. However, in the unlikely event of an oil spill, BP expects to be able to contain oil through its oil spill response and cleanup protocols. An oil spill prevention and contingency response plan was developed and approved by the Alaska Department of Environmental Conservation, U.S. Department of Transportation, U.S. Coast Guard, and BOEM (formerly MMS). The plan has been amended several times since its initial approval, with the last revision occurring in July 2010. Major changes since 1999 include the following: seasonal drilling restrictions from June 1 to July 20 and from October 1 until ice becomes 18 in (46 cm) thick; changes to the response planning standard for a well blowout as a result of reductions in well production rates; and deletion of ice auguring for monitoring potential sub-sea oil pipeline leaks during winter following demonstration of the LEOS leak detection system. Future changes to the response planning standards may be expected in response to declines in well production rates and pipeline throughput. The full plan can be viewed on the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.*

The plan consists of five parts. A short summary of the information contained in each part of the plan follows next. For more details, please refer to the plan itself.

Part 1 contains the Response Action Plan, which provides initial emergency response actions and oil spill response scenarios. The Response Action Plan lays out who is to be notified in the case of a spill and how many people need to be on hand and for how long depending on the size and type of spill. It also outlines different deployment strategies, which include the use of vessels, helicopters, fixed-wing aircraft, vehicles, heavy all-terrain vehicles, and air boats, and during which seasons these strategies could be used. Several response scenarios and strategies were developed in accordance with the Alaska Administrative Code (AAC). They describe equipment, personnel, and strategies that could be used to respond to an oil spill. It should be noted that the scenarios are for illustration only and assume conditions only for the purposes of describing general procedures, strategies, tactics, and selected operational capabilities. This part of the plan discusses oil spill scenarios and response strategies, including: An oil storage tank rupture; a well blowout under typical summer conditions; a well blowout under typical winter conditions; a crude oil transmission pipeline release; a well blowout during typical spring conditions; a crude oil transmission pipeline rupture during spring break-up; a crude oil transmission pipeline rupture during summer; a crude oil transmission pipeline rupture during fall; and a crude oil transmission pipeline rupture during winter.

Part 2 contains the Prevention Plan, which describes prevention measures to be implemented by facility personnel and inspection and maintenance programs. Personnel who handle oil equipment receive training in general North Slope work procedures, spill prevention, environmental protection awareness, safety, and site-specific orientation. Personnel also receive training in oil spill notification, oil spill source control, and hazardous waste operations and emergency response safety. This section of the plan also outlines fuel transfer procedures, leak detection, monitoring, and operating requirements for crude oil transmission pipelines, and management of oil storage tanks, including inspections and protection devices. This section also discusses the possibilities of corrosion and the monitoring that is conducted to manage the corrosion control programs. This section of the plan also contains a table outlining different types, causes, and sizes of spills and the actions that are taken and in place to prevent such potential discharges. Another table in this section outlines the types of inspections that occur on daily, weekly, monthly, and annual schedules at Northstar to ensure the equipment is still functioning properly and that leaks are not occurring.

Part 3 of the plan contains Supplemental Information. Part 3 provides background information on the facility, including descriptions of the facility, the receiving environment for potential spills, the incident command system, maximum response operating limitations, response resources (personnel and equipment), response training and drills, and protection of environmentally sensitive areas. The receiving environments include oil in open-water, in water and ice during the break-up or freeze-up periods, and on ice. In conditions up to approximately 30% ice, the trajectory of spilled oil would be based on the winds and currents at Northstar. Assuming a 10-knot wind from the northeast, oil spilled at Northstar could reach the barrier island shore of Long Island and if not contained, oil moving inland through the barrier island cuts could reach the Kuparuk River Delta. Oil trapped under a floating solid ice cover would rise and gather in pools or lenses at the bottom of the ice sheet and may become trapped or entrained as new ice grows beneath the oil. Based on the very slow moving currents under the ice near Northstar, oil is unlikely to spread beyond the initial point of contact. During freeze-up, the oil will most likely be entrained in the solidifying grease ice and slush present on the water surface prior to forming an ice sheet. Storm winds at this time often break up and disperse the newly forming ice, leaving the oil to spread temporarily in an open water condition until it becomes incorporated in the next freezing cycle. At break-up, ice concentrations are highly variable from hour to hour and over short distances. In high ice concentrations, oil spreading is reduced and the oil is partially contained by the ice. As the ice cover loosens, more oil could escape into larger openings as the floes move apart. Eventually, as the ice concentration decreases, the oil on the water surface behaves essentially as an open water spill, with localized patches being temporarily trapped by wind against individual floes. Oil present on the surface of individual floes will move with the ice as it responds to winds and nearshore currents. The spreading of oil on ice is similar to spreading of oil on land or snow. The rate is controlled by the density and viscosity of the oil, and the final contaminated area is dictated by the surface roughness of the ice. As the ice becomes rougher, the oil pools get smaller and thicker. Oil spilled on ice spreads much more slowly than on water and covers a smaller final area. As a result, slicks on stable solid ice tend to be much thicker than equivalent slicks on water. The effective containment provided by even a minimal degree of ice roughness (inches) translates to far less cleanup time with the need for fewer resources than would be needed to deal with the equivalent spill on open water. In the Supplemental Information section of the plan, a description of the different environments (*e.g.,* open-water, freeze-up, etc.) is provided, including when those conditions occur and the types of ice thickness that are typical during each season.

The command system, which is described in Part 3, is compatible with the Alaska Regional Response Team Unified Plan and is based on the National Incident Management System. According to the plan, oil spill removal during the freeze-up or break-up seasons can be greatly enhanced by in situ burning. The ice provides containment, increasing the encounter rate and concentrating the oil for burning and recovery. The consensus of research on spill response in broken ice conditions is that in situ burning is an effective response technique, with removal rates exceeding 85 percent in many situations (Shell *et al.,* 1983; SL Ross, 1983; SL Ross and DF Dickins, 1987; Singsaas *et al.,* 1994). A considerable amount of research has demonstrated in situ burning in broken ice. The research includes several smaller-scale field and tank tests (SL Ross *et al.,* 2003; Shell *et al.,* 1983; Brown and Goodman, 1986; Buist and Dickins, 1987; Smith and Diaz, 1987; Bech *et al.,* 1993; Guénette and Wighus, 1996) and one large field test (Singsaas *et al.,* 1994). Most of the tests involved large volumes of oil placed in a static test field of broken ice, resulting in substantial slick thicknesses for ignition. The few tests in unrestricted ice fields or in dynamic ice have indicated that the efficacy of in situ burning is sensitive to ice concentration and dynamics and thus the tendency for the ice floes to naturally contain the oil, the thickness (or coverage) of oil in leads between floes, and the presence or absence of brash (created when larger ice features interact or degrade) or frazil (''soupy'' mixture of very small ice particles that form as seawater freezes) ice which can absorb the oil. Oil spilled on solid ice or among broken ice in concentrations equal to or greater than 6-tenths has a high probability of becoming naturally contained in thicknesses sufficient for combustion. Field experience has shown that it is the small ice pieces (*e.g.,* the brash and frazil, or slush, ice) that accumulate with the oil against the edges of larger ice features (floes) and control the concentration (*e.g.,* thickness) of oil in an area, and control the rate at which the oil subsequently thins and spreads. The plan contains a summary discussion on the current state of understanding the scientific principles and physical processes involved for in situ burning of oil on melt pools during the ice melt phase in June or on water between floes during the break-up period in July, based on SL Ross *et al.* (2003). Further discussion also covers in situ burning of thinner slicks in mobile broken ice comprised of brash or frazil ice during the freeze-up shoulder season in October. Please refer to the plan for these discussions.

Part 4 discusses Best Available Technology (BAT). This section provides a rationale for the prevention technology in place at the facility and a determination of whether or not it is the best available technology. The plan identifies two methods for regaining well control once an incident has escalated to a surface blowout scenario as described in Part 1 of the plan. The two methods are: Well-capping and relief well drilling. BP investigations indicate that well-capping constitutes the BAT for source control of a blowout. Well-capping response operations are highly dependent on the severity of the well control situation. BP has the ability to move specialized personnel and equipment, *e.g.,* capping stack or cutting tools, to North Slope locations upon declaration of a well control event. The materials to execute control (*e.g.,* junk shots, hot tapping, freezing, or crimping), are small enough that they can be quickly made available to remote locations, even by aircraft, as necessary. BP has an inventory of well control firefighting equipment permanently warehoused on the North Slope. This equipment includes two 6,000 gallons per minute (gpm) fire pumps, associated piping, lighting, transfer pumps, Athey wagons, specialized nozzles, and fire monitor shacks. Maintaining this equipment on the North Slope minimizes the time to mobilize and transport well control response equipment in an actual blowout event. Relief well drilling technology is compatible to North Slope drilling operations although it may be sensitive to both the well location and well types; however, it can be a timely process. Onshore North Slope relief well durations are often estimated in the 40- to 90-day range. While BP has determined that well capping constitutes BAT for well source control, BP has deemed it prudent to also activate a separate team to pursue a relief well plan parallel to and independent of the primary well capping plan.

The pipeline source control procedures, required by the AAC, involve the placement of automatic shutdown valves at each terminus and at the shore crossing to stop the flow of oil or product/gas into the Northstar pipelines. Additionally, the oil pipeline across the Putuligayuk River includes a manual valve on both sides of the river. There are two technology options for the valves: Automatic ball valves and automatic gate valves. Both valve options, when installed in new condition, are similar in terms of availability, transferability, cost, compatibility, and feasibility. In terms of effectiveness, ball valves typically have slightly faster closure times than gate valves. For Northstar, automatic ball valves (block and bleed type) are used. As required by 18 AAC 75.055(b), the flow of oil or product/gas can be completely stopped by these valves within one hour after a discharge has been detected. The valve closure time for these types of valves is usually on the order of 2 to 3 minutes.

Part 5 outlines the Response Planning Standard, which provides calculations of the applicable response planning standards for Northstar, including a detailed basis for the calculation reductions to be applied to the response planning standards.

Mitigation Conclusions

NMFS has carefully evaluated the applicant's proposed mitigation measures and considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another:

• The manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals;

• The proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and

• The practicability of the measure for applicant implementation.

Based on our evaluation of the applicant's proposed measures, NMFS has preliminarily determined that the mitigation measures proposed above provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance. Proposed measures to ensure availability of such species or stock for taking for certain subsistence uses is discussed later in this document (see ''Impact on Availability of Affected Species or Stock for Taking for Subsistence Uses'' section).

The proposed rule comment period will afford the public an opportunity to submit recommendations, views, and/or concerns regarding this action and the proposed mitigation measures. While NMFS has determined preliminarily that the proposed mitigation measures presented in this document will effect the least practicable adverse impact on the affected species or stocks and their habitat, NMFS will consider all public comments to help inform our final decision. Consequently, the proposed mitigation measures may be refined, modified, removed, or added to prior to the issuance of the final rule based on public comments received, and where appropriate, further analysis of any additional mitigation measures.

Proposed Monitoring and Reporting

In order to issue an ITA for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must, where applicable, 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 ITAs 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.

The monitoring program proposed by BP in its application and described here is based on the continuation of previous monitoring conducted at Northstar. Information on previous monitoring can be found in the ''Previous Activities and Monitoring'' section found later in this document. The proposed monitoring program may be modified or supplemented based on comments or new information received from the public during the public comment period or from the peer review panel (see the ''Monitoring Plan Peer Review'' section later in this document).

