Petition for Incidental Take Regulations for Oil and Gas Activities in the Beaufort Sea and Adjacent Lands in 2016-2021

May 5, 2014

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Table of Contents

Page

1.0 Statement of Request and Context 1
1.1 Nature of Request 1
1.2 Regulatory Context 3
1.2.1 Marine Mammal Protection Act 3
1.2.2 Endangered Species Act 5
1.2.3 National Environmental Policy Act 6
1.2.4 Future Regulatory Developments 6
1.3 Scientific Context 7
1.4 Information Submitted in Response to the Requirements of 50 CFR §18.27 8

2.0 Description of Activities 10
2.1 Oil and Gas Activity 10
2.2 Geological and Geophysical Surveys 12
2.2.1 Geotechnical Site Investigation 12
2.2.2 Reflection Seismic Exploration 12
2.2.2.1 Vibroseis 13
2.2.2.2 Airgun and Watergun Seismic Data Collection 13
2.2.2.3 Explosives Seismic Data Collection 14
2.2.3 Vertical Seismic Profiles 14
2.2.4 Seafloor Imagery 14
2.2.4.1 Offshore Bathymetry 15
2.2.5 Ultra Shallow Water Array 15
2.3 Environmental Studies 15
2.4 Offshore and Onshore Exploration Drilling 16
2.4.1 Artificial Islands 16
2.4.2 Caisson-retained Island 16
2.4.3 Steel Drilling Caisson 16
2.4.4 Bottom-Supported Drilling Units 17
2.4.5 Floating Drilling Vessels 17
2.4.6 Ice Pads, Roads, and Islands 18
2.5 Development and Production 18
2.5.1 Prudhoe Bay Unit 22
2.5.2 Kuparuk River Unit 22
2.5.3 Greater Point McIntyre 22
2.5.4 Milne Point 23
2.5.5 Endicott 23
2.5.6 Badami 23
2.5.7 Alpine Oil Fields 23
2.5.8 Greater Mooses Tooth 24
2.5.9 Northstar 24
2.5.10 Oooguruk Unit 24
2.5.11 Nikaitchuq Unit 24
2.5.12 Point Thomson 24
2.6 Oil Production Processes 25
2.6.1 Production Facilities 25
2.6.2 Production Wastes 26

2.7 Support and Distribution ... 27
2.7.1 Support Operations ... 27
2.7.2 Trans-Alaska Pipeline System ... 27
2.8 Planned and Potential Future Activities 2016-2021 ... 28
2.8.1 Bureau of Ocean Energy Management Outer Continental Shelf Lease Sales ... 28
2.8.2 National Petroleum Reserve – Alaska ... 28
2.8.3 State of Alaska Lease Sales ... 29
2.8.4 Liberty Oilfield ... 29
2.8.5 Alpine Satellites Development ... 29
2.8.6 Shell Offshore Exploration Activities ... 30
2.8.7 Mustang – Western Region Expansion ... 30
2.8.8 Telemark Development ... 30
2.8.9 Beechey Point / East Shore ... 31
2.8.10 Tofkat ... 31
2.8.11 Nuna ... 31
2.8.12 West End Development ... 32
2.8.13 Potential Future Gas Pipeline ... 32
2.8.13.1 Alaska Liquefied Natural Gas ... 32
2.8.13.2 Alaska Stand Alone Gas Pipeline ... 32
2.8.14 Gas Hydrate Exploration and Research ... 33

3.0 DATES, DURATION, AND REGION OF ACTIVITIES ... 34

4.0 SPECIES, NUMBER, AND TYPE OF TAKE ... 35
4.1 Polar Bear ... 35
4.1.1 Polar Bear Behavioral Responses during Past Activities ... 36
4.1.1.1 Polar Bear Responses during Past OCS Activities ... 36
4.1.1.2 Seismic Surveys ... 36
4.1.1.3 Shallow Hazards Surveys ... 36
4.1.1.4 Exploration Drilling ... 37
4.1.1.5 Polar Bear Responses during Past Onshore / Coastal Activities ... 37
4.1.2 Projected Polar Bear Behavioral Responses 2016-2021 ... 39
4.1.2.1 Future OCS Oil and Gas Activities ... 39
4.1.2.2 Future Onshore / Coastal Oil and Gas Activities ... 39
4.1.2.3 Total Potential Polar Bear Behavioral Responses 2016-2021 ... 40
4.2 Pacific Walrus ... 41

5.0 STATUS, DISTRIBUTION, AND SEASONAL DISTRIBUTION OF SPECIES ... 42
5.1 Polar Bear ... 42
5.1.1 Population Status and Trend ... 42
5.1.1.1 Southern Beaufort Sea Population ... 43
5.1.2 Distribution and Seasonal Distribution ... 43
5.1.3 Feeding Ecology ... 46
5.1.4 Reproduction ... 46
5.1.5 Denning ... 47
5.1.6 Survival ... 48
5.1.7 Sea Ice and Climate Change ... 48
5.2 Pacific Walrus ... 49
5.2.1 Population Status and Trend ... 49
5.2.2 Distribution and Seasonal Distribution ... 50
5.2.3 Feeding Ecology ... 50

5.2.4 Reproduction ... 52
5.2.5 Survival ... 52
5.2.6 Climate Change ... 52

6.0 ANTICIPATED IMPACT ON SPECIES ... 54
6.1 Polar Bear ... 54
6.1.1 Noise ... 54
6.1.1.1 Noise Background ... 54
6.1.1.2 Potential Effects of Noise on Wildlife ... 56
6.1.1.3 Hearing Abilities of Polar Bear ... 57
6.1.1.4 Description of Noise Sources ... 57
6.1.1.5 Potential Impacts on Polar Bear ... 59
6.1.2 Physical Obstruction ... 60
6.1.3 Human Encounters ... 61
6.1.4 Spills ... 61
6.1.5 Summary of Anticipated Impacts ... 63
6.2 Pacific Walrus ... 63
6.2.1 Noise ... 63
6.2.1.1 Hearing Abilities of Walrus ... 63
6.2.1.2 Potential Impacts on Pacific Walrus ... 64
6.2.2 Physical Obstruction ... 65
6.2.3 Human Encounters ... 65
6.2.4 Spills ... 65
6.2.5 Summary of Anticipated Impacts ... 66

7.0 ANTICIPATED IMPACT ON SUBSISTENCE ... 67
7.1 Subsistence Species Synopsis ... 67
7.1.1 Polar Bear ... 67
7.1.2 Pacific Walrus ... 67
7.2 Subsistence Harvests by Community ... 68
7.2.1 Kaktovik ... 68
7.2.2 Nuiqsut ... 68
7.2.3 Barrow ... 69
7.3 Summary of Anticipated Impacts ... 70

8.0 ANTICIPATED IMPACT ON HABITAT ... 71
8.1 Polar Bear ... 71
8.1.1 Noise ... 71
8.1.2 Facility Development and Operations ... 71
8.1.3 Spills ... 72
8.2 Pacific Walrus ... 73
8.2.1 Noise ... 73
8.2.2 Spills ... 73
8.3 Climate Change ... 74
8.3.1 GHG Emissions ... 74
8.3.2 Effects of Climate Change on Oil and Gas Activities ... 75

9.0 ANTICIPATED IMPACT OF HABITAT LOSS OR MODIFICATION ON SPECIES ... 76

10.0 MITIGATION MEASURES ... 77
10.1 Mitigation Measures ... 77

10.2 Spill Prevention ... 78
10.3 Spill Response ... 80
10.3.1 Oil Fate and Behavior in Arctic Waters ... 81
10.3.2 Spill Response Techniques ... 81
10.3.2.1 Detection and Monitoring ... 81
10.3.2.2 Open Water Offshore Response ... 81
10.3.2.3 Broken Ice Offshore Response ... 82
10.3.2.4 Response to Oil in Solid Ice ... 83
10.3.2.5 Nearshore Response ... 83
10.3.2.6 Spring Recovery ... 84
10.3.3 Wildlife Management ... 84
10.3.4 Ongoing Research and Development of New Technologies ... 85

11.0 MONITORING AND REPORTING ... 86
11.1 Monitoring ... 86
11.2 Reporting ... 86

12.0 COORDINATION OF RESEARCH EFFORTS ... 87

13.0 REFERENCES ... 88

List of Tables

Table 1-1. Location of Information in this Petition of CFR § 18.27(d) Requirements ... 9
Table 2-1. Infrastructure Area on North Slope as of 2012 (Not Including Dalton Highway) ... 19
Table 2-2. Existing and Potential Oil and Gas Development Projects on the North Slope ... 20
Table 4-1. Polar Bear Sightings at North Slope Oil and Gas Units in 2008-2012 ... 38
Table 4-2. Descriptors of Polar Bear Behavior from Observations on the North Slope in 2008-2012 ... 39
Table 4-3. Hectares (acres) of Onshore / Coastal Oil and Gas Infrastructure in 2007 and 2012 ... 40
Table 4-4. Total Potential Polar Bear Behavioral Responses ... 40
Table 6-1. Definition of Acoustical Terms ... 55
Table 7-1. Subsistence Polar Bear Harvests Reports by Year and Village ... 69
Table 7-2. Subsistence Walrus Harvests Reports by Year and Village ... 69

List of Figures

Figure 1-1. Geographic Region of Petition ... 2
Figure 2-1. Oil and Gas Units and Leaseholder Ownership in Arctic Alaska ... 11
Figure 2-2. North Slope Process Flow Diagram ... 26
Figure 5-1. Distribution of Polar Bear Populations (USFWS 2010). ... 45
Figure 5-2. Approximate Distribution of Pacific Walrus in U.S. and Russian Waters (USFWS 2010). ... 51

ABBREVIATIONS

2D	two-dimensional
3D	three-dimensional
ACS	Alaska Clean Seas
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AKLNG	Alaska Liquefied Natural Gas
AMSA	Australian Maritime Safety Authority
ANWR	Arctic National Wildlife Refuge
AOGA	Alaska Oil and Gas Association
ARRT	Alaska Regional Response Team
ASAP	Alaska Stand Alone Gas Pipeline
ASRC	Arctic Slope Regional Corporation
AUV	Autonomous Underwater Vehicles
BACT	Best Available Control Technology
bbl	barrel
BLM	Bureau of Land Management
BOE	barrels of oil equivalent
BOEM	Bureau of Ocean Energy Management
BOP	blowout preventer
boph	barrels of oil per hour
BPXA	BP Exploration Alaska Inc.
BRPC	Brooks Range Petroleum Corporation
BSEE	Bureau of Safety and Environmental Enforcement
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGF	Central Gas Facility
Chevron	Chevron USA, Inc.
CI	Confidence Interval
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	centimeter
CPAI	ConocoPhillips Alaska, Inc.

CRU	Colville River Unit
CS	Chukchi Sea
dB	decibel
DOE	Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
Eni	Eni Petroleum
ESA	Endangered Species Act
ExxonMobil	ExxonMobil Development Company
Federal Grant	Federal Agreement and Grant of Right-of-Way for the TAPS
FLIR	Forward Looking Infrared
FONSI	Finding of no significant impact
FPEIS	Final Programmatic Environmental Impact Statement
FR	Federal Register
ft	foot/feet
ft^2	square feet
GC2	Gathering Center 2
GCF	Gas Conditioning Facility
GHG	Greenhouse Gas
GIS	Geographic Information System
GMTU	Greater Mooses Tooth Unit
GPR	Ground Penetrating Radar
GPS	global positioning system
Hz	hertz
IACPB	International Agreement on the Conservation of Polar Bears
in	inch
IPCC	Intergovernmental Panel on Climate Change
ITR	incidental take regulations
ITS	incidental take statement
IUCN	International Union for Conservation of Nature
JIP	Joint Industry Project
kg	kilogram
kHz	kilohertz
km	kilometer

KRU	Kuparuk River Unit
LACT	Lease automatic custody transfer
lb	pound
LGL	LGL Research Associates
LOA	Letter of Authorization
m	meter
mi	mile
MI	Miscible injectant
mm	millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MMscfd	million standard cubic feet per day
MP	milepost
msec	Millisecond
NB	Northern Beaufort Sea
NDS1	Nuna Drill Site 1
NDS2	Nuna Drill Site 2
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NGL	natural gas liquids
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPR-A	National Petroleum Reserve-Alaska
NRC	National Research Council
NSB	North Slope Borough
NTP	Nuna Tie-in Pad
OCS	Outer Continental Shelf
ODS	Oooguruk Drill Site
OPP	Oliktok Production Pad
OSR	oil spill response
OSV	Offshore Supply Vessel
OSRV	Oil Spill Response Vessel
OTP	Oooguruk Tie-in Pad
Pa	pascal

PBSG	Polar Bear Specialist Group
PEIS	Programmatic Environmental Impact Statement
Petition	Petition for Promulgation of Incidental Take Regulations
Pioneer	Pioneer Natural Resources Alaska, Inc.
ppm	parts per million
PSD	Prevention of Significant Deterioration
PSO	Protected Species Observer
psi	pounds per square inch
PTS	permanent threshold shift
pulses/sec	pulses per second
rms	root-mean-square
ROD	Record of Decision
SBS	Southern Beaufort Sea
SDC	Steel Drilling Caisson
SDEIS	Supplemental Draft Environmental Impact Statement
SDI	Satellite Drilling Island
SEL	sound exposure level
Shell	Shell Exploration and Production Company
SID	Spy Island Drillsite
SLAR	side-looking airborne radar
SMU	Southern Miluveach Unit
SPAR	Spill Prevention and Response
SPL	Sound pressure level
TAPAA	Trans-Alaska Pipeline Authorization Act
TAPS	Trans-Alaska Pipeline System
TL	transmission loss
tpy	tons per year
TTS	temporary threshold shift
TU	Tofkat Unit
UAS	Unmanned Aerial Systems
UIC	Underground Injection Control
U.S.	United States
U.S.C.	United States Code
USACE	United States Army Corps of Engineers

USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey
USW	Ultra Shallow Water
UV/IR	ultraviolet/infrared
VLCC	Very Large Crude Carrier
VLOS	very large oil spill
VSP	vertical seismic profiles
WED	West End Development

1.0 Statement of Request and Context

1.1 Nature of Request

The Alaska Oil and Gas Association (AOGA) and non-member companies listed below, hereby petition the United States Fish & Wildlife Service (USFWS) to renew regulations, pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA), for the non-lethal unintentional taking of small numbers of polar bears (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus divergens*) incidental to oil and gas exploration, development, and production operations and all associated activities in the Beaufort Sea and adjacent northern coast (North Slope) of Alaska for the period of five years beginning August 3, 2016 extending through August 3, 2021. The requested regulations would be the ninth in a series dating from 1993 to the present.

