Petition for Incidental Take Regulations for Oil and Gas Activities in the Chukchi Sea and Adjacent Lands in 2013–2018

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DISTRIBUTION

ACRONYMS AND ABBREVIATIONS

µPa	microPascal
2D	two-dimensional
3D	three-dimensional
AOGA	Alaska Oil and Gas Association
ARRT	Alaska Regional Response Team
AUV	autonomous underwater vehicle
bbl	barrel(s)
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CI	confidence interval
cm^3	cubic centimeter
ConocoPhillips	ConocoPhillips Company
CPT	cone penetrometer
dB	decibel(s)
E&P	Exploration and Production
EA	Environmental Assessment
EIS	Environmental Impact Statement
eni	eni Petroleum US LLC
ESA	Endangered Species Act
FLIR	forward looking infrared
FONSI	Finding of No Significant Impact
FR	Federal Register
FSEIS	Final Supplemental Environmental Impact Statement
ft	feet, foot

GHG	greenhouse gas
GPS	global positioning system
Hz	Hertz
IACPB	International Agreement on the Conservation of Polar Bears
Industry	the oil and gas industry
IPCC	Intergovernmental Panel on Climate Change
ITRs	incidental take regulations
ITS	incidental take statement
JIP	Joint Industry Project
kg	kilograms
kHz	kilohertz
km	kilometers
km^2	square kilometers
lb(s)	pound(s)
LOA	Letter of Authorization
m	meter(s)
mi	mile(s)
mi^2	square miles
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
NEPA	National Environmental Policy Act of 1969
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPR–A	National Petroleum Reserve-Alaska

NSB	North Slope Borough
NSF	National Science Foundation
NTL	Notice to Lessee
OCS	Outer Continental Shelf
OSC	on-scene coordinator
Pa	Pascal
PBSG	Polar Bear Specialist Group
ppm	parts per million
psi	pounds per square inch
PTS	permanent threshold shift
re	referenced to
Repsol	Repsol E&P USA Inc.
rms	root-mean-square
Shell	Shell Gulf of Mexico, Inc.
SPL	sound pressure level
Statoil	Statoil USA E&P Inc.
TL	transmission loss
TTS	temporary threshold shift
USC	United States Code
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
VLOS	very large oil spill
VSP	vertical seismic profile
walrus(es)	Pacific walrus(es)

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1.0 STATEMENT OF REQUEST

1.1 Nature of Request

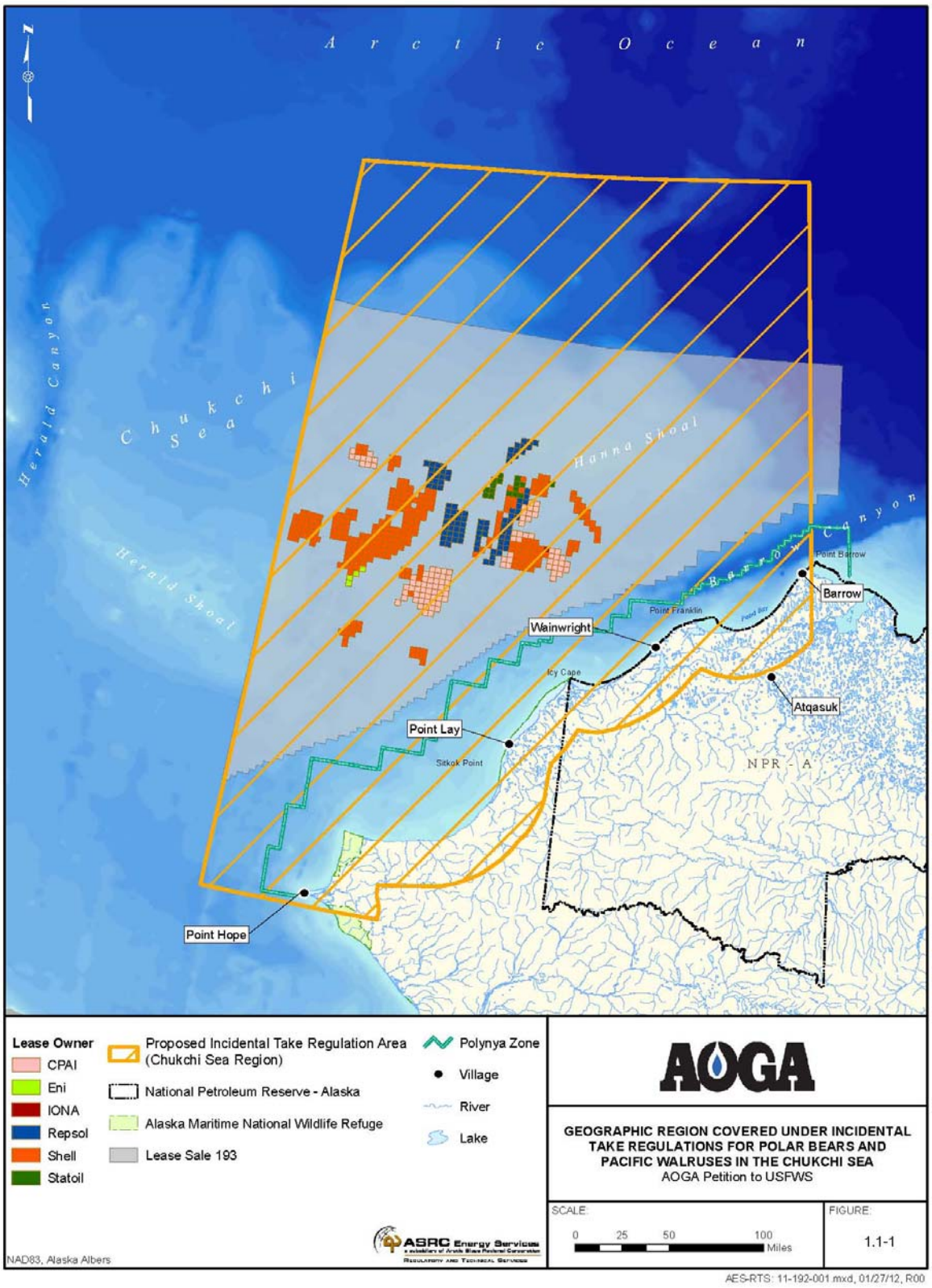
Pursuant to Section 101(a) (5) of the Marine Mammal Protection Act (MMPA); the Alaska Oil and Gas Association (AOGA), on behalf of its members; and ConocoPhillips Company (ConocoPhillips), a participating party, hereby petition the US Fish and Wildlife Service (USFWS) to promulgate incidental take regulations (ITRs) for the Chukchi Sea and adjacent coastal areas. This petition is for a period of five-years beginning June 11, 2013, and extending through June 11, 2018. Under these regulations, the USFWS can issue Letters of Authorization (LOAs) to oil and gas industry (Industry) operators to take small numbers of polar bears (*Ursus maritimus*) and Pacific walruses (*Odobenus rosmarus divergens*) (walruses) incidental to conducting oil and gas exploration within the Chukchi Sea Region (Figure 1.1-1). The Chukchi Sea Region includes the federal waters of the Outer Continental Shelf (OCS) within the Chukchi Sea Planning Area, State of Alaska waters located between the Chukchi Sea Planning Area and the Chukchi Sea coastline, and land within 40 kilometers (km) (25 miles [mi]) of the Chukchi Sea coastline from Point Hope to Point Barrow. The Chukchi Sea Region encompasses approximately 240,000 square kilometers (km^2) (92,665 square miles [mi^2]) of land and seafloor.

AOGA is a private, nonprofit trade association whose 16-member companies represent the majority of oil and gas exploration, development, production, transportation, refining, and marketing activities in Alaska. AOGA's members are as follows:

Alyeska Pipeline Service Company	Marathon Oil Company
Apache Corporation	Petro Star Inc.
BP Exploration Alaska Inc.	Pioneer Natural Resources Alaska, Inc.
Chevron Corporation	Repsol
eni Petroleum	Shell Gulf of Mexico, Inc.
ExxonMobil Production Company	Statoil
Flint Hills Resources, Inc.	Tesoro Alaska Company
Hilcorp Alaska, LLC	XTO Energy, Inc.

We request that USFWS promulgate regulations that are applicable to all persons conducting activities associated with oil and gas exploration as described in this Petition for the five-year period of time. Specifically, we request the class of activity covered by this Petition encompass all currently foreseeable oil and gas exploration that may occur within the Chukchi Sea Region during the Petition period. Consistent with prior and existing ITRs, and in consultation with USFWS, AOGA has identified this class of activity because within the identified geographic area, this class of activity may affect a small number of polar bears and walruses in substantially similar ways.

Figure 1.1-1 Geographic Region Covered under Incidental Take Regulations for Polar Bears and Walruses in the Chukchi Sea



In Summary, This Petition Requests USFWS To Authorize Non-Lethal, Unintentional, Incidental Take Of Small Numbers Of Polar Bears And Walruses During Oil And Gas Exploration Activities Within The Chukchi Sea Region During The Five-Year Period From June 11, 2013, Through June 11, 2018. The Requested Itrs Should Also Identify: Permissible Methods Of Non-Lethal Take, Measures To Ensure The Least Practicable Adverse Impact On These Species And On The Availability Of These Species For Subsistence Uses, And Requirements For Monitoring And Reporting. AOGA Further Petitions USFWS To Engage In Consultation Under Section 7 Of The Endangered Species Act (ESA) And To Complete The Environmental Impact Assessment Process For ITR Promulgation Under The National Environmental Policy Act Of 1969 (NEPA).

1.2 Regulatory Context

The following sections outline the regulatory context in which the Petition is filed and ITRs would be promulgated.

1.2.1 Marine Mammal Protection Act

Section 101(a)(5) of the MMPA, Title 16, United States Code, Section 1371(a)(5)(A) (16 USC 1371(a)(5)[A]), authorizes the Secretary of the Interior, through the USFWS, to promulgate regulations allowing the incidental, but not intentional, taking of small numbers of marine mammals associated with specified activities (other than commercial fishing), provided the total of such taking will have no more than a negligible impact on the affected marine mammal species or stocks, and does not have an unmitigable adverse impact on the availability of these species or stocks for subsistence uses. US citizens seeking to carry out activities (other than commercial fishing) that may result in the incidental taking of small numbers of these marine mammals may petition the USFWS to issue ITRs for the specified activities in a specified geographical region.

The following key terms and definitions have been promulgated in federal regulations implementing the MMPA at Title 50, Code of Federal Regulations, Section18.27(c) (50 CFR 18.27[c]):

Take means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill, any marine mammal, including, without limitation, any of the following: the collection of dead animals or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; or the negligent or intentional operation of an aircraft or vessel, or any other negligent or intentional act that results in disturbing or molesting a marine mammal.

Harassment means any act of pursuit, torment, or annoyance that has the potential to 1) injure a marine mammal or marine mammal stock in the wild (Level A harassment) or 2) 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).

Incidental, but not intentional, taking means takings that are infrequent, unavoidable, or accidental. It does not mean that the taking must be unexpected.

Small numbers is the portion of a marine mammal species or stock whose taking would have a negligible impact on that species or stock.

Negligible impact is 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.

Unmitigable adverse impact means an impact resulting from the specified activity that 1) 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) cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

ITRs promulgated under the MMPA do not permit, approve, or otherwise allow any individual activity or class of commercial, industrial, or development activities. The regulations establish a regulatory framework, linked to a specified area and a specified timeframe, to allow US citizens to apply to USFWS for an LOA. The regulations identify regulatory requirements that may be applied by USFWS depending on the nature, location, timing, and duration of an activity. Each LOA issued by USFWS imposes specific enforceable mitigation, monitoring, and reporting to ensure takes of polar bears and walruses occur in small numbers and with no more than a negligible impact on the species or stocks.

Since 1991, the oil and gas industry has requested, and USFWS has issued regulations for, incidental take authorization for conducting activities in areas of walrus and polar bear habitat in and adjacent to the Beaufort and Chukchi seas. USFWS issued incidental take regulations for walruses and polar bears in the Chukchi Sea for the periods 1991–1996 (Volume 56, Federal Register, Page 27443 [56 FR 27443]; June 14, 1991) and 2008–2013 (73 FR 33212; June 11, 2008). The current regulations will expire on June 11, 2013.

Small Numbers Analysis

The MMPA does not require specific numbers for small take analyses, leaving the determination of "small" to the agency's discretion. In issuing past regulations, USFWS reviewed the best scientific information available and found that any incidental take (Level B) reasonably likely to result from the effects of oil and gas exploration activities, as mitigated through the incidental take regulatory process, would be limited to small numbers of walruses and polar bears and would have a negligible impact on polar bear and walrus populations. The USFWS finding was based on:

- The seasonal distributions and habitat use patterns of walruses and polar bears in the Chukchi Sea;
- The timing, scale, and habitats associated with the proposed activities and the limited potential area of impact in open-water habitats, and
- Monitoring requirements and mitigation measures designed to limit interactions with, and impacts to, polar bears and walruses.

As a result of its "small numbers" analysis, USFWS concluded that:

- The number of walruses and polar bears occupying the specified geographical region during the open-water exploration season is expected to be proportionally smaller than the number of animals distributed in other regions;
- The number of walruses and polar bears using open-water habitats during offshore exploration operations is expected to be small relative to the number of animals using pack-ice habitats or coastal areas outside the areas of operation (for example, coastal areas of Chukotka Russia); and

- The footprint of authorized projects is expected to be small relative to the large range of polar bear and walrus populations. Walruses and polar bears are expected to be broadly distributed across the Chukchi Sea, the Eastern Siberian Sea (walruses), and the Beaufort Sea (polar bears) during the operating season.

Monitoring requirements and adaptive mitigation measures such as operational exclusion zones near observed animals and seasonal restrictions on offshore activities are expected to significantly limit the number of incidental takes to animals See, e.g., 76 FR 47010 (August 3, 2011, Beaufort Sea 2011-2016 incidental take regulations). The dynamic nature of sea ice habitats influences the seasonal and annual distribution and abundance of polar bears and walruses in the Chukchi Sea. This limits USFWS's ability to provide precise numerical estimates of the number of walruses and polar bears that might potentially be impacted in any given year.

No lethal takes are expected to occur, nor would any be authorized by the issuance of new ITRs in the Chukchi Sea. The nature of oil and gas exploration activities in combination with mitigation measures included in ITRs and stipulations required in individual LOAs will limit the incidental take of polar bears and walruses as a result of oil and gas exploration activities in the Chukchi Sea to small numbers, and the activities would be expected to have only a negligible impact on these species and stocks.

1.2.2 Endangered Species Act

The ESA establishes comprehensive statutory requirements intended to conserve fish, wildlife, and plants facing extinction. Section 4 of the ESA, 16 USC 6533, provides authority for the listing of species as either "threatened" or "endangered" and for the designation of "critical habitat" for listed species. Once a species has been listed, the provisions of the ESA afford protection to such species and to designated critical habitat in the form of various procedural requirements and prohibitions.

Under Section 7 of the ESA, 16 USC 1536, all federal agencies must ensure, through consultation with USFWS or the National Marine Fisheries Service (NMFS), that actions authorized, funded, or carried out by such agencies are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat designated for such species. If, as a result of consultation, USFWS concludes the proposed action is not likely to jeopardize listed species or to destroy or adversely modify designated critical habitat, it will issue an Incidental Take Statement (ITS) authorizing the take expected to occur as a result of the action. Importantly, as to ESA-listed marine mammals, no ITS may be issued for an ESA-listed marine mammal species under Section 7(b)(4)(C) of the ESA unless authorization for the incidental take has been obtained pursuant to Section 105(a)(5)(A) of the MMPA. In the Biological Opinion for Polar Bears on Chukchi Sea Incidental Take Regulations, USFWS (2008a) concluded that the total take anticipated as a result of the issuance of the current ITRs in the Chukchi Sea Region would be unlikely to result in jeopardy to the polar bear.

In addition to the consultation requirements of Section 7, Section 9 of the ESA, 16 USC 1538, prohibits any person from the taking of any endangered species in the US or on the high seas, without an incidental take authorization issued by USFWS, or as otherwise allowed by statutory exemption. A taking under the ESA is more broadly defined (at 50 CFR 17.3) than under the MMPA. In particular, in contrast to the MMPA, take under the ESA has been defined to encompass "harm," defined as "any act which actually kills or injures fish or wildlife," including "significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife." The take prohibition does not apply to species listed as "threatened." Instead, under Section 4(d) of the ESA, 16 USC 1533(d), a regulation may be promulgated applying the taking prohibitions of Section 9 to threatened species.

The polar bear is listed as a threatened species under the ESA, and critical habitat, which encompasses most of the Chukchi Sea Region, has been designated. The USFWS has also promulgated an interim special rule for the polar bear pursuant to Section 4(d) of the ESA (Interim Polar Bear 4(d) Rule, 73 FR 28306). Under the terms of the Interim Polar Bear 4(d) Rule, none of the ESA Section 9 take prohibitions apply to any activity authorized or exempted under the MMPA, provided the person carrying out the activity has complied with all applicable terms and conditions. Accordingly, activities carried out in compliance with MMPA regulations and authorizations, such as the regulation requested in this Petition and associated future LOAs, do not require authorization under the ESA with respect to polar bears.

In conjunction with issuance of the regulations proposed in this Petition, USFWS must consult under Section 7 of the ESA regarding the polar bear species. AOGA hereby requests that USFWS initiate this intra-agency consultation process. We further request that USFWS confirm that AOGA may participate in the consultation process as the "applicant."

After conducting a status review, USFWS announced in 2011 that the walrus warrants protection under the ESA but is excluded from listing by higher-priority species that need to be addressed before the walrus. It is therefore considered a candidate species but currently receives no statutory protection under the ESA. The status of the walrus will be reviewed annually and proposed rules to list the species and designate critical habitat under the ESA may be developed in the future.

1.2.3 National Environmental Policy Act

NEPA (42 USC 4332[C]), mandates a thoughtful and reasonably thorough analysis of the probable environmental impacts of a proposed major federal action, including analysis of both a reasonable range of alternatives that achieve the purpose and need for the project, and analysis of the no-action alternative. An EA is a concise document providing sufficient information and analysis to determine whether preparation of an Environmental Impact Statement (EIS) is necessary. NEPA requires preparation of an EIS for major federal actions significantly affecting the quality of the human environment. An EIS is not required if, after preparation of an EA, a federal agency issues a Finding of No Significant Impact (FONSI). The requirements of NEPA are entirely procedural. Accordingly, while NEPA mandates a thoughtful and thorough analysis, it does not establish any substantive regulatory standards or compel a particular decision to approve, modify, or disapprove a proposal.

USFWS must comply with NEPA within the process of promulgating ITRs. The proposed action – promulgation of ITRs – does not permit, authorize, or otherwise allow any oil and gas activity. Rather, the agency action being analyzed is authorization of non-lethal, incidental (non-intentional) take of small numbers of polar bears and walruses over a five-year period, in a defined geographic area, that has no more than a negligible impact on these species and that has no unmitigable adverse impact on the availability of these species for subsistence uses by Alaska Natives. Because the proposed action must necessarily have no more than a negligible impact under the MMPA, we anticipate that USFWS may, as in the past, satisfy NEPA by preparing an EA resulting in a FONSI.

1.2.4 Future Regulatory Developments

Although the applicable MMPA, ESA, and NEPA processes described above are well defined, there are at least three areas where future regulatory developments have the potential to affect the ITR requested by this Petition. The following developments may occur between the date of the Petition and issuance of the requested ITR:

- Potential Listing of the Walrus under ESA – The walrus may be listed under the ESA and critical habitat may be identified on the basis of projected future consequences of climate change. We do not anticipate that a decision to list the walrus under the ESA will delay issuance of the proposed ITR. Moreover, should walruses be listed, the scope of the necessary Section 7 consultation under the ESA will need to expand to include the walrus. Additionally, any final rule listing the walrus as threatened may be accompanied by a special rule issued under ESA Section 4(d), similar to the Interim Polar Bear 4(d) Rule.

- Regulation of Greenhouse Gas (GHG) Emissions – There is no current federal regulatory scheme that addresses GHG emissions, or related climate change impacts, except through GHG reporting to the US Environmental Protection Agency (USEPA) associated with the certain facilities and suppliers subject to regulation under 40 CFR 98. Numerous and widely varying proposals for regulation of GHG emissions have been introduced in Congress, and more are expected to follow. It is possible that Congress, the President acting by Executive authority, or federal agencies acting pursuant to existing statutory authority, may elect to regulate GHG emissions, although whether and how this will be achieved is uncertain and speculative at this time. AOGA does not anticipate that advances in GHG emissions regulation between the filing of this Petition and June 2013 will directly affect issuance of the proposed ITR; however, analysis of GHG emissions and climate change issues in connection with this ITR, pursuant to the MMPA, ESA, and NEPA, should be as current as is practicable with the evolving state of scientific information regarding climate change and GHG emissions.

- Final Polar Bear 4(d) Rule – Subsequent to the issuance of the Interim Polar Bear 4(d) Rule, the USFWS issued a Final Polar Bear 4(d) Rule that also contained a provision addressing MMPA-compliant activities, as described above (73 FR 76249) (codified at 50 C.F.R. 17.40[q]). However, the US District Court for the District of Columbia vacated and remanded the Final Polar Bear 4(d) Rule based upon the Court's finding that the USFWS violated NEPA when promulgating the Final Polar Bear 4(d) Rule. See *In re Polar Bear Endangered Species Act Listing and § 4(d) Rule Litigation*, Misc No. 08-746, Dockets 282, 283 (D.D.C) (Oct. 17, 2011, and Nov. 18, 2011). The Court further ordered that the Interim Polar Bear 4(d) Rule should be reinstated pending the issuance of a new Final Polar Bear 4(d) Rule. Under the Court's order, the USFWS is obligated to issue a final EA and new final rule by December 6, 2012.

1.3 Scientific Context

In their EA for the issuance of the current Chukchi Sea ITRs, USFWS (2008b) has concluded that oil and gas exploration activities in the Chukchi Sea result in no more than a temporary change in the behavior of individual animals, have no lasting effects on individuals or groups of polar bears and walruses, and result in no population level impacts to these species. There is no scientific evidence that oil and gas exploration activity has had, or is having, an adverse impact on survival or recruitment of polar bears and walruses.

A great deal of scientific and regulatory attention has been focused upon polar bears in recent years in connection with the listing of this species as threatened under the ESA. The regulatory processes associated with the listing by USFWS have included a thorough analysis of impacts of oil and gas activities on polar bears (USFWS 2008b). On the basis of this analysis, USFWS concluded that oil and gas activities, as regulated under the MMPA, do not pose a current or foreseeable threat to the polar bear and do not have more than a negligible impact.

Any ITRs resulting from this Petition would stipulate monitoring and reporting requirements to mitigate potential impacts to polar bears and walruses and subsistence hunting. Upon completion of activities covered under the regulations, companies have been and will be required to submit monitoring data to

USFWS. Monitoring data have been collected for activities in the Chukchi Sea and provided to the agency by Industry in accordance with authorization conditions since 2006. The monitoring and reporting requirements create a positive feedback cycle that add to the scientific knowledge base of the Chukchi Sea and help USFWS adjust regulations and take estimates to better reflect current habitat use by polar bears and walruses.

The findings of USFWS under the ESA provide an important context for this Petition. USFWS found that polar bears and walruses may be at risk in the future because of projected changes in sea-ice patterns and sea-ice reduction. USFWS also found that the activities, such as oil and gas exploration and development activities, in the arctic do not pose any risk to polar bears. The incidental takes that would be allowed by the proposed regulations are related to activities that USFWS has found to pose no threat to polar bears and, moreover, would consist of no more than short-term consequences. In other words, polar bears and walruses may be subject to future risk, but that risk is because of a global phenomenon, not oil and gas activities.

USFWS concluded that changes in sea ice habitats in the Chukchi Sea will likely result in significant changes in distribution and habitat use patterns of walruses (Garlich-Miller et al. 2011). Loss of sea ice will likely continue to cause decreased fitness and abundance and changes in distribution. By definition, the takings addressed in this Petition are non-lethal and non-intentional, and are expected to consist of no more than short-term changes in behavior with no detectable long-term injury or consequence, involving small numbers of polar bears and walruses.

1.4 Information Submitted in Response to the Requirements of 50 CFR 18.27(d)

USFWS regulations governing the issuance of regulations and LOAs permitting incidental takes under certain circumstances are codified in 50 CFR 18.27. Section 18.27(d) sets out eight (i-viii) specific items that must be addressed in requests for rulemaking pursuant to Section 101(a)(5) of the MMPA. Each of these items is addressed in detail in the following chapters. The chapter number and title addressing the corresponding 50 CFR 18.27(d) item is identified in Table 1.4-1 below.

Table 1.4-1 Location of 50 CFR 18.27(d) Requirement Information in this Petition

Chapter Number	Chapter Title	50 CFR 18.27(d) Requirement
2.0	Description of Activities	(i) A description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.
3.0	Dates, Duration, and Region of Activities	(ii) The dates and duration of such activity and the specific geographical region where it will occur.
4.0	Species, Number, and Type of Take	(iii)(A) Based upon the best available scientific information: An estimate of the species and numbers of marine mammals likely to be taken by age, sex, and reproductive condition, and the type of taking and the number of times such taking is likely of occur.
5.0	Status, Distribution, and Seasonal Distribution of Species	(iii)(B) A description of the status, distribution, and seasonal distribution of the affected species or stocks likely to be affected by such activities.
6.0	Anticipated Impact on Polar Bears and Walruses	(iii)(C) The anticipated impact of the activity upon the species or stocks.
7.0	Anticipated Impact on Subsistence	(iii)(D) The anticipated impact of the activity on the availability of the species or stocks for subsistence uses.

8.0	Anticipated Impact on Habitat	(iv) The anticipated impact of the activity upon the habitat of the marine mammal populations and the likelihood of restoration of the affected habitat.
9.0	Anticipated Impact of Habitat Loss or Modification on Species	(v) The anticipated impact of the loss or modification of the habitat on the marine mammal population involved.
10.0	Mitigation Measures	(vi) The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least-practicable adverse impact upon the affected species or stocks, their habitat, and, where relevant, on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.
11.0	Monitoring and Reporting	(vii) Suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species through an analysis of the level of taking or impacts and suggested means of minimizing burdens by coordinating such reporting requirement with other schemes already applicable to persons conducting such activity.
12.0	Coordination of Research Efforts	(viii) Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking from such specified activities and evaluating its effects.

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2.0 DESCRIPTION OF ACTIVITIES

50 CFR 18.27(d)(i) A description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.

The types of exploration activities that may be conducted in the Chukchi Sea Region during the Petition period are described in the following sections. All of these types of oil and gas exploration activities have been previously conducted in accordance with past and current ITRs applicable to the Chukchi and Beaufort seas and adjacent coastal areas. Analyses of potential impacts from these activities have been conducted by Industry and regulatory agencies over an extended period of years, and the types of reasonably anticipated effects are well documented.

The levels of activities expected to occur during the Petition period are described below. These levels are projected by year, even though the exact timing of activities are difficult to predict. The scheduling and execution of oil and gas exploration activities in the Chukchi Sea Region during the Petition period will be influenced by numerous factors, including economics, regulatory constraints, political considerations, judicial/regulatory delays, and weather and ice conditions. In addition, a company's exploration strategy could require significant modification on the basis of results of exploration activities. For these reasons, the following estimates of activities should be viewed as the expected amount of activity projected over the Petition period and not necessarily the expected activity for any given year.