The monitoring proposed by BP focuses on ringed seals and bowhead whales, as they are the most prevalent species found in the Northstar Development area. No monitoring is proposed specifically for bearded or spotted seals or for gray or beluga whales, as their occurrence near Northstar is limited. Few, if any, observations of these species were made during the intensive monitoring from 1999 to 2004. However, if sightings of these (or other) species are made, those observations will be included in the monitoring reports (described later in this document) that will be prepared.

Annual Monitoring Plans

BP proposes to continue the long-term observer program, conducted by island personnel, of ringed seals during the spring and summer. This program is intended to assess the continued long-term stability of ringed seal abundance and habitat use near Northstar as indexed by counts obtained on a regular and long-term basis. The proposed approach is to continue the Northstar seal count that is conducted during the period May 15–July 15 each year from the 108 ft (33 m) high process module by Northstar staff following a standardized protocol since 2005. Counts are made on a daily basis (weather permitting), between 11:00–19:00, in an area of approximately 3,117 ft (950 m) around the island, for a duration of approximately 15 minutes. Counts will only be made during periods with visibility of 0.62 mi (1 km) or more and with a cloud ceiling of more than 295 ft (90 m).

BP proposes to continue monitoring the bowhead migration in 2011 and subsequent years for approximately 30 days each September through the recording of bowhead calls. BP proposes to deploy a Directional Autonomous Seafloor Acoustic Recorder (DASAR; Greene *et al.,* 2004) or similar recorder about 9.3 mi (15 km) north of Northstar, consistent with a location used in past years (as far as conditions allow). The data of the offshore recorder can provide information on the total number of calls detected, the temporal pattern of calling during the recording period, possibly the bearing to calls, and call types. These data can be compared with corresponding data from the same site in previous years. If substantially higher or lower numbers of calls are recorded than were recorded at that site in previous years, further analyses and additional monitoring will be considered in consultation with NMFS and North Slope Borough (NSB) representatives. A second DASAR, or similar recorder, will be deployed at the same location to provide a reasonable level of redundancy.

In addition to the DASAR already mentioned, BP proposes to install an acoustic recorder about 1,476 ft (450 m) north of Northstar, in the same area where sounds have been recorded since 2001. This recorder will be installed for approximately 30 days each September, corresponding with the deployment of the offshore DASAR (or similar recorder). The near-island recorder will be used to record and quantify sound levels emanating from Northstar. If island sounds are found to be significantly stronger or more variable than in the past, and if it is expected that the stronger sounds will continue in subsequent years, then further consultation with NMFS and NSB representatives will occur to determine if more analyses or changes in monitoring strategy are appropriate. A second acoustic recorder will be deployed to provide a reasonable level of redundancy.

Contingency Monitoring Plans

If BP needs to conduct an activity (*i.e.,* pile driving) capable of producing pulsed underwater sound with levels ≥180 or ≥190 dB re 1 μPa (rms) at locations where whales or seals could be exposed, BP proposes to monitor safety zones defined by those levels. [The safety zones were described in the ''Proposed Mitigation'' section earlier in this document.] One or more on-island observers, as necessary to scan the area of concern, will be stationed at location(s) providing an unobstructed view of the predicted safety zone. The observer(s) will scan the safety zone continuously for marine mammals for 30 minutes prior to the operation of the sound source. Observations will continue during all periods of operation. If whales and seals are detected within the (respective) 180 or 190 dB distances, a shutdown or other appropriate mitigation measure (as described earlier in this document) shall be implemented. The sound source will be allowed to operate again when the marine mammals are observed to leave the safety zone or until 15 minutes have elapsed in the case of a pinniped or odontocete or 30 minutes in the case of a mysticete without resighting, whichever occurs sooner. The observer will record the: (1) Species and numbers of marine mammals seen within the 180 or 190 dB zones; (2) bearing and distance of the marine mammals from the observation point; and (3) behavior of marine mammals and any indication of disturbance reactions to the monitored activity.

If BP initiates significant on-ice activities (*e.g.,* construction of new ice roads, trenching for pipeline repair, or projects of similar magnitude) in previously undisturbed areas after March 1, trained dogs, or a comparable method, will be used to search for seal structures. If such activities do occur after March 1, a follow-up assessment must be conducted in May of that year to determine the fate of all seal structures located during the March monitoring. This monitoring must be conducted by a qualified biological researcher approved in advance by NMFS after a review of the observer's qualifications.

BP will conduct acoustic measurements to document sound levels, characteristics, and transmissions of airborne sounds with expected source levels of 90 dBA or greater created by on-ice activity at Northstar that have not been measured in previous years. In addition, BP will conduct acoustic measurements to document sound levels, characteristics, and transmissions of airborne sounds for sources on Northstar Island with expected received levels at the water's edge that exceed 90 dBA that have not been measured in previous years. These data will be collected in order to assist in the development of future monitoring and mitigation measures.

Monitoring Plan Peer Review

The MMPA requires that monitoring plans be independently peer reviewed ''where the proposed activity may affect the availability of a species or stock for taking for subsistence uses'' (16 U.S.C. 1371(a)(5)(D)(ii)(III)). Regarding this requirement, NMFS' implementing regulations state, ''Upon receipt of a complete monitoring plan, and at its discretion, [NMFS] will either submit the plan to members of a peer review panel for review or within 60 days of receipt of the proposed monitoring plan, schedule a workshop to review the plan'' (50 CFR 216.108(d)).

NMFS established an independent peer review panel to review BP's proposed monitoring plan associated with the MMPA application for these proposed regulations. The panel met in early March 2011. After completion of the peer review, NMFS will consider all recommendations made by the panel, incorporate appropriate changes into the monitoring requirements of the final rule and subsequent LOAs, and publish the panel's findings and recommendations in the final rule.

Reporting Measures

An annual report on marine mammal monitoring and mitigation will be submitted to NMFS, Office of Protected Resources, and NMFS, Alaska Regional Office, on June 1 of each year. The first report will cover the period from the effective date of the LOA through October 31, 2011. Subsequent reports will cover activities from November 1 of one year through October 31 of the following year. Ending each annual report with October 31 coincides with the end of the fall bowhead whale migration westward through the Beaufort Sea.

The annual reports will provide summaries of BP's Northstar activities. These summaries will include the following: (1) Dates and locations of ice-road construction; (2) on-ice activities; (3) vessel/hovercraft operations; (4) oil spills; (5) emergency training; and (6) major repair or maintenance activities that might alter the ambient sounds in a way that might have detectable effects on marine mammals, principally ringed seals and bowhead whales. The annual reports will also provide details of ringed seal and bowhead whale monitoring, the monitoring of Northstar sound via the nearshore DASAR, descriptions of any observed reactions, and documentation concerning any apparent effects on accessibility of marine mammals to subsistence hunters.

If specific mitigation and monitoring are required for activities on the sea ice initiated after March 1 (requiring searches with dogs for lairs), during the operation of strong sound sources (requiring visual observations and shutdown procedures), or for the use of new sound sources that have not previously been measured, then a preliminary summary of the activity, method of monitoring, and preliminary results will be submitted within 90 days after the cessation of that activity. The complete description of methods, results, and discussion will be submitted as part of the annual report.

In addition to annual reports, BP proposes to submit a draft comprehensive report to NMFS, Office of Protected Resources, and NMFS, Alaska Regional Office, no later than 240 days prior to the expiration of these regulations. This comprehensive technical report will provide full documentation of methods, results, and interpretation of all monitoring during the first four and a quarter years of the LOA. Before acceptance by NMFS as a final comprehensive report, the draft comprehensive report will be subject to review and modification by NMFS scientists.

Any observations concerning possible injuries, mortality, or an unusual marine mammal mortality event will be transmitted to NMFS, Office of Protected Resources, and the Alaska Stranding and Disentanglement Program, within 48 hours of the discovery. At a minimum, reported information should include: (1) The time, date, and location (latitude/longitude) of the animal(s); (2) the species identification or description of the animal(s); (3) the fate of the animal(s), if known; and (4) photographs or video footage of the animal (if equipment is available).

Adaptive Management

The final regulations governing the take of marine mammals incidental to operation of the Northstar facility in the U.S. Beaufort Sea will contain an adaptive management component. In accordance with 50 CFR 216.105(c), regulations for the proposed activity must be based on the best available information. As new information is developed, through monitoring, reporting, or research, the regulations may be modified, in whole or in part, after notice and opportunity for public review. The use of adaptive management will allow NMFS to consider new information from different sources to determine if mitigation or monitoring measures should be modified (including additions or deletions) if new data suggest that such modifications are appropriate for subsequent LOAs.

The following are some of the possible sources of applicable data:

• Results from BP's monitoring from the previous year;

• Results from general marine mammal and sound research; or

• 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.

If, during the effective dates of the regulations, new information is presented from monitoring, reporting, or research, these regulations may be modified, in whole, or in part after notice and opportunity of public review, as allowed for in 50 CFR 216.105(c). In addition, LOAs shall be withdrawn or suspended if, after notice and opportunity for public comment, the Assistant Administrator finds, among other things, the regulations are not being substantially complied with or the taking allowed is having more than a negligible impact on the species or stock or an unmitigable adverse impact on the availability of marine mammal species or stocks for taking for subsistence uses, as allowed for in 50 CFR 216.106(e). That is, should substantial changes in marine mammal populations in the project area occur or monitoring and reporting show that operation of the Northstar facility is having more than a negligible impact on marine mammals or an unmitigable adverse impact on the availability of marine mammal species or stocks for taking for subsistence uses, then NMFS reserves the right to modify the regulations and/or withdraw or suspend a LOA after public review.

Previous Activities and Monitoring

The ''Background on the Northstar Development Facility'' section earlier in this document discussed activities that have occurred at Northstar since construction began in the winter of 1999/2000. Activities that occurred at Northstar under the current regulations (valid April 6, 2006, through April 6, 2011) include transportation (*e.g.,* helicopter, hovercraft, tracked vehicles, and vessels), production activities (*e.g.,* power generation, pipe driving, etc.), construction and maintenance activities, and monitoring programs.

Under those regulations and annual LOAs, BP has been conducting marine mammal monitoring within the action area to satisfy monitoring requirements set forth in MMPA authorizations. The monitoring programs have focused mainly on bowhead whales and ringed seals, as they are the two most common marine mammal species found in the Northstar Development area. Monitoring conducted by BP during this time period included: (1) Underwater and in-air noise measurements; (2) monitoring of ringed seal lairs; (3) monitoring of hauled out ringed seals in the spring and summer months; and (4) acoustic monitoring of the bowhead whale migration. Additionally, although it was not a requirement of the regulations or associated LOAs, BP has also incorporated work done by Michael Galginaitis. Since 2001, Galginaitis has observed and characterized the fall bowhead whale hunts at Cross Island.

As required by the regulations and annual LOAs, BP has submitted annual reports, which describe the activities and monitoring that occurred at Northstar. BP also submitted a draft comprehensive report, covering the period 2005–2009. The comprehensive report concentrates on BP's Northstar activities and associated marine mammal and acoustic monitoring projects from 2005–2009. However, monitoring work prior to 2004 is summarized in that report, and activities in 2010 at Northstar were described as well. The annual reports and draft comprehensive report (Richardson [ed.], 2010) are available on the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.* A summary of the monitoring can be found here and elsewhere in this document. This section summarizes some of the key objectives and findings; however, specific results and findings of some of the monitoring work that has been conducted at Northstar over the past decade are also described in sections throughout this document.