AOGA is a private, non-profit trade association whose 15-member companies represent the majority of oil and gas exploration, production, transportation, refining, and marketing activities in Alaska. AOGA's members are as follows:

Alyeska Pipeline Service Company	Petro Star Inc.
Apache Corporation	Caelus Natural Resources Alaska, LLC.
BP Exploration Alaska Inc. (BPXA)	Repsol
Chevron USA, Inc. (Chevron)	Shell Exploration and Production Company (Shell)
Eni Petroleum	Statoil
ExxonMobil Production Company	Tesoro Alaska Company
Flint Hills Resources, Inc.	XTO Energy, Inc.
Hilcorp Alaska, LLC	

This petition for the promulgation of regulations pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (Petition) is being filed by AOGA on behalf of its members, as well as on behalf of other participating parties. Non-AOGA members who participated in this Petition are: ConocoPhillips Alaska, Inc. (CPAI), Brooks Range Petroleum Corporation (BRPC), and Arctic Slope Regional Corporation (ASRC) Energy Services.

The geographic area of activity, illustrated in Figure 1-1, covers a total area of approximately 73.6 million acres (29.8 million hectares). The geographic area of activity remains the same as covered in the 2011-2016 Beaufort Sea Incidental Take Regulations (ITR) and includes land on the North Slope of Alaska and adjacent waters of the Beaufort Sea, including state waters and Outer Continental Shelf (OCS) waters. The area extends from Point Barrow on the west to the United States (U.S.)-Canada border on the east. The onshore boundary is 40 kilometer (km) (25 miles [mi]) inland, excluding the area within the Arctic National Wildlife Refuge (ANWR). The offshore boundary is the Bureau of Ocean Energy Management (BOEM, formerly the Minerals Management Service [MMS]) Beaufort Sea Planning Area, approximately 322 km (200 mi) offshore.

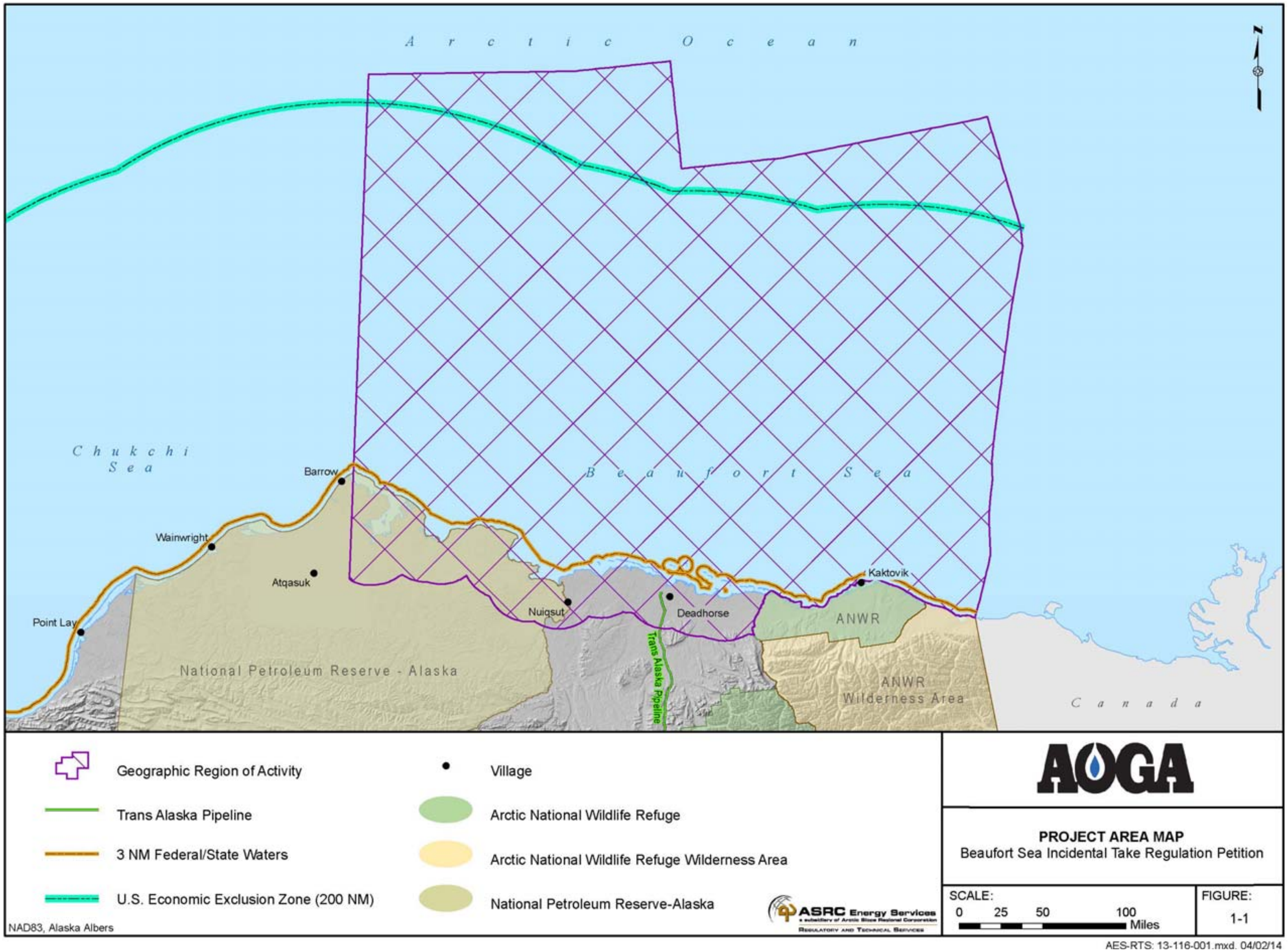

Figure 1-1. Geographic Region of Petition

As has been the case since 1993, AOGA petitions the USFWS for regulations that cover a class of activity for a period of time. Activity covered by this Petition encompasses all currently foreseeable oil and gas exploration, development, and production occurring within the area specified above for the Petition period. Consistent with the prior and existing regulations, and in consultation with USFWS, AOGA has identified this class of activity because, within the identified geographic area, this class of activity may affect small numbers of polar bear and walrus in substantially similar ways. In other words, the totality of potential effects is small for the class of activity; moreover, given the similarity in possible effects on polar bear and walrus, dividing the class into subcategories would be abstract and arbitrary, and neither comprehensive nor reasonably feasible.

This request by AOGA is consistent with the conservation and management measures stated in the 1976 International Agreement on the Conservation of Polar Bears (IACPB). The IACPB seeks to protect polar bear habitat, restrict the taking of polar bears, and restrict the commercial trade of polar bear parts. The U.S. is one of the five circumpolar countries (along with Canada, Norway, Denmark/Greenland, and the former Soviet Union) to sign the agreement.

In summary, AOGA requests that USFWS authorize the non-lethal, unintentional, incidental take of small numbers of polar bears and Pacific walrus during oil and gas activities within the identified geographic area during the five-year period from August 3, 2016 through August 3, 2021. These regulations 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. In conjunction with issuance of the requested ITRs, AOGA further petitions USFWS to engage in consultation under Section 7 of the Endangered Species Act (ESA) and to complete the associated environmental review pursuant to the National Environmental Policy Act (NEPA).

1.2 Regulatory Context

1.2.1 Marine Mammal Protection Act

Section 101(a)(5) of the MMPA, 16 United States Code (U.S.C.) § 1371(a)(5)(A), authorizes the Secretary of the Interior, through the USFWS, to promulgate regulations that allow the incidental, but not intentional, taking of small numbers of marine mammals associated with specified activities (other than commercial fishing), provided that 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. U.S. 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 50 Code of Federal Regulations (CFR) § 18.27(c):

> ***Take*** means to harass, hunt, capture or kill, or attempt to harass, hunt, capture, or kill any marine mammal.
>
> ***Harassment*** means any act of pursuit, torment, or annoyance which 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 which are infrequent, unavoidable, or accidental. It does not mean that the taking must be unexpected.

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: 1) that is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs (*i*) by causing the marine mammals to abandon or avoid hunting areas, (*ii*) directly displacing subsistence users, (*iii*) or placing physical barriers between the marine mammals and the subsistence hunters; and 2) that cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

The term "small numbers" is also defined in the regulations, but the USFWS no longer relies on that definition in response to an order by the Ninth Circuit Court of Appeals. Instead, the USFWS's "small numbers" analysis evaluates whether number of marine mammals anticipated to be taken is small relative to the size of the overall population.

Regulations promulgated under Section 101(a)(5)(A) of the MMPA do not permit, approve, or otherwise allow any individual or class of commercial, industrial, or development activity to occur. Rather, each regulation establishes a regulatory framework, linked to a specified area and a specified time frame not to exceed five years, pursuant to which U.S. citizens may apply to USFWS for a letter of authorization (LOA). The regulations identify a suite of regulatory requirements that may be applied by USFWS depending upon the nature of an activity, as well as its location, timing, and duration. Each LOA issued by USFWS imposes specific enforceable mitigation, monitoring, and reporting tailored to the activity addressed in the LOA to ensure that interactions with the identified marine mammal species or stocks occur in small numbers and with no more than a negligible impact.

Pursuant to Section 101(a)(5)(A) of the MMPA, since 1993, the oil and gas industry operating on the North Slope of Alaska and in adjacent waters of the Beaufort Sea has requested and been issued a series of regulations for incidental take authorizations for conducting activities in polar bear and walrus habitat. A detailed history of past regulations can be found in the Federal Register (FR) at 68 FR 66744 (November 28, 2003). Previous regulations were published on November 16, 1993 (58 FR 60402); August 17, 1995 (60 FR 42805); January 28, 1999 (64 FR 4328); February 3, 2000 (65 FR 16828); November 28, 2003 (68 FR 66744); August 2, 2006 (71 FR 43926 [USFWS 2006]); and August 3, 2011 (76 FR 47010). The current regulations will expire on August 3, 2016 (76 FR 47010).

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 uses information such as seasonal distributions, habitat use patterns, and industry monitoring reports to make its finding. In past regulations, the USFWS has concluded that the number of polar bears and walruses using the same geographic region as industry operations is small in comparison to the number of animals in their respective populations in the Beaufort Sea (USFWS 2011).

The USFWS also determined that the footprint of authorized projects is expected to be small compared to the geographic range of polar bear and walrus in the region. Monitoring requirements and adaptive mitigation measures are expected to significantly limit the number of incidental takes (USFWS 2011).

1.2.2 Endangered Species Act

The ESA establishes a comprehensive statutory scheme intended to conserve fish, wildlife, and plants facing extinction. Section 4 of the ESA, 16 U.S.C. § 1533, 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 and substantive requirements and prohibitions.

Under Section 7 of the ESA, 16 U.S.C. § 1536, all federal agencies must insure 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 that 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 take expected to occur as a result of the action. Importantly, as to ESA-listed marine mammals, under Section 7(b)(4)(C) of the ESA, no ITS may be issued with respect to a marine mammal unless authorization for the incidental take has been obtained pursuant to Section 105(a)(5)(A) of the MMPA.

In addition to the consultation requirements of Section 7, Section 9 of the ESA, 16 U.S.C. § 1538, broadly prohibits any person from the taking of any endangered species in the U.S. or on the high seas, except pursuant to an incidental take authorization issued by USFWS, or as otherwise allowed by statutory exemption. The ESA defines a take to mean to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (50 CFR § 17.3). In contrast to the MMPA, take under the ESA has been defined to encompass "harm," which has in turn been defined to include "significant habitat modification or degradation where it . . . injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." The take prohibition does not apply to species listed as "threatened." Instead, under Section 4(d) of the ESA, 16 U.S.C. § 1533(d), a regulation may be promulgated applying the taking prohibitions of Section 9 to threatened species.

As the ESA relates to the present Petition, USFWS has listed the polar bear as a threatened species (73 FR 28212 [May 15, 2008] [USFWS 2008a]). In addition, pursuant to Section 4(d) of the ESA, USFWS has promulgated a regulation that applies the taking prohibitions of Section 9 to the polar bear, with certain limitations (50 CFR § 17.40(q)). These limitations apply to activities conducted in compliance with incidental take authorization or an applicable exemption under the MMPA; in compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); or in areas within the jurisdiction of the U.S. but outside of existing polar bear habitat.

In response to a petition to list the Pacific walrus as threatened or endangered, the USFWS issued a finding that the listing of the Pacific walrus as threatened or endangered is warranted but precluded by higher priority actions. Accordingly, USFWS designated the Pacific walrus as a candidate species, and it is expected that USFWS will address the status of the walrus in fall of 2017.

Finally, 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."

1.2.3 National Environmental Policy Act

Section 102 of NEPA, 42 U.S.C. § 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 environmental assessment (EA) is a concise document that provides 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 that significantly affect 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 the NEPA process as a part of its analysis and promulgation of an ITR. The proposed action – the ITR – does not permit, authorize, or otherwise allow any oil and gas activity. Rather, the agency action being analyzed is authorization of non-lethal incidental (unintentional) take of small numbers of polar bear and Pacific walrus over a five-year period in a defined geographic area, that have no more than a negligible impact on these species and that have 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, we anticipate that USFWS may, as in the past, satisfy NEPA through an EA and FONSI process.

1.2.4 Future Regulatory Developments

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

- ***National Petroleum Reserve – Alaska (NPR-A) Integrated Activity Plan –*** In February 2013, Bureau of Land Management (BLM) issued a Record of Decision (ROD) for future management of the NPR-A. The decision made 11.8 million acres (4.8 million hectares) of the 22.8 million acres (9.2 million hectares) of NPR-A land available for oil and gas leasing, and made lands available for pipelines or other infrastructure to reach offshore leases. The plan also set aside some surface resources as Special Areas and established best management practices, performance-based stipulations, and monitoring studies. For conservation purposes, approximately 11 million acres (4.4 million hectares) were made unavailable to oil and gas leasing. The plan will remain effective until the BLM determines that it is appropriate to try a new approach at managing the NPR-A. Two recent Presidential Executive Orders (13580 and 13604) may result in increased interagency collaboration during permitting and review of energy projects in Alaska, under the guidance of the Interior Secretary (Hayes 2014). AOGA does not anticipate that these guidelines will result in any necessary delay in issuance of ITRs.
- ***Designation of Polar Bear Critical Habitat –*** USFWS listed the polar bear as threatened and designated an area of 484,734 square km (187,157 square mi) as polar bear critical habitat in 2010. In January 2013, the U.S. District Court of Alaska vacated and remanded the USFWS's final rule designating polar bear critical habitat, concluding that the action was arbitrary and capricious, and in violation of the ESA and the Administrative Procedure Act. If and when a new critical habitat designation will be proposed and finalized remains uncertain.