2.1 Historic and Present Oil and Gas Activity

Oil and gas exploration has taken place in the Chukchi Sea and on adjacent lands for more than 40 years. In the federal waters of the Chukchi Sea, the first permits for two-dimensional (2D) seismic surveys were issued in 1970 (MMS 2007b). The Minerals Management Service (MMS; now Bureau of Ocean Energy Management [BOEM]) issued permits for a total of 12 offshore 2D seismic surveys from 1970 to 1975. This was followed by a hiatus in which no permits were issued from 1976 to 1982. Then, between 1982 and 1991, the agency issued permits for 30 additional 2D seismic surveys in the Chukchi Sea. Three dimensional (3D) seismic surveys were first conducted in the Chukchi Sea in 2006. Through 2007, approximately 128,750 km (80,000 mi) of 2D seismic survey lines have been surveyed and 3,885 km^2 (1,500 mi^2) of 3D seismic surveys have been completed in the Chukchi Sea (MMS 2007b).

Three oil and gas lease sales (Table 2.1-1) have been held by BOEM within federal waters of the Alaska Chukchi Sea in the Chukchi Sea Planning Area, and a total of 2.0 million hectares (4.9 million acres) were leased during these sales. Small portions of the Chukchi Sea Planning Area were also offered in earlier Beaufort Sea Planning Area lease sales (Sales 97 and 124). OCS leases are currently held in the Chukchi Sea by Shell Gulf of Mexico, Inc. (Shell), ConocoPhillips, eni Petroleum US LLC (eni), Statoil USA E&P Inc. (Statoil), Repsol E&P USA Inc. (Repsol), IONA Energy Company (US) Limited, and OOGC America, Inc. The locations of current lease holdings are indicated in Figure 2.1-1.

Leasing in the OCS is conducted according to five-year plans developed by BOEM pursuant to the Outer Continental Shelf Lands Act. The current five-year plan, which has no additional lease sales scheduled for the Chukchi Sea, covers the period 2007-2012. BOEM has issued a Proposed Program and Environmental Impact Statement for 2012-2017 (BOEMRE 2011b) that includes a single sale in the Chukchi Sea. The lease sale is scheduled to take place in 2016.

Table 2.1-1 Historic Chukchi Sea Planning Area Lease Sales

Lease Sale [1,2]	Date	Tracts Offered	Leases Issued	Leased Area		Active Lease Area		Active Leases
				Acres	Hectares	Acres	Hectares	
109	1988	4,694	350	1,976,912	800,027	0	0	0
126	1991	3,476	283	159,213	64,431	0	0	0
193	2008	5,354	487	2,758,377	1,116,275	2,758,377	1,116,277	487
total	--	13,524	1,120	4,894,502	1,980,734	2,758,377	1.116,277	487

Notes: [1] Source: BOEMRE 2011(a)
[2] Small portions of the Chukchi Sea were also included in Beaufort Sea Planning Area Lease Sales 97 and 124.

Five oil and gas exploration wells have been drilled in the Chukchi Sea to date. Information about these wells is provided below in Table 2.1-2. Currently there is no offshore infrastructure and no production of oil and gas in federal waters of the Chukchi Sea.

Table 2.1-2 Historic Offshore Exploration Wells Drilled in the Chukchi Sea Region

Well	Drilling Initiated	Drilling Finished	Operator	Drilling Unit	Area	Block
Diamond	1991	1991	Chevron USA Inc	Drillship Explorer III	Hanna Shoal	6704
Popcorn	1989	1990	Shell Western E&P Inc	Drillship Explorer III	Karo	6118
Crackerjack	1990	1991	Shell Western E&P Inc	Drillship Explorer III	Karo	6669
Burger	1989	1990	Shell Western E&P Inc	Drillship Explorer III	Posey	6814
Klondike	1989	1989	Shell Western E&P Inc	Drillship Explorer III	Colbert	6323

Source: MMS 2005

The State of Alaska owns the seafloor and oil and gas resources in coastal waters from the shoreline seaward to the three-mile line, –the shoreward limit of federal waters. No oil and gas lease sales have been held in State waters along the Chukchi Sea coast. There is currently no oil and gas infrastructure and no production of oil and gas in State waters of the Chukchi Sea.

In 1996, the State of Alaska Department of Natural Resources, Division of Oil and Gas, adopted an "areawide" approach to leasing. Under areawide leasing, the State annually offers all available state acreage not currently under lease within each area. The State of Alaska has not selected a planning area in the Chukchi Sea and adjacent onshore areas. As of the preparation of this Petition, the State of Alaska has no plans to conduct a lease sale on State-owned land or water within the Chukchi Sea Region (ADNR 2011).

Most of the onshore lands within the Chukchi Sea Region north of Icy Cape are federal lands that are part of the National Petroleum Reserve–Alaska (NPR–A), which is divided into three planning areas: the Northwest NPR–A (area along the Chukchi Sea), the Northeast NPR–A, and the South NPR–A. Twelve lease sales have been held in the NPR–A to date (Table 2.1-3). Some onshore tracts in the portion of the NPR–A lying within the Chukchi Sea Region were leased for oil and gas exploration in 2004 and 2006; however, there are currently no active leases in the area.

Table 2.1-3 Historic Lease Sales within the National Petroleum Reserve–Alaska

Lease Sale	Date	Offered		Leased	
		Acres	*Hectares*	*Acres*	*Hectares*
821	1982	1,500,000	607,028	653,436	264,436
822	1982	3,500,000	1,416,399	252,000	101,980
831	1983	2,195,000	888,285	419,018	169,570
841	1984	1,600,000	647,497	0	0
851	1985	canceled	canceled	canceled	canceled
991	1999	3,900,000	1,578,274	867,000	350,862
NPR–A 2002	2002	--	--	579,269	234,421
NPR–A 2004	2004	--	--	1,403,561	568,000
NPR–A 2006	2006	939,867	380,350	--	--
NPR–A 2008	2008	--	--	131,641	53,273
NPR–A 2010	2010	--	--	28,444	11,511
NPR–A 2011	2011	3,060,176	1,238,414	141,739	57,360

Early exploration in the NPR–A (then known as the Naval Petroleum Reserve–4 or PET–4) was carried out by the US Navy in 1944–1952. The Navy drilled 81 exploration wells and collected 5,311 line kilometers (3,300 line miles) of seismic data during this time period. Following a hiatus, exploration recommenced in the area in 1973 in response to the oil embargo. The land was re-designated the NPR–A and the lands and exploration program were transferred to the US Department of Interior. From 1973 through 2003, 28 exploration wells were drilled and 21,058 line kilometers (13,085 line miles) of seismic data were collected. A number of discoveries were made during these exploration efforts and a greater number of oil and gas shows were observed. The only oil and gas development and production that occurred within the Northwest NPR–A as a result of these efforts was the development of the Barrow gas fields. These fields consist of the South Barrow Field, the East Barrow Field, and the Walakpa Field. The Walakpa Field has nine producing gas wells and a gathering line that transports the gas to facilities at the South Barrow Field. The East Barrow Field has four producing gas wells and a gathering line and road to the South Barrow Field. The South Barrow Field has eight producing gas wells, production facilities, and a transmission line to Barrow. Portions of the Walakpa Field and the South Barrow Field are located within the Chukchi Sea Region.

2.2 Types of Oil and Gas Activities Expected in 2013–2018

The levels of activities expected to occur during the Petition period are described below. These levels are projected by year, even though the exact timing of activities is difficult to predict. The scheduling and execution of oil and gas exploration activities in the Chukchi Sea Region during the Petition period will be influenced by numerous factors, including economics, regulatory constraints, political considerations, judicial/regulatory delays, and weather and ice conditions. In addition, a company's exploration strategy could require significant modification on the basis of the results of exploration activities. For these reasons, the following estimates of activities should be viewed as the expected amount of activity projected over the Petition period and not necessarily the expected activity for any given year.

2.2.1 Exploration Drilling

Descriptions of oil and gas exploration expected to occur within the Chukchi Sea Region from June 11, 2013, to June 11, 2018 are provided below.

2.2.2 Exploration Drilling

All exploration drilling expected to occur within the Chukchi Sea Region from June 11, 2013 to June 11, 2018 would take place offshore on leases in federal waters of the OCS. Detailed descriptions of offshore exploration drilling programs can be found in exploration plans submitted for approval to BOEM (ConocoPhillips 2011; Shell 2011). In addition to the drilling itself, activities associated with exploration drilling include ice management, vertical seismic profiles, and logistical support for crew change and resupply. Equipment includes a drilling unit, ice management vessels, oil spill response vessels, a helicopter, a fixed-wing aircraft, and limited shorebased facilities.

Exploration Drilling

Because of the water depths at lease holdings and within future lease sale areas, it is likely that all exploration drilling in the Chukchi Sea Region in 2013 – 2018 will be conducted from either a floating drilling unit such as a drillship or conical drilling unit, or a jack-up drilling platform. All five historical exploration wells in the Chukchi Sea Region were drilled with a drillship (*Explorer III*). Pending exploration drilling programs employ drillships (*Discoverer*) and jack-ups (GustoMSC CJ50). Some specifications for these drilling units are provided below in Table 2.2-1. Photographs of typical drillship and jack-up rig are provided in Figures 2.2.1-1 and 2.2.1-2 respectively.

Table 2.2.1-1 Specifications for Some Drilling Units[a]

Drilling Unit	Unit Type	Length	Width	Draft	Derrick Height	Accommodations [1]
Kulluk 2	conical	40.5 m (133 ft)	40.5 m (133 ft)	-	49 m (160 ft)	183
Discoverer	drillship	157 m 514 ft)	26 m (85 ft)	8.2 m (27 ft)	53 m (175 ft)	140
Explorer III	drillship	149.2 m (490 ft)	29.7 m (97 ft)	7.5 m (25 ft)	-	-
GustoMSC CJ50	jack-up	70 m (230 ft)	68 m (223 ft)	-	64 m (210 ft)	-

Notes:
[1] Accommodations is the number of berths and indicative of crew size.
[2] The Kulluk 2 is a conical drilling unit that has been identified for use in the Beaufort Sea and could be considered for the Chukchi Sea.
[a]The units represented in the table are examples of the types of units that would be used during the term of the regulations. If other units are used, we expect they would have similar specifications to those listed in the table.
ft = feet; m = meters

Exploration drilling with these types of drilling units would occur during the open-water drilling season – generally June-November – when the presence of ice is at a minimum. The drilling units and any support vessels would enter the Chukchi Sea at the beginning of the season and exit the sea at the end of the season. Drillships are generally self-propelled, whereas jack-up rigs must be towed to the drill site. The *Discoverer*, *Explorer III* and most other drillships (as well as the *Kulluk* 2) that could be used in the Chukchi Sea are stabilized at the drill site with eight to twelve 7 to 8-ton anchors. A support vessel called an anchor handler is used to set the anchors in place, which is generally within a radius of about 610–914 m (2,000–3,000 ft) from the drilling unit for water depths at current Chukchi Sea Region OCS leases. Jack-ups have retractable legs that are raised for transit and lowered to the seafloor for stabilization at the drill site.

Figure 2.2.1-1 Typical Drillship

Figure 2.2.1-2 Typical Jack-up

These drilling units are largely self-contained with accommodations for the crew, including quarters, galleys, and sanitation facilities. Some waste streams will likely be discharged to the Chukchi Sea as allowed under the current EPA National Pollutant Discharge Elimination System (NPDES) general permit. Discharged waste streams may include water-based drilling fluids, drill cuttings, domestic and treated sanitary wastewater, excess cement, bilge water, ballast water, and deck drainage.

Ice Management

All current OCS leases and planned lease sales in the Chukchi Sea Region are within areas characterized by active sea-ice movement. Per regulations at 30 CFR 250.220, operators of exploration drilling programs in the Chukchi Sea Planning Area are required to have BOEM-approved emergency plans and critical operations and curtailment procedures that may include ice management plans. Ice management is expected to be required for only a small portion of the drilling season, if at all, given the lack of sea ice observed over most current lease holdings in the Chukchi Sea Region in recent years. Most ice management would consist of actively pushing the ice off its trajectory with the bow of the ice management vessel, but some icebreaking could be required.

Vertical Seismic Profiles

Geophysical surveys referred to as vertical seismic profiles (VSPs) will likely be conducted at many of the Chukchi Sea Region drill sites where and when an exploration well is being drilled. The purpose of the survey is to ground-truth existing seismic data with geological information from the wellbore. A small airgun array is deployed at a location near or adjacent to the drilling unit, and receivers are placed (temporarily anchored) in the wellbore. The discharge volume of airgun arrays used for VSPs typically does not exceed 12,500 cubic centimeters (cm^3) (760 cubic inches [in^3]) and a typical receiver string contains up to four receivers spaced about 16 m (50 ft) apart. The sound source (airgun array) is fired repeatedly, and the reflected sonic waves are recorded by the receivers (geophones) located in the wellbore. The geophones, typically a string of them, are then raised up to the next interval in the wellbore and the process is repeated until the entire wellbore has been surveyed. The duration of a normal VSP survey is about 10–14 hours per well, depending on the depth of the well and the number of anchoring points.

Onshore Support Bases, Re-supply, and Crew Changes

Many exploration activities, including most seismic surveys, shallow hazard surveys, bathymetric surveys, and offshore geotechnical surveys, are conducted from self-sufficient vessels and require little or no support from onshore facilities in the Chukchi Sea Region. Exploration drilling programs may entail both air-support facilities where aircraft serving crew changes, search and rescue, or re-supply functions would be housed and marine support facilities where vessels may access the shoreline.

For exploration drilling programs during the specified time period, operators will likely use extant facilities such as existing airports and airstrips, hotels and office buildings, and camps in North Slope villages for any needed onshore support facilities. These existing facilities will likely be augmented with small, temporary camps that are placed on previously developed land. It is also possible that some operators may elect to use onshore support facilities located outside the Chukchi Sea Region.

The crews on mobile offshore drilling units are usually rotated every 21 to 30 days by aircraft or vessels. In the Chukchi Sea Region, all crew changes would likely be effected by helicopter. Helicopters would transport crew members directly between the drilling unit and either 1) a community with a hub airport (such as Barrow) where commercial flights would take them home, or 2) a smaller community with an airstrip, and then by fixed-wing to the hub. Given the crew sizes and staggered rotation intervals, it is likely that 1–2 helicopter trips per day would be required.

Re-supply is required for offshore drilling operations, as the drilling units cannot carry all supplies for the entire drilling season. Most re-supply of drilling operations in the Chukchi Sea Region would be carried out using offshore supply vessels that bring the supplies in from support infrastructure located outside the Chukchi Sea Region. One or two such vessels would carry out the re-supply, making several trips in and out of the Chukchi Sea Region.

2.2.3 Seismic Surveys

Seismic surveys are conducted to gather information about subsurface geology to identify potential geologic traps that may hold or act as reservoirs of oil and natural gas. The interpreted data can be used to map the deep sub-seafloor, to depths of 6,100 m (20,000 ft) or more below the seafloor depending on the survey design, sound source, and local geology.

Seismic survey equipment includes sound energy sources (airguns) and receivers (hydrophones / geophones). The airguns store compressed air that upon release forms a bubble that expands and contracts in a predictable pattern, emitting sound waves as it does. The sound energy from the source penetrates the seafloor and is reflected back to the surface where it is recorded and analyzed to produce graphic images of the subsurface features. Differences in the properties of the various rock layers found at different depths reflect the sound energy at different positions and times. This reflected energy is received by the hydrophones housed in submerged streamers towed behind the survey vessel.

The two general types of offshore seismic surveys, 2D and 3D surveys, use similar technology but differ in survey transect patterns, number of transects, number of sound sources and receptors, and data analysis. The primary difference between the two survey types is that a 3D survey has a denser grid for the transect pattern; both emit relatively similar sound levels. All seismic surveys in the 2013–2018 timeframe would be expected to occur offshore in federal waters of the OCS.

Seismic surveys are conducted with vessels capable of towing one or more seismic cables deployed in parallel to record data suitable for interpretation of structures beneath the sea bed. There is usually a single survey vessel towing the airgun array and streamers that is supported by one or two similar-sized

support vessels (chase vessels or marine mammal monitoring vessels). The survey vessel may tow up to 12 cables, or streamers, of up to 8.0 km (5.0 mi) in length, spaced 50–150 m (164–492 ft) apart. The hydrophones are deployed at regular intervals within each streamer. This set-up allows airguns and recording cables to be on the same vessel. The airgun array and streamers can be deployed at different depths, depending on the configuration of the survey and the regional geography. Seismic surveys in the Chukchi Sea Region may employ one or more airgun arrays, each with a series of airguns totaling 49,161–65,548 cm^3 (3,000–4,000 in^3) operated at about 2,000 pounds per square inch (psi). The positions of the sound source and each hydrophone group are used to accurately calculate where subsurface features are located. Positioning accuracy is required and can be achieved using a combination of acoustic networks and different geographical positioning systems.

2.2.4 Shallow Hazards Surveys

All shallow hazards surveys in the Chukchi Sea Region conducted between June 11, 2013, and June 11, 2018, which includes the entire "open-water seasons" of 2013–2018 are expected to be conducted on OCS leases in the Chukchi Sea Planning Area. Shallow hazards surveys, also known as site clearance or high-resolution surveys, are conducted to collect bathymetric data and information on the shallow geology down to depths of about 305 m (5,446 ft) below the seafloor at areas identified as potential well or drill sites. The resulting data are then interpreted and used to identify potential hazards in the area. Shallow hazards surveys must be conducted at all exploration drill sites in the OCS before drilling can be approved by BOEM. Specific requirements for these shallow hazards surveys are presented in BOEM's Notice to Lessee (NTL) 05-A01. Potential hazards may include shallow faults, shallow gas, permafrost, and hydrates. Any archaeological features such as shipwrecks would also be identified. Drilling operations can then be permitted and conducted at a location that avoids or minimizes any risks of encountering these types of features.

A number of shallow hazards surveys have occurred in the Chukchi Sea in the last 30 years and it is reasonable to assume a number of these surveys will be conducted from 2013–2018. Equipment used in past surveys included sub-bottom profilers, multi-beam bathymetric sonar, side-scan sonar, high-resolution seismic (airgun array or sparker), and magnetometers. Equipment to be used in future surveys in 2013–2018 would be expected to be these types of equipment as they are required by the above-referenced BOEM NTLs, but would not necessarily be limited to this list.

Shallow hazards surveys are conducted from vessels during the summer or open-water season along a series of transects, with different line spacing depending on the proximity to the proposed drill site and geophysical equipment to be used. Generally, a single vessel is required to conduct the survey, but in the Chukchi Sea an additional vessel is often used as a marine mammal monitoring platform. The geophysical equipment is either hull-mounted or towed behind the vessel, and sometimes is located on an autonomous underwater vehicle (AUV). Site clearance or shallow hazards surveys allow the preparation of detailed maps of the seafloor surface (side-scan sonar, multi-beam bathymetry) and shallow subsurface below (sub-bottom profiler and high-resolution seismic). Small airgun arrays (compared to those used for 3D seismic surveys) with a total volume of 258 cm^3 (40 in^3) and pressured to about 2,000 psi have been used as the energy source for past high-resolution seismic survey and would be expected to be used in future surveys in 2013–2018, but larger or smaller airguns under more or lesser pressure may be used. Sparkers have also been used in the Chukchi Sea in the past and may be used in the future. The magnetometer is used to locate and identify any ferrous (iron) objects (man-made) that might be on the seafloor.

2.2.5 Other Geophysical Surveys

Other types of geophysical surveys that have been conducted recently in the Chukchi Sea as part of the ongoing exploration effort, and are expected to continue, from 2013–2018, include ice gouge surveys, strudel scours surveys, and other bathymetric surveys (e.g., platform and pipeline surveys). These surveys use the same types of remote-sensing geophysical equipment used in shallow hazards surveys, but they are conducted for different purposes in different areas and often lack a seismic (airgun) component. Each of these types of surveys is briefly described below.

Ice Gouge Surveys

Ice gouging is the creation of troughs and ridges on the seafloor caused by the contact of the ice keels on moving ice floes with unconsolidated sediments on the seafloor. Oil and gas operators conduct these surveys to gain an understanding of the distribution, frequency, size, and orientation of ice gouging in their areas of interest in order to predict the location, size, and frequency of future ice gouging. The surveys may be conducted from June through October when the area is sufficiently clear of ice and weather permits. Equipment to be used in ice gouge surveys during this time period may include, but will not necessarily be limited to, sub-bottom profilers, multi-beam bathymetric sonar, and side-scan sonar.

Strudel Scour Surveys

Strudel scours are formed in the seafloor during a brief period in the spring when river discharge commences the breakup of the sea ice. The ice is bottom-fast, with the river discharge flowing over the top of the ice. The overflow spreads offshore and drains through the ice sheet at tidal cracks, thermal cracks, stress cracks, and seal breathing holes. Oil and gas operators conduct surveys to identify locations where this phenomenon occurs and to understand the process.

Strudel scour surveys are done in two steps. Nearshore areas (state waters) by the larger rivers are first surveyed from the air with a helicopter at the time rivers are discharging on to the sea ice (typically in May), to identify any locations where the discharge is moving through the ice. The identified areas are revisited by vessel during the open-water season (typically July–October) and bathymetric surveys are conducted along a series of transects over the identified areas. Equipment to be used in the surveys in 2013–2018 will likely include but not necessarily be limited to multi-beam bathymetric sonar, side-scan sonar, and single beam bathymetric sonar.

Bathymetry Surveys

As part of exploration, some surveys will likely be conducted to determine the feasibility of future development. This effort will include such things as pipeline and platform surveys. These surveys target areas where platforms or pipelines may be sited in the future. Similar to the aforementioned shallow hazards surveys, ice gouge surveys, and strudel scour surveys, they use geophysical equipment to delineate the bathymetry/seafloor relief and characteristics of the surficial seafloor sediments, which would subsequently be used for engineering purposes. The surveys are conducted from vessels along a series of transects. Equipment deployed on the vessel for these surveys will likely include but not necessarily be limited to sub-bottom profilers, multi-beam bathymetric sonar, side-scan sonar, and magnetometers.

2.2.6 Geotechnical Surveys

All geotechnical surveys are expected to occur within the Chukchi Sea Region between June 11, 2013, and June 11, 2018, which includes the entire "open-water seasons" of 2013–2017, and would take place offshore on leases in federal waters of the OCS, and potentially onshore. Geotechnical site investigations are performed to collect detailed data about seafloor sediments, onshore soil, and shallow geologic structures. During site investigations, boreholes are drilled to depths sufficient to characterize the soils within the zone of influence. The borings, cores, or cone penetrometer (CPT) data collected at the site define the stratigraphy and geotechnical properties at that specific location. Data from the cores may also be integrated with seismic data to develop a regional model for predicting soil conditions in areas that have not been sampled. These data are analyzed and used in determining optimal facility locations, for example, cores are needed to show whether soil will support a jack-up rig or other oil and gas exploration infrastructure. Site investigations that include archaeological, biological, and ecological data assist in the development of foundation design criteria for any planned structure.

Methodology for geotechnical surveys may vary between those conducted offshore and onshore. Onshore geotechnical surveys would likely be conducted in winter when the tundra is frozen. Rotary drilling equipment would be wheeled, tracked, or sled mounted. Offshore geotechnical studies would be conducted from dedicated vessels or support vessels associated with other operations such as drilling. The geotechnical data may be collected by gravity or drop cores, vibracores, rotary drilling, or CPT.

2.2.7 Environmental Studies

In addition to the aforementioned exploration drilling and geophysical and geotechnical surveys, there has been extensive research and monitoring over the past 40 years in a variety of disciplines, including but not limited to geomorphology (soils, ice content, permafrost); archaeology and cultural resources; vegetation mapping; analysis of fish, avian, and mammal species and their habitat; hydrology; and various other freshwater, marine, and terrestrial studies of the arctic coastal and offshore regions. Many studies are performed in cooperation with scientists from consulting companies; federal, state, and local agencies; universities; nonprofit organizations; and other local community stakeholders. Some of these studies are discussed below. Some research programs are multiyear efforts with objectives to collect baseline data or to answer specific research questions.

Many government agencies, science groups, Industry, academic institutions, and marine mammal co-management groups have coordinated ongoing studies for the Chukchi Sea Region.

The BOEM Environmental Studies Program manages approximately 60 ongoing studies in the Alaska OCS Region. The world-class, scientific research is to inform policy decisions regarding leasing and development of OCS energy and mineral resources (BOEMRE 2011a; BOEMRE 2011b).

Many of the current Chukchi Sea leaseholders participated in the Joint Industry Monitoring Program Exploration and Production (E&P) Sound and Marine Life, initiated in early 2005. One of the studies implemented under this program in 2006 and completed in 2009 was the Oil Spill Contingency for Arctic and Ice-covered Waters. The program was developed as a result of cooperation between SINTEF (The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology in Trondheim) and Shell, Chevron, Statoil, ConocoPhillips, Total, and AGIP KCO. The main objective of this project was to develop knowledge, tools, and technologies to benefit environmental oil spill response strategies in arctic and ice-covered waters (Sørstrøm et al. 2010).

Because of renewed interest in offshore oil and gas activities, the intensity of environmental research in the Chukchi Sea increased in 2006. Monitoring associated with seismic, shallow hazards, and other geotechnical surveys were conducted by various oil and gas companies. Joint Monitoring Program Reports combine the results of all Chukchi Sea monitoring programs.

ConocoPhillips initiated an interdisciplinary research program in 2008, with the participation of Shell, which focused on their respective offshore lease areas. This Chukchi Sea Environmental Studies Program is ecosystem-based, containing various components that contain physical and chemical oceanography, planktonic, benthic, fish, seabird, marine mammal, and acoustic studies. Statoil joined ConocoPhillips in this effort in 2010. These studies have been conducted in 2008, 2009, 2010, and 2011 and are expected to continue into the 2013–2018 timeframe, along with additional exploration drilling monitoring programs. More recently, Shell has also entered into a five-year collaborative science agreement with the North Slope Borough (NSB).

The National Science Foundation (NSF) also funds numerous multiyear projects and scientific studies for the Chukchi Sea area. One example of a multiyear NSF project is the 10-year construction of the $200 million Alaska Region Research Vessel, scheduled to conduct science operations beginning in 2014. This vessel will work to support ongoing studies for this area (NSF 2011a).

Academic and scientific institutions, such as Woods Hole Oceanographic Institute, Scripps Institution of Oceanography, and a number of universities and colleges, are also actively involved in collecting and analyzing data in areas that include the Chukchi Sea Region (WHOI 2011; Scripps 2011).

Stipulations on all current OCS leases in the Chukchi Sea (from Lease Sale 193) require a lessee proposing to conduct exploration operations during subsistence periods to conduct site-specific monitoring programs in consultation with NMFS-recognized co-management organizations. Recognized co-management organizations can be found under Stipulation 4 in the Record of Decision for Lease Sale 193 (BOEMRE 2011, Attachment A). Relevant co-management bodies pertaining to this Petition are the Eskimo Walrus Commission and the Alaska Nanuuq Commission. These bodies encourage self-regulation and implementation of co-management agreements, while supporting scientific programs involving these mammals in the arctic ecosystem. The Indigenous People's Council for Marine Mammals meets bi-annually and is composed of 17 total marine mammal commissions, councils, and other Alaska Native organizations.

For the Petition period of 2013–2018, studies will continue to be conducted for general monitoring purposes or in anticipation of exploration and development of Alaska's natural resources.

Industry has been conducting scientific and environmental studies in the Chukchi Sea Region since the 1980s, with an increase in the number and scope of these studies occurring since 2006. These studies will likely continue through the timeframe of the requested ITRs, with focused monitoring studies taking place during drilling efforts.

Offshore Environmental Studies

Offshore studies are likely to include ecological surveys of the benthos, plankton, fish, bird, and marine mammal communities and use of Chukchi Sea waters; acoustical studies of the distribution on seasonal use of the Chukchi Sea by marine mammals; investigations of sediment and water quality; and physical oceanographic investigations of sea ice movement, currents, and meteorology.