Prior to the start of construction (1997–1999) and during the first few years of Northstar construction and operation (2000–2002), BP conducted aerial surveys to study the distribution and abundance of seals around Northstar. In addition to aerial surveys, specially-trained dogs were also used to locate seal lairs during the ice-covered seasons of 1999–2000 and 2000–2001. It was determined that such intensive monitoring was not required after 2002; however, BP continued to observe and count seals near Northstar in order to determine if seals continued to use the area, and, if so, if that usage was similar to that found in previous years. The current monitoring consists of someone making counts from a platform between May 15 and July 15 each year, although there is some variation in the number of days observations are made during that period from year-to-year. Counts ranged from a low of three seals counted during 57 observation days in 2007 to a high of 811 seals counted during 61 observation days in 2009 (Richardson [ed.], 2010). Based on the counts that have been conducted, ringed seals continue to haul out around Northstar.

The LOAs also contained requirements to conduct underwater measurements of sounds produced by Northstar-related industrial activities. To obtain these measurements, BP deployed DASARs both near and offshore of Northstar. The exact distances and configurations are contained in Richardson [ed.] (2010). Median levels of sound were found to be low offshore of Northstar (95.4–103.1 dB re 1 μPa when measured 9.2 mi [14.9 km] away). Also, industrial sounds were found to contribute less of the sound in the 10–450 Hz band during 2005–2009 than it did during the period of 2001–2004.

Since 2001, BP has also been conducting acoustic monitoring to study the fall westward migration of bowhead whales through the Beaufort Sea and to determine whether or not sounds from Northstar are affecting that migration. The DASARs are also used for this monitoring effort. BP has studied the rate of calls per year and has also worked to localize the calls. Some of the key findings from this work showed that in 8 out of 9 seasons during the 2001–2009 period, bearings to whale calls detected at the same DASAR site 9.2 mi (14.9 km) offshore of Northstar were predominantly to the northeast or east-northeast of that location. Additionally, analysis of the 2008 data demonstrated that bowhead whale calls are directional, which may help to explain why fewer calls are detected west of Northstar than to the east (Richardson [ed.], 2010). In the comprehensive report (Richardson [ed.], 2010), BP compared calls from 2009 with those from 2001–2004 to try and draw conclusions about effects on the distribution of calling bowheads. BP found that from 2001–2004, the southern edge of the distribution of bowhead calls tended to be slightly but statistically significantly farther offshore when the underwater sound level near Northstar increased above baseline values. For the 2009 data, BP was unable to conclusively identify one specific relationship between offshore distances of bowhead calls and industrial sound.

The annual reports and comprehensive report (Richardson [ed.], 2010) also contain information on the fall Nuiqsut bowhead whale hunts. The information contained in these reports show that during 2005–2009, the whalers struck 3 or 4 whales (of a quota of 4) in all years except 2005 (only one whale struck and landed). The whalers did not attribute the poor harvest in 2005 to activities at Northstar. That year, there was severe local ice and very poor weather. There was some vessel interference; however, none of that was with vessels at or conducting activities for Northstar. Sealing activities were not common near the Northstar site prior to its construction, and they are not common there now. Most sealing occurs more than 20 mi (32 km) from Northstar.

During the period of validity of the current regulations, no activities have occurred after March 1 in previously undisturbed areas during late winter. Therefore, no monitoring with specially-trained dogs has been required. Also during this period, there were 82 reportable small spills (such as 0.25 gallons of hydraulic fluid, 3 gallons of power steering fluid, or other relatively small amounts of sewage, motor oil, hydraulic oil, sulfuric acid, etc.), three of which reached Beaufort water or ice. All material (for example, 0.03 gallons of hydraulic fluid) from these three spills was completely recovered.

NMFS has determined that BP complied with the mitigation and monitoring requirements set forth in regulations and annual LOAs. In addition, NMFS has determined that the impacts on marine mammals and on the availability of marine mammals for subsistence uses from the activity fell within the nature and scope of those anticipated and authorized in the previous authorization (supporting the analysis in the current authorization).

Estimated Take of Marine Mammals

One of the main purposes of NMFS' effects assessments is to identify the permissible methods of taking, which involves an assessment of the following criteria: the nature of the take (*e.g.,* resulting from anthropogenic noise vs. from ice road construction, *etc.*); the regulatory level of take (*i.e.,* mortality vs. Level A or Level B harassment); and the amount of take. In the ''Potential Effects of the Specified Activity on Marine Mammals'' section earlier in this document, NMFS identified the different types of effects that could potentially result from activities at BP's Northstar facility.

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].'' Take by Level B harassment is anticipated from operational sounds extending into the open-water migration paths of cetaceans and open-water areas where pinnipeds might be present, from the physical presence of personnel on the island, vehicle traffic, and by helicopter overflights. Take of hauled out pinnipeds, by harassment, could also occur as a result of in-air sound sources. Certain species may have a behavioral reaction to the sound emitted during the activities; however, hearing impairment as a result of these activities is not anticipated because of the low source levels for much of the equipment that is used. There is also a potential for take by injury or mortality of ringed seals from ice road construction activities. Because of the slow speed of hovercraft and vessels used for Northstar operations, it is highly unlikely that there would be any take from these activities.

Because BP operates the Northstar facility year-round, take of marine mammals could occur at any time of year. However, take of all marine mammal species that could potentially occur in the area is not anticipated during all seasons. This is because of the distribution and habitat preferences of certain species during certain times of the year. This is explained further in this section and BP's application (see **ADDRESSES**).

Estimated Takes in the Ice-covered Season

Potential sources of disturbance to marine mammals from the Northstar project during the ice-covered period consist primarily of vehicle traffic along the ice-road, helicopter traffic, and the ongoing production and drilling operations on the island. During the ice-covered season, the ringed seal is the only marine mammal that occurs regularly in the area of landfast ice surrounding Northstar. Spotted seals do not occur in the Beaufort Sea in the ice-covered season. Small numbers of bearded seals occur occasionally in the landfast ice in some years. Bowhead and beluga whales are absent from the Beaufort Sea in winter (or at least from the landfast ice portions of the Beaufort Sea), and in spring their eastward migrations are through offshore areas north of the landfast ice, which excludes whales from areas close to Northstar. Gray whales are also absent from this part of the Beaufort Sea during the ice-covered season. Therefore, takes of marine mammals during the ice-covered season were only estimated for ringed and bearded seals.

Potential displacement of ringed seals was more closely related to physical alteration of sea ice by industry than to exposure to detectable levels of low-frequency industrial sound during winter and spring (Williams *et al.,* 2006; Richardson *et al.,* 2008b; Moulton *et al.,* MS). The distance within which displacement of ringed seals might occur near a development like Northstar was defined as the physically affected area plus a 328 ft (100 m) buffer zone. A study from a drill site in the Canadian Beaufort Sea provided similar results (Harwood *et al.,* 2007). The Northstar ice road is typically flooded and thickened and/or cleared of snow. The physically affected ice road area is about 1,312 ft (400 m) wide, and this is extended with 328 ft (100 m) on either side to a total width of 1,969 ft (600 m) to derive the zone of displacement. This zone of displacement (or impact zone) around physically affected areas such as the ice road, work areas on the ice, and Northstar Island itself, is used to calculate the number of seals potentially affected (Richardson *et al.,* 2008b).

(1) Bearded Seal

The few bearded seals that remain in the area during winter and spring are generally found north of Northstar in association with the pack ice or the edge of the landfast ice. Bearded seals were not observed on the fast ice during the 1997 or 1998 BP/LGL surveys (G. Miller, LGL Ltd., pers. comm.), but small numbers were noted there in 1999–2002 (Moulton *et al.,* 2003b). No bearded seals were seen during spring aerial surveys from Oliktok Point to Flaxman Island (Frost *et al.,* 1997, 1998). The large size of this phocid makes it conspicuous to observers, reducing the likelihood of missing animals on the ice and hence underestimating abundance. Based on available data, and the ecology of bearded seals, it is unlikely that more than a few bearded seals (and most likely none) will be present in close proximity (<328 ft [100 m]) to the ice road and Northstar itself during the ice-covered season. The most probable number of bearded seals predicted to be potentially impacted by Northstar activities during the ice-covered season in any one year is zero. However, to allow for unexpected circumstances that might lead to take of bearded seals when they are present, BP requests take of two bearded seals per year during the ice-covered period by Level B harassment.

(2) Ringed Seal

Individual ringed seals in the Northstar area during the ice-covered season may be displaced a short distance away from the ice road corridors connecting the production islands to the mainland. However, traffic along the ice roads was at a maximum during the initial construction period in 2000, and there was no more than localized displacement of ringed seals (Williams *et al.,* 2002, 2006c; Moulton *et al.,* 2003a, 2005, MS). Seal densities near Northstar during spring were not significantly affected by industrial activities in 2000–2004 (Moulton *et al.,* 2005, MS). Seal monitoring each spring since 2005, based on visual observations from the Northstar module in the May 15–July 15 period, has shown continued occurrence of ringed seals near Northstar facilities, though with large variations within and between years (Aerts, 2009). During most of the year, all age and sex classes, except for newborn pups, could occur in the Northstar area. In late March and April, ringed seals give birth; therefore, at that time of year young pups may also be encountered.

Detailed monitoring of ringed seals near Northstar was done during spring and (in some years) winter of 1997 to 2002, including three years of Northstar construction and initial oil production (2000–2002). During the 2003–2004 and 2004–2005 ice-covered and break-up periods, no intensive ringed seal monitoring was required and seal sightings were recorded opportunistically from Northstar Island. Since 2005, these observations from Northstar have occurred in a more systematic fashion from mid-May through mid-July each year, with the main objective to document seasonal and annual variations in seals present in an area of 0.62 mi (1 km) around Northstar (Rodrigues and Williams, 2006; Rodrigues and Richardson, 2007; Aerts and Rodrigues, 2008; Aerts, 2009). BP estimated annual takes of ringed seal based on data collected from the intensive aerial monitoring program conducted in 1997–2002.

The numbers of seals present and potentially affected by Northstar activities were estimated using the 1997–2002 seal data according to the following steps (see Richardson *et al.,* 2008b for more detail):

(1) Defining a potential impact zone, *i.e.,* the area within which seals might have been affected by Northstar activities. This zone consisted of a 328 ft (100 m) buffer around the ice road, work areas on the ice, and Northstar Island and covered a total area of approximately 1.5 mi^2 (4 km^2).

(2) Defining a reference zone, *i.e.,* the area without influence of industrial

activities. This zone was defined as an area at distances of 2.5–6.2 mi (4–10 km) from the ice road, work areas on the ice, and Northstar Island. The reference zone was used to calculate the number and density of ringed seals that one would expect in the potential impact zone if there was no industrial activity. Because seal density is related to water depth, densities within the reference zone were calculated for four categories of water depth. Expected density near Northstar was a weighted average of those values (weighting by the proportions of the potential impact zone that were within each depth stratum).

(3) Calculating the expected number of seals present in the potential impact zone in the absence of industrial activities (based on data from the reference zone) for each year separately. The seal density of the reference zone was multiplied by the total area of the potential impact zone (1.5 mi^2 [4 km^2]) to obtain the maximum number of seals that could be present and potentially affected.

(4) Multiplying the number of seals calculated under step 3 with a correction factor of 2.84 (to correct for the ''detection bias'' and ''availability bias''). ''Detection bias'' refers to the fact that aerial surveyors do not see every seal that is on the ice and potentially sightable. ''Availability bias'' refers to the fact that seals are not always hauled out above the ice and snow, and thus available to be seen by aerial surveyors. Those two correction factors are based, respectively, on Frost *et al.* (1988) and Kelly and Quakenbush (1990).