- ***Petition to list Pacific Walrus under the ESA –*** USFWS has listed Pacific walrus as a candidate species, but it has been precluded by higher priority actions. The USFWS is expected to address the status of the walrus in fall of 2017.
- ***Regulation of Greenhouse Gas (GHG) Emissions –*** In 75 FR 31514, the United States Environmental Protection Agency (USEPA) promulgated the GHG Tailoring Rule. This brings the emissions of GHGs under the Prevention of Significant Deterioration (PSD) and Title V requirements. Among the components of the PSD program, the one that primarily applies to GHGs is the requirement that source owners or operators utilize Best Available Control Technology (BACT) to limit GHG emissions from the source. BACT is established by the permitting authority on a case-by-case basis and which threshold applies to a particular source, how the potential emissions are calculated, and what controls are required are all issues determined in the air permit application and approval process. AOGA does not anticipate that advances in GHG emissions regulation will directly affect issuance of the proposed ITR. 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.
- ***Designation of Bearded Seal and Ringed Seal Critical Habitat –*** In 2012, NMFS listed the bearded seal (*Erignathus barbatus*) and ringed seal (*Phoca hispida hispida*) as threatened under the ESA. Critical habitat has not been designated at this time, but NMFS may propose to designate critical habitat in the future. If and when a new critical habitat designation will be proposed and finalized remains uncertain. In 2014, the listing of the Beringia distinct population segment of bearded seal was challenged and vacated in the federal district court for the District of Alaska, resulting in no listing for bearded seals in Alaska waters.

1.3 Scientific Context

There is a very high degree of scientific consensus that the effects of oil and gas industry operations in the Beaufort Sea and the adjacent North Slope on polar bear and walrus are negligible. The oil and gas industry has been operating in these areas for the past 45 years, with activities since 1993 closely monitored and reported pursuant to Section 101(a)(5)(A) of the MMPA. Accordingly, there is substantial long-term information concerning the class of activity, the specific geographic area, and the two marine mammal species addressed in this Petition. As demonstrated by monitoring data collected under the MMPA from the past 20 years, it is known to a very high degree of reliability that the total number of annual observations of polar bears represents a small proportion of the Southern Beaufort Sea (SBS) and Chukchi/Bering Sea (CS) populations, and that the number of actual incidental takings is a small fraction of annual observations. The data with respect to Pacific walrus, which are uncommon in the Beaufort Sea, demonstrate that there has never been a recorded take within the activity area covered by this Petition as a result of human encounters. Accordingly, with decades of experience, half of which has been rigorously monitored under the MMPA, there is no scientific evidence that oil and gas activity has had, or is having an adverse impact on populations of polar bears and Pacific walruses (USFWS 2011).

In addition, 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 the impacts of oil and gas activities on polar bears. Further, industry monitoring programs and compliance with ITRs have helped advance the knowledge of polar bear ecology on the North Slope. The well-supported and unchallenged conclusions of these processes have been that oil and gas activities, as regulated pursuant to ITRs and other provisions of the MMPA, do not pose a threat to the conservation of the polar bear, and do not have more than a negligible impact. The recent and thorough extent of these detailed scientific analyses by USFWS provides further credibility and support for this Petition.

Finally, the findings of USFWS in listing the polar bear under the ESA are important context for this Petition. USFWS has found that this species may be threatened with extinction throughout all or a significant portion of its range as a result of sea ice recession caused by climate change (USFWS 2008a). USFWS has further concluded that: sea ice recession is likely to result in the presence of more polar bears for longer periods of time along the Beaufort Sea nearshore; and sea ice recession is contributing to, and likely will continue to cause, decreased fitness of individual bears, eventually resulting in population declines that may end in extinction (USFWS 2011). Under these circumstances, as assessed by USFWS in its listing decision, other adverse impacts could take on increased significance. However, it does not follow that future declines in polar bear fitness, abundance, and distribution increase the consequences of the incidental take addressed, mitigated, and monitored in this Petition. By definition, the takings addressed in this Petition are non-lethal and unintentional, and are expected to consist of no more than short-term changes in behavior with no detectable long-term injury or consequence, involving very small numbers of polar bear (and few, if any, Pacific walrus). Moreover, in its listing and 4(d) rule for the polar bear, USFWS has expressly found that oil and gas activities in the Arctic, such as those described in this Petition, do not pose a threat to the polar bear species.

1.4 Information Submitted in Response to the Requirements of 50 CFR §18.27

The USFWS regulations governing the issuance of regulations and LOAs permitting incidental takes under certain circumstances are codified at 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 that addresses the corresponding 50 CFR § 18.27(d) item is identified in Table 1-1.

Table 1-1. Location of Information in this Petition of CFR § 18.27(d) Requirements

Chapter Number	Chapter Title	CFR § 18.27(d) Requirement
2	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	Dates, Duration, and Region of Activities	(ii) The dates and duration of such activity and the specific geographical region where it will occur.
4	Species, Number, and Type of Take	(iii) Based upon the best available scientific information: (A) 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.
5	Status, Distribution, and Seasonal Distribution of Species	(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.
6	Anticipated Impact on Species	(iii)(C) The anticipated impact of the activity upon the species or stocks.
7	Anticipated Impact on Subsistence	(iii)(D) The anticipated impact of the activity on the availability of the species or stocks for subsistence uses.
8	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	Anticipated Impact of Habitat Loss or Modification on Species	(v) The anticipated impact of the loss of the habitat on the marine mammal populations involved.
10	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 on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.
11	Monitoring and Reporting	(vii) Suggested means of accomplishing the necessary monitoring and reporting 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.
12	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.

2.0 Description of Activities

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 scope of this Petition includes the activities that will be conducted during the exploration (geological and geophysical surveys, and drilling activities), development, and production phases of oil and gas activities within the Petition's geographic area (Figure 1-1). Activities that may take place between 2016 and 2021 are discussed in this section. It is important to note that all activities described in this section have been implemented during past periods of the Beaufort Sea ITRs. Accordingly, analyses of potential impacts from these activities have been conducted by industry and regulatory agencies over an extended period of years, and the range of reasonably anticipated effects is well documented.

2.1 Oil and Gas Activity

Oil and gas exploration, development, and production activities have occurred on the North Slope and in the nearshore Beaufort Sea region for more than 40 years. The Prudhoe Bay oil reservoir was discovered in 1968 and first oil was pumped in 1977 after completion of the more than 1,288 km (800 mi) of Trans-Alaska Pipeline System (TAPS) between Prudhoe Bay and Valdez. Since the first State of Alaska lease sale of North Slope acreage in December 1964, the State has leased approximately 13 million acres (5.3 million hectares) in the North Slope/Beaufort Sea region, including over 100,000 acres leased in 2014. Federal oil and gas lease sales managed under the BOEM and Bureau of Safety and Environmental Enforcement (BSEE) lease program have been held within federal waters of the Alaskan Beaufort Sea for a total of 3.7 million acres (1.5 million hectares). Approximately 39 exploratory wells have been drilled in these offshore leases. Federal lease sales have also recently occurred in the NPR-A, which is managed by the BLM. Between 1975 and 1981, 28 wells had been drilled in the NPR-A. Since the May 1999 lease sale, 20 wells have been drilled in the Northeast Planning Area of NPR-A. Current oil and gas units and leaseholder ownership are presented in Figure 2-1.

Since the first production well was drilled in the Prudhoe Bay unit, more than 15 billion barrels (bbl) of oil have been produced on the North Slope, and more than 2,000 wells have been drilled. The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) Summary Report for Alaska Oil and Gas (DOE 2013) reported that about 10 billion bbl of recoverable oil exist in the NPR-A and ANWR, with about 100 billion bbl of oil resources underlying the North Slope. North Slope oil production peaked in 1988 at 2 million bbl per day. Oil produced on the North Slope is transported south via TAPS. Most of the oil arrives at the Valdez Marine Terminal where the oil is transferred to tankers for shipment to world markets. A small portion of the oil is stored and refined in Alaska for local use.

Activities related to petroleum exploration and development in the Beaufort Sea region can include construction of ice roads and pads for general support, support services (camps, warehousing, etc.), geological and geophysical surveys (seismic), shallow hazard surveys, ice gouge and strudel scour surveys (offshore), geotechnical borings (both onshore and offshore), environmental studies, drilling wells, construction of gravel roads and pads, construction of landing strips, and installation of pipelines (both onshore and subsea pipelines and testing of equipment). In addition, well plug and abandonment procedures, gravel pad removal and site remediation work is frequently conducted at old exploration pads.

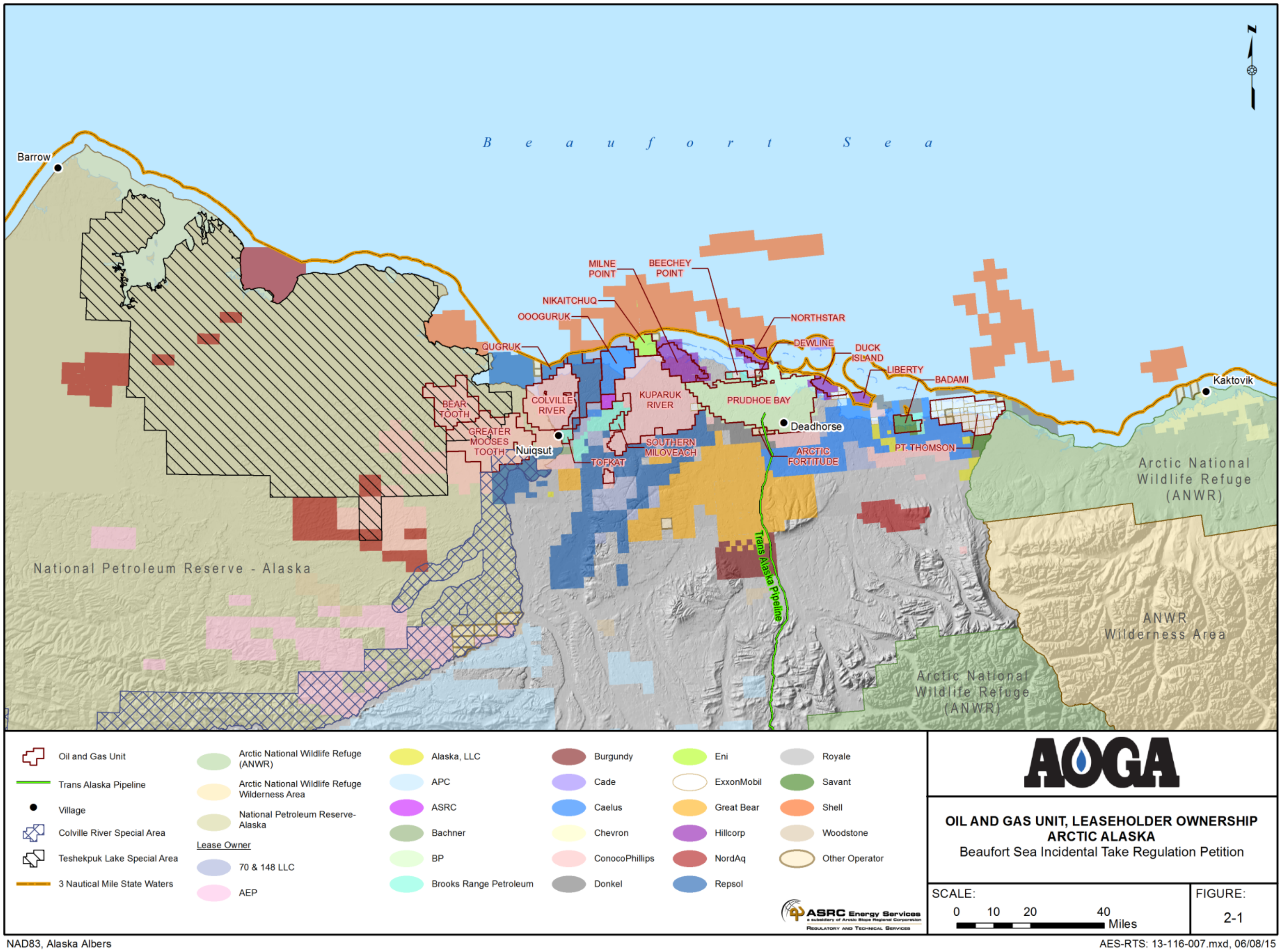

Figure 2-1. Oil and Gas Units and Leaseholder Ownership in Arctic Alaska

Total direct surface coverage calculated with Geographic Information Systems (GIS) and aerial photography in 2012 for oilfield related activities (gravel pads, roads, mine sites, and TAPS north of the Brooks Range) is 18,439 acres (7,462 hectares) or approximately 0.1 percent of the Arctic Coastal Plain between the Colville and Canning rivers. Not including TAPS, there are approximately 1,259 km (782 mi) of pipelines and 2,884 acres (1,167 hectares) of gravel roads. These measurements were conducted by Aerometric, Inc. using 2012 aerial photography. Gravel mine sites cover approximately 6,861 acres (2,777 hectares), but not all of these sites are currently in use. Gravel pads within the currently producing oilfields cover approximately 2,874 acres (1,163 hectares).

The following sections provide background information on geological and geophysical surveys, environmental studies, onshore and offshore drilling, development and production, and oil production processes (including production facilities, production wastes, production support operations, and decommissioning and abandonment/restoration). However, it is important to note that plans for exploration and development change regularly in scope and location, and some exploration may not occur at all.

2.2 Geological and Geophysical Surveys

Geological and geophysical surveys are conducted to gather information about subsurface geology. Geological surveys assist in interpreting conditions in the subsurface and may consist of potential field programs, including gravity, magnetics, and electromagnetic surveys; surface geologic surveys; geotechnical site investigations; geochemical surveys; and other evaluations requiring access to the surface of the land or seafloor. Geophysical surveys can be divided into two classes: seismic and shallow hazards surveys. Seismic surveys generally map deep strata beneath the surface of the ground in search of gas and oil-bearing rock formations. Shallow hazard surveys, also known as “site clearance” or “high resolution surveys,” are conducted to gather information on near-surface hazards up to 305 to 500 meters (m) (1,000 to 1,640 feet [ft]) below ground level, which could be encountered during drilling, as well as to determine foundation and permafrost conditions. This information is used to plan drilling operations to avoid or minimize the risk of such features.