Most bird and marine mammal surveys will be conducted from vessels. The vessels will travel along series of transects at slow speeds while observers on the vessels identify the number and species of any birds or marine mammals sighted. Densities would then be calculated on the basis of the area surveyed and numbers observed. Some marine mammal surveys will also be conducted from fixed wing aircraft as part of the mandatory marine mammal monitoring programs associated with seismic surveys and exploration drilling. Sediments and plankton, benthic invertebrate, and fish communities will be studied from vessels as well, using small sampling devices such as box cores and Van Veen grabs (sediments and benthos), plankton or bongo nets (plankton), and trawls (fish). Various types of buoys have also been deployed in the Chukchi Sea in the past for data collection, and this effort will likely continue through 2013–2017 as well. Some of these buoys document ice movement, others collect meteorological and oceanographic data, and others are acoustical recording received sounds that can later be used to document presence / absence and distribution of marine mammals.

Onshore Environmental Studies

Various types of environmental studies will likely be conducted onshore in the Chukchi Sea Region in 2013 – 2018 in support of offshore oil and gas exploration. The hydrology of coastal rivers and lakes may be studied to determine such parameters as volume, flow, and flood stages. Habitat assessments and other types of fish and wildlife surveys may be conducted to determine and document the distribution and abundance of wildlife species in the region. Surveys may also be conducted to determine the presence or absence of archaeological resources. These studies would generally be conducted by small teams of scientists that would base their operations in Chukchi Sea communities and travel to study sites by helicopter. Most surveys would be conducted on foot or from the air. Small boats may be used for hydrology studies, fish surveys, and other studies in aquatic environments.

2.3 Expected Level of Oil and Gas Activities in 2013–2018

The following sections describe the level of activities expected within the Chukchi Sea Region within the specified period of June 11, 2013, to June 11, 2018. This time period contains the entire open-water seasons of 2013–2017 but terminates before the start of the 2018 open-water season. Therefore, activities such as exploration drilling, seismic surveys, and shallow hazards surveys which are conducted in the open-water season, would not be expected to be conducted within the timeframe in 2018 as indicated below, in Section 2.3.1.

Yearly projections of expected activities are estimates with a reasonable degree of uncertainty. More or less activities may actually occur in a given year than projected in the tables following in Section 2.3.1. The projection for the total amount of activity over the 5-year period reflects the best estimate of the number and type of activities that will occur during the timeframe.

2.3.1 Offshore Activities

The expected numbers of wells, seismic surveys, and shallow hazards surveys that might occur in the Chukchi Sea Region during the June 11, 2013, to June 11, 2018, time period are indicated below in Table 2.3.1-1. This time period contains the entire open-water seasons of 2013–2017 but terminates before the start of the 2018 open-water season. Therefore, activities such as exploration drilling, seismic surveys, and shallow hazards surveys that are conducted in the open-water season would not be expected to be conducted within the timeframe in 2018, as indicated below.

We estimate that a total of 3–8 wells may be drilled per year by multiple operators in the Chukchi Sea Region. The number of wells is not necessarily reflective of the number of exploration drilling programs or drilling units. All these wells will be drilled offshore during the open-water season from self-contained

drilling units on current lease holdings in the OCS. We assume for purposes of this Petition that seismic surveys and shallow hazards surveys are expected to be conducted in 2014 and 2017, but they may be conducted in any given year.

Table 2.3.1-1 Exploration Drilling, Seismic Surveys, and Shallow Hazards Surveys in the Chukchi Sea Region, 2013–2018[a]

Year	Wells			3D Seismic Surveys			Shallow Hazards Surveys			
	No. of Operators	No. of Wells	No. of Rigs	No. of Operators	km^2	mi^2	No. of Operators	No. of Surveys	km	mi
2013	2	5	2	1	1,680	650	2	6	250	97
2014	3	7	3	1	1,680	650	2	7	285	110
2015	3	8	4	1	1,680	650	2	6	250	97
2016	3	8	4	1	0	0	2	6	250	97
2017	2	8	4	1	1,680	650	2	4	285	110
2018	0	0	0	0	0	0	0	0	0	0
Total[a]	NA	36	NA	NA	6,720	2,600	NA		1,320	511

Notes:
[a] Numbers presented in the table represent yearly projections. More or fewer activities may actually occur in a given year than projected in this table.
km / km^2 = kilometers / square kilometers
mi / mi^2 = miles / square miles
NA = not applicable
No. = number

Ice gouge surveys will likely be conducted each year of the specified period (except 2018), with surveys being conducted up to 5,000 km (3,100 mi) in length annually. Strudel scour surveys and other types of bathymetric surveys would also be conducted (State waters only) each year except 2018. Geotechnical studies, including the collection of deep and shallow corings and possibly CPT, will be conducted in conjunction with some of these offshore bathymetric surveys.

Table 2.3.1-2 Offshore Geotechnical Surveys; Other Geophysical Surveys in the Chukchi Sea Region 2013–2018[a]

Year	Offshore Geotechnical Surveys			Marine Geophysical Surveys		
	No. of Operators	Duration	No. of Borings	Ice Gouge	Strudel Scour	Bathymetry
2013	1	12 weeks	150	5,000 km (3,100 mi)	1,000 km (620 mi)	1 operator
2014	2	12 weeks	200	5,000 km (3,100 mi)	1,000 km (620 mi)	1 operator
2015	1	12 weeks	150	5,000 km (3,100 mi)	1,000 km (620 mi)	1 operator
2016	2	12 weeks	200	5,000 km (3,100 mi)	1,000 km (620 mi)	1 operator
2017	1	12 weeks	150	5,000 km (3,100 mi)	1,000 km (620 mi)	1 operator
2018	0	---	0	--	--	--
Total[a]	7	60 weeks	825	25,000 km (15,500 mi)	5,000 km (3,100 mi)	NA

Notes:
[a] Numbers presented in the table represent yearly projections. More or less activities may actually occur in a given year than projected in this table.
km = kilometers; mi = miles

Various environmental studies are expected to be taking place during 2013–2018, mostly related to the offshore exploration activities. These surveys may include physical oceanography studies (temperature, salinity, ocean acidification, currents, ice movements), sedimentation and water quality studies, ecological studies (plankton, benthos, fish, seabird, and marine mammal communities), acoustical studies (to characterize ambient and industrial sounds and to record vocalizations of marine mammals), and meteorology.

2.3.2 Onshore Activities

No exploration drilling, seismic surveys, or shallow hazard surveys are expected for onshore portions of the Chukchi Sea Region. Onshore geotechnical surveys and environmental studies are expected to be conducted each year. The expected level of these activities in 2013 – 2018 is summarized below in Table 2.3.2-1. Most geotechnical surveys would be conducted in the winter. Environmental studies will likely be conducted in spring, summer, or fall.

Table 2.3.2-1 Onshore Geotechnical Surveys in the Chukchi Sea Region, 2013–2018[a]

Year	Onshore Geotechnical		Environmental Studies (duration/year)				
	Duration	No. of Borings	Wildlife	Fisheries	Habitat Assessment	Hydrology	Archaeology
2013	60 days	150	8 weeks	8 weeks	8 weeks	16 weeks	8 weeks
2014	120 days	150	8 weeks	8 weeks	8 weeks	16 weeks	8 weeks
2015	120 days	150	8 weeks	8 weeks	8 weeks	16 weeks	8 weeks
2016	120 days	150	8 weeks	8 weeks	8 weeks	16 weeks	8 weeks
2017	120 days	150	8 weeks	8 weeks	8 weeks	16 weeks	8 weeks
2018	60 days	75	8 weeks	8 weeks	8 weeks	16 weeks	8 weeks
Total[a]	600 days	825	12 months	12 months	12 months	12 months	12 months

Notes: [a] Numbers presented in the table represent yearly projections. More or less activities may actually occur in a given year than projected in this table.

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3.0 DATES, DURATION, AND REGION OF ACTIVITIES

50 CFR 18.27(d)(ii) The dates and duration of such activity and the specific geographical region where it will occur.

Region of Activities

The specified geographic region of coverage (Chukchi Sea Region) requested in this Petition is illustrated in Figure 1.1-1. The area encompasses a total approximately 240,000 km^2 (92,665 mi^2), including land on the North Slope of Alaska adjacent to waters of the Chukchi Sea.

The offshore portion of the region encompasses all waters of the Chukchi Sea that lie north of Latitude 68°15'0" N, east of the US–Russia Convention Line of 1867, west of a north-south line through Point Barrow (71°23'29" N, -156°28'30" W, Board on Geographic Names (BGN) 1944), and extending, up to 322 km (200 mi) north of Point Barrow. The region includes that area defined as BOEM's Chukchi Sea Planning Area, and all State of Alaska waters between the federal waters of the Chukchi Sea Planning Area and the coastline.

Onshore, the Chukchi Sea Region includes all lands within 40 km (25 mi) of the Chukchi Sea coastline north of latitude 68°15'0" N and west of Point Barrow. The north-south line at Point Barrow is also the western border of the geographic region covered under the current Beaufort Sea ITRs (76 FR 47010-47054).

Dates and Duration

The ITRs requested in this Petition are for the period from June 11, 2013, to June 11, 2018. Within that time period, oil and gas exploration activities could occur during any month of the year, depending on the type of activity. Most offshore activities such as exploration drilling, seismic surveys, and shallow hazards surveys, are expected to occur only during the open-water season (June–November). Onshore activities may occur during winter (e.g., geotechnical studies), spring (e.g., hydrological studies), or summer-fall (e.g., various fish and wildlife surveys). Anticipated types of activities are described in Section 2 and additional information about the dates and duration over which the activities may occur is provided there. Because of the large number of variables influencing exploration activity, it is not possible to predict the exact dates and locations of the operations that will take place from 2013 to 2018. The specific dates and durations of the individual operations and their geographic locations will be set forth in detail when requests for LOAs are submitted by Industry applicants to USFWS.

Activities over the five-year Petition period can be expected to involve seismic surveys to determine the presence of new hydrocarbon deposits offshore, exploratory and appraisal drilling offshore to verify hydrocarbon accumulations, associated shallow hazards survey, and scientific support surveys. The descriptions of existing and future activities presented in this Petition have been compiled from information supplied by AOGA member companies including Shell, Statoil, Repsol, eni, and participating party ConocoPhillips, which currently hold leases in the Chukchi Sea Region. However, these projections are also intended to encompass activities to be undertaken by companies not participating in this Petition (i.e., contractor and subcontractor companies providing services to the oil and gas leaseholders).

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4.0 SPECIES, NUMBER, AND TYPE OF TAKE

50 CFR 18.27(d)(iii)(A) Based upon the best available scientific information: An estimate of the species and numbers of marine mammals likely to be taken by age, sex, and reproductive conditions, and the type of taking (e.g., disturbance by sound, injury or death resulting from collision, etc.) and the number of times such taking is likely to occur.

The following sections provide estimates of the numbers of polar bears and walruses that may be exposed to activities associated with oil and gas exploration in the Chukchi Sea Region in 2013 – 2018. These estimates are based on the expected levels and timing of oil and gas activities that will likely occur during this time period, as discussed in Section 2.0; the density of walruses in the Chukchi Sea, and the area that may be affected by the activity. There are uncertainties associated with each of these parameters. The scheduling and execution of the exploration activities will be influenced by many factors, including economics, regulatory constraints, political considerations, unexpected judicial/regulatory delays, weather, and the presence/absence of sea ice. An operator's exploration strategy may also change on the basis of results of the previous activity.

Walrus densities in given areas of the Chukchi Sea are highly variable, fluctuating annually, with the season, with the particular location, and with the distribution of sea ice. The estimates of walrus exposures provided below are based on our best prediction of the level of oil and gas activities that might occur during the specified time period and on mean walrus densities for the northeastern Chukchi Sea as calculated during recent geophysical surveys.

Any and all takes of polar bears or walruses that may occur as a result of these oil and gas exploration activities would consist only of Level B harassment as defined by the MMPA and described in Section 1.2.1 of this report. However, not all the animals that might be exposed to the activity would be disturbed or react to the activity, and not all animals disturbed would be disturbed to a degree that constitutes a take. Disturbance includes a variety of effects, including subtle to conspicuous changes in behavior, movement, and displacement (76 FR 77782). A disturbance or reaction must be biologically significant in that it could potentially disrupt the migration, breathing, nursing, breeding, feeding, or sheltering of the animal, for it to constitute a take (76 FR 54433). If a marine mammal reacts briefly to movement or sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual animal, much less the population (76 FR 77782). As is common practice, the exposure estimates provided in the sections below for most activity types were based the number of animals that might be within a particular distance of the activity or exposed to a particular level of sound generated by the activity. This method is likely to overestimate the numbers of animals that would be affected in some biologically important manner (76 FR 57959).

4.1 Polar Bears

The numbers of polar bears potentially exposed to the industrial activities expected to be conducted in the Chukchi Sea during the Petition period are discussed in the following sections. The estimates reflect the low densities at which polar bears occur during the time when activities will be conducted (mainly open-water season). Offshore oil and gas activities, particularly exploration drilling, seismic surveys, and shallow hazards surveys, will be conducted during the months when sea ice cover is very low, while the presence of polar bears is largely dependent on the presence of sea ice. Few polar bears are therefore expected to be exposed to the future exploration activities.

4.1.1 Exploration Drilling, Ice Management, and VSP

Exploration drilling during the Petition period is expected to only take place within current lease holdings in the OCS in 2013–2017. The Petition period ends on June 11, 2018, before the start of the open-water drilling season. A lease sale is scheduled for the Chukchi Sea in 2016, as described in the proposed OCS Five Year Plan (BOEMRE 2011), but it is highly unlikely that exploration drilling would occur in these new leases before 2018. The lease sale itself, shallow hazards surveys and associated data interpretation, and Exploration Plan submittals and approvals will not be completed in time to allow drilling in 2017.

Polar bears are found at relatively low densities across the Chukchi Sea during the open-water season, as evidenced by the limited number of observations of polar bears in the lease holdings in recent years. For example, only one polar bear was observed during all geophysical and geotechnical surveys conducted in this area of the Chukchi Sea in 2006–2010 (Hartin et al. 2011; Reiser et al. 2010, 2011; Blees et al. 2010; Brueggeman at al. 2009; Ireland et al. 2007a, 2007b, 2009; Funk et al. 2008; Patterson et al. 2007). Industry conducted joint baseline studies across much of the current lease holdings in 2008, 2009, and 2010. These studies included intensive marine mammal surveys over two or three 3,090-km^2 (1,190-mi^2) study areas each year. Nine polar bears were observed during these marine mammal surveys in 2008 (Brueggeman 2009), four were observed in 2009 (Brueggeman 2010), and three were observed in 2010 (Aerts et al. 2011). All, but two of these animals were observed on the sea ice that was still in the area during the surveys.

Polar bears were also observed during monitoring programs for exploration wells drilled in the Chukchi Sea in 1989-1991. Drilling was conducted at three well sites in 1989 (Brueggeman et al. 1990), three well sites in 1990 (Brueggeman et al. 1991), and two well sites in 1991 (Brueggeman et al. 1992). A total of 110 polar bears were observed from aerial overflights and support/ice management vessels during drilling activities at these eight sites. The combined observations from overflights and vessels yield an average of 14 polar bears observed per well site, per season.

Brueggeman et al. (1991, 1992) evaluated the behavioral responses (primarily to ice-management vessels) of polar bears observed from vessels during the 1990 and 1991 drilling seasons. An average of about 34 percent of the bears exhibited no response and 66 percent exhibited some response. Applying this response percentage to the number of bears observed indicates that an average of approximately nine polar bears were observed and exhibited some response, per well site, per season. In these instances, responses were limited to brief changes in polar bear behavior such as stopping current movement or activity, slowly walking or swimming away, or slowly approaching the vessel. None of the observed polar bear responses to exploration drilling or ice management in 1989–1991 appeared to rise to the level of incidental take.

The observational data collected in 1989–1991 is informative; however, the data should be used with caution when predicting polar bear observations for future drilling observations, because the sea ice regime in the Chukchi Sea has changed significantly since 1989–1991. Pack ice often occurred within the prospects during the 1989-1991 drilling programs. Polar bear presence was strongly correlated with the presence of pack ice. All of the 25 bears observed during the 1990 drilling program were observed in the pack ice, with ice cover at bear locations ranging from 10 to 90 percent. During the 1991 drilling program, all but one of the 65 observed polar bears were in or associated with the pack ice; one bear was observed swimming in open water approximately 9.0 km (6.0 mi) south of the ice edge. There has been a noticeable change in the sea ice regime in the Chukchi Sea since these wells were drilled (21–23 years ago), as evidenced by the reduced duration and amount of ice coverage in the Chukchi Sea over the last five years. On the basis of the reduction in pack ice expected at potential drill sites during the Petition period, we expect that the rate of polar bear observations within the prospects during Petition period will likely be lower than the rate of polar bear observations in 1989–1991. This conclusion is corroborated by the low rate of polar bear observations that occurred in 2006–2010, as detailed above. Any incidental

takes that do occur during the Petition period would be limited to short-term changes in behavior (Level B harassment) with no long-term consequences or detectable population-level effects.

4.1.2 Offshore Geophysical, Geotechnical, and Environmental Surveys

There is limited opportunity for any takes of polar bears to occur during geophysical (seismic, shallow hazards, bathymetry) surveys that are expected to be conducted in the Chukchi Sea Region during the Petition period. Polar bears are found at relatively low densities across the Chukchi Sea. Marine mammal observers monitored more than 38,000 km (23,600 mi) of shallow hazard survey trackline in the Chukchi Sea Region in 2008, 2009, 2010, and 2011; more than 138,000 km (85,750 mi) of 3D seismic survey trackline in 2006, 2007, 2008, and 2010; and 38 vibracores and rotary corings during geotechnical studies conducted in 2010 and 2011. Only one polar bear was observed during all these geophysical and geotechnical surveys (Hartin et al. 2011; Reiser et al. 2010, 2011; Blees et al. 2010; Brueggeman et al. 2009; Ireland et al. 2007a, 2007b, 2009; Funk et al. 2008; Patterson et al. 2007).

Polar bears may, at times, be encountered in low numbers, as evidenced by the joint baseline studies conducted across much of the Chukchi Sea lease areas in 2008, 2009, and 2010. During these three years, a total of 16 bears were observed. As mentioned earlier, 14 of these 16 animals were on the sea ice. However, because shallow hazards, seismic, and geotechnical surveys take place when sea ice cover is very low, only a very small number of polar bears are expected to be present, as evidenced by the results from the 2006–2011 monitoring programs that were conducted as part of seismic, shallow hazards, and geotechnical surveys. Harassment of polar bears from similar surveys planned in the Chukchi Sea Region during the Petition period are therefore unlikely. A very small number of polar bears could be encountered during these surveys, and a portion of these polar bears may exhibit brief behavioral disturbances as discussed above in Section 4.1.1.

4.1.3 Onshore Geotechnical and Environmental Surveys

Onshore geotechnical surveys to be conducted in the Chukchi Sea Region during the Petition period are expected to occur between November and April. Polar bear denning is not common in coastal lands along the US Chukchi Sea, but does occur (USFWS 2009). Mitigation measures would require onshore geotechnical operators to identify any occupied den locations through the use of the best available technology, including Forwards Looking Infrared (FLIR), and limit any disturbance within 1.6 km (1.0 mi) of the den site. Operators would also be required to implement approved polar bear interaction plans with food and waste management procedures, avoidance and encounter procedures, and personnel training requirements. Given the implementation of these and other mitigation measures described in Section 10.1, few or no polar bear takes would be expected to occur. Any takes expected to occur would likely consist only of Level B harassment.

Most future environmental studies to be conducted in the Chukchi Sea Region during the Petition period are expected to take place in June–September. Although polar bears could be present onshore, they are expected to be present in low numbers during this period, making encounters unlikely. In accordance with requested mitigation measures, operators conducting environmental studies will implement approved polar bear interaction plans with food and waste management procedures, avoidance and encounter procedures, and personnel training requirements. Given the implementation of this and other mitigation measures described in Section 10.1, few or no polar bear takes would be expected to occur. Any potential takes would likely consist only of Level B harassment.

4.2 Walruses

The potential for exposure of walruses to oil and gas activities is discussed below by type of oil and gas activity. Estimates of the numbers of walruses that may be exposed to those activities are provided. Some walruses within the area of potential effect will not be disturbed, as demonstrated in many if not all monitoring study reports, and not all instances of walrus disturbance will rise to the level of a take. Therefore, takes represent some subset of these exposure estimates. Any take that might result from these activities is expected to consist only of Level B harassment. Moreover, any take that might result would be limited to short-term changes in behavior with no long-term consequences or detectable population-level effects.

4.2.1 Exploration Drilling, Ice Management, and VSP

Exploration drilling, ice management, and VSPs, as well as vessel and helicopter support, would all be part of the exploratory drilling program. Each of these activities could potentially expose walruses to Industry activities through audible or visual cues and possibly result in incidental, but unintentional, takes as defined under the MMPA. All these activities, except for the pulsed airgun sounds from the VSP survey, generate continuous sound levels. Since the duration of the VSP survey is very short (10–14 hours) relative to a typical drilling season, the numbers of potential exposures fall within the range specified for the drilling activities (Table 4.2.1-1) and are therefore not separately specified. The majority of these exploration activities are expected to take place far from ice floes of sufficient density, thickness, or extent to encounter large aggregations of walruses. Small, isolated groups of walruses or individuals swimming in open-water may be exposed to Industry activities. There are temporal and spatial constructs around when and where the potential for larger groups of walruses swimming in open-water, or even present on relatively small-scale ice floes, may be exposed to Industry activities. However, even then, as Industry operations are conducted, adherence to the mitigation measures included in this Petition will greatly limit the potential for exposures of walruses rising even to the level of incidental, unintentional take.

Estimates of the numbers of walruses that could potentially elicit behavioral responses because of continuous sound levels of drilling activities and the physical presence of equipment are provided below in Table 4.2.1-1 for each year of activity.

Recent walrus density estimates from 2006–2010 surveys in the Chukchi Sea (Reiser et al. 2010, 2011; Blees et al. 2010; Brueggeman et al. 2009; Ireland et al. 2009, 2007a, 2007b; Funk et al. 2008; Patterson et al. 2007) and the area of effect described in monitoring reports for historical Chukchi Sea drilling programs (Brueggeman et al. 1990, 1991, 1992) were used to calculate exposure estimates. Because the activities are contemporaneous and co-located, the potential exposures were calculated based on the single activity with the greatest area of effect.

Table 4.2-1 Walruses Potentially Exposed to Exploration Drilling Activities in the Chukchi Sea Region 2013–2018[a]

Year	Wells	Number of Walruses Potentially Exposed[a,b]
2013	5	165
2014	7	231
2015	8	264
2016	8	264
2017	8	264
2018	0	0

Notes:
[a] Mean estimated walrus density from 90-day reports for Chukchi Sea shallow hazard and seismic surveys in 2006-2010 (Reiser et al. 2010, 2011; Blees et al. 2010; Brueggeman et al. 2009; Ireland et al. 2009, 2007a, 2007b; Funk et al. 2008; Patterson et al. 2007).
[b] Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take, as defined in the Marine Mammal Protection Act.

4.2.2 Seismic Surveys

Industry expects to conduct seismic surveys during the specified time period. These seismic surveys could result in the disturbance of walruses that could rise to Level B Harassment and therefore meet the definition of take. NMFS has determined that Level B harassment of marine mammals could occur at pulsed underwater sound energy levels at or above 160 decibels referenced to 1 microPascal (dB re 1 µPa), and USFWS has concurred with this determination and indicated that its use is applicable to walrus aggregations (73 FR 33212).

Seismic surveys were conducted in the Chukchi Sea in 2006, 2007, 2008, and 2010, and each of these surveys accompanied a comprehensive marine mammal and acoustical monitoring program (Blees et al. 2010; Ireland et al. 2009, 2007a, 2007b; Funk et al. 2008; Patterson et al. 2007) that provided information about the extent of the ensonified to 160 dB re 1 µPa and the number of walruses that might have been exposed to these received sound levels. The mean number of walruses exposed to sound levels of more than 160 dB re 1 µPa per unit area during these surveys, and the predicted level of seismic survey effort, were used to calculate the estimate of the numbers of walruses that might be exposed during surveys to be conducted in 2013–2018 (Table 4.2.2-1).

Table 4.2.2-1 Walruses Potentially Exposed to Received Sound Energy Levels > 160 dB re 1 µPa during Seismic Surveys in the Chukchi Sea Region 2013–2018[a].

Year	Seismic Survey Area		Mean Individuals Exposed / Unit Area		Estimated Walrus Exposures
	km^2	mi^2	per km^2	per mi^2	
2013	1,680	650	0.4405	1.1488	747
2014	1,680	650	0.4405	1.1488	747
2015	1,680	650	0.4405	1.1488	747
2016	1,680	650	0.4405	1.1488	747
2017	1,263	487	0.4405	1.1488	560
2018	0	0	0.4405	1.1488	0

Notes:
[a] Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take, as defined in the Marine Mammal Protection Act.
km^2 = square kilometers; mi^2 = square miles

4.2.3 Shallow Hazards Surveys

Shallow hazards surveys may be conducted during the specified time period. These surveys involve the use of geophysical equipment such as side-scan sonar, single beam and multi-beam sonar, sub-bottom profilers, and high-resolution seismic profiling with a small airgun or sparker. The vessel itself and the use of the small airgun array or sparker hold the most potential for disturbance of walruses.

Shallow hazard surveys were conducted in the Chukchi Sea in 2008, 2009, 2010, and 2011 and each of these surveys was accompanied by a marine mammal and acoustical monitoring program (Reiser et al. 2010, 2011; Brueggeman et al. 2009; Ireland et al. 2009). Acoustic measurements taken during these programs reveal that distances to received sound levels of 160 dB re 1 µPa are about 1.2–1.8 km (0.75–1.1 mi) from the small airgun arrays. Walrus densities estimated from the 2006–2010 surveys, the area ensonified with pulsed sound energy levels greater than 160 dB re 1 µPa during previous shallow hazard surveys, and the predicted shallow hazards survey effort were used to estimate the numbers of walruses that might be exposed during surveys in 2013– 2018 (Table 4.2.3-1).

Table 4.2.3-1 Walruses Potentially Exposed to Received Sound Energy Levels > 160 dB re 1 µPa during Shallow Hazards Surveys in the Chukchi Sea Region, 2013–2018[a].

Year	Number of Surveys	Shallow Hazard Survey Area		Estimated Number of Walrus Exposures[b]
		km^2	mi^2	
2013	6	250	97	10
2014	7	285	110	13
2015	6	250	97	10
2016	6	250	97	10
2017	4	171	66	10
2018	0	0	0	0

Notes:
[a] Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take as defined by the Marine Mammal Protection Act.
[b] On the basis of mean walrus densities from 90-day reports for past seismic and marine survey programs in the Chukchi Sea, 2006-2010 (Reiser et al. 2010, 2011; Blees et al. 2010; Brueggeman et al. 2009; Ireland et al. 2009, 2007a, 2007b; Funk et al. 2008; Patterson et al. 2007)
km^2 = square kilometers; mi^2 = square miles

4.2.4 Other Geophysical Surveys

Other geophysical surveys, which include ice gouge, strudel scour, and bathymetric surveys, have limited potential to behaviorally disturb walruses. Typical equipment used during these surveys is side-scan sonar, single-beam sonar, and multi-beam sonar. Because these instruments generate frequencies above the hearing range of walruses, have a short pulse duration, and low duty cycle, no or very brief behavioral responses can be expected.