Results of these calculations show that 3–8 seals could be present in the potential impact zone (Table 3 in BP's application and Table 3 in this document). The period 1997–1999 can be considered as a pre-construction period and 2000–2002 as a construction period, with the most intensive construction activities occurring in 2000 and 2001. This means that, if there was some displacement of ringed seals away from Northstar in the ice-covered season due to construction activities, BP would have expected fewer seals within the potential impact zone during 2000–2002 than in 1997–1999. That was not observed, although inter-year comparisons should be treated cautiously given the possibility of year-to-year differences in environmental conditions and sightability of seals during aerial surveys. The presence of numerous seals near the Northstar facilities during late spring of 2000, 2001 and 2002 indicates that any displacement effect was localized and, if it occurred at all, involved only a small fraction of the seals that would otherwise have been present. To allow for unexpected circumstances that might lead to take of ringed seals, BP requests take of eight ringed seals per year during the ice-covered period by Level B harassment. In the unlikely event that a ringed seal lair is crushed or flooded, BP also requests take of up to five ringed seals (including pups) by injury or mortality per year.

TABLE 3—NUMBERS OF RINGED SEALS EXPECTED TO OCCUR IN SPRING 1997–2002 WITHIN THE ''POTENTIAL IMPACT ZONE'' IN THE ABSENCE OF ANY NORTHSTAR IMPACT, BASED ON OBSERVED SEAL DENSITIES IN A REFERENCE AREA 2.5–6.2 MI (4–10 KM) AWAY FROM NORTHSTAR. THE POTENTIAL IMPACT ZONE INCLUDED AREAS WITHIN 328 FT (100 M) OF THE ICE ROAD AND NORTHSTAR/SEAL ISLAND (RICHARDSON ET AL., 2008B)

BP/LGL survey	Expected density [a] (seals/km^2)	Expected number of seals within potential impact zone	
		Uncorrected	Corrected [b]
1997	0.54	2	6
1998	0.36	1	4
1999	0.29	1	3
2000	0.59	2	7
2001	0.56	2	6
2002	0.67	3	8
Average 1997–2002	0.50	2	6

[a] This is the average uncorrected densities based on data from the zone 4–10 km away from the 2004 development zone, controlling for water depth by weighting density based on the proportions of the potential impact zone within the various depth strata.

[b] This is the ''uncorrected'' number multiplied by the 1.22 correction factor for seals hauled out but not seen by observers (Frost *et al.,* 1988), and by the 2.33 correction factor for seals not hauled out (Kelly and Quakenbush, 1990).

Estimated Takes in the Break-Up Season

Potential sources of disturbance to marine mammals from the Northstar project during the break-up period consist primarily of hovercraft and helicopter traffic, as well as the ongoing production and drilling operations on the island. Spotted seals and bowhead, gray, and beluga whales are expected to be absent from the Northstar project area during the break-up period. Therefore, take of those species during the break-up period was not estimated.

Similar to the ice-covered season, BP predicts that only very few bearded seals (and most likely none) could be present within the potential impact zone around the ice road and Northstar facilities during the break-up period. The most probable number of bearded seals predicted to be potentially impacted by Northstar activities during break-up in any one year is zero. However, to account for the possible presence of low numbers of bearded seals during this time, NMFS proposes to authorize the take of two bearded seals per year during the break-up season.

Impacts to ringed seals from Northstar activities during the break-up period are anticipated to be similar to those predicted during the ice-covered period. Additionally, the number of ringed seals present within the potential impact zone during the break-up period is expected to be similar to the number present during the ice-covered season. It is possible that some of these seals are the same individuals already counted as present during the latter stages of the ice-covered season (B. Kelly, pers. comm.). Thus, if any seals were affected during break-up, it is probable that some of these would be the same individuals. BP states that the requested Level B take of eight ringed seals per year during the ice-covered periods of 2011–2016 (see preceding subsection) is expected to also cover potentially affected seals during break-up. However, in case the same seals are taken during both periods, NMFS proposes to authorize the take of eight ringed seals by Level B harassment per year during the break-up period.

Estimated Takes in the Open-Water Season

Potential sources of disturbance to marine mammals from the Northstar project during the open-water period consist primarily of hovercraft and ACS vessels used for transfers of crew and supplies, barge and tugboat traffic, helicopter traffic, and the ongoing production and drilling operations on the island. During the open-water season all six species for which take authorization is sought can potentially be present in the Northstar area. Estimated annual numbers of potential open-water takes for each of these six species are summarized next.

(1) Spotted Seal

Pupping and mating occur in the spring when spotted seals are not in the Beaufort Sea. Hence, young pups would not be encountered in the Northstar Development area. All other sex and age classes may be encountered in small numbers during late summer/autumn. Spotted seals are most often found in waters adjacent to river deltas during the open-water season in the Beaufort Sea, and major haul-out concentrations are absent close to the project area. A small number of spotted seal haul-outs are (or were) located in the central Beaufort Sea in the deltas of the Colville River (which is more than 50 mi [80 km] from Northstar) and, previously, the Sagavanirktok River. Historically, these sites supported as many as 400–600 spotted seals, but in the late 1990s, less than 20 seals have been seen at any one site (Johnson *et al.,* 1999). In total, there are probably no more than a few tens of spotted seals along the coast of the central Alaska Beaufort Sea during summer and early fall. No spotted seals were positively identified during BP's Northstar marine mammal monitoring activities, although a few spotted seals might have been present. A total of 12 spotted seals were positively identified near the source vessel during open-water seismic programs in the central Alaskan Beaufort Sea generally near Northstar from 1996 to 2001 (Moulton and Lawson, 2002). Numbers seen per year ranged from zero (in 1998 and 2000) to four (in 1999). BP, therefore, predicts that it is unlikely that any spotted seals will be ''taken'' during Northstar operations. However, to account for the possibility that spotted seals could occur in small numbers in the proximity of Northstar, NMFS proposes to authorize the take of five spotted seals per year during the open-water period by Level B harassment.

(2) Bearded Seal

During the open-water season, bearded seals are widely and sparsely distributed in areas of pack ice and open water, including some individuals in relatively shallow water as far south as Northstar. Studies indicate that pups and other young bearded seals up to 3 years of age comprise 40–45% of the population (Nelson *et al.,* n.d.), and that younger animals tend to occur closer to shore. Therefore, although all age and sex classes could be encountered, bearded seals encountered in the Northstar project area during the open-water period are likely to be young, non-reproductive animals. Bearded seals, if present, may be exposed to noise and other stimuli from production activities and vessel and aircraft traffic on and around the island. It is possible that some individuals may be briefly disturbed or show localized avoidance, but it is not anticipated to have any significant impact on the species. BP assumes that brief reactions that do not disrupt behavioral patterns in a biologically significant manner (*i.e.,* looking at a passing vessel or helicopter) do not constitute harassment (NMFS, 2000, 2001). Given that and the low number of bearded seals potentially present, the estimated number of bearded seal ''takes'' during the open-water season is zero. However, to allow for unexpected circumstances, BP requests the take of one bearded seal per year during the open-water period.

(3) Ringed Seal

Because ringed seals are resident in the Beaufort Sea, they are the most abundant and most frequently encountered seal species in the Northstar area. During the open-water period, all sex and age classes (except neonates) could potentially be encountered. The estimated number of seals that potentially might be harassed by noise from Northstar production activities or from vessel and aircraft traffic are based on the following three assumptions:

(1) Seals present within a 0.62 mi (1 km) distance (1.2 mi² [3.1 km²] area) of Northstar might be potentially disturbed by construction and other activities on the island.

(2) The density of seals within that area would be no more than 2x the density observed during boat-based surveys for seals within the general Prudhoe Bay area in 1996–2001 (0.19 seals/km² × 2 = 0.38 seals/km²; Moulton and Lawson, 2002).

(3) Individual seals within the affected area are replaced once for each of thirteen 7-day intervals during the open-water period (mid July to mid October).

The first of these points assumes that seals in open water are not significantly affected by passing vessels (or helicopters) that they could occasionally encounter in areas >0.62 mi (1 km) from Northstar. Passing boats and helicopters might cause startle reactions and other short-term effects.

Based on the above assumptions, BP estimated that 15 ringed seals might be present and potentially affected during the open-water season (*i.e.,* 3.1 km² × 0.38 seals/km² × 13 weeks). BP notes that this estimate is subject to wide uncertainty (in either direction) given the uncertainties in each of the three assumptions listed above. There is no specific evidence that any of the seals occurring near Northstar during the 1997–2009 open-water seasons were disturbed appreciably or otherwise affected by BP's activities (Williams *et al.,* 2006a; Moulton *et al.,* 2003a, 2005; Rodrigues *et al.,* 2006; Rodrigues and Richardson, 2007; Aerts and Rodrigues, 2008; Aerts, 2009). BP requests the take of 15 ringed seals per year during the open-water season by Level B harassment.

(4) Bowhead Whale

Bowhead whales are not resident in the region of activity. During the open-water season, relatively few westward migrating bowheads occur within 6.2 mi (10 km) of Northstar during most years. However, in some years (especially years with relatively low ice cover) a larger percentage of the bowhead population migrates within 6.2–9.3 mi (10–15 km) of Northstar (Treacy, 1998; Blackwell *et al.,* 2007, 2009). The bowhead whale population in the Bering-Chukchi-Beaufort area was estimated to include approximately 10,545 animals (CV = 0.128) in 2001. To estimate the 2011 population size for purposes of calculating potential ''takes'', the annual rate of increase was assumed to be steady at 3.4% (George *et al.,* 2004). Based on these figures, the 2011 population size could be approximately 14,625 bowhead whales.

About 43.7% of the bowheads in the Bering-Chukchi-Beaufort stock are sexually mature (Koski *et al.,* 2004), and about 25% of the mature females are pregnant during autumn migration (Zeh *et al.,* 1993). About 50.5% of the whales in this stock are juveniles (excluding calves), and 5.8% are calves (Koski *et al.,* 2004). The sex ratio is close to 1:1; about half of each category would be males and half females. There are few data on the age and sex composition of bowhead whales that have been sighted near the Prudhoe Bay area. The few data from the area and more extensive data from more easterly parts of the Alaskan Beaufort Sea in late summer/autumn (Koski and Johnson, 1987; Koski and Miller, 2002, 2009) suggest that almost all age and sex categories of bowheads could be encountered, *i.e.,* males, non-pregnant females, pregnant females, and calves (mostly 3–6 months old). Newly born calves (< 1 month old) are not likely to be encountered during the fall (Nerini *et al.,* 1984; Koski *et al.,* 1993). Koski and Miller (2009) found that, at least in the more easterly part of the Beaufort Sea, subadults were disproportionately present in water < 656 ft (200 m) deep, and that small subadult whales were the dominant group in shallow (< 66 ft [20 m]) nearshore habitats with the size of whales increasing with increasing water depth. The potential take of bowhead whales from Northstar activities would be limited to Level B harassment (including avoidance reactions and other behavioral changes). Most bowheads that could be encountered would be migrating, so it is unlikely that an individual bowhead would be harassed more than once.

The acoustic monitoring of the bowhead whale migration during the early years of Northstar operations is described in the final Comprehensive Report of 1999–2004 (Richardson [ed.], 2008: Chapters 7–12). The monitoring was designed to determine whether the southern edge of the distribution of calling bowhead whales tended to be farther offshore with increased levels of underwater sounds from Northstar construction and operational activities. If the southernmost calling bowheads detected by the acoustic monitoring system tended to be farther offshore when Northstar operations were noisy than when they were quieter, this was to be taken as evidence of a Northstar effect. The initial monitoring objectives did not call for estimating the numbers of bowhead whales that were affected based on the acoustic localization data, but this was added as an objective in an updated monitoring plan (LGL and Greeneridge, 2000) prepared subsequent to issuance of the initial 5-yr regulations in May 2000. It was anticipated that the geographic scale of any documented effect, as a function of Northstar sound level, would provide a basis for estimating the number of whales affected. As early as 2001, it was noted that—given the difficulty in separating displacement effects from effects on calling behavior—the estimates of numbers affected would concern numbers of whales whose movements and/or calling behavior were affected by Northstar activities (BPXA, 2001).