2.2.1 Geotechnical Site Investigation

Shallow cores provide information about soil conditions where onshore or offshore pipelines, structures, or other facilities are planned, or to define where facilities may not be sited. Soil borings define the soil stratigraphy and geotechnical properties at selected points and may be integrated with seismic data to develop a regional model for predicting soil conditions in areas not sampled.

2.2.2 Reflection Seismic Exploration

Reflection seismology, or “seismic” as it is more commonly referred to by the oil and gas industry, is used to map the subsurface structure of rock formations. Seismic technology is used by geophysicists who interpret the data to map structural traps that could potentially contain hydrocarbons. Seismic exploration is the primary method of exploring for potential hydrocarbon deposits on land, under the sea, and in the transition zone (the interface area between sea and land). The general principle is to send sound energy waves (using an energy source like airgun or vibroseis) into the ground or water, where the different layers within the Earth's crust reflect back this energy. These reflected energy waves are recorded over a predetermined time period (called the record length) by using hydrophones in water and geophones on land. The reflected signals are recorded onto a storage medium, which is usually magnetic tape. The data are then processed and seismic profiles are produced. These profiles are then interpreted for possible hydrocarbon containing structures.

Shallow hazard surveys acquire high resolution profile data and are an integral part of site clearance prior to drilling offshore wells. High resolution profiling is accomplished typically through the use of a high-frequency sub-bottom profiler, an intermediate-frequency profiler, and a multi-channel system. A sub-bottom profiler is used to map geologic features by modulating frequency and pulse rate of an acoustic signal. Intermediate-frequency profilers outline the fine strata and density layers of the subsurface sediments, often referred to as a "boomer." A multi-channel system tows an array of hydrophones that receive the signal from various sizes and numbers of guns, often referred to as a "sparker."

Seismic crews on the North Slope are typically between 80 and 160 personnel. Substantial logistical support is required to cover not only the seismic operation itself, but also to support the main camp (for catering, waste management and disposal, camp accommodations, washing facilities, water supply, laundry, etc.), fly camps (temporary camps set up away from the main camp on large land seismic operations), all of the crew vehicles (maintenance, fuel, spares, etc.), security, possible helicopter operations, restocking of the explosive magazine, medical support, scientists, marine mammal observers, and many other logistical and support functions.

2.2.2.1 Vibroseis

Vibroseis seismic operations use truck-mounted vibrators that systematically put variable frequency energy into the earth. These can be used both onshore and on offshore sea ice. At least 1.2 m (4 ft) of sea ice is required to support heavy vehicles used to transport equipment offshore for exploration activities. These ice conditions vary, but generally exist from sometime in January until sometime in May in the area of activity. The exploration techniques are most commonly used on landfast ice; they can be used in areas of stable offshore pack ice but are less effective. Several vehicles are normally associated with a typical vibroseis operation. One or two vehicles with survey crews move ahead of the operation and mark the source receiver points. Occasionally, bulldozers are needed to build snow ramps on the steep terrain or to smooth offshore rough ice within the survey area.

A typical wintertime exploration seismic crew consists of 40 to 160 personnel. Roughly 75 percent of the personnel routinely work on the active seismic crew, with approximately 50 percent of those working in vehicles and the remainder outside laying and retrieving geophones and cable. Other members of the team are focused on health, safety, or environmental issues, or general camp support.

With the vibroseis technique, activity on the surveyed seismic line begins with the placement of sensors or geophones. All sensors operate independently and have fixed GPS locations. The vibrators move to the beginning of the line, and recording begins. The vibrators move along a source line, which is at some distance or angle to a sensor line. The vibrators begin vibrating in synchrony via a simultaneous radio signal to all vehicles.

2.2.2.2 Airgun and Watergun Seismic Data Collection

Airgun arrays produce sound waves from multiple guns fired simultaneously that produce sudden releases of pressurized air bubbles to create the sound source, while "ocean bottom cable or nodes" or "streamer cables" with attached hydrophones receive the returned echoes. These seismic techniques use compressed air or water in a cylinder at a pressure of about 2,000 pounds per square inch (psi) released from the gun. In shallow waters or in transition (land and marine) surveys, ocean bottom cable is laid out on the ocean bottom with hydrophones or nodes; these hydrophones will measure the energy reflected by the geology. Typically, there will be a source vessel that deploys the airgun array and there will be multiple (generally one to four) cable or node vessels that lay and pick up the cable or nodes.

To accurately calculate where subsurface features are located, navigators compute the position of both the sound source and each hydrophone group. The positioning accuracy required is achieved using a combination of acoustic networks and differential global positioning system (GPS) receivers.

2.2.2.3 Explosives Seismic Data Collection

Explosives can also be used on land as a source of energy to achieve energy waves for seismic surveys. The field procedures for seismic activities using explosives are essentially the same as outlined in the vibroseis section. Explosives are typically set on land at implanted depths of 10 to 30 m (30 to 100 ft). Charges of high velocity explosives of 15 to 45 kilogram (kg) (33 to 99 pounds [lb]) are normally loaded into each hole or “shotpoint,” and each shotpoint's charge is remotely detonated individually by the recording crew to produce a seismic record. Current practice limits the use of the explosive method to onshore operation.

2.2.3 Vertical Seismic Profiles

Vertical seismic profiles (VSPs) involve lowering geophones into a well bore on land or offshore and repeatedly activating the energy source. VSPs are elaborate checkshots that are used to calibrate seismic sections to well data (i.e., to correlate the reflections on the recorded seismic data with formations seen during drilling). VSPs are a form of well logging and are conducted both on and off the drill pad. VSP operations are usually crewed by fewer than eight people. If conducted during winter, four or five of the operators remain in the vehicles (vibrators) within 1.6 to 5 km (1 to 3 mi) of the rig, while the others are located at the rig.

2.2.4 Seafloor Imagery

Side-scan sonar is a sideward-looking, two-channel, narrow-beam instrument that emits a sound pulse and “listens” for its return. The sound energy transmitted is in a shape that sweeps the seafloor resulting in a 2D image that produces a detailed representation of the seafloor and any features or objects on it. Side-scan sonar emits high frequency sound typically between 120 and 132 kilohertz (kHz) band, occasionally reaching frequencies up to 410 to 445 kHz. The transmission pulse length can range from 20 milliseconds (msec) to 400 msec, depending on the equipment used. The sonar is typically towed behind a vessel.

2.2.4.1 Offshore Bathymetry

Bathymetry studies are sometimes conducted during the winter ice-season, and the open water season, but prior to seismic surveys to obtain information on water depths, seafloor contours, hazards, and other environmental conditions. These studies are typically conducted using echosounders, such as single-beam or multi-beam sonar devices.

Echosounders measure the time it takes for sound to travel from a transducer, to the seafloor, and back to a receiver. The travel time can be converted to a depth value by multiplying it with the sound velocity of the water column. Echosounders are generally mounted to the ship hull or on a side-mounted pole and could be a single-beam with one transducer, or a multi-beam with an array of transducers. The single-beam sonar device emits a high frequency single pulse of sound directly below the ship along the vessel trackline and provides a continuous recording of water depth along the survey track. Generally these recorders require compensation to rectify the data point. The sonar can operate at a frequency of either 100 kHz or 200 kHz and emits approximately 15 pulses per second (pulses/sec). Each pulse phase is between 0.03 and 0.12 msec. These data can also provide information on evidence of water column anomalies which could indicate gas escaping into the water column.

A multi-beam sonar device is comprised of a transducer array that emits a swath of sound. The seafloor coverage swath of the multi-beam sonar depends on water depth, but is usually equal to two to four times the water depth. This sonar typically operates at a frequency of 240 kHz. It emits approximately 15 pulses/sec, with each pulse duration lasting 21 to 225 msec for a swath that can cover up to 500 m (1,640 ft) in width. The multi-beam system requires additional non-acoustic equipment including a motion sensor (on vessel) to measure heave, roll, and pitch; a gyrocompass (on vessel); and a sound velocity probe (lowered from the vessel when the vessel is stationary). These data provide a 3D view of the seafloor in the surveyed area.

2.2.5 Ultra Shallow Water Array

Ultra Shallow Water (USW) array is a device composed of a series of air powered seismic sound sources (shots) with variable power outputs. The “source array” transmits energy through the water where reflected energy is received by a multi-channel marine digital recording streamer system. This tool is useful in finding shallow faults and amplitude anomalies in the seafloor.

2.3 Environmental Studies

In addition to geological and geotechnical surveys, over the past 40 years there has been extensive research and monitoring 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; acoustic monitoring, 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; scientists from oil and gas industry; federal, state, and local agencies; universities; non-profit organizations; and other local community stakeholders. Some research programs are multi-year efforts with objectives to collect baseline data, fulfill permit or regulatory obligations, or to answer specific research questions. These data are used to:

- understand the life cycles and natural variability of wildlife resources, most notably marine and terrestrial mammals, and plant communities;
- assess wildlife populations and plant communities within active oilfields and proposed developments;
- identify the location of important cultural and historical artifacts in order to avoid these areas during exploration and development phases; and
- understand the potential for impacts to tundra, air, and aquatic resources through exploration activities.

For the Petition period of 2016 to 2021, studies will continue to be conducted for general monitoring purposes or in anticipation of exploration and development of natural resources in the U.S. Beaufort Sea region.

2.4 Offshore and Onshore Exploration Drilling

There are currently three principal forms of exploratory drilling platforms used in offshore exploration; artificial and natural islands; bottom-founded and bottom-supported structures; and floating vessels. Onshore exploration in the Alaskan Arctic may be conducted from ice pads (single season or multi-season) and gravel pads.

2.4.1 Artificial Islands

Artificial islands are constructed in shallow offshore waters for use as drilling platforms. In the Arctic, artificial islands have been constructed from a combination of gravel, boulders, artificial structures (e.g., caissons which are watertight retaining structures), and/or ice. Artificial islands can be constructed at various times of the year. During summer, gravel is removed from the seafloor or onshore sites and barged to the proposed site and deposited to form the island. In the winter, gravel is transported over ice roads from an onshore site to the island site. After the artificial island is constructed to its full size, slope protection systems are installed, as appropriate for local oceanographic conditions, to reduce ice ride-up and erosion of the island. Once the island is complete, a drilling rig is transported to the island. Approximately 100 personnel operate a typical rig site. Due to economic and engineering considerations, gravel island construction has historically been restricted to waters less than 15 m (50 ft) deep.

2.4.2 Caisson-retained Island

Caisson-retained islands are similar in construction and design to other artificial islands with one significant exception. Rather than relying entirely on gravel or large boulders for support, the island contains one or more floatable concrete or steel caissons, which rest on an underwater gravel berm or on the ocean floor in water less than 6 m (20 ft) deep. The berm is constructed with dredged or deposited material to within 6 m (20 ft) of the sea surface. When each caisson is in place, the resulting concrete or steel ring is filled with sand to give the structure stability. This design, like the artificial gravel island, allows drilling to occur all year. When drilling is completed, the center core of sand can be dredged out, the caissons refloated, and the structure moved to a new location. The berm is left to erode by the natural action of the ocean. Personnel numbers on a caisson-retained island would be equivalent to those on an artificial island.

2.4.3 Steel Drilling Caisson

The Steel Drilling Caisson (SDC), a bottom-founded structure, is a “fit for purpose” drilling unit constructed typically by modifying the forward section of an ocean-going Very Large Crude Carrier (VLCC). The main body of the structure is approximately 162 m (531 ft) long, 53 m (174 ft) wide, and 25 m (83 ft) high. The deck has been cantilevered to provide additional space. The stability of the system under ice loading is provided by water ballasting of the original cargo tanks. Shotcrete has been applied to the base of the unit to increase its coefficient of friction. The SDC is designed to conduct exploratory year-round drilling under Arctic environmental conditions. On its first two deployments in the Canadian Beaufort, the SDC was supported by subsea gravel berms. For its third deployment in Harrison Bay in 1986, a steel component was constructed to support the SDC in lieu of the gravel berms. It was also used in 2002 by EnCana on the McCovey prospect. The steel base configuration adds 13 m (44 ft) to the design height of the structure and allows deployment of the SDC in water depths of 8 to 24 m (25 to 80 ft) without bottom preparation. The SDC requires minimal support during the drilling season. It is typically stocked with supplies before being moved to a drill site. Two or three tugs and/or supply vessels tow the SDC to or from the drill site during open water periods. Deployment and recovery of the SDC require less than one week each. Personnel (typically a maximum of 100) and some smaller equipment are transported to and from the SDC by helicopter. Fuel and larger items, if required, are transported by supply vessel.

2.4.4 Bottom-Supported Drilling Units

Bottom-supported drilling units typically consist of a buoyant hull with legs that are lowered to the seafloor once the rig is in place. The legs then support the rig when it is raised above the water surface, creating the drilling platform. Jack-up rigs are the bottom-supported drilling units most likely to be used for exploration drilling in Beaufort Sea OCS waters.

In contrast to floating drilling vessels, jack-up units are generally not self-propelled and must be towed to the drill site by tugs. Heavy lift vessels are generally required for the transport of jack-up rigs over long distances. These types of drilling units can be used in relatively shallow waters, generally under 400 ft (120 m). Jack-up rigs typically are used during ice free periods: however new jack-up rigs are designed to withstand multi-year ice floes. Oil spill response, ice management and offshore supply operations would be conducted similarly to those described in Section 2.4.5.

2.4.5 Floating Drilling Vessels

Floating drilling vessels that may be used for exploration drilling in Beaufort Sea OCS waters include drillships (e.g., *Northern Explorer II*, *Noble Discoverer*), semisubmersibles, or other floating vessels in which the hull does not rest on the seafloor. Drillships are generally self-propelled. These types of drilling vessels can typically be used in water depths greater than 18 m (60 ft) in the Beaufort Sea. This range makes them more suitable for the deeper water exploratory prospects than the “bottom founded” units such as the islands or the SDC mentioned in previous sections. Floating drilling vessel crews typically range from 100 to 200 personnel to operate the marine and drilling systems and ensure the safety of the operation (not including support or ice management vessels). These types of floating drilling vessels are held over a well drilling location either by a mooring system (consisting of an anchor, chain, and wire rope) or by the use of dynamic positioning (omni-directional thrusters coupled with a computer control system).