The physical presence of survey vessels could potentially result in behavioral disturbance of walruses. Brueggeman et al. (1990, 1991, 1992) found that oil and gas support vessels had little effect on walruses when stationary or drifting, but caused some disturbance when maneuvering, with most reactions occurring within about 0.5 km (0.31 mi) of the vessel. Whether a walrus is reacting to the presence of a vessel or to the sound it generates is not always clear. Assuming disturbance occurs within about 0.5 km (0.31 mi) of the vessel, only a few walruses are expected to show disturbance behavior from vessel exposure, as indicated in Table 4.2.4-1.

Table 4.2.4-1 Walruses Potentially Exposed to Geophysical Surveys in the Chukchi Sea Region, 2013–2018

Year	Ice Gouge		Strudel Scour		Bathymetric and Other		Total Exposures
	Surveys [a]	No. of Exposures	Surveys [b]	No. of Exposures	Surveys	No. of Exposures	
2013	1	5	1	0	1	1	6
2014	2	10	1	0	1	1	11
2015	1	5	1	0	1	1	6
2016	2	10	1	0	1	1	11
2017	1	5	1	0	1	1	6
2018	0	0	1	0	0	0	0

Notes:

[a] Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take, as defined by the Marine Mammal Protection Act.

[b] These surveys are done at various locations through the course of the season, numbers indicate the number of operators conducting surveys during that season

4.2.5 Geotechnical Surveys

Onshore geotechnical surveys are not expected to have any effect on walruses given that the surveys are conducted in winter when walruses are generally not present at coastal haul-out areas in the Chukchi Sea Region. Offshore geotechnical surveys conducted during the open-water season could potentially disturb walruses; however, any disturbance would be limited to a relatively small area around the vessel/coring operation. Hartin et al. (2011) reported that sound levels generated by a rotary coring operation in the Chukchi Sea fell to a level of less than 160 dB within a radial distance of 2.0 m (6.6 ft) from the vessel. Given the observed densities of walruses in the Chukchi Sea and the limited area that would be ensonified by the offshore geotechnical surveys, few (if any) walruses would likely be exposed to sound levels that can elicit behavior responses. We have included an estimate of five walruses that could be exposed to accommodate contingencies.

Table 4.2-5-1 Walruses Potentially Exposed to Geotechnical Surveys in the Chukchi Sea Region 2013–2018[a,b].

Year	Offshore Geotechnical Surveys			Onshore Geotechnical Surveys			Total Exposures
	Surveys	Duration	Exposures	Surveys	Duration	Exposures	
2013	1	12 weeks	5	1	60 days	0	5
2014	2	12 weeks	10	1	120 days	0	10
2015	1	12 weeks	5	1	120 days	0	5
2016	2	12 weeks	10	1	120 days	0	10
2017	1	12 weeks	5	1	120 days	0	5
2018	1	6 weeks	0	1	60 days	0	0

Notes:

[a] Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take, as defined in the Marine Mammal Protection Act.

[b] One survey consists of all geotechnical borings conducted by an operator in a season.

4.2.6 Environmental Studies

Onshore environmental studies present little or no opportunity for the disturbance of walruses. Activities would not be conducted in areas where walruses are known to use coastal haul-outs. Offshore environmental and acoustic studies are expected to be an integrated part of the industrial activities. Walruses have been observed during these surveys, but in most cases, their behavioral responses, if any occurred at all, were very subtle and brief. No known takes have occurred. We have included an estimate of one walrus exposure per year for offshore environmental studies

Table 4.2.6-1 Walruses Potentially Exposed to Environmental Studies in the Chukchi Sea Region, 2013–2018[a].

Year	Offshore Environmental Studies			Onshore Environmental Studies			Total Exposures
	Studies	Duration	Exposures	Studies	Duration	Exposures	
2013	1	12 weeks	1	1	16 weeks	0	1
2014	1	12 weeks	1	1	16 weeks	0	1
2015	1	12 weeks	1	1	16 weeks	0	1
2016	1	12 weeks	1	1	16 weeks	0	1
2017	1	12 weeks	1	1	16 weeks	0	1
2018	0	--	0	1	--	0	0

Notes: a Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take, as defined in the Marine Mammal Protection Act.

4.2.7 Total Walrus Exposures

The total estimated exposures of walruses to industrial activities that are predicted to occur over the period 2013–2018 are provided by year in Table 4.2-7-1. Not all exposures will in behavioral responses that are considered Level B harassment, as defined under the MMPA.

Table 4.2.7-1 Walruses Potentially Exposed to Oil and Gas Exploration Activities in the Chukchi Sea Region, 2013–2018[a]

Year	Drilling	Seismic Surveys	Shallow Hazards	Other Geophysical Surveys	Geotechnical	Environmental Studies	Total
2013	165	747	10	9	5	1	937
2014	231	747	13	15	10	1	1,017
2015	264	747	10	9	5	1	1,036
2016	264	747	10	15	10	1	1,047
2017	264	560	10	9	5	1	849
2018	0	0	0	0	0	0	0

Notes: [a] Numbers represent projected exposures, not takes. The number of takes is expected to be smaller, because not all exposures result in incidental take, as defined in the Marine Mammal Protection Act.

5.0 STATUS, DISTRIBUTION, AND SEASONAL DISTRIBUTION OF SPECIES

50 CFR 18.27(d)(iii)(B) A description of the status, distribution, and seasonal distribution (when applicable) of the affected species or stocks likely to be affected by such activities.

5.1 Polar Bears

The following sections describe the status, distribution, and seasonal distribution trends of polar bears, particularly the Chukchi and Beaufort Sea populations. Critical habitat (sea ice and terrestrial) are discussed, as well as feeding habits, reproduction, denning, survival, and climate change effects on polar bears.

5.1.1 Population Status and Trend

Polar bears are marine mammals subject to the protections of the MMPA under the administration of the USFWS. In May 2008, the USFWS listed the polar bear as a threatened species under the ESA. The USFWS based this determination on the expectation that polar bear sea ice habitat is declining throughout the range of the species, and the decline is predicted to continue for the foreseeable future. The USFWS determined this predicted loss of sea ice threatens the species throughout its range (USFWS 2008c).

Coincident with the polar bear listing rule, the USFWS promulgated the Interim Polar Bear 4(d) Rule pursuant to Section 4(d) of the ESA (73 FR 28306). Under the terms of the Interim Polar Bear 4(d) Rule, none of the ESA Section 9 take prohibitions apply to any activity that is authorized or exempted under the MMPA, provided that the person carrying out the activity has complied with all applicable terms and conditions. As described above, the Interim Polar Bear 4(d) Rule is currently effective, pending the issuance of a new final rule that is expected at the end of 2012.

In December 2010, USFWS published a final rule to designate critical habitat for the threatened polar bear, effective January 6, 2011 (75 FR 76086–76137). Designated critical habitat encompasses three areas or units: Unit 1–Sea Ice Habitat; Unit 2–Terrestrial Denning Habitat; and Unit 3–Barrier Island Habitat. The total area designated as critical habitat covers 484,734 km2 (187,157 mi^2) of which about 96 percent is sea ice habitat. The units are:

- Sea ice habitat: Extends from the Canadian border in the east to a point south of Hooper Bay, located over the continental shelf; including ice over water out to the 300-m (984-ft) water depth contour or limits of the US Exclusive Economic Zone;

- Terrestrial denning habitat: The lands within 32 km (20 mi) of the northern coast of Alaska from the Canadian border west to the Kavik River, and the lands within 8 km (5 mi) of the shoreline between the Kavik River and Barrow; and

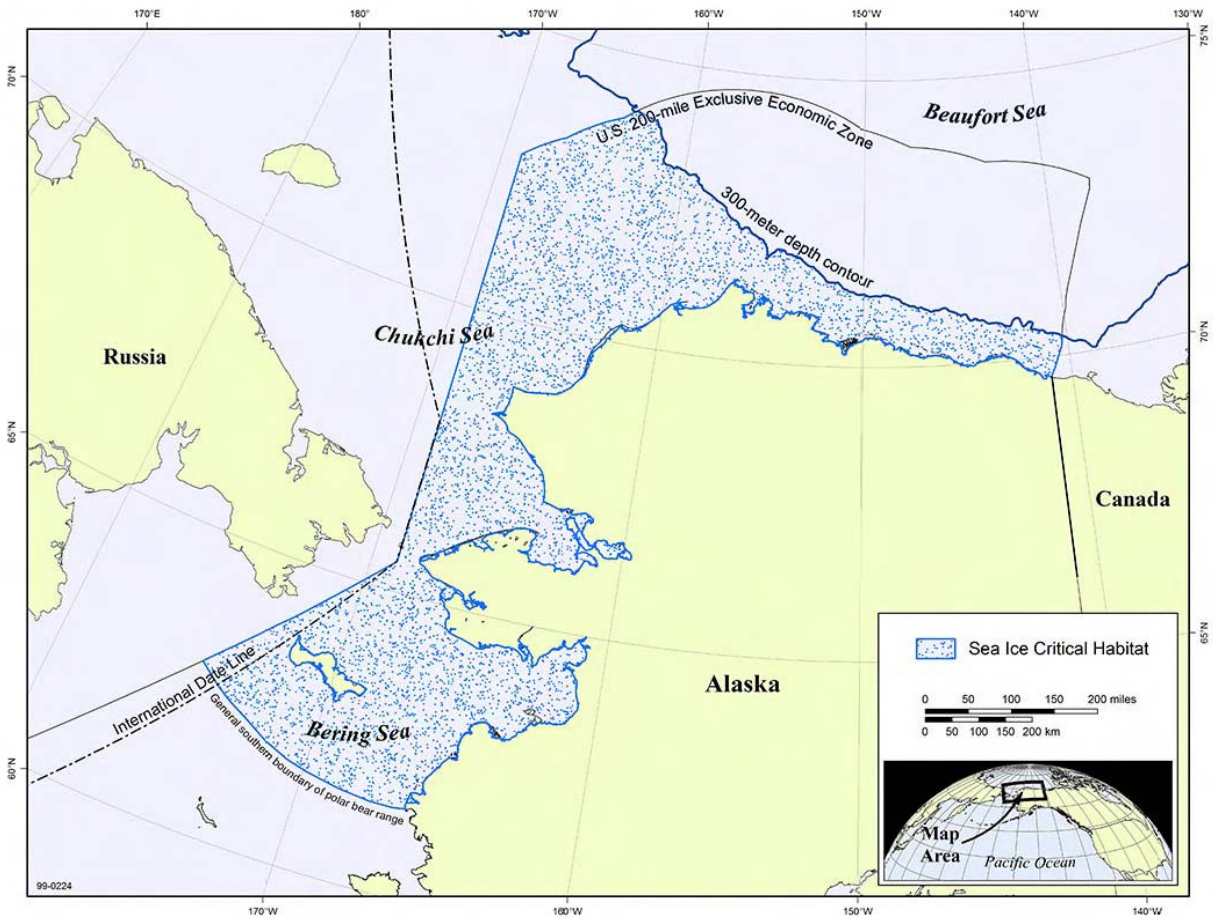
- Barrier Island habitat: The offshore islands along Alaska's northern coast from the Canadian border west to Barrow, south to Point Hope, southwest to Wales, southeast to Nome, and ending at Hooper Bay, Alaska.

Locations of sea Ice Critical Habitat and Barrier Island Critical Habitat are indicated in Figures 5.1.1-1 and 5.1.1-2. All Terrestrial Denning Critical Habitat is located east of Barrow outside of the Chukchi Sea Region and is therefore not discussed further in this Petition or shown in the figures.

Certain locations within these areas were exempted from the critical habitat designation. These are:

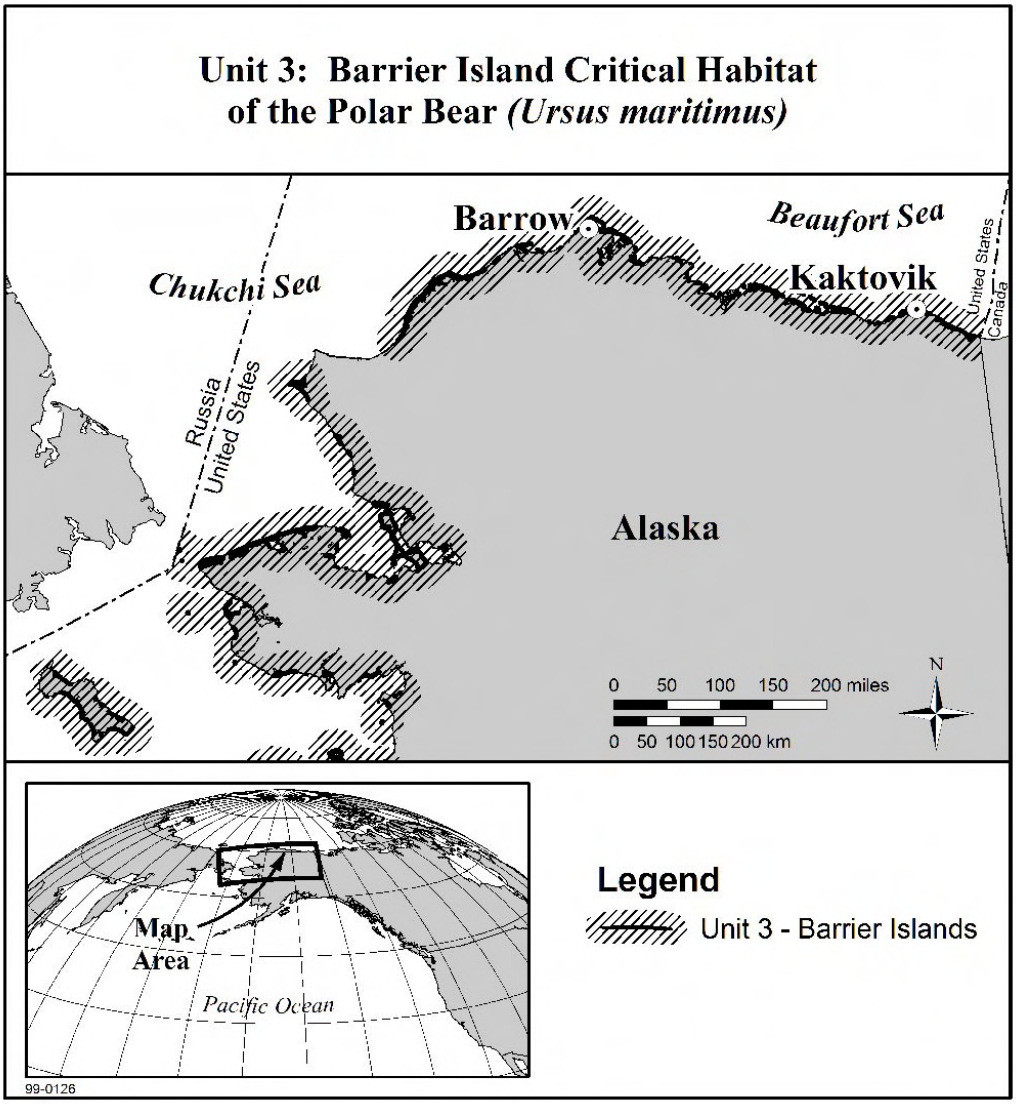
- Five US Air Force radar sites located at Point Barrow, Point Lonely, Oliktok Point, Point Bullen, and Barter Island (measures to protect polar bears occurring in habitats within or adjacent to these facilities are included in the rule);
- Townsites at the Native communities of Barrow and Kaktovik; and
- All existing manmade structures, regardless of land ownership status (USFWS 2010a)

Figure 5.1.1-1 Sea Ice Critical Habitat of the Polar Bear



(Source: USFWS 2010a)

Figure 5.1.1-2. Barrier Island Critical Habitat of the Polar Bear



(Source: USFWS 2010a)

The worldwide abundance of polar bears is estimated to be between 20,000–25,000 animals (Obbard et al. 2010). These estimates were derived from information presented at the International Union for Conservation of Nature Polar Bear Specialist Group (PBSG) meeting held in Copenhagen in June/July 2009 and updated with results that became available in March 2010 (Obbard et al. 2010). The PBSG has recognized 19 relatively separate populations or stocks of polar bears and the ranges of these populations have substantial overlap. Two of these populations, the Southern Beaufort Sea population and the Chukchi/Bering Sea population, are found within the Chukchi Sea Region.

Although not statistically concluded, the status of the Southern Beaufort Sea population is designated by USFWS as reduced and the predicted trend is declining (Aars et al. 2006). A recent analysis of the body condition of adult polar bears and cub survival suggests that polar bears may be experiencing a decline in nutritional status that may be related to changing sea ice conditions (Rode et al. 2007). More studies are required to address the status and trend of this population before firm conclusions can be made.

5.1.2 Distribution and Seasonal Distribution

Polar bears have a circumpolar distribution throughout the northern hemisphere (Amstrup et al. 1986) and occur in relatively low densities throughout most ice-covered areas (DeMaster and Stirling, 1981). The Chukchi/Bering Sea population and the Southern Beaufort Sea population overlap considerably in the Chukchi Sea Region, particularly between Point Hope and Barrow (Figure 5.1.1-1).

The Chukchi/Bering Sea subpopulation is widely distributed seasonally on the sea ice in the Chukchi Sea and northern Bering Sea, including the adjacent coastal areas of Alaska and Russia. The eastern boundary of the Chukchi/Bering Sea population is near Colville Delta (Arthur et al. 1996, p. 219; Amstrup et al. 2004), and the western boundary is near Chauniskaya Bay in the Eastern Siberian Sea. The best available data indicate the minimum population estimate of the Chukchi/Bering Sea population is 2,000 animals (IUCN 2006) although USFWS considers this estimate unsuitable for evaluating status and trend of this population (USFWS 2010b).

The Southern Beaufort Sea population occurs between Icy Cape, Alaska, on the western boundary and Pearce Point, Northwest Territories, Canada (Amstrup et al. 1986; Stirling 1988). The size of the Southern Beaufort Sea population was estimated to be approximately 1,800 animals in 1986 (Amstrup et al. 1986). A new population assessment derived from capture-recapture data collected during 2001 to 2006 estimated 1,526 (with a 95 percent confidence interval [CI] = 1,211–1,841) polar bears in the region in 2006 (Regehr et al. 2006). Because the precision of the earlier estimate was low, the two estimates cannot be statistically differentiated.

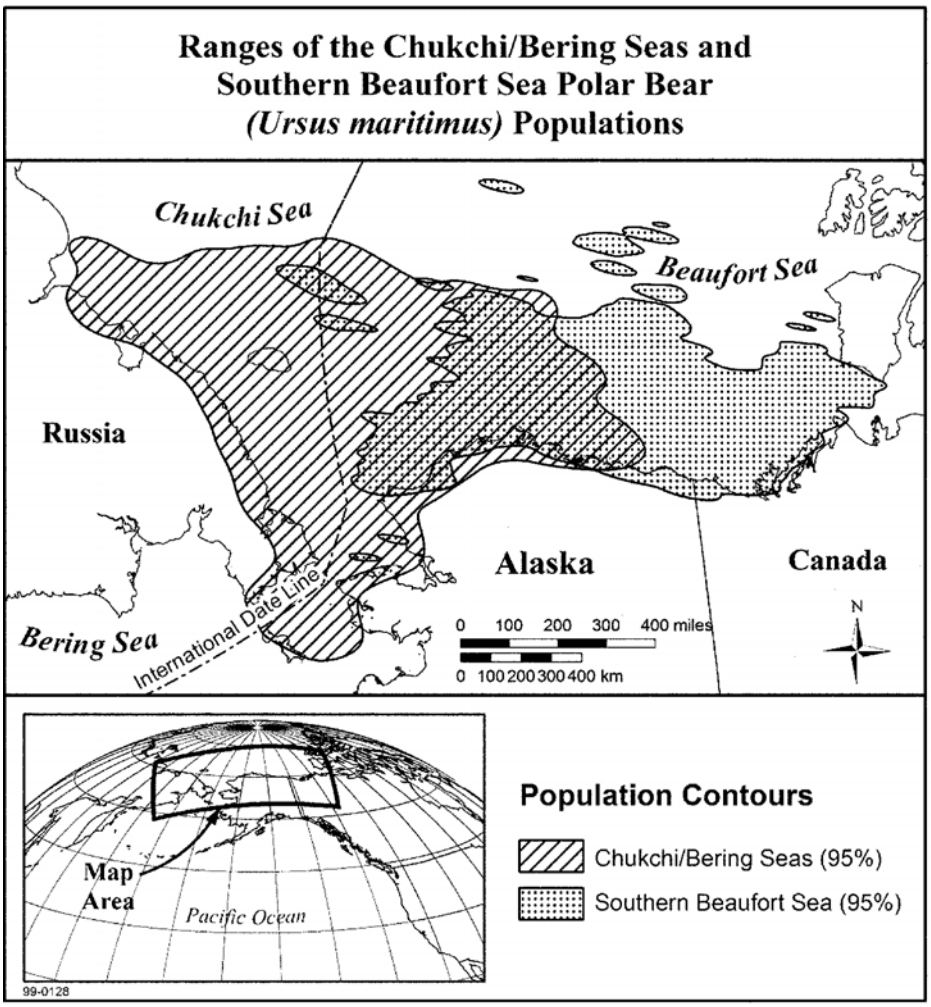
The distribution and movement patterns of some polar bear populations during the open-water and early fall seasons have changed in recent years. In the Beaufort Sea, polar bears are being found onshore in numbers greater than recorded in recent years (Schliebe et al. 2006). This is in part related to the accelerated sea ice retreat and the increasing numbers of bowhead whale (*Balaena mysticetus*) carcasses left by whalers at Cross Island and Kaktovik (S. Miller 2001, pers. comm.). The whale carcasses provide a readily available food source for the polar bears in these areas (Schliebe et al. 2006). The future distribution and seasonal movements of polar bears will likely be linked to the loss of their preferred habitat, sea ice (Durner et al. 2007).

The sea ice provides polar bears with habitat to hunt seals, to seek mates and breed, for maternity denning, to move to terrestrial maternal denning areas, and it provides a moving platform enabling them to make long-distance movements (Stirling & Derocher 1993).

In October, polar bears begin to migrate south with the advance of sea ice. Beginning in May they follow the retreating sea ice back north (Amstrup 2003). During winter, polar bears den on the sea ice and along the northern Alaska coastline and feed on ringed seals (*Phoca hispida*) using the shorefast ice (Amstrup and Gardner, 1994). During the summer, when sea ice disappears from the Bering Sea and is greatly reduced in the Chukchi Sea in July through October, polar bears move as much as several thousand kilometers north to stay with the pack ice (Garner et al. 1990).

Data from telemetry studies of female polar bears indicate their movements are not random, nor do they passively follow ocean currents on the ice as previously thought (Mauritzen et al. 2001). Results show strong fidelity to broad activity areas used over multiple years (Ferguson et al. 1997). Activity areas have not been determined for many of the populations, and available data reflect movement patterns collected before the recent changes of ice conditions.

Figure 5.1.2-1. Distribution of Polar Bear Populations (75 FR 76086)



Radio collar studies indicate that male and female polar bears have similar activity areas on a monthly basis, but males travel farther each month (Amstrup et al. 2000). Telemetry data from radio-collared females indicate some individuals occupy home ranges (or "multi-annual activity areas") that they seldom leave (Amstrup 1993). The size of a polar bear's home range is determined, in part, by the annual pattern of freezeup and breakup of sea ice, and therefore by the distance a bear must travel to obtain access to prey (Stirling 1988; Durner et al. 2004). A bear that has consistent access to ice, leads (channels of open-water through areas of ice), and seals may have a relatively small home range, while bears in areas such as the Barents, Greenland, Chukchi, Bering, or Baffin seas may move many hundreds of km each year to remain in contact with sea ice from which they can hunt (Born et al.1997; Mauritzen et al. 2001; Ferguson et al. 2001; Amstrup 2003; Wiig et al. 2003). Individual home ranges are large, averaging 244,463 km^2 (94,388 mi^2) in the Beaufort Sea (Garner et al. 1990; Amstrup et al. 2000).

5.1.3 Feeding

Polar bears are carnivorous and are the top predator of the arctic marine ecosystem. Polar bears prey heavily on ice seals, predominantly ringed seals (*Phoca hispida*) and, to a lesser extent, bearded seals (Erignathus barbatus). The relationship between ringed seals and polar bears is so close that in certain areas ringed seal abundance may control polar bear densities, while polar bear predation, in turn, regulates ringed seal density and reproductive success (Hammill and Smith 1991; Stirling and Oritsland 1995).

Over half the caloric content of a seal is contained within the layer of fat between the skin and underlying muscle (Stirling and McEwan 1975). Polar bears show their preference for this calorie-rich fat by quickly removing the fat layer from beneath the skin after catching a seal. On average, an adult polar bear needs approximately 2 kilograms (kg) (4.4 pounds [lbs]) of seal fat per day to survive (Best 1985). Polar bears hunt along pressure ridges in the fast ice and their keen sense of smell leads them to seal birth lairs to feed on newborn pups (Stirling and Archibald 1977; Furgal et al. 1996). Polar bears are opportunistic feeders and feed on a variety of other prey and carcasses, including beluga whales (*Delphinapterus leucas*), arctic cod (*Arctogadus glacialis*), Canada geese (*Branta canadensis*) and their eggs, walruses, and bowhead whales (*Balaena mysticetus)* (Smith 1985; Jefferson et al. 1993; Smith and Hill 1996; Deroche et al. 2000). Lunn and Stenhouse (1985) reported possible cannibalism among polar bears.

Derocher et al. 2004 hypothesized that prey availability to polar bears may be altered because of reduced prey abundance, changes in prey distribution, and changes in sea ice availability as a platform for hunting seals. Some polar bears in northern Alaska have begun to arrive near sites where subsistence hunters consistently leave the carcasses of harvested bowhead whales. The discarded bowhead carcasses may provide a substantial proportion of the annual energy requirements for these bears (Schliebe et al. 2006).

5.1.4 Reproduction

Polar bear mating occurs from April to June followed by a delayed implantation of the fertilized egg during September to December. Females give birth within the confines of the maternity den the following December or January (Harington 1968; Jefferson et al. 1993). Females give birth to one or two, and occasionally three, cubs an average of every 3.6 years (Jefferson et al.1993; Lentfer and Hensel 1980). Cubs remain with their mothers for 1.4 to 3.4 years (Derocher et al.1993; Ramsay and Stirling 1988). In general, females six years of age or older successfully wean more young than younger bears; however, females as young as four years old can produce offspring (Ramsay and Stirling 1988).

Studies suggest that in areas with lower ringed seal densities female polar bears usually do not breed for the first time until they are five-years of age (Stirling et al. 1976; Lentfer and Hensel, 1980). Females that are more than 20 years old have a very high rate of cub loss or do not successfully reproduce. The maximum reproductive age reported for Alaska polar bears is 18 years (Amstrup and DeMaster 1988).

5.1.5 Denning

Pregnant female polar bears excavate dens in snow on land, pack ice, or shorefast ice in the fall to early winter period and enter the dens from October to early November (Amstrup and Gardner 1994). Successful denning by polar bears requires an accumulation of sufficient snow combined with winds to cause snow accumulation leeward of topographic features creating the denning habitat (Harington 1968). The common characteristic of all denning habitat is topographic features, that catch snow in the autumn and early winter (Durner et al. 2003). In the central Beaufort Sea, Amstrup and Gardner (1994) found that polar bear dens were concentrated near or north of the Beaufort Sea coastline in eastern Alaska and the Yukon Territory (Figure 5.1.1-2). Of 22 terrestrial dens examined on the coastal plain of northern Alaska, most dens were located on or associated with pronounced landscapes (primarily coastal and river banks,

but also a lake shore and an abandoned oil field gravel pad) distinguishable from the surrounding terrain in summer and physically suited to catch snow in the early winter (Durner et al. 2003). Insufficient data exist to accurately quantify polar bear denning along the Alaska Chukchi Sea coast; however, dens in the area are less concentrated than in other areas in the arctic (USFWS 2008a).