In fact, the monitoring results provided evidence ($P < 0.01$ each year) of an effect on the southern part of the migration corridor during all four of the autumn migration seasons for which detailed data were acquired, *i.e.,* 2001–2004 (McDonald *et al.,* 2008; Richardson and McDonald, 2008). In 2001, the apparent southern edge of the distribution of calling whales was an estimated 0.95 mi (1.53 km) farther offshore when sound at industrial frequencies (28–90 Hz), measured 1,444 ft (440 m) from Northstar and averaged over 45 min preceding the call, increased from 94.3 to 103.7 dB re 1 μPa. In 2002, the apparent southern edge of the call distribution was an estimated 1.46 mi (2.35 km) farther offshore during times when transient sounds associated with boat traffic were present during the preceding 2 hr. In 2003 and 2004, the apparent southern edge was estimated to be farther offshore when tones were recorded in the 10–450 Hz band just prior to the call. In 2003, the apparent offshore shift was by an estimated 0.47 mi (0.76 km) when tones were present within the preceding 15 min. In 2004, the apparent shift was 1.39 mi (2.24 km) when tones were present within the preceding 2 hr.

Based on the amount of time bowhead whales are expected to be present in the general vicinity of the Northstar Development area and the fact that most of the whales migrate past the area beyond the 120-dB sound isopleths (NMFS' threshold for Level B harassment from continuous sound sources), which typically extend out less than 1.24–2.5 mi (2–4 km) from the island, it is estimated that only a small number of bowhead whales will be taken by harassment each year as a result of BP's activities. Therefore, BP requests the take of 15 bowhead whales per year during the open-water season by Level B harassment.

(5) Gray Whale

Gray whales are uncommon in the Prudhoe Bay area, with no more than a few sightings in summer or early autumn in any one year, and usually no sightings (Miller *et al.,* 1999; Treacy, 2000, 2002a,b). During the extensive aerial survey programs funded by MMS (Bowhead Whale Aerial Survey Program surveys), only one gray whale was sighted in the central Alaskan Beaufort Sea from 1979 to 2007. Gray whales were mostly sighted around Point Barrow. Small numbers of gray whales were sighted on several occasions in the central Alaskan Beaufort, *e.g.,* in the Harrison Bay area (Miller *et al.,* 1999; Treacy, 2000), in the Camden Bay area (Christie *et al.,* 2009) and one single sighting near Northstar production island (Williams and Coltrane, 2002). Several single gray whales have been seen farther east in the Canadian Beaufort Sea (Rugh and Fraker, 1981; LGL Ltd., unpubl. data), indicating that small numbers must travel through the Alaskan Beaufort during some summers. Gray whale calls have been recorded northeast of Barrow during the winter, indicating that some whales overwinter in the western Beaufort Sea (Stafford *et al.,* 2007). Gray whales do not call very often when on their summer feeding grounds, and the infrequent calls are not very strong (M. Dahlheim and S. Moore, NMFS, pers. comm.). No gray whale calls were recognized in the data from the acoustic monitoring system near Northstar in 2000–2008. No specific data on age or sex composition are available for the few gray whales that move east into the Beaufort Sea. All sex and age classes (including pregnant females) could be found, with the exception of calves less than six months of age.

If a few gray whales occur in the Prudhoe Bay area, it is unlikely that they would be affected appreciably by Northstar sounds. Gray whales typically do not show avoidance of sources of continuous industrial sound unless the received broadband level exceeds approximately 120 dB re 1 μPa (Malme *et al.,* 1984, 1988; Richardson *et al.,* 1995b; Southall *et al.,* 2007). The broadband received level approximately 1,476 ft (450 m) seaward from Northstar did not exceed 120 dB 1 μPa in the operational period 2004–2008 (95th percentiles), except when a vessel was passing close to Northstar or the acoustic recorders (maximum levels). It is possible that one or more gray whales, if present, might have been disturbed briefly during close approach by a vessel, but no such occurrences were documented in the past. It is most likely that no gray whales will be affected by activities at Northstar during any one year. However, to account for the possibility that a low number of gray whales could occur near Northstar, BP requests the take of two gray whales per year during the open-water period by Level B harassment.

(6) Beluga Whale

The Beaufort Sea beluga population was estimated at 39,258 individuals in 1992, with a maximum annual rate of increase of 4% (Hill and DeMaster, 1998; Angliss and Allen, 2009). Assuming a continued 4% annual growth rate, the population size could be approximately 79,650 beluga whales in 2011. However, the 4% estimate is a maximum value and does not include loss of animals due to subsistence harvest or natural mortality factors. Angliss and Allen (2009) consider the current annual rate of increase to be unknown. Thus, the population size in 2011 may be less than the estimated value. Additionally, the southern edge of the main fall migration corridor is approximately 62 mi (100 km) north of the Northstar region. A few migrating belugas were observed in nearshore waters of the central Alaskan Beaufort Sea by aerial and vessel-based surveyors during seismic monitoring programs from 1996–2001 (LGL and Greeneridge, 1996a; Miller *et al.,* 1997, 1998b, 1999). Results from aerial surveys conducted in 2006–2008 during seismic and shallow hazard surveys in the Harrison Bay and Camden Bay area also show that the majority of belugas occur along the shelf break, although there were some observations in nearshore areas (Christie *et al.,* 2009). Vessel-based surveyors observed a group of three belugas in Foggy Island Bay in July 2008, during BP's Liberty seismic survey (Aerts *et al.,* 2008) and small groups of westward traveling belugas have occasionally been sighted around Northstar and Endicott, mostly in late July to early/mid-August (John K. Dorsett, Todd Winkel, BP, pers. comm.). Any potential take of these beluga whales in nearshore waters is expected to be limited to Level B harassment. Belugas from the Chukchi stock occur in the Alaskan Beaufort Sea in summer but are even less likely than the Beaufort stock to be encountered in the nearshore areas where sounds from Northstar will be audible.

The few animals involved could include all age and sex classes. Calving probably occurs in June to August in the Beaufort Sea region and calves 1–4 months of age could be encountered in summer or autumn. Most of the few belugas that could be encountered would be engaged in migration, so it is unlikely that a given beluga would be repeatedly "taken by harassment".

Based on available information on the presence and abundance of beluga whales, the following data and assumptions were used to estimate the number of belugas that could be present and potentially disturbed by Northstar activities:

(1) Aerial survey data from 1979 to 2000, including both MMS and LGL surveys, were used to estimate the proportion of belugas migrating through waters ≤ 2.5 mi (4 km) seaward of Northstar. Of the belugas traveling through the surveyed waters (generally inshore of the 328-ft [100-m] contour), the overall percentage observed in waters offshore of Northstar during 1997–2000 was 0.62% (8 of 1,289 belugas). The maximum percentage for any one year was for 1996, when 6 of 153 (3.9%) were ≤ 2.5 mi (4 km) offshore of Northstar. These figures are based on beluga sightings within the area 147°00′ to 150°30′ W.

(2) Most beluga whales migrate far offshore; the proportion migrating through the surveyed area is unknown but was assumed by Miller *et al.* (1999) to be less than or equal to 20%, which is probably an overestimate.

(3) The disturbance radius for belugas exposed to construction and operational activities in the Beaufort Sea is not well defined (Richardson *et al.,* 1995a), but BPXA (1999) assumed that the potential radius of disturbance was ≤ 0.62 mi (1 km) around the island. (There are no Northstar-specific data that could be used to obtain a better estimate than this ≤ 0.62 mi [1 km] figure.) Based on the assumed 0.62 mi (1 km) radius, it is expected that no more than 20% of the belugas migrating ≤ 2.5 mi (4 km) seaward of Northstar would approach within 0.62 mi (1 km) of the Northstar Island in the absence of any industrial activity there. However, since the 0.62 mi (1 km) value was arbitrary, NMFS calculated take of beluga whales based on the 120-dB radius of 2.5 mi (4 km).

(4) Satellite-tagging data show that some members of the Chukchi Sea stock of belugas could also occur in the Beaufort Sea generally near Northstar during late summer and autumn (Suydam *et al.,* 2001, 2003). However, they (like the Beaufort belugas) tend to remain at or beyond the shelf break when in the Alaskan Beaufort Sea during that season. That, combined with the small size of the Chukchi stock, means that consideration of Chukchi belugas would not appreciably change the estimated numbers of belugas that might occur near Northstar.

From these values, the number of belugas that might approach within 2.5 mi (4 km) of Northstar (in the absence of industrial activities) during the open water season is approximately 20 belugas based on the average distribution: 0.0025 × 0.2 × 39,258. Therefore, NMFS proposes to authorize the take of 20 beluga whales per year during the open-water period by Level B harassment.

Summary of Proposed Take

BP has requested the take of six marine mammal species incidental to operational activities at the Northstar facility. However, because some of these species only occur in the Beaufort Sea on a seasonal basis, take of all six species has not been requested for an entire year. BP broke out its take requests into three seasons: Ice-covered season; break-up period; and open-water season. Ringed and bearded seals are the only species for which take was requested in all three seasons. Take of all six species was only requested for the open-water season. With the exception of the request for five ringed seal (including pups) takes by injury or mortality per year, all requested takes are by Level B harassment.

Table 4 in this document summarizes the abundance, take estimates, and percent of population for the six species for which NMFS is proposing to authorize take.

TABLE 4—POPULATION ABUNDANCE ESTIMATES, TOTAL ANNUAL PROPOSED TAKE (WHEN COMBINING TAKES FROM THE ICE-COVERED, BREAK-UP, AND OPEN-WATER SEASONS), AND PERCENTAGE OF POPULATION THAT MAY BE TAKEN FOR THE POTENTIALLY AFFECTED SPECIES

Species	Abundance	Total annual proposed level B take	Total annual injury or mortality take	Percentage of stock or population
Ringed Seal	[1] 249,000	20	5	0.01
Bearded Seal	[1] 250,000–300,000	5	0	< 0.01
Spotted Seal	[1] 59,214	5	0	0.01
Bowhead Whale	[2] 14,625	15	0	0.1
Beluga Whale	[1] 39,258	39	0	0.1
Gray Whale	[1] 17,752	2	0	0.01

[1] Abundance estimates in NMFS 2010 Alaska SAR (Allen and Angliss, 2011).
[2] Estimate from George *et al.* (2004) with an annual growth rate of 3.4%.

Because Prudhoe Bay (and the U.S. Beaufort Sea as a whole) represents only a small fraction of the Arctic basin where these animals occur, NMFS has preliminarily determined that only small numbers of the marine mammal species or stocks in the area would be potentially affected by operation of the Northstar facility. The take estimates presented in this section of the document do not take into consideration the mitigation and monitoring measures that are proposed for inclusion in the regulations (if issued).

Negligible Impact and Small Numbers Analysis and Preliminary Determination

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.'' In making a negligible impact determination, NMFS considers a variety of factors, including but not limited to: (1) The number of anticipated mortalities; (2) the number and nature of anticipated injuries; (3) the number, nature, intensity, and duration of Level B harassment; and (4) the context in which the takes occur.