These types of floating drilling vessels operate during the Arctic drilling season with the potential to work during break-up and freeze-up, provided that support vessels are available to manage ice. Operations are supported by one or more ice management vessels (icebreakers) to ensure ice does not encroach on operations. If one of these vessels is moored, then an anchor-handling vessel is required to support the operations. A barge and tug, or other type of Oil Spill Response Vessel (OSRV), typically accompany these floating drilling vessels to provide a standby safety vessel, oil spill response capabilities, and refueling support. Most supplies (including fuel) necessary to complete drilling activities are stored on the drilling and support vessels or Offshore Supply Vessels (OSVs); however, a shallow draft re-supply vessel can be utilized to move critical equipment to and from marine terminals/docks. Helicopters based at existing shore facilities routinely transfer personnel and additional equipment. Flights may average between 7 and 40 trips a week. Fuel and supply caches may also be deployed on some occasions.

2.4.6 Ice Pads, Roads, and Islands

Ice roads provide seasonal routes for heavy equipment and supplies to be moved to remote areas, both onshore and offshore. These temporary, seasonal roads are constructed by spreading water from local sources (abandoned mine sites, lakes, rivers, seawater) to create a rigid surface. On land and along river corridors, ice roads and pads are constructed from freshwater sources. Most often and when available, abandoned mine sites that have filled with freshwater are used for construction of ice roads on tundra or along river banks. In cases where mine site water is not available, freshwater lakes are used for ice road construction. For grounded ice roads in shallow (< 2 m [< 6.5 ft]) waters of the Beaufort Sea, seawater is initially used for the foundation and the ice road is eventually "capped" with freshwater, strengthening the road. Floating ice roads may also be constructed over deeper water. Ice bridges may be constructed to provide winter access across frozen rivers. Ice airstrips are also constructed to facilitate access and are built in the same manner as ice roads. Ice drilling and storage pads are now commonly used for winter exploration pads. Ice pads are also built in a similar way to ice roads and ice airstrips. The thickness of ice roads, pads, and bridges depends on the loads that must be supported and on terrain, and can range from 15 centimeter (cm) (6 inches [in]) to 3 m (10 ft). Offshore ice pads may be thicker.

Insulated ice pads are occasionally used to allow the ice structure to remain intact through summer, and thus, be used for multiple drilling seasons. Offshore ice islands and offshore ice roads are built using similar techniques to their onshore counterparts.

2.5 Development and Production

Existing North Slope development and production operations extend from the Colville River in the west to Point Thomson and Badami in the east. Badami, Point Thomson, and the Colville River fields are developments without permanent access roads; access is available to these fields by airstrips, barges, and seasonal ice roads. Sales oil pipelines extend from these fields and connect to TAPS. North Slope oilfield developments include a series of major fields and their associated satellite fields. In some cases a new oilfield discovery has been developed completely using existing infrastructure. Thus, the Prudhoe Bay oilfield unit encompasses the Prudhoe Bay, Lisburne, Niakuk, West Beach, North Prudhoe Bay, Point McIntyre, Borealis, Midnight Sun, Polaris, Aurora, and Orion reservoirs; the Kuparuk oilfield development incorporates the Kuparuk, West Sak, Tarn, Palm, Tabasco, and Meltwater oilfields and the Colville River Unit encompasses the Fiord Nechelik, Fiord Kuparuk, Qannik, Nanuq Nanuq, Nanuq Kuparuk, and the Alpine oilfields. Figure 2-1 depicts oil and gas units and leaseholder ownership on the North Slope. Table 2-1 summarizes the area of infrastructure. This area was calculated using recent (2012) aerial photography by Aerometric, Inc. Table 2-2 summarizes existing and potential future oil and gas developments.

Table 2-1. Infrastructure Area on North Slope as of 2012 (Not Including Dalton Highway)

Infrastructure Type	Acres	Hectares
Gravel roads and causeway		
Roads	2,884	1,167
Causeway	231	94
Total gravel road and causeway area	**3,115**	**1,261**
Airstrips (gravel or paved)	**321**	**130**
Offshore gravel pads, islands		
Exploration islands	53	21
Production islands (drillsite, process, support)	149	61
Total offshore gravel pad, island area	**202**	**82**
Gravel pads		
Production pads, drill sites	2,887	1,168
Processing facility pads	854	345
Support pads (camps, power stations)	1,828	740
Exploration site	261	106
Total gravel pad area	5,830	2,359
Total gravel footprint	**9,468**	**3,832**
Other affected areas		
Exploration site-disturbed area around gravel pad	639	259
Exploration airstrip-thin gravel, tundra scar	50	20
Peat roads	517	209
Tractor trail, tundra scar	258	104
Exploration roads-thin gravel, tundra scar	177	72
Gravel pad removed, site in process of recovery	426	172
Gravel pad removed, site is recovered	60	24
Total other affected area	**2,127**	**860**
Gravel mines		
In rivers	5,385	2,179
In tundra	1,476	598
Total gravel mine area	**6,861**	**2,777**
Total impacted area	**18,439**	**7,462**

Source:
National Research Council, 2003
Update by Ken Ambrosius, Aerometric, Inc., October 2, 2013

Table 2-2. Existing and Potential Oil and Gas Development Projects on the North Slope

Unit	Name	Type of Production	Reserve Location	Production Location	Year Discovered	Year in Production
Existing						
Badami	Badami	Oil	Onshore/Offshore	Onshore	1990	1998
Colville River	Alpine	Oil	Onshore	Onshore	1994	2000
Colville River	CD-3 Fjord	Oil	Onshore	Onshore	1992	2006
Colville River	CD-4 Nanuk/q	Oil	Onshore	Onshore	1996	2006
Duck Island	Eider	Oil	Offshore	Offshore	1998	1998
*Duck Island	/1	Oil	Offshore	Offshore	1978	1986
Duck Island	Sag Delta North	Oil	Offshore	Offshore	1982	1989
Kuparuk River	Kuparuk	Oil	Onshore/Offshore	Onshore	1969	1981
Kuparuk River	Meltwater	Oil	Onshore	Onshore	2000	2002
Kuparuk River	Tabasco	Oil	Onshore	Onshore	1992	1998
Kuparuk River	Tarn	Oil	Onshore	Onshore	1991	1998
Kuparuk River	West Sak	Oil	Onshore	Onshore	1969	1997
Milne Point	Milne Point	Oil	Onshore/Offshore	Onshore	1969	1985
Milne Point	Sag River	Oil	Onshore	Onshore	1969	1994
Milne Point	Schrader Bluff	Oil	Onshore	Onshore	1969	1991
Nikaitchuq	Nikaitchuq	Oil	Offshore	Offshore	2004	2009
Northstar	Northstar	Oil	Offshore	Offshore	1984	2001
Oooguruk	Oooguruk	Oil	Offshore	Offshore	1993	2008
Point Thomson	Point Thomson	Oil & Gas	Onshore/Offshore	Onshore	1977	2016
Prudhoe Bay	Aurora	Oil	Onshore	Onshore	1999	2001
Prudhoe Bay	Lisburne	Oil	Onshore	Onshore	1967	1981
Prudhoe Bay	Midnight Sun	Oil	Onshore	Onshore	1998	1999
Prudhoe Bay	N. Prudhoe Bay	Oil	Onshore	Onshore	1970	1993
Prudhoe Bay	Niakuk	Oil	Offshore	Onshore	1985	1994
Prudhoe Bay	NW Eileen/Borealis	Oil	Onshore	Onshore	1999	2001
Prudhoe Bay	Polaris	Oil	Onshore	Onshore	1999	2001
Prudhoe Bay	Prudhoe Bay	Oil	Onshore	Onshore	1967	1977
Prudhoe Bay	Pt. McIntyre	Oil	Offshore	Onshore	1988	1993
Prudhoe Bay	West Beach	Oil	Onshore/Offshore	Onshore	1976	1994
	Cascade	Oil	Onshore	Onshore	1993	1996
	East Barrow	Gas	Onshore	Onshore	1974	1981
	Palm	Oil	Onshore	Onshore	2001	2003
	Sag Delta	Oil	Offshore	Onshore	1976	1989
	South Barrow	Gas	Onshore	Onshore	1949	1950

Unit	Name	Type of Production	Reserve Location	Production Location	Year Discovered	Year in Production
	Walakpa	Gas	Onshore	Onshore	1980	1992
Planned/Potential						
Beaufort	Flaxman Island	Oil	Offshore	Onshore	1975	NA
Beaufort	Gwydyr Bay	Oil	Onshore/Offshore	Onshore	1969	NA
Beaufort	Kuvlum	Oil	Offshore	Offshore	1987	NA
Colville River	CD5 Alpine W.	Oil	Onshore	Onshore	2000	2015
Greater Mooses Tooth	GMT1, CD6	Oil	Onshore	Onshore	2000	2017
Liberty	Liberty	Oil	Offshore	Offshore	1983	NA
NPR-A	Gubik	Gas	Onshore	Onshore	1950	NA
Oooguruk	Nuna	Oil	Offshore	Onshore	2011	NA
Kuparuk	Sharktooth, DS 2S	Oil	Onshore	Onshore	2012	NA
	Ataruq/Two Bits	Oil	Onshore	Onshore	2000	NA
	GMT2 Rendezvous	Oil	Onshore	Onshore	2000	2020
	E. Umiat	Gas	Onshore	Offshore	1964	NA
	East Kuparuk	Gas	Onshore	Offshore	1976	NA
	Fish Creek	Oil	Onshore	Offshore	1946	NA
	Hammerhead/Sivulliq	Oil	Offshore	Offshore	1985	NA
	Hemi Springs	Oil	Onshore	Offshore	1984	NA
	Kalubik	Oil	Offshore	Onshore	1992	NA
	Kavik	Gas	Onshore	Offshore	1969	NA
	Kemik	Gas	Onshore	Offshore	1972	NA
	Meade	Gas	Onshore	Offshore	1950	NA
	Mikkelson	Oil	Onshore	Onshore	1978	NA
	Pete's Wicked	Oil	Onshore	Onshore	1997	NA
	Sandpiper	Oil & Gas	Offshore	Offshore	1986	NA
	Simpson	Oil	Onshore	Offshore	1950	NA
	Sourdough	Oil	Onshore	Onshore	1994	NA
	Square Lake	Gas	Onshore	Offshore	1952	NA
	Stinson	Oil	Offshore	Offshore	1990	NA
	Sukukik	Oil	Onshore	Onshore	1988	NA
	Ugnu	Oil	Onshore	Offshore	1984	NA
	Umiat	Oil	Onshore	Offshore	1946	NA
	Wolf Creek	Gas	Onshore	Offshore	1951	NA
	Yukon Gold	Oil	Onshore	Onshore	1994	NA

NA = Not yet in production

2.5.1 Prudhoe Bay Unit

The Prudhoe Bay Unit is the largest oilfield by production in North America and ranks among the 20 largest oilfields ever discovered worldwide. Over 11.5 billion bbl have been produced from a field originally estimated to have 25 billion bbl of oil in place. The Prudhoe Bay oilfield also contains an estimated 26 trillion cubic ft of recoverable natural gas. More than 1,100 wells are currently in operation in the greater Prudhoe Bay oilfields, approximately 830 of which are producing oil (others are for gas or water injection). Average daily production in 2012 was approximately 255,500 bbl of oil equivalent (BOE).

The total development area in the Prudhoe Bay Unit is approximately 6,883 acres (2,785 hectares). On the east side of the field the Main Construction Camp can accommodate up to 625 people, the Prudhoe Bay Operations Center houses up to 449 people, and the Tarmac camp houses 244 people. The Base Operations Center on the western side of the Prudhoe Bay oilfield can accommodate 474 people. Additional personnel are housed at facilities in nearby Deadhorse or in temporary camps placed on existing gravel pads on lease.

2.5.2 Kuparuk River Unit

The Kuparuk oilfield is the second-largest producing oilfield in North America. More than 2.6 billion bbl of oil are expected to be produced from this oilfield. The Greater Kuparuk Area includes the satellite oilfields of Tarn, Palm, Tabasco, West Sak, and Meltwater. These satellite fields have been developed using existing facilities. To date, nearly 1,200 wells have been drilled in the Greater Kuparuk Area, and there are currently 47 producing drill sites. The total development area in the Greater Kuparuk Area is approximately 1,508 acres (603 hectares), including 167 km (104 mi) of gravel roads, 231 km (144 mi) of pipelines, 6 gravel mine sites, and over 50 gravel pads.

Additional infield and peripheral development from existing, expanded, or new drill sites within the Kuparuk River Unit (KRU) will continue for the foreseeable future. A new Kuparuk drill site in the southwest portion of the KRU requiring approximately 3.2 km (2 mi) of additional gravel road, pipelines, and power lines is currently planned for construction starting in 2014 with development drilling starting in 2015. Plans to expand the 1H drill site to accommodate wells are planned for 2015 and expected to be complete by 2017. Other pad expansions and two additional drill sites in the eastern portion of the KRU may be developed later this decade to access additional oil resources.

The Kuparuk Operations Center and Kuparuk Construction Camp are able to accommodate up to 1,200 personnel. Camps located at the Kuparuk Industrial Center are primarily used for personnel overflow for construction activities and to avoid having drilling camps in proximity to drilling activities.

2.5.3 Greater Point McIntyre

The Greater Point McIntyre Area encompasses the Point McIntyre field and nearby satellite fields of West Beach, North Prudhoe Bay, Niakuk, and Western Niakuk. The Point McIntyre area is located 11.3 km (7 mi) north of Prudhoe Bay. It was discovered in 1988 and came online in 1993. BPXA produces the Point McIntyre area from two drill site gravel pads. The field’s production peaked in 1996 at 170,000 bbl per day, whereas in 2012 production averaged 25,612 bbl per day with 39 production wells and five injectors in operation. Cumulative oil production as of December 1, 2012 was 704 million BOE.

2.5.4 Milne Point

Located approximately 56 km (35 mi) northwest of Prudhoe Bay, the Milne Point oilfield was discovered in 1969 and began production in 1985. The field consists of more than 220 wells drilled from 12 gravel pads. Milne Point produces from three main fields: Kuparuk, Schrader Bluff, and Sag River. Cumulative oil production as of December 1, 2012 was 308 million BOE. Average daily production rate in 2012 was 17,539 BOE with 114 production wells online. The total developed area of the Milne Point field is 450 acres (182 hectares) of gravel footprints, including 181 acres (73 hectares) of gravel pads, 50 km (31 mi) of gravel roads, one gravel mine site and 93 km (58 mi) of pipelines. The Milne Point Operations Center has accommodations for up to 180 people.