Fidelity to denning locations was investigated by Amstrup and Gardner (1994), in which 27 females were located at up to four successive maternity dens. Bears that denned once on pack ice were more likely to den on pack ice than on land in subsequent years. Similarly, bears were faithful to general geographic areas – those that denned once in the eastern half of the Alaska coast were more likely to den there than to move to the west in subsequent years. Annual variations in weather, ice conditions, prey availability, and the long-distance movements of polar bears make recurrence of exact denning locations unlikely and no fidelity to specific den sites has been reported (Amstrup et al. 1986; Amstrup et al. 2000; Garner et al. 1990).

Polar bears give birth in the dens during mid-winter (Kostyan, 1954; Harington, 1968; Ramsay and Dunbrack 1986). Survival and growth of the cubs depends on the warmth and stability of the environment within the maternal den (Blix and Lentfer 1979). Family groups emerge from dens sometime between late February and early April, when cubs are about three months old and able to survive outside the den (Blix and Lentfer 1979; Blix and Lentfer 1992; Smith et al. 2007).

Predicted declines in sea ice habitat availability and distribution may impose greater impacts on pregnant females seeking denning habitat or leaving dens with cubs than on any other age group (Durner et al. 2007). Fischbach et al. 2007 evaluated the changes in distribution of polar bear maternal dens in the Beaufort Sea between 1985 and 2005, using satellite telemetry. The proportion of dens on pack ice declined from 62 percent from 1985 to 1994 to 37 percent between 1998 and 2004, and among pack-ice dens fewer occurred in the western Beaufort Sea after 1998. The study hypothesized that the proportion of polar bears denning in terrestrial sites may increase until autumn ice retreats far enough from the shore to preclude offshore pregnant females from reaching the Alaska coast for denning purposes.

Regehr, et al. (2007), determined the survival and breeding success of polar bears in the Southern Beaufort Sea were high from 2001 to 2003 and markedly lower for 2004 and 2005. Although there is uncertainty regarding these data, one possible explanation is that these declines were associated with increases in the duration of the ice-free period over the continental shelf. During years with long ice-free periods, polar bears spend less time foraging over the continental shelf in summer and autumn and may suffer physical risks from swimming for long distances (Regehr et al. 2007).

5.1.6 Survival

Polar bears are long-lived mammals not known to be susceptible to disease, parasites, or injury (Schliebe, et al. 2006). The oldest known female polar bear in the wild was 32 years of age and the oldest known male was 28, although few bears in the wild live beyond 20 years (Stirling 1990). Survival rates increase up to a certain age, with cubs-of-the-year having the lowest rates and prime age adults (between 5 and 20 years of age) having survival rates that can exceed 90 percent (Schliebe et al. 2006; USFWS 2008a). Amstrup and Durner (1995) report that high survival rates (exceeding 90 percent for adult females) are essential to sustain populations. Survival of cubs is dependent on their weight when they exit dens (Derocher and Stirling 1992), and most cub mortality occurs early in the period after emergence from the den (Amstrup and Durner 1995; Derocher and Stirling 1996), with early-age mortality generally associated with starvation (Derocher and Stirling 1996). Survival of cubs to weaning stage (generally 27 to 28 months) is generally estimated to range from 15 to 56 percent of births (Schliebe et al. 2006). Although infanticide by male polar bears has been well documented (Hansson and Thomassen 1983;

Larsen 1985; Taylor et al. 1985; Derocher and Wiig 1999), it is thought that this does not account for a large percentage of the cub mortality.

Population age structure data indicate subadults (2–5 years old) survive at lower rates than adults (Amstrup 1995), probably because their hunting and survival skills are not fully developed (Stirling and Latour 1978). Eberhardt (1985) hypothesized adult survival rates must be in the upper 90 percent range to sustain polar bear populations. Studies using telemetry monitoring of individual animals (Amstrup and Durner 1995) estimated adult female survival in prime age groups may exceed 96 percent, and survival estimates are a reflection of the characteristics and qualities of an ecosystem to maintain the health of individual bears (Schliebe et al. 2006). Polar bears that manage to avoid serious injury may become too old and feeble to hunt efficiently and most are generally believed to die of old age or nutritional deficits.

Injuries sustained in fights over mates or in predation attempts can lead to mortalities of polar bears (Amstrup et al. 2006). In an extensive review of ursid parasites, Rogers and Rogers (1976) found that seven endoparasites had been reported in polar bears. Only *Trichinella* spp., however, had been observed in wild polar bears. Certain species of nematodes and cestodes reported in captive polar bears have not occurred in the wild. *Trichinella* can be quite common in polar bears and has been observed throughout their range. Concentrations of this parasite in some tissues can be high, but infections are not normally fatal (Rausch 1970; Dick and Belosevic 1978; Larsen and Kjos-Hanssen 1983; Taylor et al. 1985).

5.1.7 Sea Ice and Climate Change

Polar bears are an ice-obligate species relying on sea ice as a habitat to hunt, feed, seek mates and breed, den, and rest. Recent years have seen record low September arctic sea ice extent, and the shallow continental shelf waters of the Chukchi Sea experienced a rapid and complete retreat of sea ice during the summer of 2007 (NSIDC 2007).

The Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) IPCC (2007) observed that decreases in snow and ice extent are consistent with climate warming, and satellite data since 1978 show annual average arctic ice extent has shrunk by 2.7 percent (90 percent CI = 2.1 to 3.3 percent) per decade, with larger decreases in summer of 7.4 percent (90 percent CI = 5.0 to 9.8 percent) per decade.

Recent studies have indicated that changes in the sea ice are likely to affect the distribution and abundance of polar bears throughout their range, as well as impact many aspects of their life history. Declines in sea ice extent and degrading ice in the Southern Sea have been associated with an increasing shift toward land-based denning (Fischbach et al. 2007); declines in cub survival (Regehr et al. 2006); and observations of drowned, emaciated, and cannibalized polar bears (Amstrup et al. 2006). Regehr et al. (2007) concluded that, in 2002, the ice-free period over the continental shelf in the Southern Beaufort Sea region was relatively short (mean 92 days) and survival of adult female polar bears was high (approximately 0.99, 90 percent CI = 0.10 to 1.0). In 2004 and 2005, the ice-free period was longer (mean 135 days) and survival of adult female polar bears was lower (approximately 0.77, 90 percent CI = 0.53 to 0.94). Breeding and cub-of-the-year litter survival also declined from high rates to lower rates in latter years of the study. Regehr et al. (2007) further concluded that although the precision of estimated vital rates was low, subsequent analysis (Hunter et al. 2007) indicated the declines in vital rates associated with longer ice-free periods have ramifications for the probability of persistence of the Southern Beaufort Sea population of polar bears.

Many of these studies suggest other factors could have caused or contributed to the reported changes in polar bear life history, including changes in prey distribution and abundance, disease, readily available food sources, and hunting patterns. Accordingly, while sea ice changes are well documented, our understanding of the response of polar bears and their prey to changing sea ice conditions remains uncertain.

Amstrup et al. (2007) grouped the 19 polar bear subpopulations into four ecological regions to forecast the range-wide status of polar bears in the 21st century on the basis of their ecological relationship to sea ice. These included the Polar Basin Divergent Ecoregion encompassing the Southern Beaufort Sea population. Projections of future sea ice for each ecoregion were incorporated into two models of polar bear habitat and potential response. Under both modeling approaches, polar bear populations were forecast to decline throughout their range during the 21st century.

5.2 Walruses

The following sections describe the status, distribution, and seasonal distribution trends of walruses. Also discussed are feeding, reproduction, survival and climate change effects on walrus.

5.2.1 Population Status and Trend

The walrus is not listed as threatened or endangered under the ESA or classified as depleted or a strategic stock under the MMPA. The walrus is considered a candidate species for listing under the ESA. A 12-month finding by USFWS (2011a) determined that while scientific evidence may warrant listing walruses as threatened or endangered under the ESA, there are higher priority species that need to be addressed before the walrus. USFWS will review the status of the walrus annually and a proposed rule to list the species may be developed in the future (76 FR 7634-7679).

Walruses are found throughout arctic waters and are typically associated with the offshore pack ice (USFWS 2007). The Alaska walrus population is found throughout the northern Bering Sea and the Chukchi Sea. Walruses are occasionally observed in the Beaufort Sea during the open-water season, but are considered extralimital east of Point Barrow (Fay 1982).

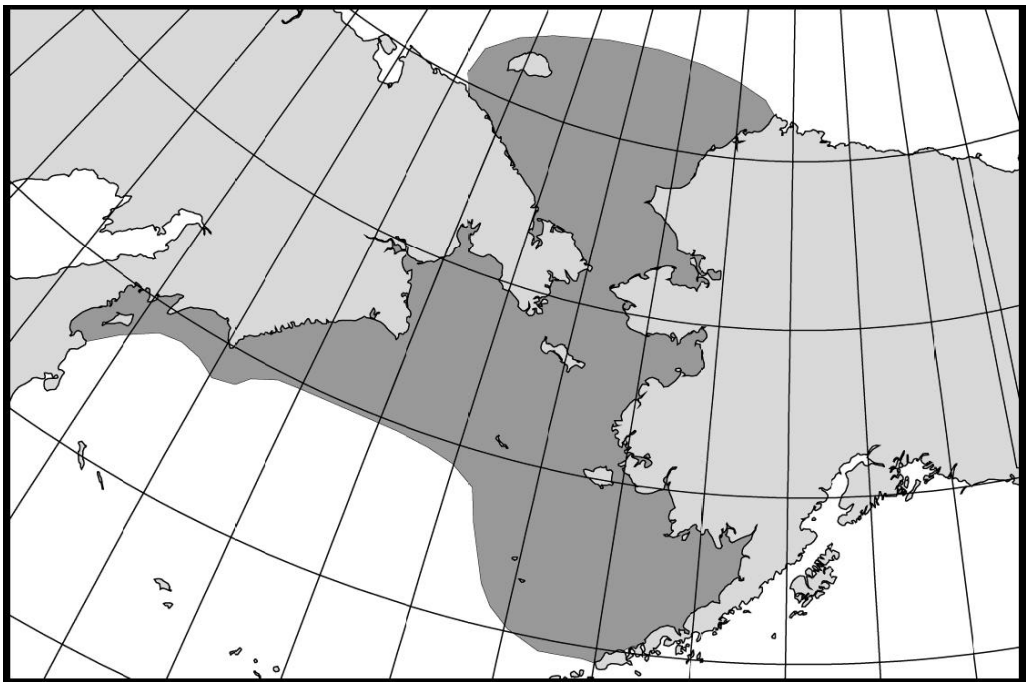
The current size of the walrus population is unknown. Estimates of the pre-exploitation population of the walrus range from 200,000–250,000 animals (Angliss and Outlaw 2008). Over the past 150 years, the population was depleted by over-harvesting, but it has been allowed to recover to pre-exploitation levels (Fay et al. 1989). Between 1975–1990, aerial surveys were carried out by the US and Russia at five-year intervals, producing population estimates ranging from 201,000–234,000 animals. These conservative population estimates do not, however, provide a basis for determining trends in population size, because survey results are not directly comparable. Surveys varied in methods, timing, and segments of the population surveyed. The surveys also had an incomplete coverage (Hills and Gilbert 1994; Gilbert et al. 1992; USFWS 2011a). Efforts to survey the walrus population were suspended after 1990 because unresolved problems with survey methods produced population estimates with unacceptably large confidence intervals (Gilbert et al. 1992; Gilbert 1999). Surveys have not been completed within a timeframe that could account for the redistribution of individual walruses before weather conditions either delayed the effort or completely terminated the survey before the occupied habitat had been covered (Speckman et al. 2010).

A range-wide survey of the walrus population was undertaken in March and April of 2006 by the USFWS in conjunction with the US Geological Survey (USGS) and Russian scientists, resulting in a minimum estimate of 129,000 walruses. Scientists consider this estimate negatively biased because weather forced an early end to the survey season and much of the southwest Bering Sea was not surveyed (Speckman et al. 2010).

5.2.2 Distribution and Seasonal Distribution

Walruses occur seasonally from Bristol Bay to Point Barrow in the Bering and Chukchi seas. Most winter in the Bering Sea and migrate northward during spring and return south during the fall, following the retreat and advance of the sea ice. Walruses mostly inhabit the edge of the moving ice over the shallow waters of the continental shelf of the Bering and Chukchi seas. Walruses summering in the Chukchi Sea are dispersed widely across the leading edge of the pack ice from Wrangel Island to the Alaska coast (Estes and Gilbert 1978).

Figure 5.2.2-1. Approximate Distribution of Walruses in US and Russian Waters.



(Source: Angliss and Outlaw 2008).

Because walruses prefer a combination of shallow water depth and sufficient ice conditions, their distribution varies seasonally (USFWS 2008c). Although seasonal movements of walruses are not completely known, they are directly related to both gender and seasonal advance and retreat of the sea ice (Fay 1982). Adult males generally travel to coastal haul-outs in Bristol Bay and the Gulf of Anadyr in spring (Jay and Hills 2005) and tend to remain in the Bering Sea year-round. Females, pups, and juveniles summer in the Chukchi Sea. Adult females and young move northward into the Chukchi Sea Region in May and occupy areas of unconsolidated pack ice within 100 km (62 mi) of the leading pack-ice edge (Gilbert 1999).

Walruses are found in waters less than 200 m (656 feet) deep along the pack-ice margin where ice concentrations are less than 80 percent (Fay 1982). This ice-covered, shallow, continental shelf is important for walruses, because the ice platform provides habitat necessary for resting between foraging trips for calves incapable of deep or long-term diving (USFWS 2011b). Floating sea ice is also important for birthing, nursing, isolation from predators, and for passive transport to new feeding areas (USFWS 2011b). Therefore, walruses can be expected in shallow waters near the coast, on shelf pack ice, and also offshore on unconsolidated ice.

In October, as the pack ice advances, large herds are found along the leading edge of the ice. In winter, they continue to follow the advancing ice through the Bering Straits (USFWS 2011b). During winter, large concentrations of walruses occur south of the Bering Strait and southwest of St. Lawrence Island near the ice edge. Smaller concentrations occur east of the Pribilof Islands and southwest of Cape Navarin along the Koryak coast. Fay (1982) suggested those adult females, their young, and a few adult males winter in the center of the ice, while juveniles and sub-adults occupy the periphery. These animals follow the retreating ice in spring and summer and, as a result, congregate between Barrow and Wrangel Island in the Chukchi Sea.

In recent low-ice years, walruses appear to more frequently use coastal haul-outs during the summer. When pack ice is not available, walruses use coastal haul-outs to rest. Generally, large groups of up to several thousand walruses can be found along the edge of the pack ice between Icy Cape and Point Barrow in July. With the retreat of pack ice in August, walruses are found farther offshore, with the majority of concentrations to the northwest of Barrow. Large aggregations of walruses hauled out onshore from Peard Bay to Lisburne were first observed in 2007 (Funk et al. 2009) and again in 2009 and 2010 (Fishbach et al. 2009; Delarue et al. 2011). Haul-out areas are known to exist along the northern coastline of Chukotka, and on Wrangell and Herald islands, which are considered important haul-out areas in September, especially in years when the pack ice retreats far to the north. In recent years, the coastal haul-outs in Chukotka have seen regular and persistent use in the fall. Russian biologists attribute the increased use of these coastal haul-outs to diminishing sea-ice habitat. A similar event was recorded along the Alaska coastline in August–September 2007, 2009, 2010, and 2011, when several thousand animals were reported along the Chukchi Sea coast between Barrow and Cape Lisburne (Thomas et al. 2009; Clarke et al. 2011).

Vessel-based and nearshore aerial surveys conducted as part of marine mammal monitoring programs associated with offshore seismic surveys in the Chukchi Sea recorded 16 large haul-outs with approximately 3,000 walruses on the Chukchi Sea coast from Barrow to Cape Lisburne in 2007. In August 2007, vessel-based observers encountered 1,000 walruses in open-water 161 km (100 mi) northwest of Wainwright and aerial surveys counted more than 300 walruses in open-water during a survey between Wainwright and Point Lay. On the basis of acoustic records of walrus vocalizations near Point Lay, the walruses began hauling out on land as early as August 10. Scientists have reported a lag of about 20 days between the disappearance of sea ice in offshore areas and the formation of coastal haul-outs along the Alaska coast (Thomas et al. 2009). Aerial surveys began on August 25 and continued to document large numbers of walruses on land through early October. Before 2007, there were few documented cases of walrus haul-outs on the Chukchi coast. In 2008, there was substantially more ice in the offshore Chukchi Sea until mid-September and there were no large aggregations of walruses observed onshore. Walruses seemed to gather on coastal haul-outs again in 2009, 2010, and 2011 (Fishbach et al. 2009; Delarue et al. 2011; Clarke et al. 2011).

The Chukchi Offshore Monitoring in Drilling Area program contains an aerial survey component to study the distribution and relative abundance of marine mammals in the Chukchi Sea Planning Area. This aerial survey was flown from June to November 2008 to 2011 and provides insights into walrus distributions (Clarke et al. 2011). Walruses were sighted all months except November, and their distribution was

associated with sea-ice coverage in June through early August, shifting to nearshore habitat, both in open-water and in coastal haul-outs, in late August and September. Coastal haul-outs were documented at Icy Cape, Alaska, in 2009 and near Point Lay and Cape Lisburne, Alaska, in 2010. Preliminary data from daily survey reports indicated that walruses again used coastal haul-outs along the Chukchi Sea coast in 2011 (Clarke et al. 2011). Information about walrus vocalizations recorded during a region-wide Chukchi Sea acoustic monitoring program showed that walrus call counts peaked in August and September. The 2009 data provided evidence of a southwesterly movement from mid-September on, which is probably indicative of the onset of the migration toward the Bering Strait. By mid-October, the number of walruses in the study area was showing strong signs of decline in all years, but the overwinter data indicate that some walruses remain in the Chukchi Sea until December or January (Delarue et al. 2011).

5.2.3 Feeding

Walruses can have a large effect on their prey and play an important role in the arctic ecosystem by influencing the structure of benthic invertebrate communities. They mainly feed on bivalve mollusks (clams) obtained from bottom sediments along the shallow continental shelf, typically at depths of 80 m (262 ft) or less (Fay 1982). The Bering and Chukchi Seas support high densities of benthic invertebrates (Grebmeier et al. 2006 a,b). In Bristol Bay, 98 percent of satellite locations of tagged walruses were in water depths less than or equal to 60 m (197 ft) (Jay and Hills 2005). Walruses can eat more than 50 clams during a single seven-minute dive to the seafloor and consume 35 to 50 kg (77–110 lbs) of food per day. Pregnant and nursing walruses consume even more food (Fay 1985; Born et al. 2003).

Walruses feed on a variety of benthic invertebrates, including worms, snails, shrimp, crabs, and some slow-moving fish (Jefferson et al. 1993; USFWS 2011b). Walruses have been reported to feed on seals and small whales (Jefferson et al. 1993), and even on seabirds (Gjertz 1990). They mainly feed between June and November when the young are growing and adult females are accumulating fat stores for the breeding season (Fay 1982).

Hauling out on moving ice provides significant advantages for foraging walruses, including proximity to varying food supplies and relative freedom from disturbance when resting (Fay 1974). Because walruses feed on benthic invertebrates, which are distributed in patches, this continually moving ice allows walruses to feed over a larger area without much effort.

As walruses root along the seafloor in search of food, they plow through large quantities of sediment (Nelson and Johnson 1987; Nelson et al. 1994). They remove large quantities of prey from the seafloor, affect the size structure of clam populations, mix bottom sediments while foraging, create new microhabitats from discarded shells, and generate food for seafloor scavengers from uneaten scraps of prey (Oliver et al. 1983).

5.2.4 Reproduction

Walruses are long-lived animals with low reproduction rates. Male walruses reach sexual maturity between six and seven years of age, but are usually unable to successfully compete for females until reaching full body size at age 15 or older (Fay 1982; USFWS 2011b). Females reach sexual maturity around four to seven years of age and give birth to one calf every two or more years (Fay 1982; USFWS 2011b). Mating usually occurs between January and March. Implantation is delayed until June or July (Fay 1982). Gestation lasts 11 months (a total of 15 months after mating) and birth occurs between April and June during the annual northward migration. Calves weigh about 63 kg (139 lbs) at birth and are usually weaned by age two (Fay 1982).

5.2.5 Survival

Walruses are preyed upon by polar bears, killer whales, and subsistence hunters. The magnitude of natural mortality is unknown, but is assumed to be low, given the population's low productivity. Eskimo hunters from St. Lawrence Island have described walruses becoming emaciated after becoming entrapped in heavy ice. It is probable that in some instances those walruses starve to death but no scientific documentation of such events exists.

Serious injury and death can result from interactions with other walruses, mainly resulting from strikes with tusks and trampling. Skin lacerations and subcutaneous hemorrhages from tusk strikes are common in both sexes and all age classes. The most serious wounds are observed on males during the breeding season, when they wound each other during vigorous fights in the water. Trampling can result in reproductive failure, injury, and death during stampedes at crowded haul-outs. Such events have been observed at Wrangel Island in the Chukchi Sea and the Punuk Islands in the Bering Sea (USFWS 2008b).

5.2.6 Sea Ice and Climate Change

USFWS conducted a status review of walruses in response to a petition to list the species as threatened or endangered under the ESA. The agency concluded that the warming climate and loss of summer sea ice will likely result in a population decline of walruses, although the time period over which this change will occur and the magnitude of the decline are uncertain (USFWS 2011b). On the basis of this conclusion, USFWS considers the walrus a candidate for listing and will conduct annual status reviews, likely proposing to list the species as threatened or endangered under the ESA in the future.

As discussed earlier in this section, sea ice plays an important role in the life history of the walrus. Sea ice is receding earlier during the summer from over the continental shelf of the Chukchi Sea. Chadwick and Fischbach (2008) hypothesize that when the sea ice recedes beyond the continental shelf, to locations over the deep ocean basin, walruses must either continue to haul out on the sea ice with little access to food, or abandon the sea ice and move to coastal areas where they can rest on land. During the record minimum sea ice extent in summer 2007 (NSIDC 2007), the Chukchi Sea shelf contained little to no ice for approximately 80 days and several thousand walruses hauled out on the shores of northwestern Alaska, which had not been previously documented (Chadwick and Fischbach 2008). Since 2007, similar haul-outs have been observed along the Chukchi Sea coast in 2009, 2010, and 2011 (Thomas et al. 2009; Clarke et al. 2010; NMFS and MMS 2011).

As more walruses haul out on land instead of sea ice, nearshore prey populations and forage foods may be subjected to greater pressure. Today, it is unknown whether more concentrated foraging by walruses will change or deplete nearshore prey communities, or if walrus energetics will be affected if prey do become less abundant. A better understanding of walrus movement and foraging patterns is necessary to determine the effects of decreasing availability of sea ice on walruses and the food sources upon which they depend.

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6.0 ANTICIPATED IMPACT ON POLAR BEARS AND WALRUSES

50 CFR 18.27(d)(iii)(C) The anticipated impact of the activity upon the species or stocks.

Section 6 provides an overview of the potential impacts of proposed oil and gas exploration activities expected to occur in the Chukchi Sea Region from 2013 to 2018. Anticipated effects on polar bears and walruses are limited to include temporary and localized changes in behavior with no long-term consequences or detectable population-level effects. The footprint of the activities covered in this Petition is small compared to the range of either species. Mitigation measures will be implemented by Industry to minimize any potential effects on polar bears and walruses. See Section 10.0 for more information about mitigation measures. Additionally, USFWS also recently evaluated the potential effects of promulgation ITRs on the Chukchi Sea Region and issued a final EA pursuant to NEPA (USFWS 2008b).

The following subsections provide an overview of acoustic terminology, a general background of sound effects on wildlife, a brief description of sound sources associated with oil and gas activities, and potential impacts of sound on polar bears and walruses.

6.1 Sound Background Information

Sound is a physical phenomenon made up of small vibrations traveling through a medium, such as air or water. The disturbed particles of the medium move against undisturbed particles, causing an increase in pressure. This increase in pressure causes adjacent undisturbed particles to move away, spreading the disturbance away from its origin. This combination of pressure and particle motion makes up the acoustic wave.

Sound pressure and intensity are often quantified using dBs. The mathematical definition of a decibel is the base 10 logarithmic function of the ratio of the pressure fluctuation to a reference pressure. Decibels are measured using a logarithmic scale, so sound levels cannot be added or subtracted directly. For example, if the intensity (pressure) of a sound doubles, the sound level increases by 3 dB, regardless of the initial sound level: 40 dB + 40 dB = 43 dB, and 60 dB + 60 dB = 63 dB. A doubling of sound pressure adds 6 dB. The decibel measures the difference in orders of magnitude (x 10), so 10 dB means 10 times the power, 20 dB means 100 times the power, 30 dB means 1,000 times the power, and so on.

The decibel is a relative measure, so any absolute value expressed in dB means nothing without the appropriate reference. The metric describing the change in pressure (amplitude) is the Pascal (Pa), approximately equal to 0.0001465 psi. In this Petition, all underwater sound levels are expressed in decibels referenced to 1 micro Pascal (dB re 1 μPa) and all airborne sound levels are expressed in dB re 20 μPa.

Hertz (Hz) is the measure of how many times per second the crest of a sound pressure wave passes a fixed point. For example, when a drummer beats a drum, the skin of the drum vibrates a number of times per second. If the drum skin vibrates 100 times per second, it generates a sound pressure wave that is oscillating at 100 Hz, and this pressure oscillation is perceived by the ear and brain as a tonal pitch of 100 Hz. Sound frequencies between 20 and 20,000 Hz are within the range of sensitivity of the best human ear. The hearing sensitivities of the animals of interest in this Petition will be discussed in the text below.

As sound propagates out from the source, there are many factors that reduce the amplitude. These factors include the spreading of sound over a wide area (spreading loss), loss to friction between particles that vibrate (absorption), and scattering and reflections from objects in the path (including surface or seafloor). The total reduction in amplitude because of these and other factors is called the transmission loss (TL).

TL parameters vary with frequency, temperature, wind, sea conditions, source and receiver depth, water chemistry, and bottom composition and topography.

Table 6.1-1 contains the definitions of some terms commonly used to describe underwater sounds. Two common descriptors are the instantaneous peak sound pressure level (SPL) and the root-mean-square (rms) over a defined averaging period. The peak pressure is the instantaneous maximum or minimum overpressure observed during each sound event. The rms level is the square root of the energy divided by a defined period of time.

Table 6.1-1. Definitions of Acoustical Terms

Term	Definition
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level (SPL)	Sound pressure is the force per unit area, usually expressed in µPa (or 20 micro Newtons per square meter), where 1 Pa is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure. Sound pressure level is the quantity that is directly measured by a sound-level meter.
Frequency (Hz or kHz)	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as Hertz (Hz). Typical human hearing ranges from 20–20,000 Hz (or 20 kilohertz [kHz]).
Peak Sound Pressure (unweighted) (dB re 1 µPa)	Peak sound pressure level is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz–20,000 Hz. This pressure is expressed in this Petition as dB re 1 µPa (dB).
Root-Mean-Square (rms) dB re 1 µPa	The rms level is the square root of the energy divided by a defined time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprises that portion of waveform containing 90 percent of the sound energy for one impulse.
Ambient Sound Level	The background sound level, which is a composite of sound from all sources near and far. The normal or existing level of environmental sound at a given location.

6.1.1 Description of Sound Sources

Sound in the Chukchi Sea Region will be generated by multiple sources, including physical, biological, and anthropogenic. Physical sound is produced by physical sources such as wind, atmospheric sound, earthquakes, waves and currents, and ice. Biological sound is produced by living organisms, including marine mammals, fish, and invertebrates. Anthropogenic sound is generated by manmade sources, including air and vessel traffic, seismic surveys, icebreakers, supply ships, and exploratory drilling. Additional sources of anthropogenic noise not associated with industry activities include barge traffic, delivering fuel and other supplies to villages, and privately owned boats used for subsistence hunting that produce anthropogenic sound not associated with industry activities.