No injuries or mortalities are anticipated for bearded and spotted seals or for bowhead, beluga, and gray whales. There is the potential for a small number of injuries or mortalities to ringed seals (no more than five per year) as a result of ice road construction activities during the ice-covered season. These injuries or mortalities could occur if a ringed seal lair is crushed or flooded. Additionally, animals in the area are not anticipated to incur any hearing impairment (*i.e.,* TTS, a Level B harassment, or PTS, a Level A [injury] harassment), as acoustic measurements indicate source levels below 180 dB and 190 dB, which are the thresholds used by NMFS for acoustic injury to marine mammals. All other takes are anticipated to be by Level B behavioral harassment only. Certain species may have a behavioral reaction (*e.g.,* increased swim speed, avoidance of the area, etc.) to the sound emitted during the operational activities. Table 2 in this document outlines the number of takes that are anticipated as a result of BP's proposed activities. These takes are anticipated to be of low intensity due to the low level of sound emitted by the majority of the activities themselves. Activities occur at Northstar year-round, but the majority of these activities produce low-level continuous sounds. Only on rare occasions are more high-intensity pulsed sounds emitted into the surrounding environment. The ringed seal (and possibly the bearded seal) are the only species that occur in the area year-round.

Even though activities occur throughout the year, none of the cetacean species occur near Northstar all year. Cetaceans are most likely to occur in the late summer and autumn seasons. However, even during that time, much of the populations of those species migrate past the area farther offshore than the area where Northstar sounds can be heard. Spotted seals also tend to only be present in the open-water season. Moreover, they are more common in the Colville River Delta area, which is more than 50 mi (80 km) west of the Northstar Development area, than in the waters surrounding Northstar. Ringed and bearded seals could be found in the area year-round. However, many of them remain far enough from the facility, outside of areas of harassment. Additionally, ringed seals have been observed in the area every year since the beginning of construction and into the subsequent operational years.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hr cycle). Behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) 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). Even though activities occur on successive days at Northstar, none of the cetacean species are anticipated to incur impacts on successive days. In the vicinity of Northstar, cetaceans are migrating through the area. Therefore, it is unlikely that the same animals are impacted on successive days. The closest known bowhead whale feeding ground is Camden Bay, which is more than 62 mi (100 km) east of Northstar. The same individual bearded and spotted seals are also not likely to occur in the proposed project area on successive days. Individual ringed seals may occur in the proposed project area on successive days. However, monitoring results (which were discussed earlier in this document) indicate that operation of the Northstar facility has not affected activities such as resting and pupping in the area.

Of the six marine mammal species for which take authorization is proposed, only one is listed as endangered under the ESA: the bowhead whale. The bowhead whale is also considered depleted under the MMPA. As stated previously in this document, the affected bowhead whale stock has been increasing at a rate of 3.4% per year since 2001. Certain stocks or populations of gray and beluga whales and spotted seals are listed as endangered or are proposed for listing under the ESA; however, none of those stocks or populations occur in the proposed activity area. On December 10, 2010, NMFS published a notification of proposed threatened status for subspecies of the ringed seal (75 FR 77476) and a notification of proposed threatened and not warranted status for subspecies and distinct population segments of the bearded seal (75 FR 77496) in the **Federal Register**. These threatened listings will likely be completed prior to the expiration of these regulations (if issued). Neither of these two ice seal species is currently considered depleted under the MMPA. There is currently no established critical habitat in the proposed project area for any of these six species.

The population estimates for the species that may potentially be taken as a result of BP's proposed activities were presented earlier in this document. For reasons described earlier in this document, the maximum calculated number of individual marine mammals for each species that could potentially be taken annually is small relative to the overall population sizes (less than 1% of each of the six populations or stocks).

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 mitigation and monitoring measures, NMFS preliminarily finds that operation of the BP Northstar facility will result in the incidental take of small numbers of marine mammals and that the total taking from BP's proposed activities will have a negligible impact on the affected species or stocks.

Impact on Availability of Affected Species or Stock for Taking for Subsistence Uses

Relevant Subsistence Uses

The disturbance and potential displacement of marine mammals by sounds from island production activities are the principal concerns related to subsistence use of the area. However, contamination of animals and traditional hunting areas by oil (in the unlikely event that an oil spill did occur) is also a concern. Subsistence remains the basis for Alaska Native culture and community. Marine mammals are legally hunted in Alaskan waters by coastal Alaska Natives. In rural Alaska, subsistence activities are often central to many aspects of human existence, including patterns of family life, artistic expression, and community religious and celebratory activities. Additionally, the animals taken for subsistence provide a significant portion of the food that will last the community throughout the year. The main species that are hunted include bowhead and beluga whales, ringed, spotted, and bearded seals, walruses, and polar bears. (As mentioned previously in this document, both the walrus and the polar bear are under the USFWS' jurisdiction.) The importance of each of these species varies among the communities and is largely based on availability.

Residents of the village of Nuiqsut are the primary subsistence users in the project area. The communities of Barrow and Kaktovik also harvest resources that pass through the area of interest but do not hunt in or near the Northstar area. Subsistence hunters from all three communities conduct an annual hunt for autumn-migrating bowhead whales. Barrow also conducts a bowhead hunt in spring. Residents of all three communities hunt seals. Other subsistence activities include fishing, waterfowl and seaduck harvests, and hunting for walrus, beluga whales, polar bears, caribou, and moose. Relevant harvest data are summarized in Tables 8 and 9 in BP's application (see **ADDRESSES**).

Nuiqsut is the community closest to the Northstar development (approximately 54 mi [87 km] southwest from Northstar). Nuiqsut hunters harvest bowhead whales only during the fall whaling season (Long, 1996). In recent years, Nuiqsut whalers have typically landed three or four whales per year (see Table 9 in BP's application). Nuiqsut whalers concentrate their efforts on areas north and east of Cross Island, generally in water depths greater than 66 ft (20 m; Galginaitis, 2009). Cross Island is the principal base for Nuiqsut whalers while they are hunting bowheads (Long, 1996). Cross Island is located approximately 16.8 mi (27 km) east of Northstar.

Kaktovik whalers search for whales east, north, and occasionally west of Kaktovik. Kaktovik is located approximately 124 mi (200 km) east of Northstar Island. The westernmost reported harvest location was about 13 mi (21 km) west of Kaktovik, near 70°10′ N., 144°11′ W. (Kaleak, 1996). That site is about 112 mi (180 km) east of Northstar Island.

Barrow whalers search for whales much farther from the Northstar area—about 155+ mi (250+ km) to the west. However, given the westward migration of bowheads in autumn, Barrow (unlike Kaktovik) is ''downstream'' from the Northstar region during that season. Barrow hunters have expressed concern about the possibility that bowheads might be deflected offshore by Northstar and then remain offshore as they pass Barrow.

Beluga whales are not a prevailing subsistence resource in the communities of Kaktovik and Nuiqsut. Kaktovik hunters may harvest one beluga whale in conjunction with the bowhead hunt; however, it appears that most households obtain beluga through exchanges with other communities. Although Nuiqsut hunters have not hunted belugas for many years while on Cross Island for the fall hunt, this does not mean that they may not return to this practice in the future. Data presented by Braund and Kruse (2009) indicate that only one percent of Barrow's total harvest between 1962 and 1982 was of beluga whales and that it did not account for any of the harvested animals between 1987 and 1989.

Ringed seals are available to subsistence users in the Beaufort Sea year-round, but they are primarily hunted in the winter or spring due to the rich availability of other mammals in the summer. Bearded seals are primarily hunted during July in the Beaufort Sea; however, in 2007, bearded seals were harvested in the months of August and September at the mouth of the Colville River Delta, which is more than 50 mi (80 km) from Northstar. However, this sealing area can reach as far east as Pingok Island, which is approximately 17 mi (27 km) west of Northstar. An annual bearded seal harvest occurs in the vicinity of Thetis Island (which is a considerable distance from Northstar) in July through August. Approximately 20 bearded seals are harvested annually through this hunt. Spotted seals are harvested by some of the villages in the summer months. Nuiqsut hunters typically hunt spotted seals in the nearshore waters off the Colville River Delta. The majority of the more established seal hunts that occur in the Beaufort Sea, such as the Colville delta area hunts, are located a significant distance (in some instances 50 mi [80 km] or more) from the proposed project area.

Potential Impacts to Subsistence Uses

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.

Noise and general activity during BP's proposed drilling program have the potential to impact marine mammals hunted by Native Alaskans. Additionally, if an oil spill occurred (even though it is unlikely), there could be impacts to marine mammals hunted by Native Alaskans and to the hunts themselves. In the case of cetaceans, the most common reaction to anthropogenic sounds (as noted previously in this document) is avoidance of the ensonified area. In the case of bowhead whales, this often means that the animals divert from their normal migratory path by several kilometers. Helicopter activity also has the potential to disturb cetaceans and pinnipeds by causing them to vacate the area. Additionally, general vessel presence in the vicinity of traditional hunting areas could negatively impact a hunt.

In the case of subsistence hunts for bowhead whales in the Beaufort Sea, there could be an adverse impact on the hunt if the whales were deflected seaward (further from shore) in traditional hunting areas. The impact would be that whaling crews would have to travel greater distances to intercept westward migrating whales, thereby creating a safety hazard for whaling crews and/or limiting chances of successfully striking and landing bowheads.

Oil spills might affect the hunt for bowhead whales. The harvest period for bowhead whales is probably the time of greatest risk that a relatively large-scale spill would reduce the availability of bowhead whales for subsistence uses. Pipeline spills are possible for the total production period of Northstar. Spills could occur at any time of the year. However, spills at most times of year would not affect bowheads, as bowheads are present near Northstar for only several weeks during late summer and early autumn. Bowheads travel along migration corridors that are far offshore of the planned production islands and pipelines during spring and somewhat offshore of those facilities during autumn. Under the prevailing east-wind conditions, oil spills from Northstar would not move directly into the main hunting area east and north of Cross Island. However, oil spills could extend into the hunting area under certain wind and current regimes (Anderson *et al.,* 1999).

Even in the case of a major spill, it is unlikely that more than a small minority of the bowheads encountered by hunters would be contaminated by oil. However, disturbance associated with reconnaissance and cleanup activities could affect whales and thus accessibility of whales to hunters. In the very unlikely event that a major spill incident occurred during the relatively short fall whaling season, it is possible that hunting would be affected significantly.

Ringed seals are more likely than bowheads to be affected by spill incidents because they occur in the development areas throughout the year and are more likely than whales to occur close to Northstar. Small numbers of bearded seals could also be affected, especially by a spill during the open-water season. Potential effects on subsistence use of seals will still be relatively low, as the areas most likely to be affected are not areas heavily used for seal hunting. However, wind and currents could carry spilled oil west from Northstar to areas where seal hunting occurs. It is possible that oil-contaminated seals could be harvested.

Oil spill cleanup activity could exacerbate and increase disturbance effects on subsistence species, cause localized displacement of subsistence species, and alter or reduce access to those species by hunters. On the other hand, the displacement of marine mammals away from oil-contaminated areas by cleanup activities would reduce the likelihood of direct contact with oil and thus reduce the likelihood of tainting or other impacts on the mammals.