2.5.5 Endicott

The Endicott oilfield is located approximately 16 km (10 mi) northeast of Prudhoe Bay. It is the first continuously producing offshore field in the U.S. Arctic. The Endicott oilfield was developed from two man-made gravel islands connected to the mainland by a gravel causeway. The operations center and processing facilities are located on the 58-acre (24-hectare) Main Production Island. One hundred thirteen wells have been drilled to develop the field, 88 of which are still operable. Five hundred one million BOE have been produced at the Endicott Processing Facility as of August 2013. The average daily production rate at this time was approximately 8,800 BOE. Production at Endicott includes the processing of oil from the Endicott reservoir in the Kekiktuk formation and two satellite fields (Eider and Sag Delta North) which are in the Ivishak formation and were drilled from Endicott's Main Production Island. The total area of Endicott development is 522 acres (210 hectares) of land (this includes the 2008 Satellite Drilling Island [SDI] pad expansion to support the Liberty Rig) with 24 km (15 mi) of roads, 43 km (24 mi) of pipelines, and one gravel mine site. Approximately 75 people are housed at the Endicott Base Operations Camp (BOC) on Endicott's Main Production Island (MPI).

2.5.6 Badami

Production began from the Badami oilfield in 1998, but has not been continuous. The Badami oilfield is located approximately 56 km (35 mi) east of Prudhoe Bay and is currently the most easterly producing oilfield on the North Slope. The Badami Development Area is approximately 85 acres (34 hectares) of tundra including 7 km (4.5 mi) of gravel roads, 56 km (35 mi) of pipeline, one gravel mine site, and two gravel pads with a total of eight wells. There is no permanent road connection from Badami to Prudhoe Bay. The pipeline connecting the Badami oilfield to the common carrier pipeline system at Endicott was built from an ice road.

2.5.7 Alpine Oil Fields

Discovered in 1996, the Alpine oilfield, the first oilfield to be produced in the Colville River Unit (CRU), began production in November 2000. Alpine is the westernmost oilfield on the North Slope, located 50 km (31 mi) west of the Kuparuk oilfield and just 14 km (9 mi) northeast of the village of Nuiqsut. Although the Alpine reservoir covers 124,204 acres (50,264 hectares), it has been developed from just limited acreage of pads and associated roads. The CRU features a combined production pad/drill site (CD1) and four additional drill sites (CD2, CD3, CD4, and CD5) with an estimated 180 wells. Production is from six fields: Alpine, Fiord Nechelik, Fiord Kuparuk, Nanuq Nanuq, Nanuq Kuparuk, and Qannik. There is no permanent road connecting Alpine with the Kuparuk oilfield; small aircraft are used to provide supplies and crew changeovers. Major resupply activities occur in the winter, using an ice road that is constructed annually between the two fields. The Alpine base camp can house approximately 630 personnel.

2.5.8 Greater Mooses Tooth

The Greater Mooses Tooth Unit (GMTU) was established in 2008 through petition to BLM. CPAI requested that the BLM designate and approve the proposed Unit Area so CPAI could perform exploration and development operations in an efficient and logical manner under a unit plan of operations. Previous developments (CD1, CD2, CD3, and CD4) and the recently constructed CD5 are in a different reservoir within the established CRU. GMT1 was previously identified as CD6 and was renamed after it was determined that it would not be part of the CRU and would be in the newly established GMTU.

2.5.9 Northstar

The Northstar oilfield was discovered in 1983 and developed by BPXA in 1995. The offshore oilfield is located 6 km (4 mi) northwest of the Point McIntyre field and 10 km (6 mi) from Prudhoe Bay in about 11.9 m (39 ft) of water. The 15,360-hectare (38,400-acre) reservoir has now been developed from a 2-hectare (5-acre) artificial island. Production from the Northstar reservoir began in late 2001, and production averaged 11,900 BOE per day in August 2013. Cumulative oil production through August 15, 2013 was approximately 158.26 million bbl. Twenty nine wells were drilled to develop the Northstar oilfield, 28 of which are still operable. A subsea pipeline connects facilities to the Prudhoe Bay oilfield. The on-site Base Operations Center houses 50 people and access to the island is via helicopter, hovercraft, boat, tucker, and vehicle during the winter ice road season.

2.5.10 Oooguruk Unit

The Oooguruk Unit is located adjacent to KRU in shallow waters of Harrison Bay. Caelus constructed the Oooguruk Drill Site (ODS) and Oooguruk Tie-in Pad (OTP) in 2006 on State of Alaska leases. A subsea flowline was constructed to transfer produced fluids 9.2 km (5.7 mi) from ODS to shore. The subsea flowline transitions to an aboveground flowline supported on vertical support members for 3.9 km (2.4 mi) to OTP for approximately 12.5 acres (5.06 hectares). The ODS (6 acres [2.4 hectares]) will support 48 wells drilled to the Nuiqsut, Torok, and Kuparuk reservoirs. The wells are contained in well bay modules. Expansion of ODS is proposed to increase the working surface area from 6 acres (2.4 hectares) to 9.5 acres (3.8 hectares). The wellbay modules will have a capacity for an additional 24 wells, if needed. Development drilling began in 2007 with unit production commencing in 2008. The ODS helicopter sling load area would be expanded seaward .02 hectares (.05 acre).

2.5.11 Nikaitchuq Unit

The Nikaitchuq Unit is located at Spy Island, north of Oliktok Point and the KRU, and northwest of the Milne Point Unit. Former operator Kerr-McGee Oil and Gas Corporation drilled exploratory wells immediately adjacent to Spy Island, 6.4 km (4 mi) north of Oliktok Point in 2004-2005. In 2007, Eni became the operator in the area, after acquiring Armstrong Oil & Gas interests. In 2007, Eni received State approval for expansion of the unit, combining it with the former Tuvaaq Unit and adding a segment from the KRU. Two additional exploratory wells were drilled at Oliktok Points I-1 and I-2, and development drilling began in 2008. Eni constructed an offshore gravel pad, named Spy Island Drillsite (SID) and onshore production facilities on the Oliktok Production Pad (OPP) on State of Alaska leases. A subsea flowline was constructed to transfer produced fluids from SID to shore. Production began in 2011 at OPP and in 2012 at SID. An expanded development program is underway to recover oil from the Schrader Bluff OA and N reservoirs.

2.5.12 Point Thomson

The Point Thomson Unit is located approximately 32 km (20 mi) east of the Badami field.

The Point Thomson reservoir straddles the coastline with a greater part of the reservoir underlying the Beaufort Sea, however all wells and supporting infrastructure will be located onshore. Full development contemplates wells drilled from a Central Pad and up to two satellite drill sites. Construction of field central processing facilities, gathering lines, an export pipeline to the Badami pipeline, camps, and an airstrip began in 2013 and will continue through 2015, with anticipated production commencing in 2016. No permanent roads will connect Point Thomson with the Alaska all-weather road system at Prudhoe Bay. Infield gravel roads will connect the drill sites with the central production facilities, camp, and airstrip. Ice roads will be constructed annually during drilling and construction between Prudhoe Bay and Point Thomson and barges will be used in most years to provide equipment and supplies to Point Thomson during the open water periods.

Point Thomson full field development, which would include sale of natural gas in connection with the proposed Alaska LNG project and additional liquids production, is currently under design and study. This expansion would require additional wells, field facilities and pipelines, all of which would be located within the geographic area of activity applicable to these Incidental Take Regulations. However, only certain activities are currently contemplated to occur within the effective period of the proposed ITRs and will be more limited in scope during that time than the facility construction activities currently underway to support initial production in 2016. Onshore field investigations may be required at the Point Thomson Unit to collect environmental and engineering data; these studies could include geotechnical borings, hydrology surveys, ambient air monitoring, and sediment sampling, and would be anticipated to occur within the time period 2016-2021. Annual winter ice roads would be required starting in 2019 to enable equipment and facilities mobilization needed to establish camps on existing pads, install linear infrastructure, extract and place gravel for new pads and in-field roads, and make upgrades to marine facilities.

The timing and nature of additional facilities for the expansion currently under consideration at Point Thomson will depend upon initial field performance and potentially the ultimate timing of an agreement to construct an Alaska gas pipeline to export gas off the North Slope.

2.6 Oil Production Processes

2.6.1 Production Facilities

Wells are drilled into oil bearing zones to bring oil to the surface. Wells are typically grouped on gravel pads (or islands), commonly called well pads or drill sites, or offshore on development platforms. During development design, pads are placed to optimize oil recovery within the constraints of drilling reach and environmental protection. In general, at the surface well-head, a mix of crude oil, water, and natural gas flows into the manifold building, also located on the well pad. The primary function of the manifold building is to combine production from multiple wells and route it to separation facilities via cross-country flow lines. Some remote locations with space limitations decrease the footprint of the manifold building by utilizing multi-phase flow meters instead of a test separator. Production from a well may be diverted through the multi-phase flow meter or sent directly to a common production flow line. Crude oil from offshore remote locations is transported via buried subsea pipelines to onshore flow lines that deliver it to the separation facilities.

At the separation facilities (also called production facilities, gathering centers, or flow stations), gas, oil, and water are separated. Following the separation process, oil is routed by pipeline to Pump Station 1, which is the beginning of the TAPS. The separated water (referred to as produced water) is sent via pipeline back to the well pads where it is typically injected back into the reservoir to help maintain reservoir pressure and enhance recovery of oil. Most of the produced gas is also reinjected to maintain reservoir pressure. A portion of the gas may be used to fuel the overall production operation. In the Prudhoe Bay Unit, gas is first routed to the Central Gas Facility (CGF) where natural gas liquids (NGLs) and miscible injectant (MI) are extracted using a low temperature separation process. The NGLs are shipped via TAPS with the crude oil. MI is sent via pipelines to the well pads where it is injected for enhanced oil recovery. After the NGLs and MI are removed, the remaining gas is routed to compressors at both the CGF and the Central Compressor Plant, where it is compressed for re-injection into the gas cap of the reservoir. In older fields, such as Prudhoe Bay and Kuparuk, the crude oil fraction of production fluids is substantially less than the water and gas fraction. A diagram illustrating the oil production process is provided in Figure 2-2.

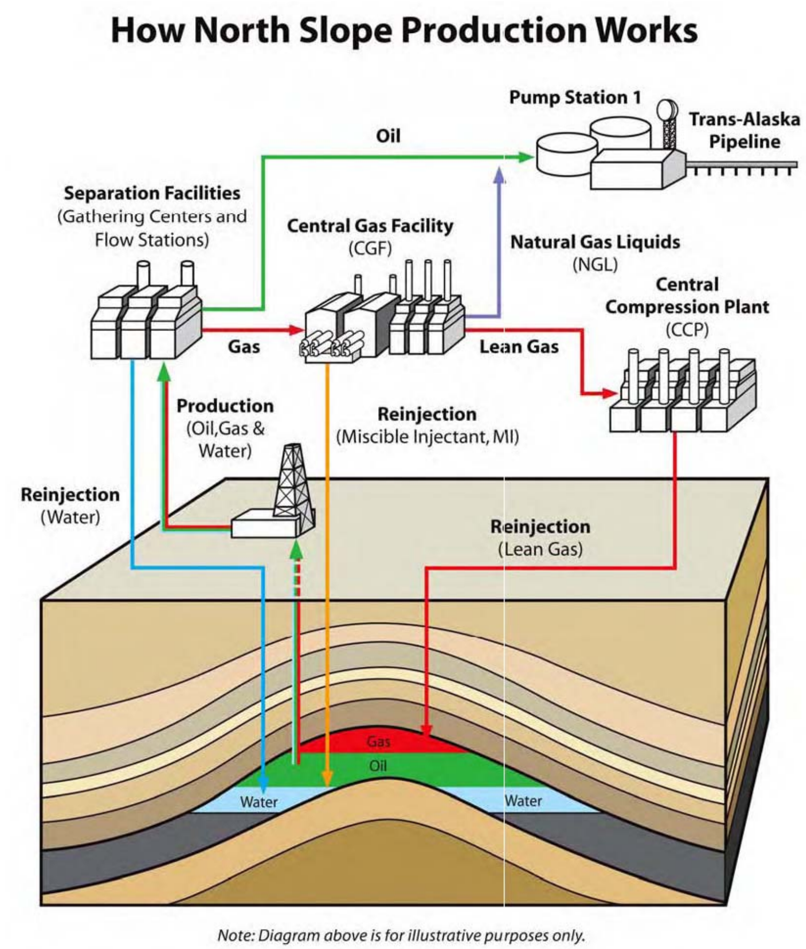

Figure 2-2. North Slope Process Flow Diagram

2.6.2 Production Wastes

Production wastes include drilling muds that are used to lubricate and maintain the well bore during drilling, and rock fragments known as cuttings, removed by the drill bit. Drilling muds are either waterbased mixtures comprised of naturally occurring clays and weighting materials with small amounts of other additives or oil-based mixtures comprised of mineral oil and weighting materials with small amounts of other additives. Until the 1990s, these production wastes were typically placed in “reserve pits" built into the gravel drilling pads; however, new technology has eliminated the need for reserve pits by grinding the cuttings and re-injecting the muds and ground cuttings into deep, confined geologic formations. Subsurface waste disposal is regulated by the USEPA and the State of Alaska under the Underground Injection Control (UIC) and National Pollutant Discharge Elimination System (NPDES) General Permits programs.

Other wastes generated by oilfield operations include well treatment fluids, chemicals used for processing crude oil, rig washwater, accumulated materials such as hydrocarbons solids, sands, and emulsion from production separators and fluid treating vessels, and cooling waters. These wastes are handled by using a variety of techniques, including recycling, underground injection, beneficial reuse in enhanced oil recovery, and shipment to approved offsite facilities.

A small amount of hazardous waste is generated by production facilities. These wastes are handled in accordance with USEPA regulations. Hazardous wastes are sent out of state by truck, rail, and barge to USEPA permitted disposal facilities in the contiguous U.S.

Non-hazardous solid waste and sanitary wastes are also generated at North Slope oilfield facilities. Solid wastes such as empty drums, paper products, wood, etc., are handled at the North Slope Borough (NSB) landfill or incinerated. Disposable food waste is also handled at the NSB landfill facility or incinerated, and wildlife resistant dumpsters have been installed in the oilfield to minimize wildlife attraction to these potential food sources. Sewage wastes are physically and chemically treated by wastewater treatment facilities. North Slope area facilities also operate various recycling programs. Paper products, wood, scrap metal, cardboard, electronics, and other materials are collected and transported off the North Slope to appropriate recycling facilities.

2.7 Support and Distribution

2.7.1 Support Operations

Equipment and people associated with exploration, development, and production operations are transported to and from the facilities by truck or bus, aircraft, hovercraft, marine vessel, or barge towed by a vessel. Equipment and materials are transported to the North Slope by truck. Aircraft, both fixed wing and helicopters, are used for movement of personnel, mail, rush-cargo, and perishable items. Marine vessel, barges, and tugs are used to transport items in open water.