Wind has the greatest influence on the overall ambient underwater sound levels in the arctic environment because of its effect on the ice and water. Biological sounds such as the mating calls of seals and whales also contribute significantly to ambient sound levels. Ice cover can alter the underwater sound characteristics dramatically. The factors influencing acoustic properties include type and degree of ice cover; whether it is shorefast ice, moving pack ice, or at marginal ice zone; chemical characteristics of the ice itself; and decreased air temperatures resulting in cracking of rigid ice (NRC 2003). During the open-

water season, anthropogenic sources can include geotechnical and geophysical surveys, exploratory drilling, and vessel and aircraft traffic. During the ice-covered season, sound sources can include on-ice vehicle and aircraft traffic.

Sound sources can also be categorized into either stationary or mobile sources. Stationary sources include construction, maintenance, repair, and remediation activities; operations at production facilities; and drilling operations from onshore or offshore facilities. Mobile sources include vessel and aircraft traffic, open-water seismic exploration; winter vibroseis (a seismic vibrator device that propagates energy signals over an extended period of time) programs; geotechnical surveys; ice road construction and associated vehicle traffic, including tracked vehicles and snowmobiles; dredging; and icebreakers.

Sound can also be categorized by the temporal nature of the sound. Pulsed sound sources can elicit different responses from marine mammals than a continuous sound source. Sound from a vessel would be considered a continuous sound source, while the pulses from an airgun would be considered a pulsed source of sound.

Drilling

Sound from drilling operations varies with equipment type. On the basis of the results of drillship sounds from the *Northern Explorer II* and a support vessel recorded in the 1980s, and re-modeled recently, the aggregate broadband source level for a drillship and support vessel is 175 dB re μPa at 1 m, on the basis of precautionary interpretation of the third-party measurement data (Greene 1987; Miles et al. 1987). Auxiliary sound is also created during drilling operations from supply vessels and aircraft.

Seismic Surveys

During typical seismic surveys, the amount of acoustic energy released is directly proportional to the operating pressure and number of airguns used as an energy source. A review of literature about airgun acoustics by NRC (2003) reported a maximum output peak SPL of 260 dB re 1 μPa) in the vertical far field. The location of where this peak SPL would be received by a marine mammal is dependent on the makeup of the array, water depth, and physical properties of the water. Seismic surveys in the Chukchi Sea have an established 180 dB isopleth exclusion zone (also called a safety zone) for walruses and a 190 dB isopleth exclusion zone for polar bears, from the seismic survey sound source. This zone must be free of polar bears and walruses before the survey can begin and must remain free of marine mammals during the survey. The purpose of the exclusion zone is to protect polar bears and walruses from the potential for Level A harassment (injury/harm) (MMS 2007).

Vessel Traffic

Vessel traffic contributes to underwater sound (Richardson et al. 1995; NRC 2003). Sound is created primarily by propeller cavitations, but other machinery (e.g., diesel engines, generators, pumps, fans, etc.) also contribute to the overall sound level. Vessel sound is a combination of narrowband tonal sounds at specific frequencies and broadband sounds with energy spread over a range of frequencies. Sound levels and frequencies are related to vessel size, design, speed, and load. Broadband source levels range from 150–180 dB re 1 μPa, with components extending to 100 kHz, but usually peaking between 50–150 Hz (Richardson et al. 1995). Regular vessel traffic, other than that associated with oil and gas exploration activities, will likely also be present in the Chukchi Sea Region, such as those associated with local subsistence activity and barges delivering fuel and other goods.

Ice Management

Ice-management operations are expected to have the greatest potential for disturbances to walruses. Icebreaking ships produce louder and more variable sounds than those typically produced by vessels of similar size or power, causing substantial increases in sound levels out to at least 5 km (3.1 mi) (Richardson et al. 1995). The primary source of increased sound is the propeller cavitations during alternating periods of ramming and backing. Broadband source levels have been measured to be approximately 180 dB re 1 μPa, with dominant tones at 50 Hz (Richardson et al. 1995). To alleviate potential impacts to hauled-out walruses from both visual and noise disturbance, all vessels must maintain minimum operational distances from any observed walrus group. See Section 10.0 for mitigation measures pertaining to noise and visual impact.

6.1.2 Potential Effects of Sound on Marine Mammals

The effects of sound on marine mammals are highly variable (Richardson et al. 1995) and can range among the following:

- The sound may have no effect, because it is too weak to be heard by the animal;
- The sound may be audible, but not strong enough to elicit a behavioral response;
- The sound may elicit a behavioral response;
- The animal may become habituated to the sound if the sound is repeated;
- The sound could be strong enough to mask the hearing ability of the marine mammal; and
- The sound may be loud enough to cause temporary or permanent reduction in hearing sensitivity.

A change in marine mammal behavior is the most common impact associated with certain levels of sound introduced into the environment. Repeated exposure of an individual may directly affect reproductive physiology as individuals incur energetic costs or lose mating or foraging opportunities by repeatedly reacting to or avoiding sound. Animals may also be forced to retreat from favorable habitat in order to avoid aversive anthropogenic sound levels. Though the direct effects of sound on wildlife may be the most obvious, sound may also have indirect effects on population dynamics through changes in habitat use, courtship and mating, reproduction and parental care, and possibly migration patterns. In species relying on acoustic communication, anthropogenic sound may adversely affect individual behavior by making signal detection difficult because of masking and thus altering the dynamic interaction between the producers and perceivers of communicative signals.

Habituation of animals to their environment also is a significant factor in assessing potential impacts of sound. The definition of habituation is “the elimination of the organism’s response to often recurring, biologically irrelevant stimuli without impairment of its reaction to others.” Habituation is ubiquitous in the animal kingdom (Peeke and Petrinovich 1984). More predictable sources of disturbance can lead to greater habituation (Aquatic Mammals 2007). Situations in which similar sound-producing activities occur in the same habitat at frequent intervals may therefore affect locally breeding wildlife less than less-frequent or less-predictable activities (NRC 2003).

Excessive sound may cause physical impairments of marine mammals, such as temporary threshold shift (TTS), which is the temporary loss of hearing, but full hearing returns or permanent threshold shift (PTS), in which there is a partial or complete loss of hearing. Mortality rates of adults may change due to hearing

loss, a serious hazard in predator-prey interactions. Other effects of sound on wildlife may be more subtle, such as those affecting heart rate or communication.

In assessing potential effects of sound, Richardson et al. (1995) has suggested four criteria for defining zones of influence. These zones are shown below, from greatest influence to least:

Zone of hearing loss, discomfort, or injury: The area within which the received sound level is potentially high enough to cause discomfort or tissue damage to auditory or other systems. This includes TTS (temporary loss in hearing) or PTS (loss in hearing at specific frequencies, or deafness). Non-auditory physiological effects or injuries theoretically might occur in marine mammals exposed to strong underwater sound, including stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage.

Zone of masking: The area within which the sound may interfere with detection of other sounds, including communication calls, prey sounds, or other environmental sounds.

Zone of responsiveness: The area within which the animal reacts behaviorally or physiologically. The behavioral responses of marine mammals to sound is dependent upon a number of factors, including: 1) acoustic characteristics of the sound source of interest, 2) physical and behavioral state of animals at time of exposure, 3) ambient acoustic and ecological characteristics of the environment, and 4) context of the sound (e.g., does it sound like a predator) (Richardson et al. 1995; Southall et al. 2007). Temporary behavioral effects from sound are often simply evidence an animal has heard a sound and may not indicate lasting consequence for exposed individuals (Southall et al. 2007).

Zone of audibility: The area within which the marine mammal might hear the sound. Marine mammals as a group have functional hearing ranges of 10 Hz–180 kHz, with best thresholds near 40 dB re 1 μPa (Ketten 1998; Southall et al. 2007). Hearing capabilities of the species included in this Petition are discussed further below.

6.2 Polar Bears

Impacts on polar bears by Industry activities during the past 40 years have been minimal, as shown by the small number of documented incidents. Polar bears have been encountered at or near coastal and offshore production facilities, or along roads and causeways linking these facilities to the mainland. Activities that will occur offshore during 2013–2018 will be during the open-water season when the pack ice is far offshore, limiting the probability of encountering more than a very few polar bears. Furthermore, anticipated impacts from oil and gas exploration activities in the Chukchi Sea Region are expected to be no more than temporary and localized changes in behavior with no effect on recruitment or survival of the population. The area of oil and gas exploration activities ensonified by ≥ 160 db re 1 μPa is small compared to the broad range of polar bears. As seen in Table 4.1-1, the number of polar bears expected to be exposed to sound levels ≥ 160 db re 1 μPa is small compared to the population of polar bears in the Chukchi Sea.

Any onshore activities such as those associated with environmental studies or a shorebase could potentially result in direct human encounters. Approximately half of recorded encounters may result in a deterrence event, where bears are deterred from industrial areas. The number of bears being deterred represents a small proportion of the population and there is no evidence that deterrence has had any impact on the survival and recruitment of polar bears (USFWS 2006). The implementation of polar bear interaction plans has helped raise employee awareness about the importance of bear avoidance and has minimized the impact of human-polar bear encounters.

With more than 40 years of oil and gas exploration and development in Alaska, the existing data reliably demonstrate that, with proper management, the potential negative effects of oil and gas exploration activities on polar bears can be minimized (USFWS 2008c). With the implementation of effective mitigation measures, Industry activities are anticipated to have a short-term, temporary impact on a small number of individual polar bears and no more than a negligible impact, if any, on the Chukchi Sea population. See Section 10.0 for more information about mitigation measures.

6.2.1 Potential Impacts from Seismic Activity

Impacts from seismic activity are mainly caused by sound generated by airguns. The levels of sound required to cause TTS or PTS are not known for polar bears; however, evidence suggests they are likely beyond sound levels created by the oil and gas industrial activities, with the possible exception of close proximity to underwater seismic airguns. Polar bears are not known to communicate underwater and there have not been any studies conducted to determine whether polar bears are affected by underwater sound.

Nachtigall et al. (2007) measured in-air hearing of three polar bears using evoked auditory potentials. Measurements were not obtainable at 1 kHz; best sensitivity was found in the range from 11.2–22.5 kHz. Preliminary behavioral testing of hearing indicates that polar bears can hear down to at least 14 Hz and up to 25 kHz.

Monitoring during seismic surveys has documented the presence of polar bears and reported that polar bears typically reacted by moving away from the sound source both on ice and in the water (USFWS 2008b). There has never been more than a temporary behavioral disturbance recorded for polar bears exposed to seismic operations in the Alaska arctic. The most likely response would be short-term, temporary, behavioral avoidance. Marine mammals showing behavioral avoidance of seismic vessels are unlikely to incur auditory impairment (USFWS 2008a). Furthermore, implementation of the mitigation measures during seismic surveys to shut down when a polar bear enters the safety zone of 190 dB re 1 μPa rms, and the fact that the seismic surveys would occur during the open-water season when polar bears are unlikely to be in the area, would further reduce the likelihood that a polar bear would be injured due to seismic surveys. Therefore, the anticipated impact from seismic sound is anticipated to be negligible on the polar bear population within the Chukchi Sea Region.

6.2.2 Potential Impacts from Drilling Activities

Most impacts from exploration drilling are from underwater sounds of drilling activity. Sound emitted by stationary sources, including drilling, is relatively predictable and can attract polar bears to the area, as they are known to be curious. In the offshore environment, this does not likely result in a human encounter. Human activities onshore that have the potential to attract polar bears could result in an encounter, and unintentional harassment, lethal take, or intentional deterrence. Conversely, sound from Industry activities may act as a deterrent to keep bears from coming into the area, which would reduce the number of potential human encounters.

Oil and gas activities expected to occur during the period covered by this Petition take place during the open-water season and are generally limited to vessel-based exploration activities. There is the potential that some vessels might encounter polar bears on the sea ice and cause a behavioral response. Any response, if it happens at all, is more likely to be triggered by the physical presence than the airborne sounds generated by the vessel. Moreover, the vessel activity would occur generally south of the sea ice used by polar bears. Because of the solitary nature and widespread distribution of the polar bear, disturbance from vessel traffic would be short-term, localized, temporary, and limited to a few individuals. Therefore, the anticipated impact on the polar bear population is anticipated to be negligible.

The potential for oil and gas activities to disturb polar bears dens does exist. Industry makes a concerted effort to avoid known polar bear dens found as a result of locating USGS-radio-collared pregnant females or documentation by FLIR surveys around the oil fields. These dens, monitored by USFWS, represent only a small percentage of the total active polar bear dens located in the area. LOA conditions require oil and gas operations to avoid known polar bear dens by 1.6 km (1.0 mi). From 2002–2006, four previously unknown maternal dens were encountered by Industry during project activities (USFWS 2006). Industry reports unknown dens to the USFWS, which then establishes mitigation measures, such as the 1.6-km (1-mi) exclusion zone, to minimize the potential disturbance from oil and gas activities. As stated earlier, all Industry activities are expected to occur during the open-water season when there is no polar bear denning activity.

Human-bear interactions are governed by polar bear interaction plans developed by and in collaboration with USFWS and oil and gas companies. The plans provide guidance for minimizing polar bear encounters through personnel training, polar bear guards, lighting, snow clearance, waste management and garbage control, agency communication, site clearance, and site-specific safety briefings for polar bear awareness. Employee training programs are designed to educate field personnel about the dangers of human-bear encounters and to implement safety procedures in the event of a bear sighting.

6.2.3 Potential Impacts from Vessels and Aircraft

During open-water season, polar bears typically remain offshore in the pack ice and are not usually present in the more frequent vessel traffic area, which is south of the pack ice. There is a potential that an occasional polar bear on ice floes could encounter a vessel, with the physical presence of the vessel is more likely to cause a disturbance than its airborne sound. Because of the solitary nature and widespread distribution of the polar bear, disturbance from vessel traffic would be short-term and temporary and limited to a few individuals. Therefore, no significant impact on the polar bear population is expected.

Behavioral reactions of polar bears to aircraft depend on the distance and type of aircraft. Polar bears run away from aircraft passing at low altitudes. Routine aircraft traffic may result in short-term, temporary disturbances to a few individual polar bears, but the impact, if any, on the polar bear population is expected to be no more than negligible.

Amstrup (1993) reported most polar bears in dens continue to occupy the dens after close approaches by aircraft. Although the snow attenuates some aircraft sound (Blix and Lentfer 1992), it is possible that the repeated overflights may cause polar bears to abandon or depart their dens. Most oil and gas exploration activities in the Chukchi Sea will occur during the open-water seasons during 2013 – 2017, not during winter when polar bears are occupying dens. Additionally, required mitigation measures including minimum flight elevations over polar bear areas and flight restrictions around known polar bear dens would reduce the potential for bears to be disturbed by aircraft. See Section 10.0 for more information on mitigation measures.

6.2.4 Potential Impacts from Physical Obstruction

There is little chance that oil and gas facilities would act as physical obstructions to polar bears. Most of these facilities are located further inland, where polar bears are found less frequently. There would be an insignificant chance of physical obstruction imposed by offshore drillships, drilling units, or support vessels. Offshore and coastal facilities are more likely to be approached by polar bears. Displacement of animals because of physical obstructions would be short-term and localized.

Polar bears have shown that they have little fear of man-made structures (Stirling 1988) and are capable of climbing and crossing gravel roadways. Offshore production facilities have been approached by polar bears, but, because of facility designs, the bears are not able to directly access the facilities (USFWS 2006).

Physical obstructions may be small-scale and localized, however they are not expected to have a negative impact on individual polar bears or the Chukchi Sea population.

6.2.5 Potential Impacts from Spills

In a recent analysis of a potential very large oil spill (VLOS), BOEM found that the chance of such a spill occurring during oil and gas exploration activities is very low (BOEMRE 2011). USFWS cannot authorize takes resulting from a VLOS. This section is included to acknowledge the very low likelihood of impact from a very low likely event. Although there have been no known oil spills that have impacted any polar bears the potential impacts that oil, fuel, and waste product spills could have on polar bears and other marine mammals are a serious concern. In the unlikely event of an oil spill, depending on the quantity, the season, and other characteristics of the spill, polar bears could be exposed to spilled substances during open-water and ice-covered seasons in onshore and offshore habitats. They may be impacted by external contact with oil or contaminants, ingestion of oil, or inhalation of fumes.

An experiment was conducted in 1980 to study the effects of oil on polar bears. The bears were forced to remain in oil for prolonged periods of time and the effects were noted. Observed impacts included acute inflammation of the nasal passages, marked epidermal responses, anemia, anorexia, and biochemical changes indicative of stress, renal impairment, and death (USFWS 2011c; Øritsland et al. 1981).

Oiling of the fur and skin also causes significant thermoregulatory problems and reduces insulation value. Oiled bears are also more likely to ingest the oil through grooming.

Oil ingestion by polar bears through consumption of contaminated prey and by grooming or nursing could have pathological effects, depending on the amount of oil ingested and the individual's physiological state (USFWS 2011c). If a large enough amount of oil is ingested, it could cause mortality in the individual, as it did in two of the three bears in the 1980 experiment. Other hazardous wastes and substances may pose the same type of risks. These risks can be mitigated by proper containment and spill response plans, as well as immediate cleanup.

Polar bears swimming in or walking adjacent to an oil spill may inhale petroleum vapors. Inhalation of highly concentrated vapors, such as gasoline in excess of 10,000 parts per million (ppm), is typically fatal (Boesch and Rabalais 1987). At lower concentrations, up to 1,000 ppm, humans and laboratory animals can develop inflammation of the nasal passages, hemorrhaging, and congestion of the lungs (Boesch and Rabalais 1987). Øritsland et al. (1981) reported on the effects of vapor inhalation on captive polar bears. Their report indicated inhalation of hydrocarbons from crude oil in a confined space may have been a factor in the death of two of three polar bears exposed to oil in their experiments.

Small spills on land or in water are typically cleaned up immediately and pose little threat to polar bears. Larger spills, however, may be a much greater threat. Historically, large spills associated with Alaska oil and gas activities on the North Slope have been production-related and occurred at facilities or pipelines connecting wells on land (USFWS 2006). No large crude oil spills have occurred during exploration drilling in the Alaska OCS or in the waters of the Alaska OCS. See Sections 10.2 and 10.3 for information about oil spill prevention and response.

6.3 Walruses

Impacts from offshore oil and gas exploration activities on walruses are expected to be limited to short-term and localized changes in behavior with no effect on recruitment or survival (Level B). There have been no documented walrus mortalities as result of oil and gas exploration activities, and no mortalities are expected to occur as a result of the activities described in this Petition. The footprint of anticipated oil and gas exploration activities in the Chukchi Sea is small compared to the range of walruses. Mitigation measures will be implemented to minimize potential impacts to walruses, including the use of marine mammal observers (MMOs) to monitor for all marine mammals, flight altitude restrictions, and minimum-distance requirements from walruses hauled out on land or ice. Aggregations of walruses will also be avoided by vessels associated with oil and gas exploration activities. See Section 10.0 for more information on mitigation measures. In sum, the activities described in this Petition are expected to have no more than a negligible adverse impact on walruses.

6.3.1 Potential Impacts from Seismic Activity

Impacts from seismic activity are mainly caused by sound generated by airguns. Walruses hear sounds both in air and in water. The in-air hearing of a walrus was tested from 8 Hz–125 kHz and it was determined that 2 kHz and 250 Hz are the most sensitive frequencies, although they were able to hear at all frequency ranges tested (Kastelein et al. 1996). The underwater hearing ability was also tested and determined to be the most sensitive at 12 kHz (Kastelein et al. 2002). Most of the sound sources discussed below would be audible to walruses. Impacts as a result of oil and gas activities are discussed in more detail in the recent *Status Review of the Pacific Walrus* (*Odobenus rosmarus divergens*) (Garlich-Miller, et al. 2011) prepared in response to a petition to list the species as threatened or endangered under the ESA (USFWS 2011b).

Seismic surveys are mobile pulsed-sound sources likely to result in sound exposure to walruses in open-water in the Chukchi Sea Region from 2013 to 2018. Sound from airgun arrays may be audible several km (mi) from the source. Walruses are thought to begin altering their behavior at received levels above 160 dB re 1 μPa, although not all individuals exposed to 160 dB re 1 μPa will exhibit behavioral changes. Small numbers of walruses may be exposed to and possibly disturbed by pulsed sounds associated with marine seismic surveys during oil and gas activities. The likely response will be avoidance or tolerance (USFWS 2008b).

Walruses may suffer physical hearing impairment when exposed to sounds equal to or greater than 218 dB re 1 μPa (Southall et al. 2007). Sounds from seismic sources may be loud enough to cause hearing damage to walruses that are in close proximity to the source. USFWS established a safety zone for walruses inside the 180 dB re 1 μPa sound isopleth to prevent physical injury of walruses.

Seismic survey operators employ MMOs to monitor sound isopleth radii determined during sound source verification before the onset of the survey. If a walrus is within or about to enter the 180 dB re 1 μPa isopleth, the MMO will call on the operator to immediately either shut down or power down airguns to reduce the sound level. See Section 10.0 for more information about implementation of this mitigation measure.

Furthermore, seismic activities typically occur in ice-free areas to prevent damage to the airgun array. Walruses' preference for water with sea ice present will reduce the potential for exposure to seismic sound, although animals traveling through open-water between foraging or resting areas may still be exposed. Impacts to individual walruses and the Alaska population are expected to be negligible.

6.3.2 Potential Impacts from Drilling Activities

Most impacts from exploration drilling are from underwater sounds of drilling activity. Offshore drilling of exploration wells is a stationary and constant sound source, as opposed to the mobile, pulsed sound associated with seismic operations. Sounds from drilling are within the hearing range of the walrus and could result in disturbance to a small number of individuals. Sound from drilling and associated icebreaker activity is anticipated to disturb no more than a few individuals with no impact to the population.

Results from monitoring studies conducted in the late 1980s revealed that walruses did not exhibit an avoidance reaction when drilling vessels were anchored or drifting and did not appear to be affected by drilling sounds (Brueggeman et al. 1990). With the retreat of the pack ice, walruses inhabited areas near drilling activities for only a short period of time. Walrus density and group size before and during drilling were found not to differ, but distribution did change. Walruses showed no preference for a particular amount of ice cover before operations but preferred areas of moderate ice cover during operations, particularly operations involving ice-breaking activities. The walruses were fairly evenly distributed across the pack ice and from the ice edge and prospect before operations, but they became more distant and clumped during ice-breaking operations. Once ice-breaking activities stopped, walruses once again became more evenly distributed, indicating that any effects were brief and that walruses may adjust to operational or drilling sounds.

Icebreakers could unintentionally impact walruses at farther distances than routine vessel traffic (Fay et al. 1984). Walruses on ice have been observed to become alert and dive into the water when icebreakers passed over 2 km (1.2 mi) away (Fay et al. 1984; Brueggeman et al. 1990; 1991; 1992). In addition, Brueggeman et al. (1990) suggest that walruses on ice floes may avoid icebreakers by 10 to 15 km (9.3 mi).

The probability of encountering walruses during drilling or ice management operations is highly dependent on the presence of ice in the area. More walruses will likely be present within the Chukchi Sea Region when ice is available for use. Effects on walruses as a result of sound from drilling and associated activities would probably be limited to slight changes in distribution, with some walruses avoiding the area or retreating to the center of the ice floe. All such effects would be minor and temporary, lasting only as long as the ice and the walruses are in the area.

6.3.3 Potential Impacts from Vessels and Aircraft

Impacts from vessels and aircraft associated with oil and gas exploration activities are not expected to include more than temporary and localized changes in behavior. Flight altitude restrictions and minimum distance limitations are implemented near walrus groups. See Section 10.0 for more information on mitigation measures.

The behavioral response of walruses to vessel traffic is extremely variable. Richardson et al. (1995) reviewed various studies of the reactions of walruses to ships and boats and found that some studies reported no reaction, while other studies showed that high-frequency sound from outboards may be more disturbing than low-frequency sound from diesel engines.

Reaction by walruses to vessel traffic appears to be dependent upon vessel type, distance, speed, and the walruses' previous exposure to disturbances (USFWS 2011b). Vessels will maintain a minimum operational separation distance as determined by the USFWS around any polar bears or walruses observed on land or ice, to the extent practicable. See Section 10 for additional details. Ice management operations are expected to have the greatest potential for disturbances, because these operations typically

require the vessel to accelerate, reverse directions, and turn rapidly, thereby maximizing propeller cavitations and resulting sound levels (USFWS 2011b). Icebreaking activities have resulted in the displacement of some walrus groups up to several miles away. However, most groups of hauled-out walruses showed little reaction beyond 0.8 km (0.5 mi) (Brueggeman et al. 1990). Variables such as wind speed and direction are also thought to contribute to variability in detection and response (USFWS 2011b).

Richardson et al. (1995) summarized that the response to ships depends strongly on distance and ship speed, as well as previous exposure to hunting. Brueggeman et al. (1991) reported that 81 percent of walruses encountered by vessels in the Chukchi Sea exhibited no reaction to ship activities within less than a mile, which suggests that they may be tolerant of ship activities and movements. Females with young are typically more wary than males, and walruses encountered in open-water are less responsive than those at haul-outs. They also reported that walruses in the water showed little concern about an approaching vessel unless the ship was actually about to run over them. Even then, they simply dove and swam away (Fay et al. 1984). Fay observed that when a ship was stationary, walruses often swam to within 20 m (66 ft). Frequently, they dove under the ship and surfaced on the other side. Underwater sound from vessel traffic has the potential to mask the sounds of walruses that are very close to the sound source. Because of the low numbers of walruses observed in open-water, impacts, if any, from vessel traffic would be limited and would have no lasting impacts to the Chukchi Sea population.

The behavioral response of walruses to aircraft traffic also varies with distance, flight pattern, and type of aircraft, as well as age, sex, and size of the individual walruses (USFWS 2011b). Aircraft will not operate at altitudes lower than 457 m (1,500 ft) except during takeoff and landing when within 800 m (0.5 mi) of walrus groups, except during an emergency, and helicopters will not hover or circle above or within 800 m (0.5 mi) of walrus groups. See Section 10.0 for more information about mitigation measures. Richardson et al. (1995) reviewed the responses of walruses to aircraft and summarized that individual responses to aircraft can range from orientation (i.e., looking at the aircraft) to leaving the haul-out. In general, small herds on haul-out sites (terrestrial and pack ice) seem more easily disturbed than large groups, and that adult females and calves are more likely to enter the water during disturbance. Stronger reactions occur when low-flying aircraft pass overhead or cause abrupt changes in sound. The greatest potential impact of aircraft is when the disturbance causes large numbers of walruses to stampede into the water, which may result in the trampling of calves. Most aircraft traffic in the area of activity normally occurs inland and at altitudes that are unlikely to affect walruses.

In August–September 2007, 2009, 2010, and 2011, several thousand animals were reported along the Chukchi Sea coast between Barrow and Cape Lisburne. During aerial surveys over the Chukchi Sea, observers of walruses in sea-ice habitats have reported little walrus reaction to small fixed-winged aircraft above 305 m (1,000 ft) (USFWS 2008b).

Walruses should not be adversely affected by aircraft traffic if the required aircraft minimum altitudes are followed (MMS 2007). Therefore, aircraft traffic would have no more than a negligible impact, if any, on individual walruses or the population.

6.3.4 Potential Impacts from Physical Obstruction

It is unlikely that walruses would be negatively impacted by a physical obstruction caused by oil and gas exploration activities. Oil and gas exploration activities in the Chukchi Sea will use drillships, drilling units, and support vessels. It is unlikely that these stationary offshore vessels would affect the movement of walruses; any displacement of animals because of a physical obstruction would be short-term and localized. In the event that walruses are encountered on a stationary facility, the Industry will record and report the interaction.