One of the most persistent effects of EVOS was the reduced harvest and consumption of subsistence resources due to the local perception that they had been tainted by oil (Fall and Utermohle, 1995). The concentrations of petroleum-related aromatic compound (AC) metabolites in the bile of harbor seals were greatly elevated in harbor seals from oiled areas of Prince William Sound (PWS). Mean concentrations of phenanthrene equivalents for oiled seals from PWS were over 70 times greater than for control areas and over 20 times higher than for presumably unoiled areas of PWS (Frost *et al.,* 1994b). Concentrations of hydrocarbons in harbor seal tissues collected in PWS 1 year after EVOS were not significantly different from seals collected in non-oiled areas; however, average concentrations of AC metabolites in bile were still significantly higher than those observed in un-oiled areas (Frost *et al.,* 1994b). The pattern of reduced consumption of marine subsistence resources by the local population persisted for at least 1 year. Most affected communities had returned to documented pre-spill harvest levels by the third year after the spill. Even then, some households in these communities still reported that subsistence resources had not recovered to pre-spill levels. Harvest levels of subsistence resources for the three communities most affected by the spill still were below pre-spill averages even after 3 years. By then, the concern was mainly about smaller numbers of animals rather than contamination. However, contamination remained an important concern for some households (Fall and Utermohle, 1995). As an example, an elder stopped eating local salmon after the spill, even though salmon is the most important subsistence resource, and he ate it every day up to that point. Similar effects could be expected after a spill on the North Slope, with the extent of the decline in harvest and use, and the temporal duration of the effect, dependent upon the size and location of the spill. This analysis reflects the local perception that oil spills pose the greatest potential danger associated with offshore oil production.

Plan of Cooperation (POC)

Regulations at 50 CFR 216.104(a)(12) require MMPA authorization applicants for activities that take place in Arctic waters to provide a POC 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. BP and the Alaska Eskimo Whaling Commission (AEWC) established a conflict avoidance agreement to mitigate the noise and/or traffic impacts of offshore oil and gas production related activities on subsistence whaling. In addition, the NSB and residents from Barrow, Nuiqsut, and Kaktovik participated in the development of the Final Environmental Impact Statement (FEIS) for the Northstar project. Local residents provided traditional knowledge of the physical, biological, and human environment, which was incorporated into the Northstar FEIS. Also included in the Northstar FEIS is information gathered from the 1996 community data collection, along with relevant testimony during past public hearings in the communities of Barrow, Nuiqsut, and Kaktovik. This data collection has helped ensure that the concerns of NSB residents about marine mammals and subsistence are taken into account in the development of the project designs, permit stipulations, monitoring programs, and mitigation measures.

BP meets annually with communities on the North Slope to discuss the Northstar Development project. Stakeholder and peer review meetings convened by NMFS have been held at least annually from 1998 to the present to discuss proposed monitoring and mitigation plans, and results of completed monitoring and mitigation. Those meetings have included representatives of the concerned communities, the AEWC, the NSB, Federal, state, and university biologists, the Marine Mammal Commission, and other interested parties. One function of those meetings has been to coordinate planned construction and operational activities with subsistence whaling activity. The agreements have and likely will address the following: Operational agreement and communications procedures; when/where agreement becomes effective; general communications scheme, by season; Northstar Island operations, by season; conflict avoidance; seasonally sensitive areas; vessel navigation; air navigation; marine mammal and acoustic monitoring activities; measures to avoid impacts to marine mammals; measures to avoid impacts in areas of active whaling; emergency assistance; and dispute resolution process.

Most vessel and helicopter traffic will occur inshore of the bowhead migration corridor. BP does not often approach bowhead whales with these vessels or aircraft. Insofar as possible, BP will ensure that vessel traffic near areas of particular concern for whaling will be completed before the end of August, as the fall bowhead hunts in Kaktovik and Cross Island (Nuiqsut) typically begin around September 1 each year. Additionally, any approaches of bowhead whales by vessels or helicopters will not occur within the area where Nuiqsut hunters typically search for bowheads. Essential traffic to and from Northstar has been and will continue to be closely coordinated with the NSB and AEWC to avoid disruptions of subsistence activities. Unless limited by weather conditions, BP maintains a minimum flight altitude of 1,000 ft (305 m), except during takeoffs and landings, and all helicopter transits occur in a specified corridor from the mainland.

Unmitigable Adverse Impact Analysis and Preliminary Determination

NMFS has preliminarily determined that BP's proposed operation of the Northstar facility will not have an unmitigable adverse impact on the availability of marine mammal species or stocks for taking for subsistence uses. This preliminary determination is supported by the fact that BP works closely with the NSB, AEWC, and hunters of Nuiqsut to ensure that impacts are avoided or minimized during the annual fall bowhead whale hunt at Cross Island (the closest whale hunt to Northstar). Vessel and air traffic will be kept to a minimum during the bowhead hunt in order to keep from harassing the animals, which could possibly make them more difficult to hunt. To minimize the potential for conflicts with subsistence users, marine vessels transiting between Prudhoe Bay or West Dock and Northstar Island travel shoreward of the barrier islands as much as possible and avoid the Cross Island area during the bowhead hunting season in autumn. The fall hunt at Kaktovik occurs well to the east of Northstar (approximately 124 mi [200 km] away), so there should be no impacts to hunters of that community, since the whales will reach Kaktovik well before they enter areas that may be ensonified by activities at Northstar. Barrow is more than 155 mi (250 km) west of Northstar. Even though the whales will have to pass by Northstar before reaching Barrow for the fall hunt, the community is well beyond the range of detectable noise from Northstar. In the spring, the whales will reach Barrow before Northstar. Therefore, no impacts are anticipated on the spring bowhead whale hunt for the Barrow community.

Beluga whales are not a primary target of subsistence hunts by the Beaufort Sea communities. However, Nuiqsut whalers at Cross Island have been known to take a beluga in conjunction with the fall bowhead whale hunt. Therefore, the reasons stated previously regarding no unmitigable adverse impact to bowhead hunting at Cross Island are also applicable to beluga hunts. Additionally, should Kaktovik or Barrow conduct a beluga hunt, the distance from Northstar of these two communities would ensure no unmitigable adverse impact to those hunts.

Subsistence hunts of ice seals can occur year-round in the Beaufort Sea. However, hunts do not typically occur in the direct vicinity of Northstar. Some of the more established seal hunts occur in areas more than 20–30 mi (32–48 km) from Northstar. It is not anticipated that there would be any impacts to the seals themselves that would make them unavailable to Native Alaskans. Additionally, there is not anticipated to be any adverse effects to the hunters due to conflicts with them in traditional hunting grounds.

In the unlikely event of a major oil spill that spread into Beaufort Sea ice or water, there could be major impacts on the availability of marine mammals for subsistence uses. As discussed earlier in this document, the probability of a major oil spill occurring over the life of the project is low (S.L. Ross Environmental Research Ltd., 1998). Additionally, BP developed an oil spill prevention and contingency response plan, which was approved by several Federal agencies, including the U.S. Coast Guard. BP also conducts routine inspections of and maintenance on the pipeline (as described earlier in this document; see the ''Expected Activities in 2011–2016'' section) to help reduce the likelihood of a major oil spill. To help with preparedness in the event of a major oil spill, BP conducts emergency and oil spill response training activities at various times throughout the year. Equipment and techniques used during oil spill response exercises are continually updated.

Based on the measures described in BP's POC, the proposed mitigation and monitoring measures (described earlier in this document), and the project design itself, NMFS has determined preliminarily that there will not be an unmitigable adverse impact on subsistence uses from BP's operation of the Northstar facility. Even though there could be unmitigable adverse impacts on subsistence uses from a major oil spill, because of the low probability of such an event occurring and the measures that BP implements to reduce the likelihood of a major oil spill, NMFS has preliminarily determined that there will not be an unmitigable adverse impact to subsistence uses from an oil spill at Northstar.

Endangered Species Act (ESA)

On March 4, 1999, NMFS concluded consultation with the U.S. Army Corps of Engineers on permitting the construction and operation of the Northstar site. The finding of that consultation was that construction and operation at Northstar is not likely to jeopardize the continued existence of the bowhead whale. Since no critical habitat has been established for that species, the consultation also concluded that none would be affected.

The bowhead whale is still the only species listed as endangered under the ESA found in the proposed project area. However, on December 10, 2010, NMFS published notification of proposed threatened status for subspecies of the ringed seal (75 FR 77476) and notification of proposed threatened and not warranted status for subspecies and distinct population segments of the bearded seal (75 FR 77496) in the **Federal Register**. These species will likely be listed as threatened under the ESA prior to expiration of these regulations (if issued). Therefore, the NMFS Permits, Conservation and Education Division will consult with the NMFS Endangered Species Division on the issuance of regulations and subsequent LOAs under section 101(a)(5)(A) of the MMPA for this activity. This consultation will be concluded prior to a determination on the issuance of the final rule and will be taken into account in decision-making on the final rule and LOA.

National Environmental Policy Act (NEPA)

On February 5, 1999 (64 FR 5789), the Environmental Protection Agency noted the availability for public review and comment of a FEIS prepared by the U.S. Army Corps of Engineers under NEPA on Beaufort Sea oil and gas development at Northstar. Based upon a review of the FEIS and comments received on the Draft and Final EIS, NMFS adopted the FEIS on May 18, 2000. Because of the age of the FEIS and the availability of new scientific information, NMFS is currently conducting a new analysis, pursuant to NEPA, to determine whether or not the issuance of MMPA rulemaking and subsequent LOA(s) may have a significant effect on the human environment. This analysis will be completed prior to the issuance or denial of these proposed regulations and will be taken into account in decision-making on the final rule and LOA.

Classification

OMB has determined that this proposed rule is not significant for purposes of Executive Order 12866.

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. BP Exploration (Alaska) Inc. is the only entity that would be subject to the requirements in these proposed regulations. BP Exploration (Alaska) Inc. is an upstream strategic performance unit of the BP Group. Globally, BP ranks among the 10 largest oil companies and is the fourth largest corporation. In 2008, BP Exploration (Alaska) Inc. had 2,000 employees alone, and, as of December 31, 2009, BP Group had more than 80,000 employees worldwide. Therefore, it 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. Send comments regarding any aspect of this data collection, including suggestions for reducing the burden, to NMFS and the OMB Desk Officer (see **ADDRESSES**).

List of Subjects in 50 CFR Part 217

Exports, Fish, Imports, Indians, Labeling, Marine mammals, Penalties, Reporting and recordkeeping requirements, Seafood, Transportation.

Dated: June 23, 2011.

John Oliver,

Deputy Assistant Administrator for Operations, 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. Subpart O is added to part 217 to read as follows:

Subpart O—Taking of Marine Mammals Incidental to Operation of Offshore Oil and Gas Facilities in the U.S. Beaufort Sea

Sec.

217.140 Specified activity and specified geographical region.
217.141 Effective dates.
217.142 Permissible methods of taking.
217.143 Prohibitions.
217.144 Mitigation.
217.145 Measures to ensure availability of species for subsistence uses.
217.146 Requirements for monitoring and reporting.
217.147 Applications for Letters of Authorization.
217.148 Letters of Authorization.
217.149 Renewal of Letters of Authorization and adaptive management.
217.150 Modifications of Letters of Authorization.

Subpart O—Taking of Marine Mammals Incidental to Operation of Offshore Oil and Gas Facilities in the U.S. Beaufort Sea

§ 217.140 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to BP Exploration (Alaska) Inc. (BP) and those persons it authorizes 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 operation of offshore oil and gas facilities in the U.S. Beaufort Sea, Alaska, in the Northstar Development Area.

(b) The taking of marine mammals by BP may be authorized in a Letter of Authorization only if it occurs in the geographic region that encompasses the Northstar Oil and Gas Development area within state and/or Federal waters in the U.S. Beaufort Sea.

§ 217.141 Effective dates.

Regulations in this subpart become effective upon issuance of the final rule.

§ 217.142 Permissible methods of taking.

(a) Under Letters of Authorization issued pursuant to §§ 216.106 and 217.148 of this chapter, the Holder of the Letter of Authorization (hereinafter ''BP'') may incidentally, but not intentionally, take marine mammals within the area described in § 217.140(b), provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate Letter of Authorization.