Much of the barge traffic during the open water season unloads from two dockheads at West Dock. The West Dock Users Group coordinates the deliveries and use of the West Dock facilities during the busy open water season. Large sealift barges carrying modules for North Slope infrastructure projects typically off-load modules at West Dock and haul the modules to North Slope destinations. Maintenance dredging is performed as needed at West Dock to ensure barge and sealifts can safely use West Dock. Current permits authorize the removal of up to 220,000 cubic yards of dredge material annually from the navigation channels leading to West Dock.

2.7.2 Trans-Alaska Pipeline System

TAPS is a 122-cm (48-in) diameter crude oil transportation pipeline system that originates at Pump Station 1 in the Prudhoe Bay Oilfield, and extends 1,287 km (800 mi) across the state to its terminus at the Valdez Marine Terminal. Alyeska Pipeline Service Company, as operator of the pipeline, conducts pipeline operations, maintenance and emergency response along the pipeline right-of-way, including approximately 37 km (23 mi) of pipeline located within 40 km (25 mi) of the Beaufort Sea coastline. Personnel are based out of pump stations, and reside in designated living facilities, where lodging and eating amenities are maintained. In addition to routine operations, project work and emergency response training takes place at various distances from the pump stations. Operations and maintenance of the pipeline and facilities includes a 238-km (148-mi) natural gas line that extends south from Pump Station 1 that supplies fuel to power turbines at Pump Stations 3 and 4. Travel primarily occurs along established roads, such as the Spine Road and the Dalton Highway, or along the pipeline right-of-way work pads. The Dalton Highway corridor is shared with the general public.

Congress enacted the Trans-Alaska Pipeline Authorization Act (TAPAA) on November 16, 1973. The Federal Agreement and Grant of Right-of-Way for the TAPS (Federal Grant) was issued on January 23, 1974, and the State Right-of-Way Lease for the TAPS was issued on May 3, 1974. The Federal Grant, as renewed, expires on May 2, 2034. On November 26, 2002, the lease for state land along the pipeline corridor was renewed for an additional 30 years.

2.8 Planned and Potential Future Activities 2016-2021

Projecting specific activities for 2016 through 2021 is uncertain because Arctic oil and gas planning itself carries an inherent level of uncertainty as it is subject to a web of complex operational, economic, and regulatory concerns. Moreover, even those oilfields in an advance stage of planning may not actually be developed. For example, the Liberty oilfield was discovered in 1982 by Shell Oil Company and subsequently acquired by BPXA in 1996 after Shell relinquished its leases. BPXA drilled a well from Tern Island in the winter of 1996−1997, and based on the results of that well, BPXA proceeded with plans to develop the reservoir. Construction activities were initially planned for the 1999−2000 winter season but were subsequently deferred. In early 2002, BPXA announced that it was suspending permit applications to develop the Liberty oilfield. In the fall of 2004, BPXA re-initiated permitting for Liberty with the signing of a Memorandum of Understanding for permit evaluation and the NEPA process. Initial construction activities for the Liberty Development began in early 2009. BPXA suspended construction efforts a few years later, changing the development and production vision which would require different permits. In 2014, Hilcorp Alaska bought a 50 percent share in Liberty and took over operatorship of the Liberty development. This demonstrates the uncertainty of identifying future activities since they are driven by a variety of economic, regulatory, and environmental factors beyond the control of the oil and gas industry.

The sections below provide descriptions of potential activities for 2016 through 2021 based on the best available information and represent the oil and gas industry’s best projection of the type and magnitude of activities. These are primarily based on information relating to BOEM OCS lease sales, State of Alaska lease sales, NPR-A activities, and potential development/exploration sites. Seismic exploration and exploratory drilling could occur at unidentified locations and potential new satellite oilfields across the North Slope in areas recently leased or in those areas subject to continuing evaluation.

2.8.1 Bureau of Ocean Energy Management Outer Continental Shelf Lease Sales

The BOEM manages the Alaska OCS region encompassing 600 million acres (242 million hectares). Of that acreage, approximately 65 million acres (26 million hectare) are within the Beaufort Sea Planning Area, the area within scope of the Petition request. In July 2012, BOEM issued the Final Programmatic Environmental Impact Statement (PEIS) for future lease sales planned for the Beaufort Sea Planning Area. Sale 186 was held in 2003, resulting in the leasing of 34 tracts encompassing 181,810 acres (73,576 hectares). Sale 195 occurred in 2005, resulting in the leasing of 117 tracts encompassing 607,285 acres (245,760 hectares). Sale 202 was held in 2007, resulting in the leasing of 90 tracts covering 490,700 acres (198,580 hectares). BOEM plans one more lease sale in the Beaufort Sea through 2017:

Lease Sale 242. BOEM issued the PEIS for these areas in July 2012 and it is available at http://www.boem.gov/5-Year/2012-2017/PEIS.aspx. Leasing information from BOEM is located at http://www.boem.gov/Oil-and-Gas-Energy-Program/.

2.8.2 National Petroleum Reserve – Alaska

The BLM manages over 23 million acres (9 million hectares) in the NPR-A, and the ROD for the NPR-A Integrated Activity Plan and associated EIS was signed on February 21, 2013. The ROD emphasizes multiple uses of the NPR-A, consultations with local residents, and coordinated scientific studies to protect wildlife habitat, subsistence areas, and other resources. The NPR-A Integrated Activity Plan and EIS addressed potential future industrial activities including pipeline and other oil and gas infrastructure development, oil and gas leasing and exploration, and offshore oil and gas development. The decision also recommends stipulations and best management practices to regulate permitted activities in the NPR-A. The ROD makes approximately 11.8 million acres (4.7 hectares) available for oil and gas leasing. Since 2000, 29 wells have been drilled in the NPR-A (BLM 2013a). Lease sales have occurred regularly in the NPR-A; the 1999 lease sale sold 867,514 acres (351,070 hectares), the 2002 sold 579,269 acres (234,422 hectares), the 2004 sold 1,403,561 acres (568,001 hectares), the 2006 sold 939,867 acres (380,351 hectares), the 2008 sold 1,656,574 acres (670,392 hectares), the 2010 sold 28,444 acres (11,510 hectares), the 2011 sold 119,987 acres (48,557 hectares), and the 2012 sold 160,628 acres (65,003 hectares) (BLM 2013b). The first lease sale under the February 2013 ROD occurred on November 6, 2013, and sold 245,293 acres (99,267 hectares). BLM anticipates having subsequent annual lease sales. Current operator/ownership information is available on the BLM NPR-A website at http://www.blm.gov/ak/st/en/prog/energy/oil_gas/npra.html.

In the Northeast Planning Area, CPAI applied for permits for the 2012 – 2017 winter drilling program at seven sites in the Northeast Planning Area of the NPR-A (Cassin #1 & Cassin #6, Flat Top #1, and Rendezvous #3, and additional Cassin wells), including 144 km (84 mi) of new right-of-way corridors and 15 new water supply lakes. CPAI is planning to further continue to develop their exploration program in the Northeast Planning Area throughout the duration of the requested regulations.

2.8.3 State of Alaska Lease Sales

In 1996, Alaska Department of Natural Resources (ADNR), Oil and Gas Division, adopted an “areawide” approach to leasing. Under areawide leasing, the state offers all available state acreage not currently under lease within each area annually. The area of activity in this Petition includes the North Slope and Beaufort Sea planning areas. Lease sale data are available on the ADNR website at: http://www.dog.dnr.state.ak.us/oil/index.htm. Projected activities may include exploration, facility maintenance and construction, and operation activities.

The North Slope planning area has 1,225 tracts that lie between the NPR-A and the ANWR. The southern boundary of the North Slope sale area is the Umiat baseline. In this planning area, several lease sales have been held to date. As of July 2013, there are 831 active leases on the North Slope, encompassing 2.24 million acres (906,496 hectares), and 224 active leases in the state waters of the Beaufort Sea, encompassing 615,296 acres (249,000 hectares).

The Beaufort Sea Planning Area encompasses a gross area of approximately 2 million acres (809,370 hectares) divided into 573 tracts ranging in size from 640 to 5,760 acres (259 to 2,330 hectares). These tracts are located within the NSB and consist of State-owned tidal and submerged lands in the Beaufort Sea between the Canadian Border and Point Barrow. The sale area is adjacent to both the NPR-A and the ANWR. The southern fringe of the sale area includes some state-owned uplands lying between the NPR-A and the ANWR. Several lease sales have been held to date. As of July 2013, there are 226 active leases in the state waters of the Beaufort Sea, encompassing 606,446 acres (245,420 hectares). The last Beaufort Sea areawide lease sale held on November 7, 2012, resulted in the sale of 26 tracts for a total of 99,200 acres (40,145 hectares) on the North Slope. The 2013 lease sale occurred on November 6, and sold 5,120 acres (2,072 hectares). ADNR plans to continue hosting areawide lease sales on an annual basis.

2.8.4 Liberty Oilfield

Hilcorp is evaluating development of the Liberty oilfield. The Liberty reservoir is located in federal waters in Foggy Island Bay about 13 km (8 mi) east of the Endicott SDI. The project concept is to build a gravel island situated over the reservoir with full on-island processing facility (similar to Northstar). Additional infrastructure would include a 12.9 km (8-mi)-long subsea pipeline carrying sales oil south to tie in to the existing Badami pipeline and a mine site. Environmental, archeological, and geotechnical work activities will occur to support the development and help inform decisions. A Development Plan of Production was submitted to BOEM and BSEE on December 30, 2014. If the decision is made to proceed, first oil is estimated in 2020. This project concept supersedes the cancelled Liberty ultraextended-reach drilling project.

2.8.5 Milne Point Development

Hilcorp is evaluating the plan forward for the Milne Point Expansion. Up to six new wells are proposed from the existing infrastructure at L Pad for the summer of 2015. Permit applications have been submitted for these wells. The proposed timeline listed below for the Milne Point Expansion includes flexibility and options as Hilcorp trues up the results from the initial L Pad drilling program.

2015

- Drilling at L and F Pad: June 2015 thru July 2016
- L Pad Gravel Expansion in summer of 2015

2016

- Drilling at C Pad: July 2016 – February 2017
- Plan for February 2017 drilling from new pad
- Conduct aquatic and habitat assessments and geotechnical studies

2017

- Drilling from new pad – February 2017

2.8.6 Alpine Satellites Development

In September of 2004, BLM released the Alpine Satellites Development Plan EIS, which evaluated the addition of up to five drill sites in the Alpine development area. Two of the drill sites, CD-3 (also known as Fiord), and CD4 (also known as Nanuq), are in the Colville River Delta and were completed and brought online in 2006. The remaining three drill sites (CD5, GMT1 – formerly CD6, and GMT2 – formerly CD7) were envisioned as being routed back to the existing infrastructure at Alpine via a road and bridge over the Nigliq Channel of the Colville River. The CD5 development (also known as Alpine West) has received all the necessary permits and funding approvals and construction will be completed in 2015. The other two drill sites are planned to be connected to CD-5 via road; however, the permitting for these developments has not been completed. CD5, GMT1 (Lookout prospect) and GMT2 (Rendezvous prospect) are located in the Northeast NPR-A, an area bordered by the Beaufort Sea coast to the north, and Brooks Range to the south. Gravel sources available for extraction are from an existing mine near Nuiqsut (owned by ASRC) and a potential new gravel mine site (Clover) near the Ublutuoch River in

NPR-A. In addition to new drill site development in the NPR-A, expansion of the existing CRU drill sites is being considered to allow drilling of additional wells in-lieu of adding new drill sites in the Colville River Delta. Shell Offshore Exploration Activities

Shell anticipates that it may conduct Beaufort Sea exploration drilling programs between 2016 and 2021 on its BOEM Alaska OCS leases and its State of Alaska offshore leases. As of July 2013, Shell held majority or partial interest in 138 OCS leases and 18 state leases in the greater Beaufort Sea area. Additional Shell exploration drilling programs may also occur on any offshore Beaufort Sea leases acquired by Shell at future lease sales held by the BOEM or the State of Alaska, or by Shell acquiring interest in leases held by other companies.

During the open water Arctic drilling season, Shell would conduct exploration and or/delineation drilling through use of a floating drilling vessel, along with attendant ice management and oil spill response (OSR) equipment. For the winter drilling season, Shell would conduct drilling through use of an ice island or bottom-founded structure, along with attendant OSR equipment.

2.8.7 Mustang – Western Region Expansion

BRPC is planning an expansion of the Mustang Development in the region around the Southern Miluveach Unit (SMU), located west of KRU, on the North Slope. These satellite developments will be processed through the Mustang Processing Facility. Four satellite drill sites are anticipated. Construction of one drill site per year is anticipated from 2017 and 2020.

Each of the four drill site pads will cover approximately 9 acres (3.6 hectares) and will be located in the region between the KRU and CRU. To provide year-round access, a gravel road will be built for each drill site connecting back to the Mustang anchor development. Approximately 32.2 km (20 mi) of gravel road will need to be constructed to tie in all four drill sites.

Production will be transported via pipeline back to the Mustang processing facility. Approximately 32.2 km (20 mi) of pipeline will be needed to tie each drill site back to Mustang and will run adjacent to the gravel road(s).

2.8.8 Telemark Development

BRPC plans to begin gravel construction on the first satellite road and pad in 2016. Each subsequent drill site will begin gravel construction one year later with expected production to begin in the following year.

BRPC is planning the Telemark Development, near the Badami Unit, to produce oil on the eastern North Slope. BRPC plans to leverage existing infrastructure to develop the field and expects to lay very little gravel for the development.

BRPC will construct a 2.4 km (1.5 mi) pipeline to transport recovered oil to the Badami surface facility for processing. Processed crude oil will be shipped through the Badami pipeline and eventually through TAPS.

2.8.9 Beechey Point / East Shore

BRPC is planning the East Shore Development Project to produce oil from several relatively small hydrocarbon accumulations on the central North Slope. The field lies adjacent to the Prudhoe Bay and Midnight Sun fields and BRPC plans to leverage nearby, existing infrastructure to develop this field. BRPC plans to utilize horizontal drilling technology to further minimize surface impact.

The East Shore pad will cover approximately 15 acres (6.07 hectares) and a gravel road of approximately 8.9 km (5.5 mi) will be constructed to connect to existing Prudhoe Bay infrastructure to provide year-round access to well and production facilities.