6.3.4.1 Human Encounters

Vessels that encounter walruses are required to divert around the animals and make every effort to avoid disturbing them, unless there is a legitimate safety concern for not following this mitigation procedure. Close approaches to walruses are prohibited. See Section 10.0 for more information about mitigation measures. Given the fact that the exploration activities will occur during the open-water season, there is only a small chance that there will be any walruses in the area. Any human-walrus interactions will be recorded and reported. These human encounters are expected to have no more than a negligible impact on individuals and a negligible impact, if any, on the Alaska stock.

6.3.5 Potential Impacts from Spills

USFWS cannot authorize takes from a large oil spill. This section is included to acknowledge the very low likelihood of impacts from a very low likely event. As discussed previously, the chance of a VLOS occurring from oil and gas exploration activities in the Chukchi Sea is very low (BOEMRE 2011). However, impacts on walruses in the unlikely event of such a spill remain a serious concern. Walruses could be impacted by external contact with oil or contaminants, ingestion of oil, or inhalation of fumes, depending on the quantity, the season, and other characteristics of the spill.

There is the potential for oil, production waste, and chemical spills to negatively impact individual walruses by displacing animals or by causing injury or death. The indirect effects of oil spills on walrus habitat may include impacting the benthic invertebrates on which they feed. Oil settling on the ocean floor has the potential to reduce the availability of benthic invertebrates as a food source as a result of smothering and toxicity (USFWS 2006). Some polynuclear aromatics that are carcinogenic and toxic may also become concentrated in the food chain (Etkin 1997). Mitigation measures undertaken by Industry would assist in reducing any impact on the benthic environment. Refer to Section 10 for additional information. There is also the potential for incidental operational spills to occur during transfer of fuel, refueling, handling of lubricants and liquid products, and general maintenance of equipment. Walruses may be impacted by external contact with oil, ingestion of oil, or inhalation of fumes. They could encounter oil spills during open-water and ice-covered seasons in the offshore or onshore habitat (USFWS 2006). If those hazardous substances are spilled on land, ice, or water, Industry procedures require immediate cleanup.

Walruses are most vulnerable to the effects of an oil spill at coastal haul-outs, particularly along the northern coast of Chukotka and Wrangel Island, where the preponderance of walruses using haul-outs in the autumn are females and juveniles (Kochnev, 2004). There are nine major haul-outs along the coast of the Russian Chukchi Sea. Up to 125,000 walruses, mostly females with calves, have been estimated to use coastal haul-outs on Wrangel Island in the Russian arctic (Kochnev 2004). Large aggregations of walruses on the Alaska Chukchi Sea coast were not observed before 2007. In August and September of 2007, tens of thousands of walruses were observed hauled out in locations along the Alaska Chukchi Sea coast between Peard Bay and Cape Lisburne (Fishbach et al. 2009). Since 2007, this coastal area of Alaska has been used seasonally used by walruses displaced by the lessening abundance of sea ice. Displacement from these crucial areas would likely result in population-level impacts on recruitment and survival.

Walruses are long-lived animals with low rates of natural mortality and low rates of reproduction, which would severely limit the ability of the walrus population to recover from any adverse impacts associated with a large oil spill. There have been no known mortalities to walruses as a result of oil and gas activities, and none is expected to occur as a result of the proposed activities. If a large oil spill occurred, contacted, and extensively oiled coastal habitats during the open-water season, the presence of cleanup personnel, boats, and aircraft operating in the cleanup area would be expected to displace walruses and to

contribute to increased stress and reduced pup survival. These effects may occur during cleanup; however, it is not expected to greatly affect behavior and movement beyond the area (within about 1.6 km [1 mi]) of activity or after cleanup (MMS 1989; MMS 2003).

In the event that a walrus were swimming adjacent to an oil spill, it is likely that it would inhale petroleum vapors. Inhalation of highly concentrated vapors, such as gasoline in excess of 10,000 ppm, is typically fatal (Boesch and Rabalais 1987). At lower concentrations, up to 1,000 ppm, humans and laboratory animals can develop inflammation, hemorrhaging, and congestion of the lungs (Boesch and Rabalais 1987).

Small, localized spills are typically cleaned up quickly and pose little to no threat to walruses. Large spills, however, may pose a potentially more serious threat. Historically, large spills associated with Alaska oil and gas activities on the North Slope have been production-related and have occurred at production facilities or pipelines connecting wells on land (USFWS 2006). This situation is doubtful to occur in the project area because exploration activities are the only activities that will occur during the duration of this Petition, and therefore poses little threat to walruses.

Onshore oil spills would not impact walruses unless the spill moved into the offshore environment or near a haul-out area (USFWS 2006). Little is known about the effects of oil or other chemical compounds on walruses; however, oil and production waste spills have been documented to cause a range of physiological and toxic effects on other pinnipeds. Components of oil can burn eyes; burn skin; and irritate or damage sensitive membranes in the nose, eyes, and mouth (USFWS 2006). If ingested, these components can damage red blood cells; suppress immune systems; strain the liver, spleen, and kidneys; and interfere with the reproductive system of animals (AMSA 2002). Walruses do not exhibit grooming behavior, which lessens the chance of ingestion of oil (USFWS 2006). After a period of exposure, inhalation of hydrocarbon fumes can cause pulmonary hemorrhages, inflammation, congestion, and nerve damage (USFWS 2006). Walrus calves may die as a result of abandonment. If the mother cannot identify its pup by smell in the large colony, the mother may reject attempts by the pup to suckle (AMSA 2002). See Sections 10.2 and 10.3 for a more detailed discussion of oil spill prevention and response.

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7.0 ANTICIPATED IMPACT ON SUBSISTENCE

50 CFR 18.27(d)(iii)(D) The anticipated impact of the activity on the availability of the species or stocks for subsistence uses.

Oil and gas exploration activities must be conducted so as to minimize impacts on the availability of subsistence resources. The impact of oil and gas exploration activities during the open-water periods of 2013 – 2017 on the availability of polar bears and walruses for subsistence harvests has been, and is anticipated to remain negligible because of the following:

- Distribution, movement, and numbers of polar bears in the Chukchi Sea Region are not expected to be affected by oil and gas exploration activities, because such activities will occur during ice free periods.
- Polar bears are hunted primarily during the ice-covered period, when little or no offshore oil and gas exploration activities will be conducted.
- Walruses occur at coastal haul-out locations during the summer months when the pack ice is far offshore. Because of USFWS restrictions on oil and gas activity near haul-outs, impacts on walruses using coastal haul-outs are not expected. See Section 10.0 for more information about mitigation measures.

Furthermore, regular communication among Industry, Native communities, and marine mammal co-management groups (i.e., the Alaska Nanuuq Commission and Eskimo Walrus Commission) will further reduce the likelihood of interference with subsistence harvests. All operators cooperate with communities near the Chukchi Sea coast to reduce the interference of oil and gas exploration activities on the availability of these animals for subsistence uses. As required by USFWS, Plans of Cooperation are prepared by Industry when a potential for impacts on subsistence resources exists to give communities and co-management groups an effective method to voice concerns and to assist Industry in developing mitigation measures to minimize impacts. See Section 10 for more information about mitigation measures.

7.1 Subsistence Species Synopsis

The MMPA defines subsistence as: the customary and traditional uses by rural Alaska residents of marine mammals for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of marine mammals taken for personal or family consumption; and for barter, or sharing for personal or family consumption (MMPA 2011). Subsistence hunting is a vital practice of northern Alaska communities. Subsistence harvest provides food, clothing, and materials that are used to produce cultural items.

Subsistence products have significant material and economic importance. To effectively harvest subsistence resources, monetary resources are needed. Individuals and families that practice subsistence hunting spend cash to purchase equipment such as large boats, all-terrain vehicles, rifles, and ammunition. The amount spent in subsistence hunting varies by household (MMS 2007). Arts and crafts are created by using subsistence materials and are sold for income. An example of subsistence arts and crafts is the parka, or kuspuk, a jacket used for hunting and recreation. The parka is made carefully with various furs and skins (Langdon 2002).

Subsistence resources have significant Iñupiat cultural meaning and harvest activities express central cultural values. During Nalukataq, the spring bowhead whale festival, subsistence food is shared and thanks are given to the umialiks (whaling captains), the bowhead whale, and the community for its labors. The Nalukataq exemplifies Iñupiat values of sharing, respect for nature, and respect of community. Subsistence ceremonies maintain ties between families and create relationships among communities (Langdon, 2002).

A wide array of subsistence resources are harvested on the North Slope. Generally, communities hunt resources most available to them during specific seasons. To harvest animals proficiently, strategic places and times are chosen depending on the yearly cycle. Communities in the area of activity are Barrow, Point Lay, Point Hope, and Wainwright. These communities pursue diverse resources that include aquatic and terrestrial animals. Bowhead whales are heavily harvested, along with beluga whales, seals, and walruses. Caribou is also a main food source. Birds and fish are harvested depending on the annual cycle (URS 2009). Polar bears are an important subsistence resource, harvested for food and clothing. The fur is used to make cold weather gear. Walruses are harvested for food, ivory, which is used in creating traditional artwork (MMS 1990).

7.1.1 Polar Bears

Traditionally, Iñupiat hunters harvested polar bears for subsistence use. The majority of polar bears hunted before the 1950s were by Alaska Natives (USFWS 2008a). A review of records of skins shipped from Alaska from 1925 to 1953 estimated an annual statewide harvest of 120 polar bears by Alaska Natives for this time period. In the 1950s–1970s, recreational hunting commonly employed aircraft, increasing the average annual harvest to about 250. Annual polar bear harvest decreased between 1973 and 1984, following the passing of the MMPA in 1972.

Under the MMPA, Alaska Natives living in coastal communities are allowed to hunt polar bears only for subsistence and cultural use. From the 1990s to 2000s, the annual harvest of the Chukchi/Bering stock further declined from 92 to 43 per year (USFWS 2010b). Currently, Chukchi Sea polar bear population numbers are unknown. Polar bears continue to be hunted by Iñupiat communities for food and to create traditional arts and crafts.

A treaty regarding polar bears between Native and government representatives of the US and Russia was signed in 2000 to meet the subsistence needs of Native people while managing and protecting the shared polar bear population. During a meeting in June 2010, an upper limit of 19 females and 39 males per year was placed on polar bear harvests. The Alaska share of the harvest is 29 polar bears per year (75 FR 65507).

7.1.2 Walruses

Historically, walruses have been harvested by Iñupiat communities for food and for manufacturing handicrafts. These handicrafts are then sold, given, or bartered to relatives and friends (MMS 1990). The Chukchi Sea coast villages have access to walruses each summer (Bacon 2009). Walrus harvesting is uncommon east of Barrow, as this is the eastern extent of the walruses' summer range. The USFWS records estimated annual harvest levels in Russia and the US indicate annual harvest between 4,000–8,000 walruses in 1960-1980. The largest harvests occurred in 1980–1990 when annual harvests ranged from 8,000–16,000 walruses. Recent harvest levels are lower and are comparable to 1960s records (USFWS 2010c). Subsistence harvest of walruses by Alaska Natives is not limited by quota, but monitored closely by USFWS.

7.2 Subsistence Harvests by Community

7.2.1 Wainwright

Wainwright is located on the Chukchi Sea coast, approximately 145 km (90 mi) southwest of Barrow. The community is situated 5 km (3 mi) northeast of the Kuk River estuary (ADCCED 2011). The community is dependent on subsistence harvest resources such as fish, migratory birds, invertebrates, plant resources, terrestrial, and marine mammals. The majority of marine subsistence activities are conducted between Icy Cape in the south and Point Franklin and Peard Bay in the north (MMS 2007).

Polar Bears

Wainwright residents harvest polar bears in the fall and winter around Icy Cape, at the headland from Point Belcher to Point Franklin (AES 2006). From 1987 to 2006, Wainwright residents harvested about 113 polar bears per year but none since 2007 (Figure 7.2.1-1) (USFWS 2011d).

Walruses

Walruses are typically harvested from June through August along the southern end of the retreating pack ice. Wainwright residents have consistently harvested more walruses than any other community on the North Slope (AES 2006), harvesting about 52 walruses per year from 1987 to 2003. This harvest level dropped to about 12 per year in 2007 to 2010. A total of 949 walruses have been harvested by Wainwright hunters between 1987 and 2010 (Table 7.2.1-2).

Table 7.2.1-1 Subsistence Polar Bear Harvest Reports by Year and Village

Polar Bear Subsistence Harvests								
	1987–2006		2007	2008	2009	2010	2007–2010	
	Total	Mean	Annual	Annual	Annual	Annual	Total	Mean
Wainwright	113	6	0	0	0	0	0	0
Barrow	356	19	12	11	8	6	37	9
Point Lay	30	2	0	0	0	0	0	0
Point Hope	198	11	9	9	5	2	25	5
Atqasuk	6	0	0	0	0	0	0	0
years	19		1	1	1	1	5	

Notes: Polar bears reported and tagged as harvested and tagged by Alaska Native subsistence hunters in accordance with the Marine Mammal Marking, Tagging, and Report Rule (50 CFR 18.23). Data published: June 24, 2011. (Source: USFWS 2011d).

Table 7.2.1-2 Subsistence Walrus Harvest Reports by Year and Village

Walrus Subsistence Harvest									
	1987–2006		2007	2008	2009	2010	2007–2010		1987–2010
	Total	Mean	Annual	Annual	Annual	Annual	Total	Mean	Total
Wainright	891	47	16	5	31	6	58	15	949
Barrow	450	24	16	27	13	4	60	15	510
Pt Lay	80	4	11	12	4	2	29	7	109
Pt Hope	113	6	25	1	3	1	30	8	143
Atqasuk	0	0	0	0	0	0	0	0	0
years	17		1	1	1	1	4		

Notes: Walruses reported as harvested and tagged by Alaska Native subsistence hunters in accordance with the Marine Mammal Marking, Tagging, and Report Rule (50 CFR 18.23). Data published: November 5, 2008. (Source: USFWS 2011d).

7.2.2 Point Lay

Point Lay has a population of 189 (ADCCED 2011). The village is 245 km (152 mi) southwest of Barrow, on the Chukchi Sea but sheltered from the ocean by the Kasegaluk Lagoon (AES 2006). A number of species of fish, birds, and mammals use the lagoon, giving residents a variety of resources to be harvested (Bacon 2009).

Polar Bears

Point Lay residents mainly harvest polar bears from fall to spring, between the months of September and April. Annual polar bear harvest for Point Lay from 1987–2006 was about two bears per year, considerably lower than Barrow (19/year), Wainwright (6/year), and Point Hope (2/year) (Table 7.2.1-1).

Walruses

Point Lay residents harvest walruses from June to August along the Kasegaluk Lagoon. Community hunters venture as far south as Icy Cape and as far as 32 km (20 mi) offshore. The average harvest was about five walruses per year from 1989 to 2006, and 29 from 2007 – 2010 (Table 7.2.1-2).

7.2.3 Barrow

Barrow is the northernmost community in the US, located on the Chukchi Sea coast, 16 km (10 mi) south of Point Barrow. The community is the economic, transportation, and administrative center for the NSB, with a population of approximately 4,212 (ADCCED 2011). Barrow hunters harvest bowhead whales in the fall, primarily east of Barrow as far east as the western edge of Smith Bay. In the fall hunters pursue bowhead whales up to 48 km (30mi) offshore, while spring whaling takes place at leads in the ice off the Nuvuk Spit. Barrow residents also harvest seals, beluga whales, waterfowl, and caribou (ENSR 2006).

Polar Bears

Barrow is the largest community in the North Slope and regularly has the highest annual polar bear harvest. Residents hunt polar bears on the sea ice or along leads from October to June. The annual polar bear harvest for Barrow from 1987–2006 averaged 18.73 polar bears, which is considerably higher than the 2007–2010 average. Refer to Table 7.2.1-1 for average yearly data.

Walruses

Walruses are hunted depending on the ice conditions. Barrow hunters harvest walruses in summer and fall (June through September), with the use of boats, when the fast ice breaks up, making it easier for hunters to intercept walrus herds migrating north to pack ice (URS 2009). Barrow hunters pursue walruses, ranging from the western end of Smith Bay in the east to the Wainwright area in the west. Walruses are normally harvested 32-80 km (20–50 mi) offshore (ENSR 2006). From August to September, Barrow residents hunt walruses onshore at local haul-out locations. The main haul-out hunting area extends from Milliktagvik north to Point Franklin (AES 2006). The annual walrus harvest (25 walruses) was much higher in the 1989 to 2006 period than for the more recent 2007–2010 period (12 walruses) (Table 7.2.1-2).

7.2.4 Point Hope

Point Hope, with a population of 674, is located near the tip of Point Hope Peninsula on a spit that forms the western extension of the northwest Alaska coast (ADCCED 2011). The community is situated 400 km (248 mi) southwest of Barrow. The earliest residents of the area came 2,000 years ago for bowhead whaling. The Point Hope Peninsula is one of the longest constantly inhabited places in North America (AES 2006). In the summer and fall seasons, marine and terrestrial mammals, fish, migratory birds and their eggs, and invertebrates are harvested (Bacon 2009).

Polar Bears

Polar bears are generally harvested by Point Hope resident, from January to April, and occasionally starting in October in the area south of the point up to16 km (10 mi) offshore (AES 2006). Point Hope residents harvested 198 polar bears from 1987 to 2006. The total harvest of polar bears for the period 2007–2010 was 25, as displayed in Table 7.2.1-1.

Walruses

Walruses are hunted by Point Hope residents from May to July along the southern shore of the point from Point Hope to Akoviknak Lagoon (AES 2006). Point Hope hunters harvested a total of 113 walruses from 1989–2006 and 30 from 2007–2010 (Table 7.2.1-2).

7.2.5 Atqasuk

Atqasuk has a population of 233. The village is situated near the Meade River, 97 km (60 mi) south of Barrow (ADCCED 2011). The community is located in the Interior, so residents have limited access to the ocean in the north, making marine mammal harvest limited; however, individuals commonly travel to neighboring coastal communities to join crews to participate in marine mammal harvests.

Polar Bears

Because Atqasuk is an inland village, polar bear harvests are limited. No polar bears were harvested by Atqasuk hunters from 1987–2010 (Table 7.2.1-1).

Walruses

Marine mammal harvests are restricted because of the location of the village but individuals from Atqasuk will travel to coastal villages such as Barrow and Wainwright to join crews hunting marine mammals. Six walruses were harvested from Atqasuk residents from 1989 to 2010 (Table 7.2.1-2).

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8.0 ANTICIPATED IMPACT ON HABITAT

50 CFR 18.27(d)(iv) The anticipated impact of the activity upon the habitat of the marine mammal populations and the likelihood of restoration of the affected habitat.

8.1 Polar Bears

Documented impacts on polar bear habitat in Alaska by oil and gas activities during the past 40 years have been minimal. Given the effective use of mitigation measures and their continued use in the future, the low level of oil and gas activities occurring near polar bear habitat, and the temporary and localized nature of many of the oil and gas activities, it is anticipated that Industry will have a minimal impact on polar bear habitat. Furthermore, activities covered by this Petition will be limited to oil and gas exploration activities that will only be conducted during the open-water months from June through November. Polar bears are not expected to inhabit the exploration areas during these months, because open-water is not considered to be a habitat type frequently used by polar bears. Polar bears depend on the presence of sea ice for effective and efficient hunting, feeding, reproduction, and resting (USFWS 2008a). Open-water is, however, a fundamental part of the marine ecosystem supporting seals, the principal prey of polar bears.

8.1.1 Sound

Sound introduced into the environment by exploration activities in the Chukchi Sea Region could influence polar bears indirectly by impacting prey species such as bearded seals (*Erignathus barbatus*), ringed seals (*Pusa hispida*), and spotted seals (*Phoca largha*). Anthropogenic sound may affect marine mammals in various ways, ranging from small behavioral changes to physical injury, depending upon sound level. See Section 6.0 for more information about impacts on polar bears.

Sound from oil and gas exploration has the potential to disturb the ice seals on which polar bears prey. The primary source of sound disturbance to these species would be from the air and vessel traffic associated with exploration activities, seismic survey operations, icebreakers, and ice management activities. A secondary source of sound would be from exploration drilling activities, although most of this sound is of relatively low frequency and at low sound levels.

Sound from vessel and aircraft traffic could potentially cause disturbances to the seals hauled out on the ice. The numbers of seals potentially affected, however, is expected to be small, because of the relatively low number of disturbance events and the dispersed distribution of seals in the area of activity. Exploration activities are expected to be conducted in open-water with very little ice (the primary resting habitat for ice seals) present. Small changes in seal distribution in open water would therefore have negligible effect on polar bears, as they hunt seals primarily on the pack ice. Furthermore, seals in the region could habituate to some of the oil and gas exploration activity-related sound. Blackwell, et al. (2004), reported that ringed seals exhibited tolerance to industrial sound associated with construction activities, including pile driving, at the Northstar Island oil production facility in the Beaufort Sea.

8.1.2 Spills

USFWS cannot authorize takes from a large oil spill. This Section is included to acknowledge the very low likelihood of impacts from a very low likely event (BOEMRE 2011). See Section 10.0 for information about mitigation measures. Impacts resulting from the unlikely event of a large oil spill in the Chukchi Sea Region on polar bears are of concern (USFWS 2006). Oil spills may have an indirect effect

on polar bears by negatively impacting the condition of foraging, breeding, and resting habitat as well as reducing the availability and distribution of ringed seals and other prey species. Any impacts from an oil spill resulting from the activities described in this Petition are expected to be localized to a small amount of habitat, relative to that available in the Chukchi Sea during the open-water season.

The potential impact of a large spill, such as a well blowout, on polar bear habitat would depend on multiple factors including the following:

- Time of year,
- Environmental conditions,
- Magnitude and origin of the spill, and
- The success of cleanup efforts.

A large spill in fall or spring during the formation or breakup of sea ice presents a greater risk because of difficulties associated with cleanup, and the increased presence of polar bears in foraging habitat over the continental shelf (USFWS 2008c). Amstrup, et al. (2000), concluded that the release of oil trapped under the ice from an underwater spill during the winter could be catastrophic during spring breakup if bears were present (USFWS 2008c). During the autumn freezeup and spring breakup periods, any oil spilled in the marine environment would likely concentrate and accumulate in open leads and polynyas, areas of high activity for both polar bears and seals (USFWS 2008c).

In the unlikely event of a large spill, reduction of suitable foraging habitat and prey availability for polar bears would be a major concern. Low density and wide distribution of polar bears minimizes the potential impacts from a large oil spill on polar bear stocks. The main polar bear prey, the ringed seal, uses shorefast ice, pack ice, and offshore pack ice covering a broad geographic range. Polar bears may travel long distances in search of suitable prey. Indirect impacts on polar bears because of impacts on prey resources may be lessened because of flexibility with regard to nutritional resources. Reports are available describing incidents where polar bears were observed changing prey species from ringed seals to other seals when necessary (Iverson et al. 2006; Stirling and Parkinson 2006).

The potential impact of a major oil spill on polar bear habitat is of great concern, although the probability of a large oil spill occurring is very low. Any small spill that could potentially occur is expected to be localized and cleaned up quickly, minimizing potential impact on polar bear habitat. In the unlikely event that a large oil spill occurs, existing detection, containment and recovery procedures, and waste holding practices provide adequate protection to minimize impacts to polar bear habitat. See Section 10.0 for more information on mitigation measures.

8.2 Walruses

Walruses winter in the Bering Sea. As the season changes into spring – summer, the sea ice retreats northward, and the females and calves follow the retreating ice into the Chukchi Sea. Most of the male population stays in the Bering Sea, using terrestrial haul-out locations. Walruses are found with the moving pack ice over the shallow waters of the Bering Sea and Chukchi Sea continental shelf throughout the summer months and into early autumn. Historically, large aggregations of walruses (tens of thousands) have used haul-outs on the Russian shores of the Chukchi Sea in early autumn when the sea ice was at its annual minimum. Light ice conditions in 2007, 2009, 2010, and 2011 resulted in the use of coastal haul-outs along the Chukchi Sea coast by hundreds to thousands of walruses (Thomas et al. 2009;

Clarke et al. 2011). Haul-outs of this magnitude were not documented along the Alaska shores of the Chukchi Sea before 2007.

A study by the USGS in 2009 observed a mass mortality event of walruses along the Alaska Chukchi coast (Fischbach et al. 2009). Though the exact cause (or causes) of this mass mortality are unknown, it is speculated that the event was related to the declining sea ice habitat over the Chukchi Sea continental shelf. This reduction in sea ice may have forced the walruses to swim a large distance to shore, causing exhaustion and possible drowning. Previous studies have linked walrus deaths at haul-out locations to trampling, exhaustion from extended exposure to open-sea conditions, and separation of calves from their mothers.

8.2.1 Sound

Little information is available regarding how or if sound from oil and gas activities affects benthic organisms, the primary walrus prey. As reviewed in NRC (2003), cephalopods (octopods and squid) and crabs have statocysts that may detect low-frequency sounds. Most prey species are sedentary and are not likely to be effected further than a meter (approximately 3 feet) from the airgun. Marine invertebrates do not hear in the same manner as vertebrates, but they are able to sense vibrations and movements associated with sound production to detect potential predators, prey, tides, and currents (DOSITS 2008). This is accomplished using special sensory organs known as chordotonal organs, a type of internal mechanoreceptor. The organs sense pressure, movement, and tension. They detect cues generated from vibrations that may be associated with sound. Refer to Section 6 for the potential direct impacts that sound may have on walruses.

8.2.2 Exploration Drilling Footprint

Activities associated with exploratory drilling within the Chukchi Sea Region are anticipated to have no more than a negligible impact on walrus habitat or prey. The footprint of the well and adjacent area of cuttings deposition on the seabed could smother benthic organisms, but that footprint area is a very small portion of the range of walrus foraging habitat. Furthermore, exploration wells are temporary, and benthic organisms are expected to re-colonize the area. Impacts to the benthic walrus prey are expected to be temporary and localized, therefore having a minimal effect on walruses. Accompanying the exploratory drilling platform will be aircraft, support vessels, and ice management vessels. These will also have an associated impact footprint, but will be easily avoided by the walrus, as they are not sedentary animals, and they will avoid the area during the short time that there is activity in the area.

8.2.3 Spills

USFWS cannot authorize takes from a large oil spill. This section is included to acknowledge the very low likelihood of impacts from a very low likely event (BOEMRE 2011). See Section 10.0 for information on mitigation measures. Walruses may be affected by impacts on benthic prey from oil or fuel products in the unlikely event of a spill. Oil settling on the ocean floor has the potential to reduce the availability of benthic invertebrates available for nutrition as a result of smothering and toxic effects (USFWS 2006). Furthermore, some carcinogenic and toxic polynuclear aromatics could potentially become concentrated in the food chain (Etkin 1997). However, operational mitigation measures implemented by Industry would minimize any impact on the benthic walrus prey. See Section 10 for information about mitigation measures.

8.3 Climate Change

The Council on Environmental Quality issued guidance under NEPA indicating climate change is a reasonably foreseeable impact of GHG emissions. As stated earlier, USFWS concluded climate change poses a threat to the survival of polar bears and walruses, based on projected reductions in the amount of arctic sea ice over the foreseeable future. This section summarizes the potential contribution of GHG emissions and, indirectly, climate change, by Chukchi Sea oil and gas exploration, and the potential for climate change to amplify effects associated with oil and gas exploration activities

8.3.1 Greenhouse Gas Emissions

Oil and gas exploration makes way for the eventual use of hydrocarbon products, (which are sources of GHGs), by consumers. No production is expected to occur during the 5-year period of the regulation. Thus, there will be no production of oil/gas that could be consumed and indirectly contribute to GHG emissions as a result of the activities covered by this regulation. However, it is extremely difficult to meaningfully quantify the contribution of such activities to global climate change, particularly in the arctic, for several reasons, including:

- International, federal, and State of Alaska laws do not regulate GHGs. Accordingly, data about GHG emissions from past and present industrial activity are not available. The MMS estimated the contribution of GHGs from OCS oil and gas activities in the Chukchi Lease Sale 193 EIS (MMS 2007).