(b) The activities identified in § 217.140(a) must be conducted in a manner that minimizes, to the greatest extent practicable, any adverse impacts on marine mammals and their habitat.

(c) The incidental take of marine mammals under the activities identified in § 217.140(a) is limited to the following species and by the indicated method and amount of take:

(1) Level B Harassment:

(i) Cetaceans:

(A) Bowhead whale (*Balaena mysticetus*)—75 (an average of 15 annually)

(B) Gray whale (*Eschrichtius robustus*)—10 (an average of 2 annually)

(C) Beluga whale (*Delphinapterus leucas*)—100 (an average of 20 annually)

(ii) Pinnipeds:

(A) Ringed seal (*Phoca hispida*)—155 (an average of 31 annually)

(B) Bearded seal (*Erignathus barbatus*)—25 (an average of 5 annually)

(C) Spotted seal (*Phoca largha*)—25 (an average of 5 annually)

(2) Level A Harassment and Mortality: Ringed seal—25 (an average of 5 annually)

§ 217.143 Prohibitions.

Notwithstanding takings contemplated in § 217.140 and authorized by a Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter, no person in connection with the activities described in § 217.140 may:

(a) Take any marine mammal not specified in § 217.142(c);

(b) Take any marine mammal specified in § 217.142(c) other than by incidental take as specified in §§ 217.142(c)(1) and (c)(2);

(c) Take a marine mammal specified in § 217.172(c) if such taking results in more than a negligible impact on the species or stocks of such marine mammal;

(d) Take a marine mammal specified in § 217.172(c) if such taking results in an unmitigable adverse impact on the species or stock for taking for subsistence uses; or

(e) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter.

§ 217.144 Mitigation.

(a) When conducting the activities identified in § 217.140(a), the mitigation measures contained in the Letter of Authorization issued under §§ 216.106 and 217.148 must be implemented. These mitigation measures include but are not limited to:

(1) Ice-covered Season:

(i) In order to reduce the taking of ringed seals to the lowest level practicable, BP must begin winter construction activities, principally ice roads, as soon as possible once weather and ice conditions permit such activity.

(ii) Any ice roads or other construction activities that are initiated after March 1, in previously undisturbed areas in waters deeper than 10 ft (3 m), must be surveyed, using trained dogs in order to identify and avoid ringed seal structures by a minimum of 492 ft (150 m).

(iii) After March 1 of each year, activities should avoid, to the greatest extent practicable, disturbance of any located seal structure.

(2) Open-water Season:

(i) BP will establish and monitor, during all daylight hours, a 190 dB re 1 μPa (rms) safety zone for seals around the island for all activities with sound pressure levels (SPLs) that are expected to exceed that level in waters beyond the Northstar facility on Seal Island.

(ii) BP will establish and monitor, during all daylight hours, a 180 dB re 1 μPa (rms) safety zone for whales around the island for all activities with SPLs that are expected to exceed that level in waters beyond the Northstar facility at Seal Island.

(iii) If any marine mammals are observed within the relevant safety zone, described in § 217.144(a)(2)(i) or (ii), the activity creating the noise will shutdown or reduce its SPL sufficiently to ensure that received SPLs do not exceed those prescribed SPL intensities at the affected marine mammal. The shutdown or reduced SPL shall be maintained until such time as the observed marine mammal(s) has been seen to have left the applicable safety zone or until 15 minutes have elapsed in the case of a pinniped or odontocete or 30 minutes in the case of a mysticete without resighting, whichever occurs sooner.

(iv) The entire safety zones prescribed in § 217.144(a)(2)(i) or (ii) must be visible during the entire 30-minute pre-activity monitoring time period in order for the activity to begin.

(v) New drilling into oil-bearing strata shall not take place during either open-water or spring-time broken ice conditions.

(vi) All non-essential boats, barge, and air traffic will be scheduled to avoid periods when bowhead whales are migrating through the area where they may be affected by noise from these activities.

(3) Helicopter flights to support Northstar activities must be limited to a corridor from Seal Island to the mainland, and, except when limited by weather or personnel safety, must maintain a minimum altitude of 1,000 ft (305 m), except during takeoff and landing.

(4) Additional mitigation measures as contained in a Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter.

(b) [Reserved]

§ 217.145 Measures to ensure availability of species for subsistence uses.

When applying for a Letter of Authorization pursuant to § 217.147 or a renewal of a Letter of Authorization pursuant to § 217.149, BP must submit a Plan of Cooperation that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammal species or stocks for taking for subsistence uses. A plan shall include the following:

(a) A statement that the applicant has notified and met with the affected subsistence communities to discuss proposed activities and to resolve potential conflicts regarding timing and methods of operation;

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

(c) What plans BP has to continue to meet with the affected communities to notify the communities of any changes in operation.

§ 217.146 Requirements for monitoring and reporting.

(a) BP must notify the Alaska Regional Office, NMFS, within 48 hours of starting ice road construction, cessation of ice road usage, and the commencement of icebreaking activities for the Northstar facility.

(b) BP must designate qualified, on-site individuals, approved in advance by NMFS, to conduct the mitigation, monitoring, and reporting activities specified in the Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter.

(c) Monitoring measures during the ice-covered season shall include, but are not limited to, the following:

(1) After March 1, trained dogs must be used to detect seal lairs in previously undisturbed areas that may be potentially affected by on-ice construction activity, if any. Surveys for seal structures should be conducted to a minimum distance of 492 ft (150 m) from the outer edges of any disturbance.

(2) If ice road construction occurs after March 1, conduct a follow-up assessment in May of that year of the fate of all seal structures located during monitoring conducted under § 217.146(c)(1) near the physically disturbed areas.

(3) BP shall conduct acoustic measurements to document sound levels, characteristics, and transmissions of airborne sounds with expected source levels of 90 dBA or greater created by on-ice activity at Northstar that have not been measured in previous years. In addition, BP shall conduct acoustic measurements to document sound levels, characteristics, and transmissions of airborne sounds for sources on Northstar Island with expected received levels at the water's edge that exceed 90 dBA that have not been measured in previous years.

(d) Monitoring measures during the open-water season shall include, but are not limited to, the following:

(1) Acoustic monitoring of the bowhead whale migration.

(2) BP shall monitor the safety zones of activities capable of producing pulsed underwater sound with levels ≥180 or ≥190 dB re 1 μPa (rms) at locations where whales or seals could be exposed. At least one on-island observer shall be stationed at a location providing an unobstructed view of the predicted safety zone. The observer(s) shall scan the safety zone continuously for marine mammals for 30 minutes prior to the operation of the sound source. Observations shall continue during all periods of operation. The observer shall record the: Species and numbers of marine mammals seen within the 180 or 190 dB zones; bearing and distance of the marine mammals from the observation point; and behavior of marine mammals and any indication of disturbance reactions to the monitored activity.

(e) BP shall conduct any additional monitoring measures contained in a Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter.

(f) BP shall submit an annual report to NMFS within the time period specified in a Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter.

(g) If specific mitigation and monitoring are required for activities on the sea ice initiated after March 1 (requiring searches with dogs for lairs), during the operation of strong sound sources (requiring visual observations and shutdown procedures), or for the use of new sound sources that have not previously been measured, then a preliminary summary of the activity, method of monitoring, and preliminary results shall be submitted to NMFS within 90 days after the cessation of that activity. The complete description of methods, results, and discussion shall be submitted as part of the annual report.

(h) BP shall submit a draft comprehensive report to NMFS, Office of Protected Resources, and NMFS, Alaska Regional Office (specific contact information to be provided in Letter of Authorization), no later than 240 days prior to the expiration of these regulations. This comprehensive technical report shall provide full documentation of methods, results, and interpretation of all monitoring during the first four and a quarter years of the LOA. Before acceptance by NMFS as a final comprehensive report, the draft comprehensive report shall be subject to review and modification by NMFS scientists.

(i) Any observations concerning possible injuries, mortality, or an unusual marine mammal mortality event shall be transmitted to NMFS, Office of Protected Resources, and the Alaska Stranding and Disentanglement Program (specific contact information to be provided in Letter of Authorization), within 48 hours of the discovery. At a minimum, reported information shall include: The time, date, and location (latitude/longitude) of the animal(s); the species identification or description of the animal(s); the fate of the animal(s), if known; and photographs or video footage of the animal (if equipment is available).

§ 217.147 Applications for Letters of Authorization.

(a) To incidentally take marine mammals pursuant to these regulations, the U.S. Citizen (as defined by § 216.103) conducting the activity identified in § 217.140(a) (*i.e.,* BP) must apply for and obtain either an initial Letter of Authorization in accordance with § 217.148 or a renewal under § 217.149.

(b) [Reserved]

§ 217.148 Letters of Authorization.

(a) A Letter of Authorization, unless suspended or revoked, shall be valid for a period of time not to exceed the period of validity of this subpart.

(b) The Letter of Authorization shall set forth:

(1) Permissible methods of incidental taking;

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

(3) Requirements for mitigation, monitoring and reporting.

(c) Issuance and renewal of the Letter of Authorization shall be based on a determination that the total number of marine mammals taken by the activity as a whole will have no more than a negligible impact on the affected species or stock of marine mammal(s) and will not have an unmitigable adverse impact on the availability of species or stocks of marine mammals for taking for subsistence uses.

§ 217.149 Renewal of Letters of Authorization and adaptive management.

(a) A Letter of Authorization issued under § 216.106 and § 217.148 of this chapter for the activity identified in § 217.140(a) shall be renewed upon request by the applicant or determination by NMFS and the applicant that modifications are appropriate pursuant to the adaptive management component of these regulations, provided that:

(1) NMFS is notified that the activity described in the application submitted under § 217.147 will be undertaken and that there will not be a substantial modification to the described work, mitigation or monitoring undertaken during the upcoming 12 months;

(2) NMFS recieves the monitoring reports required under § 217.146(f) and (g); and

(3) NMFS determines that the mitigation, monitoring and reporting measures required under §§ 217.144 and 217.146 and the Letter of Authorization issued under §§ 216.106 and 217.148 of this chapter were undertaken and will be undertaken during the upcoming annual period of validity of a renewed Letter of Authorization.

(b) If either a request for a renewal of a Letter of Authorization issued under §§ 216.106 and 217.149 of this chapter or a determination by NMFS and the applicant that modifications are appropriate pursuant to the adaptive management component of these regulations 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. Review and comment on renewals of Letters of Authorization are restricted to:

(1) New cited information and data indicating that the determinations made in this document are in need of reconsideration, and

(2) Proposed substantive 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**.

(d) *Adaptive Management*—NMFS may modify or augment the existing mitigation or monitoring measures (after consulting with BP regarding the practicability of the modifications) 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. Below are some of the possible sources of new data that could contribute to the decision to modify the mitigation or monitoring measures:

(1) Results from BP's monitoring from the previous year;

(2) Results from general marine mammal and sound research; or

(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.

§ 217.150 Modifications of Letters of Authorization.

(a) Except as provided in paragraph (b) of this section, no substantive modification (including withdrawal or suspension) to the Letter of Authorization issued by NMFS, pursuant to §§ 216.106 and 217.148 of this chapter and subject to the provisions of this subpart, shall be made until after notification and an opportunity for public comment has been provided. For purposes of this paragraph, a renewal of a Letter of Authorization under § 217.149, without modification (except for the period of validity), is not considered a substantive modification.

(b) If the Assistant Administrator determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in § 217.142(c), a Letter of Authorization issued pursuant to §§ 216.106 and 217.148 of this chapter may be substantively modified without prior notification and an opportunity for public comment. Notification will be published in the **Federal Register** within 30 days subsequent to the action.

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