- Activities contributing to GHG emissions on the North Slope in the future are uncertain. Quantifying the contribution of GHGs by such future activities is highly speculative, especially given possible changes in the regulatory environment.

- Atmospheric carbon levels have not been connected to responses of species and their habitats. It is speculative to assess the relative extent of such a nonexistent connection between site-specific sources of GHG emissions and potential impacts on polar bear or walrus habitat.

- USFWS will evaluate the effect of promulgating ITRs. Such regulations will not authorize oil and gas exploration activities but rather authorize the resulting take of small numbers of polar bears and walruses as a result of those activities.

- USFWS does not have discretionary authority under the MMPA to regulate GHG emissions.

- Environmental impacts resulting from GHG emissions from energy consumption at distant locations are well outside the scope of this proposed ITR and the authority of USFWS under the MMPA.

- Oil and gas is projected to remain a significant energy source from 2013 – 2018 and for the foreseeable future thereafter. In the event that progression of oil and gas exploration in the Chukchi Sea were curtailed because of the failure to implement ITRs, the resulting lack in contribution to GHG emissions would be offset by emissions from activities elsewhere in order to satisfy domestic energy demands.

Oil and natural gas exploration activities could potentially have minor adverse impacts on air quality that would be caused by emissions from diesel engines in vessels and heavy equipment, gas turbines, and generators used for power generation. This increase in concentrations of criteria pollutants would be small

and localized, and the overall effects would be low and would not exceed any Clean Air Act standards. Oil and gas exploration in the Chukchi Sea Region would result in a negligible contribution to US and global greenhouse gas emissions (MMS 2007). For more information about GHG emissions in the Chukchi Sea, see MMS' Lease Sale 193 Final Environmental Impact Statement.

8.3.2 Effects of Climate Change on Oil and Gas Activities

Continuing recession of sea ice is likely to affect the distribution and abundance of polar bears and walruses throughout their range, resulting in an increased presence in nearshore areas. Incidents of human-wildlife interactions with both animals will likely occur more frequently. The increased nearshore presence of polar bears may in turn cause an increase of intentional polar bear deterrence events to deflect polar bears away from facilities and humans.

Because of the many uncertainties associated with the pace and effects of climate change, it is not possible to accurately predict the extent to which these interactions will increase between 2013 – 2018. Training of employees, management practices, and monitoring by Industry have minimized the potential adverse effects on polar bear and walrus habitat from activities over the past 40 years of documented Industry presence in the Beaufort and Chukchi seas. We anticipate the number of non-lethal, short-term, incidental takes in the Chukchi Sea Region from 2013 – 2018 to be small and have a negligible impact on polar bear and walrus populations, considering the low densities and wide distributions of both species. An increased potential for human-walrus interactions resulting from climate change in offshore open-water areas is not expected.

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9.0 ANTICIPATED IMPACT OF HABITAT LOSS OR MODIFICATION ON SPECIES

50 CFR 18.27(d)(v) The anticipated impact of the loss of the habitat on the marine mammal populations involved.

As detailed above, oil and gas exploration activities are not expected to have more than a negligible impact to polar bear and walrus habitat. In addition, mitigation measures will be implemented to ensure protection of polar bear and walrus habitat. Because of the short-term, temporary, and localized nature of oil and gas exploration activities, we conclude, on the basis of all of the analyses and information presented above, that impacts to polar bear and walrus habitat, if any, will be negligible. Finally, we note that this section addresses "habitat" generally, as that term is used under applicable MMPA regulations. The ESA separately provides for the designation of "critical habitat." Critical habitat has been designated for the polar bear, but has not been designated for walruses because walruses have not been listed as "threatened" or "endangered" under the ESA.

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10.0 MITIGATION MEASURES

50 CFR 18.27(d)(vi) The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Oil and gas exploration could result in impacts on polar bears and walruses. This section will discuss mitigation measures that will be used to reduce impacts. Industry will coordinate with the appropriate federal, state, and local regulatory agencies to develop mitigation measures to minimize potential impacts to polar bears and walruses. All mitigation measures will be coordinated with, and approved by, the appropriate regulatory agencies before implementation.

10.1 Operational Mitigation Measures

The following is a list of standard mitigation measures implemented by the oil and gas industry that have been developed to reduce impacts on polar bears and walruses. These, or similar measures, are expected to be implemented in future operations described in this Petition.

- Operators will designate a qualified individual or individuals to observe, record, and report the effects of their activities on polar bears and walruses.
- Operators will submit a polar bear and walrus interaction plan to USFWS for approval before the onset of exploration activities. The approved plan will be on site during activities and will include descriptions of the following:
  - The type of activity, including when and where the activity will occur;
  - A food and waste management plan;
  - Personnel training materials and procedures;
  - Site at-risk locations and situations;
  - Snow management plan (for onshore winter activities);
  - Polar bear and walrus observation and reporting procedures; and
  - Polar bear and walrus avoidance and encounter procedures.
- Operators will conduct activities in a way that minimizes adverse impacts to polar bears and walruses, their habitat, and their availability for subsistence uses.
- Operators will consult, as needed, with affected subsistence communities and marine mammal management groups to discuss potential conflicts with subsistence polar bear and walrus hunting.
- If community concerns suggest the activities may adversely impact subsistence uses of these species, a Plan of Cooperation will be developed by the operator, as required by the applicable ITRs, to avoid potential conflicts with subsistence hunting.
- Marine vessels will maintain a minimum operational separation distance as determined by the USFWS around any polar bears or walruses observed on land or ice, to the extent practicable.
- Aircraft will not operate at altitudes lower than 457 m (1,500 ft), except during takeoff and landing, when within 800 m (0.5 mi) of walrus groups, except during an emergency.

- Helicopters will not hover or circle above or within 800 m (0.5 mi) of walrus groups (EIS Lease 193).

- Trained MMOs may be used for some marine activities to monitor impacts of activities on polar bears and walruses. All MMOs are required to complete a NMFS-approved training program.

- Operators will identify the location of potential polar bear dens when conducting activities during the denning season in the coastal areas of the Chukchi Sea through the use of best available technology, such as FLIR imagery or polar-bear-scent-trained dogs.

- Operators will limit disturbance around known occupied dens by timing of activities. A minimum 1.6 km (1 mi) exclusion buffer will surround known dens. If dens are occupied, this exclusion buffer will limit disturbance or operators will conduct activities after the female bears emerge from their dens. Extenuating circumstances will require a separate review on a case-by-case basis. A mitigation plans can be developed, in consultation with the USFWS, to allow certain activities within the 1.6 km (1 mi) buffer.

- At their own discretion, USFWS will be allowed to place an observer on site to monitor impacts of activities on polar bears.

- Seismic surveys and associated support vessels shall maintain a minimum distance of 800 m (0.5 mi) from polar bears or walruses hauled out on land or ice to prevent:
  - Possible trampling or separation of walrus cow/calf pairs,
  - Exhaustion of polar bears (by causing them to swim greater distances).

- To minimize the effects from seismic impulses, operators will use MMOs to monitor the exclusion zone (a radius defined by a 190 dB re 1 μPa safety zone for polar bears and 180 dB re 1 μPa safety zone for walruses) from the center of the sound source, to ensure marine mammals are not in this zone for at least 15 minutes (for pinnipeds) or 30 minutes (for cetaceans) before ramp-up, during the survey, and before resuming seismic surveys after shut-downs.

- If marine mammals are observed within the safety radius, the seismic surveys will be suspended until the exclusion zone is free of marine mammals for a minimum of 30 minutes.

- If the seismic array is shut down, it will not be restarted during nighttime hours or during periods of obstructed/diminished sight until conditions allow for the complete observation of the exclusion zone for a minimum of 30 minutes.

- Seismic arrays will be started slowly; i.e., the firing of a single airgun and gradually increasing the number of airguns fired over a period of 20–40 minutes. The seismic array will be immediately shut down if any marine mammal is detected within safety radii. MMOs will report all marine mammals that enter the exclusion zone.

Each operator will continue to coordinate with USFWS and others to develop and implement any additional measures, if needed. Operators will develop project-specific mitigation measures.

10.2 Spill Prevention

The oil and gas industry is committed to spill prevention and the protection of the arctic marine environment. To ensure effective prevention programs are in place, operators are committed to use the best control methods and equipment for blowout prevention, fuel transfers, and in all aspects of operations. In addition, field personnel will be trained to follow procedures and management practices to eliminate spills. The Industry's commitment to spill prevention and training has demonstrated its ability to effectively mitigate impacts on marine mammals, wildlife, fisheries, and their habitats. Future activities proposed in the Chukchi Sea will be coordinated with federal, state, and local resource agencies, to ensure the Industry remains committed to spill prevention.

Before operations, each operator will prepare exploration and spill response plans for review and approval by BOEM and the Bureau of Safety and Environmental Enforcement. The plans will be developed to reflect use of the best available control technologies and describe the methods and techniques used for prevention, response, and recovery of discharges. Active coordination of prevention programs with federal, state, and local agencies helps ensure effective plan implementation and continuous overall success.

10.3 Spill Response

Historically, large spills occur very rarely on the OCS. BOEMRE reported (2011) that six large well control incidents (≥ 1,000 barrels [bbl]) have occurred on the OCS since 1964. Of these six well control incidents, five took place between 1964 and1970, and the sixth was the Deepwater Horizon event of 2010. During the interval between 1971 and 2010, a total of 15,491 exploration wells were drilled on the US OCS and the single large oil spill (≥ 1,000 bbl) occurring during that period was the Deepwater Horizon event. The Deepwater Horizon incident has resulted in the Industry carefully examining all aspects of arctic offshore drilling to ensure maximum operational safeguards are in place. Every planned well will be thoroughly evaluated and designed to employ the most advanced multiple well-control barriers and systems. Rigorous pre-planning, together with real-time continuous downhole monitoring and multi-layer control systems, ensures that the probability of an exploration blowout remains extremely unlikely within the Chukchi Sea.

To date, a total of 98 exploration wells have been drilled within Alaska's OCS, including 35 exploration wells in the Chukchi and Beaufort seas from 1982–2003. No large spills have occurred on Alaska's OCS from exploration drilling. The historical spill record from all 35 Chukchi and Beaufort Sea exploration wells reveals a combined total spill volume of 26.7 bbl with an estimated 24 bbl recovered (MMS 2008). On the basis of history, the most likely spill event would be small and confined to a relatively small area of impact during exploration drilling operations. Any possible adverse affects upon marine mammals would be short-term and mitigated through subsequent containment and recovery actions.

BOEM recently issued the Final Supplemental Environmental Impact Statement (FSEIS) for Lease Sale 193, which represents the most current and thorough assessment of spill probabilities, trajectories, and response techniques (BOEMRE 2011). FSEIS Appendices B and D contain the VLOS analyses for a well control incident in the Chukchi Sea. Using a hypothetical high volume of oil and long duration of release, the analyses estimated the calculated probabilities of oil originating from a given area would contact a specific environmental resource area, land segment, or boundary segment over different time periods. Nonetheless, the analyses also clearly acknowledged that the chance of a VLOS occurring is very low, on the basis of the historical OCS record (BOEMRE 2011). Additionally, BOEM has recently implemented numerous enhancements to the safety, inspection, and prevention program through strengthened rules, Notices to Lessees, and regulations.

10.3.1 Oil Fate and Behavior in Arctic Waters

Cold water conditions generally affect the fate and behavior of oil by slowing chemical and biological weathering processes. The presence of ice can serve as natural containment, inhibiting oil dispersion and emulsification. Consequently, low water temperatures and ice provide environmental conditions that can be used to advantage by extension of the response time window for effective recovery operations and impact mitigation.

In cold sea water, crude oil is subject to normal weathering processes at reduced rates in comparison with oil released into warm seawater. These weathering processes would include spreading, evaporation, dissolution, dispersion into the water column, photochemical oxidation, emulsification with water, and biological degradation. The slower rate of spreading because of increased viscosity of oil in colder water may reduce the overall spill impacts. Chilled oil also evaporates more slowly, thus prolonging the timeframe when the volatile fractions of oil can be ignited and efficiently burned.

The presence of ice concentrations can act as a natural barrier impeding the dispersion of oil onto larger surface areas and slowing evaporation. Large expanses of ice also can dampen wave formation by limiting the effect of wind fetch on water surfaces. As a consequence, reduced wave action slows the dissolution of oil into the water column and the exposure potential for marine life. Oil confined by ice edges can remain in pockets of concentration for mechanical recovery by skimmers or removal by burning.

During freezeup, oil can be incorporated into the grease ice and slush ice as the sheet begins to form. The oil in a forming ice sheet may continue to be affected by weathering processes, particularly in the upper ice layers. Oil from a subsurface release can become encapsulated into the ice, and weathering processes are essentially halted until prolonged spring thaw and breakup. With warming, oil trapped under and in the ice migrates to the ice surface through open brine channels, while emulsified oils tend to be released more slowly because of their increased viscosities. Oil pooling on the surface of melting ice may be removed by burning if relatively unweathered, or by mechanical methods when in larger concentrations.

10.3.2 Spill Response Techniques

More than 40 years of oil and gas operations on Alaska's North Slope provides an extensive body of knowledge and experience with spill response in the arctic. In addition, the Industry has provided funding and support for international research and development programs aimed at increasing and enhancing available effective response techniques for offshore arctic conditions. The following sections summarize proven response techniques in use to mitigate and recover oil in the event of a spill.

Discharge Detection and Monitoring

Oil movement can be tracked using a variety of techniques, including visual or forward-looking infrared radar surveys conducted from an aircraft, the deployment of Global Positioning System (GPS) devices, various remote sensing techniques, beacons, and AUVs. Additionally, predictive spill trajectory modeling can be used to forecast oil movement on the basis of oil characteristics, weather conditions, and water currents. Ice-strengthened tracking buoys or GPS recorders can be deployed and monitored using satellite systems and may remain operational for extended periods of time. Ground penetrating radar can be used to detect and map oil under first-year ice and efforts are underway to extend this capability detection under thick multi-year ice.

Open-water Response

Mechanical Containment and Recovery

Mechanical containment and recovery methods are used as one of the foremost options for oil removal in open-water conditions. Mechanical recovery tactics include the use of open-apex booms to encounter surface oil slicks and concentrate it for recovery by vessel-mounted skimming units. Working in configuration with skimming vessels, work boats tow containment boom to intercept and direct oil to skimmers and pumps that collect the oil and transfer it to storage containers. Additionally, booms can be deployed along shorelines for protection or to contain and concentrate oil driven by wind or current for recovery by skimmers placed on or near the shore. A wide variety of skimmers have been developed to work efficiently with different oils, viscosities, and weathering states.

Controlled In-situ Burning

In-situ burning is an alternative response strategy that has the potential advantages of high encounter rates and rapid removal of oil. In open-water conditions and light-ice conditions, fire containment boom is deployed to capture, thicken, and isolate spilled oil for safe ignition. Successful ignition requires oil thickness greater than 2–3 mm (.08–.12 in). The oil removal rate is determined by factors including the fire's diameter, slick thickness, oil type, and environmental conditions. Generally, effective in-situ burning must be conducted before an oil slick starts to weather and the lighter, more volatile components vaporize. Burning operations would only be conducted with the approval of a Unified Command consisting of federal agencies and lease stakeholders. Combustion plumes would be closely monitored and could affect air quality for a short period of time.

Burning oil can provide very high rates of elimination. Oil burns at a rate of about 100 gallons per square foot/day. A single 152-m (500-foot) fire boom intercepting oil may provide enough containment to support a burn rate as high as 15,000 bbl per day. Controlled burning also can achieve removal rates of 85–95 percent in many circumstances. This elimination can provide benefits by preventing marine mammals coming into contact with oil, reducing the overall quantity and persistence, and removing oil before it can reach sensitive habitats or shorelines.

Dispersants as a Possible Future Arctic Response Option

Continuing scientific efforts are directed at improving the performance of dispersants for use in arctic conditions. As dispersants can be rapidly applied over large surface areas, they provide potential benefits over mechanical methods by reducing oil concentrations that could potentially contact marine birds and mammals. Dispersants can also be used in heavy-sea states when conditions limit the effectiveness of mechanical equipment. Dispersants may be the one of best response methods to reduce potential oil impacts to shorelines and habitats.

Dispersants act as chemical surfactants that, when applied to a slick, lower the surface tension between oil and water, causing oil to break into droplets under wave energy and widely disperse. Higher wave action leads to a higher degree of dispersion. Biodegradation processes can act more quickly on the oil droplets.

Response in Broken Ice

Mechanical Containment and Recovery

From 10–30 percent coverage, conventional boom and skimmer configurations can be generally deployed from vessels for effective operations. As ice concentrations increase, mechanical response must move toward smaller, more maneuverable vessels operating with short, side-arm booms to direct oil to skimmers, or with independent, over-the-side skimmers deployed in pockets of oil contained between ice cakes and floes or within leads in the ice. Higher concentrations of ice can act as a natural barrier to confine the spread of oil and keep it a thickness suitable for mechanical skimming devices. However, the overall effectiveness of mechanical recovery will be affected to some degree by icing and freezing of equipment, limited access to the oil, separation of oil from ice and water, and increased oil viscosity.

Controlled In-situ Burning

Ice concentrations can aid with in-situ burning by reducing surface spreading and wave action to maintain slick thicknesses. In open-water up to 30 percent coverage, fire booms can be deployed to concentrate and contain oil, as the ice concentration generally will not provide adequate confinement. In 30–60 percent ice coverage with limited oil confinement by ice, in situ can be selectively used where booms can be deployed or where oil is naturally confined by ice in adequate thicknesses to support ignition. Ice coverage of 60–90 percent is generally sufficient to confine oil thick enough to support combustion by igniters deployed via helicopter onto slicks.

Dispersants in Broken Ice

Recent field experiments have verified that dispersants can be efficiently used in cold waters where ice is present. Colder weather slows the weathering process, increasing the window of opportunity for dispersing oil into the water column. To counteract the wave-action dampening effect of ice coverage, extra mixing and turbulence can be created by use of the main vessel's thrusters or prop wash. This can actually comparatively increase the efficiency of oil dispersion, making the size of mechanically dispersed oil droplets smaller than naturally dispersed oil.

Response in Solid Ice

Solid ice cover offers the holding capacity to limit the spread of oil beneath ice. After oil comes in contact with ice under the ice surface, it spreads and collects in cavities and under ice depressions where present or until equilibrium is reached. In time, oil may also become encapsulated within the ice as it continues to form. Low temperature and lack of wave action act to reduce oil spreading, evaporation, emulsification, and dispersion. Oil can be accessed under solid ice by cutting trenches or drilling holes for recovery by vacuum pumps and skimmers. In-situ burning may be effectively used on surfacing oil thick enough to support combustion.

Oil on the surface of solid, stable ice can be contained by building snow and ice berms and trenches. Conventional mechanical methods and in-situ burning may be used for effective removal as appropriate.

10.3.3 Wildlife Management

One of the highest priorities of spill response is the protection of wildlife and mitigation of harm to habitat. To achieve this objective, response efforts will be directed toward the containment and recovery of oil to minimize, to the extent possible, oil contacting polar bears, walruses, and other wildlife. Industry is committed to developing protective response strategies in close collaboration with federal, state, and local representatives within the Unified Command, including the USFWS.

A wildlife management plan would be developed for polar bears and walruses and implemented with approval of the Unified Command. The wildlife plan would be prepared following guidance, as appropriate under the circumstances and environmental conditions at the time of the spill, included in Annex G of the Alaska Regional Response Team (ARRT) Wildlife Protection Guidelines for Alaska (2002) and the USFWS Oil Spill Response Plan for Polar Bears in Alaska (1999). A three-tiered strategy approach is recommended by the ARRT and USFWS for response, as follows:

Primary response for the protection of polar bears and walruses emphasizes controlling the release and spread at the source to prevent oil from contacting marine mammals and reaching sensitive areas where animals concentrate, such as denning and feeding sites. Priority should be placed on protecting pinniped haul-out and rookery beaches. In addition, the primary response should include removal of oiled carcasses to prevent marine mammals, such as polar bears, from ingesting oil as they scavenge for food. Sensitive sites should be avoided by response personnel to minimize disturbance.

Secondary response would involve deterring or hazing polar bears from oil slick areas or contaminated habitat. Herding pinnipeds at haul-out or rookery areas may be feasible before pupping and after weaning when territorial bonding is weakest. Herding may be accomplished by employing techniques such as scare sounds or vessel maneuvers. In some cases, capture and relocation may be the only option for animals at risk. Use of any secondary response activities must have the approval of the USFWS and the federal On-scene Coordinator (OSC).

Tertiary response strategy is to attempt to capture and treat oiled animals. For polar bears and pinnipeds, capture and treatment would be hazardous activity and should be performed only by personnel authorized by the USFWS. Tertiary response actions must have the approval of the USFWS and the federal OSC.

10.3.4 Ongoing Research and Development of New Technologies

Industry has engaged in continuing efforts to study and develop proven methods to enhance response capabilities in the arctic and marine ice environment. One such effort is the Joint Industry Project (JIP) on Oil in Ice established to achieve the following primary objectives:

- To improve the ability to protect the arctic environment against oil spills,
- To provide an improved basis for oil spill related decision-making, and
- To advance the state-of-the-art in arctic oil spill response.

Under the coordination and management provided by SINTEF, the JIP conducted a series of projects from 2007–2010 that included:

- Evaluation of the remote sensing technologies for detecting and mapping oil under ice, operating from aircraft, satellites, vessels, and on the ice surface. Sensing systems assessed include FLIR, ground-penetrating radar, side-looking airborne radar, satellite-based synthetic aperture radar, and trained dogs.

- In cooperation with manufacturers, development and performance of field testing of ice-capable mechanical skimmers in the Barents Sea during broken ice conditions. Field testing provided measurement of recovery effectiveness for various ice concentrations. Two out of the five skimmers tested during the large-scale JIP field experiments in 2008 and 2009 have been developed for commercial use.

- Performance of field verification of laboratory studies on oil weathering and ignitability of oil in ice for improved in-situ burning under variable ice conditions. The data provide improved capability to predict the weathering of oil spills in cold and ice conditions for selection of appropriate response techniques.

- Better understanding of the "window of opportunity" for dispersants in arctic areas with broken ice and development of application equipment appropriate to the environment.

Evaluation and further development of chemical surface-active agents, commonly referred to as "herders," for their effectiveness at contracting thin films of oil into thicker slicks that enable removal by mechanical means or in-situ burning.

11.0 MONITORING AND REPORTING

50 CFR 18.27(d)(vii) Suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species through an analysis of the level of taking or impacts and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity.

The following sections list the monitoring and reporting measures and objectives the operators may undertake to increase the knowledge of species and monitor potential impacts of activities.

11.1 Monitoring

When conducting studies to monitor for polar bears and walruses, their distribution, or their reactions to production, development, and exploration activities, operators will provide trained personnel to:

- Identify the number of animals encountered by authorized activities by species, as well as age/size and sex;
- Coordinate with any ongoing studies;
- Collect data comparable to previous related data about the same species; and
- Submit raw copies of the data to appropriate government agencies to be included in existing government databases for those species.

Marine Mammal Monitoring Plans will be created by each operator and will be approved by the appropriate agency. These will include methods to complete the tasks listed above and will be site-specific and dependent on the location and timing of activity relative to habitat (den sites, travel corridors, food sources). Community meetings and consultation with local Native groups will occur to ensure proposed activities will not interfere in a significant way with subsistence hunting, and a Plan of Cooperation will be submitted to the USFWS, in addition to the Marine Mammal Monitoring Plan. Should a marine mammal be sighted during industrial operations, procedures outlined in the Marine Mammal Monitoring Plans will be implemented to minimize impacts to polar bears and walruses.

All marine mammal sightings will be recorded. The record will state when and how the polar bears or walruses are encountered, the number of individuals encountered, and their behavior. To the greatest extent possible, group size, age, sex, duration of interaction, and closest approach to activity will also be recorded. MMOs or polar bear monitors will be required if polar bears are known to frequent the project area or known polar bear dens are present.

11.2 Reporting

All sightings will be reported to the appropriate federal, state, and local agencies in a timely fashion. In addition, each operator conducting exploration and development activities will submit an “after action monitoring report” to the USFWS Alaska Regional Director, Marine Mammal Management Office, within 90 days of completion of the activity. For operators conducting production activities, an annual report will be submitted for the preceding year’s activities. These reports will include the following information:

- Date and time of activities;
- Date and location of polar bear and walrus activities related to monitoring activities;
- Results of the monitoring activities, including estimated levels of take; and
- Dates and locations of polar bear and walrus activities related to operational activity when the sightings occurred.

Whenever a polar bear is hazed for any reason, a Polar Bear Sighting Report will be filled out and submitted to the Alaska Department of Fish and Game and to the USFWS within 24 hours.

12.0 COORDINATION OF RESEARCH EFFORTS

50 CFR 18.27(d)(viii) Suggested means of learning of, encouraging, and coordinating research opportunities, plans and activities relating to reducing such incidental taking from such specified activities, and evaluating its effects.

Operators will coordinate closely with the USFWS, any other federal organizations, the State of Alaska, Native communities, and their own consultants concerning measures to minimize the impacts of all activities on the species, stocks, and subsistence use of polar bears and walruses. Operators will also cooperate with these entities to coordinate monitoring programs and research opportunities and to address all measures that can be taken to eliminate or minimize any impacts from Industry activities.

All activities will be conducted in accordance with federal, state, and local regulations. As such, all monitoring and reporting procedures will be strictly adhered to in an effort to gain larger baseline data about these species in the arctic. Operators will cooperate with marine mammal researchers in the Chukchi Sea area in sharing data about polar bears, walruses, and other marine mammal species that occur in the project areas. The information will also be shared with relevant governmental and private groups conducting studies.

In 2011, the National Oceanographic and Atmospheric Administration (NOAA), Shell, ConocoPhillips, and Statoil signed an agreement to share ocean, coastal, meteorological, and other climate data for the arctic. Scientific data sets that will be shared include information about weather and ocean observations, biology of the arctic, and sea ice and sea floor mapping. NOAA will share this data and information with the public to the extent possible on their Web site and through other existing services.

Shell, ConocoPhillips, and Statoil have also collaborated to conduct environmental baseline studies in the Chukchi Sea. The initiative began in 2008 by ConocoPhillips; Shell joined and, in 2010, Statoil also joined the team. The baseline studies follow an ecosystem approach and are designed as multiyear scientific studies of the environment. Specific scientific disciplines included in the studies are physical oceanography and meteorology; nutrients, primary production, and zooplankton ecology; benthic ecology; fisheries ecology; seabird ecology; marine mammal ecology; and passive acoustics monitoring.

Since 2006, research has been conducted in the arctic through the JIP's Sound and Marine Life Program. Initially, the JIP consisted of 14 companies, 13 of which were members of the International Association of Oil and Gas Producers, each contributing to research initiatives at a total of $8.2 million annually. The program was intended to last three years, and in 2010 was extended. The extended phase of research began in January 2010. These extension studies include 70 research projects over five-years at a total of $36 million. Nine companies currently make up the JIP, including many Alaska operators. Research being conducted during the extension studies will gather data about sound source characterizations, sound propagation, sound mitigation, measurement tools, behavioral disturbance, effects on populations, and other areas of interest.

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