Sales oil will be transported via a ~ 1.6 km (~1 mi) pipeline from the East Shore pad to a lease automatic custody transfer (LACT) metering skid adjacent to the Northstar pipeline.

Gravel construction is expected to begin in 2018. Facilities will be constructed during 2019 and first oil is planned for 2020.

2.8.10 Tofkat

BRPC is proposing the Tofkat Development Project, in the Tofkat Unit (TU), to produce oil from a relatively small hydrocarbon accumulation on the western North Slope. BRPC plans to leverage nearby, existing infrastructure and produce from horizontal wells to minimize the surface impact of the facility.

The Tofkat gravel pad will cover approximately 15 acres (6.07 hectares) and a gravel road of approximately 8 km (5 mi) will be constructed to connect to future CRU infrastructure north of TU.

Sales oil will be transported via a 8 km (5 mi) pipeline from the Tofkat pad to a custody transfer (LACT) metering skid adjacent to the Alpine pipeline. Gravel construction is expected to begin in 2020.

2.8.11 Nuna

The Nuna project is located along the east side of the Colville River Delta; adjacent to KRU; and approximately 35.4 km (22 mi) northeast of Nuiqsut, Alaska. Caelus built one drillsite (Nuna Drill Site 1 [NDS1]) during the winter of 2015 and may build a second. NDS1 would then be drilled, produced, and produced fluids transported to the existing OTP. An access road connection from existing infrastructure to NDS1 was constructed and begins at KRU drill site 3S. In addition to NDS1 (22 acres [8.9 hectares]), two gravel pads may be constructed:

- 13 acres (5.2 hectares) for Nuna Drill Site 2 (NDS2) (10-15 wells)
- 0.5 acres (0.2 hectares) for the Nuna Tie-in Pad (NTP), which would include a pig launching and receiving facility for the aboveground flowlines

An access road would also be constructed for (NDS2). Expansion of OTP increased the working surface area from 7.6 acres (3.07 hectares) to 12.5 acres (5.06 hectares) to provide surface facilities to support the NDS1. A new seawater line 8.4 km (5.2 mi) in length is proposed for installation from a new tie-in pad of 0.18 acres (0.07 hectare) near the KRU Central Processing Facility #3 to OTP to supply additional seawater for reservoir injection at both NDS1 and ODS.

2.8.12 Tulimaniq Unit

Caelus plans to drill up to two oil and gas exploration wells during the winter of 2015-2016 near the delta of the Ikpikpuk River in the southern portion of Smith Bay. The Tulimaniq #1 drillsite is approximately 95 km (59 mi) southeast of Point Barrow. Caelus proposes construction of four ice pads: two drilling ice pads, one camp ice pad near Lake M654, and one resupply camp ice pad at DS-2P. Caelus also proposes a camp at Point Lonely.

The drilling pads will be circular with a 500 ft diameter in approximately 0.3 to 1.2 m (1 to 4 ft) of water. Facilities proposed on the drilling ice pads include a drill rig, office trailer, fuel storage, drilling fluids tank farm, cuttings bins, spill response connex, lined storage area and a casing/tubulars area.

The Lake M654 ice pad will be approximately 229 m by 152 m (750 ft by 500 ft) and located to the east of M654. Facilities to be placed on the Lake M654 pad include a 64-bed camp, 52-bed camp, 35-bed camp, fuel storage, and spill response connex. All drilling and support personnel will be housed at the M654 pad.

The DS-2P ice pad will be approximately 122 m by 122 m (400 ft by 400 ft). Facilities to be placed on the 2P pad include a 35-bed camp and fuel storage. Resupply personnel will be housed at the 2P pad.

Separate from the camp pad, Caelus proposes an ice airstrip up to 1,524 m (5,000 ft) long on Lake M654. The airstrip will be used by medium to small aircraft to transport project components, crew and fuel. A temporary airport will be also be located there.

Existing airstrips near the project site have been identified and evaluated for use, if necessary. These backup airstrips include the 1,402 m (4,600 ft) gravel airstrip at Point Lonely, approximately 38.6 km (24 mi) east of the drilling ice pad and a 518 m (1,700 ft) airstrip at Cape Simpson approximately 32 km (20 mi) northwest of the drilling ice pad.

Critical materials and equipment will be barged from West Dock to Point Lonely or Camp Lonely during the Beaufort Sea open water season in summer 2015. Caelus' barging contractors are aware of the requirements of and will comply with the Conflict Avoidance Agreement.

The primary route for non-critical and resupply items will begin from a staging pad adjacent to DS-2P, cross the Colville River at Ocean Point and proceed along the historical travel route before heading north to the Tulimaniq drillsite. Frozen overland and oversea ice trails will be used to transport supplies and equipment from Prudhoe Bay to the project area. Existing permanent gravel roads and frozen trails will be used to the maximum extent possible.

Pre-packing of the trail will be requested prior to the official tundra opening to preserve early snow. Overland travel to the drill pad will be via approved low-pressure all-terrain vehicles from staging areas. Thermistors will be installed to transmit data including real-time soil temperature at depth via satellite and can provide information for determining tundra travel opening dates. Thermistors will be installed using limited helicopter operations.

A third of the equipment and materials will be consumed/back hauled during drilling, another third will be demobilized via the overland snow trail or by the oversea ice trail with the final third taken to Point Lonely for staging and then barged to Oliktok Point or West Dock during summer 2016.

2.8.13 West End Development

The Prudhoe Bay Unit owners are evaluating potential activities as part of the West End Development (WED) Program. The program consists of three components:

1. Improving capacity at existing facilities and infrastructure which may include modifications to Gathering Center 2 (GC2) separation and handling, and additional heat for fluids entering GC2.
2. Constructing a new pad (I-Pad) in the far Northwest GC2 area, near the Milne Point Road, to access the Schrader Bluff and Kuparuk reservoirs, and potentially the Sag reservoir.

3. Expanding S-Pad (~ 5 acres [2 hectares]) and drilling additional wells at both M and S-Pads to access the Schrader Bluff, Kuparuk, and Sag reservoirs.

2.8.14 Potential Future Gas Pipeline

Two major partnerships are currently proposing to construct a natural gas pipeline that would transport natural gas from the North Slope. Only a small portion (40 km [25 mi] inland) of a pipeline would occur within the specified area of activity covered under this Petition. The two proposed projects are discussed below.

2.8.14.1 Alaska Liquefied Natural Gas Project

The Alaska Gasline Development Corporation, BP Alaska LNG LLC, ConocoPhillips Alaska LNG Company, ExxonMobil Alaska LNG LLC, and TransCanada Alaska Midstream LP (Applicants) plan to construct one integrated LNG Project (Project) with interdependent facilities for the purpose of liquefying supplies of natural gas from Alaska, in particular the Point Thomson Unit (PTU) and Prudhoe Bay Unit (PBU) production fields on the Alaska North Slope (North Slope), for export in foreign commerce and opportunity for in-state deliveries of natural gas.

Alaska LNG includes the following interdependent components: a liquefaction facility (Liquefaction Facility) in Southcentral Alaska; an approximately 800-mile, large diameter gas pipeline (Mainline); a gas treatment plant (GTP) on the North Slope; a gas transmission line connecting the GTP to the PTU gas production facility (PTU Transmission Line); and a gas transmission line connecting the GTP to the PBU gas production facility (PBU Transmission Line).

With respect to this petition, only the GTP, the PTU Transmission Line, the PBU Transmission Line, and a portion of the Mainline as proposed would be located within the geographic area of activity applicable to these Incidental Take Regulations. Development of these project components would subsequently require installation of new facilities including processing modules and linear infrastructure as well as associated logistics support activities such as ice roads, gravel infrastructure, camps, coastal barging, sealifts, and laydown areas. However, only certain discrete construction activities are currently contemplated to occur within the effective period of the proposed ITRs. These include potential expansion of PBU West Dock beginning in 2020, gravel extraction near Prudhoe Bay beginning in 2019, placement of gravel for facility development and access roads in 2019, and ice road construction in 2018-2021 to enable development activities.

During the effective period of the proposed ITRs, Alaska LNG design and scoping will require field investigations onshore and nearshore at and near Prudhoe Bay and between Prudhoe Bay and the PTU to collect baseline environmental and engineering data; these studies which are anticipated to be conducted from 2016-2018 may include (but are not limited to) geotechnical borings, fish surveys, water quality testing, archaeological surveys, bathymetry studies, sediment sampling, metocean data gathering, wetland and vegetation mapping, and ambient air monitoring.

While this summary assumes that Alaska LNG will move forward on the schedule currently contemplated, Alaska LNG and associated facilities remain subject to numerous engineering, environmental, permitting, and commercial determinations prior to decisions sanctioning construction.

2.8.14.2 Alaska Stand Alone Gas Pipeline

The proposed Alaska Stand Alone Gas Pipeline (ASAP) project is a 61-cm (24-in)-diameter natural gas pipeline with a natural gas flow rate of 500 million standard cubic feet per day (MMscfd) at peak capacity. The proposed pipeline will be buried, except from mileposts (MPs) 0 to 6 and at elevated bridge stream crossings, compressor stations, possible fault crossings, pigging facilities, and off-take valve locations. The pipeline system will be designed to transport a highly conditioned natural gas highly enriched in non-methane hydrocarbons.

The proposed routing of the ASAP is from Prudhoe Bay following the TAPS and Dalton Highway corridors, generally paralleling the Dalton Highway corridor from the North Slope to near Livengood, northwest of Fairbanks. At Livengood, the pipeline route heads south, through Minto Flats, before joining the Parks Highway corridor west of Fairbanks, near Nenana. From there it continues south and terminates at MP 737, where it will connect at MP 39 of the Beluga Pipeline (ENSTAR's distribution system) near Big Lake. A lateral pipeline to Fairbanks (Fairbanks Lateral) will take off from the main pipeline just a few miles north of Nenana, at Dunbar. The Fairbanks Lateral will travel northeast to Fairbanks, a distance of approximately 56.3 km (35 mi).

The proposed ASAP project would require a Gas Conditioning Facility (GCF) to be constructed near Prudhoe Bay. This GCF is expected to require a large sealift of modules that will be off-loaded at West Dock. This sealift will likely require dredging a navigational channel to the West Dock dockhead that would be deeper than the existing navigational channel at West Dock. The sealift for the GCF modules would also require improvements to West Dock, including the placement of breasting dolphins and raising the height of the existing dockhead to accept the large modules.

2.8.15 Gas Hydrate Exploration and Research

There has been a growing interest in the North Slope's gas hydrate resource in the past five years. It is estimated that the North Slope has in excess of 85 trillion cubic feet of technically recoverable gas hydrate reserves (Collette 1995). Federal funds from the U.S. Department of Energy support domestic gas hydrate exploration, research and development programs. U.S. federal-industry partnerships are expected to begin long-term production testing on the North Slope in the next few years (Ruppel 2011). The State of Alaska has conveyed its support of gas hydrate research and development by establishing the Eileen hydrate trend deferred area near Milne Point, offering leases specifically for gas hydrate exploration and research.

A few recent gas hydrate exploration and test wells have been drilled within the Petition area. With both federal and state government agencies supporting this research, interest in gas hydrates is expected to grow during in the coming years. This interest may be somewhat moderated by the many questions regarding the economic viability of developing gas hydrate resources. For these reasons a relatively low, but an increasing level of gas hydrate exploration and research is expected during the Petition period.

3.0 DATES, DURATION, AND REGION OF ACTIVITIES

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

The geographic area of activity, illustrated in Figure 1-1, covers a total area of approximately 68.9 million acres (27.9 million hectares). The area of activity includes land on the North Slope and adjacent waters of the Beaufort Sea including state waters and OCS waters. The area extends from Point Barrow on the west to the U.S.-Canada border on the east. The onshore boundary is 40 km (25 mi) inland, excluding the area within ANWR. The offshore boundary is the BOEM Beaufort Sea Planning Area, approximately 322 km (200 mi) offshore.

Some of the activities to be conducted are expected to occur on a year-round basis. Anticipated types of activities are outlined in Chapter 2. Activities over the next five-year period can be expected to involve: continued operations in the existing, producing oilfields, in-field drilling, and maintenance activities to maximize production in the existing oilfields, seismic survey activities to determine the presence of new hydrocarbon deposits (both onshore and offshore), exploratory and appraisal drilling both onshore and offshore to verify hydrocarbon accumulations, development of new oilfields following exploratory activity, cleanup activities from decommissioning, and closeout of exploration and/or production facilities.

The locations of these activities are assumed, for the purpose of this Petition, to be approximately equally divided among the onshore and offshore tracts presently under lease and to be leased during the period under consideration. Remediation and closeout activities at decommissioned exploratory well sites or production facilities could occur at up to 10 sites annually at various locations across the North Slope, where activities have been previously conducted.

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 over the next five-year period. The specific dates and durations of the individual operations and their geographic locations will, however, be set forth in detail when requests for LOAs are submitted by industry applicants to USFWS.

The descriptions of existing and future activities presented in this Petition have been compiled from information supplied by AOGA member companies and the following non-members: CPAI, BRPC, and ASRC. These projections are also intended to encompass activities to be undertaken by companies not participating in this Petition (i.e., contractor and sub-contractor companies providing services to the oil and gas lease holders).

4.0 SPECIES, NUMBER, AND TYPE OF TAKE

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.

Pursuant to Section 101(a)(5) of the MMPA, AOGA petitions the USFWS to renew regulations for taking of polar bear and Pacific walrus incidental to oil and gas exploration, development, and production operations and all associated activities on the North Slope (area shown in Figure 1-1) for the period of five years beginning August 3, 2016 and extending through August 3, 2021. Renewal of the regulations would allow the incidental, but not intentional, non-lethal taking of small numbers of polar bears and Pacific walruses in the event that incidental takes occur from oil and gas activities in the aforementioned area.

AOGA anticipates that all incidental takes addressed by this Petition will be non-lethal and is petitioning for incidental Level B harassment take authority for both polar bears and walruses. This Petition does not seek take authorization for intentional harassment, mortality and injury, or for Level A harassment (see supra § 1.2.1). Intentional harassment authorizations are separately applied for individually by each operating company and authorized pursuant to Sections 101(a)(4), 109(h), and 112(c) of the MMPA.

Not all the animals exposed to an activity will necessarily have a behavioral response to, or be disturbed by the activities described in this Petition. Further, not all behavioral responses will be to a degree of causing a disruption of behavioral patterns that constitute a take as defined in the MMPA. According to the USFWS's guidelines, behavioral responses may include subtle to obvious changes in behavior, movement, or displacement (76 FR 77782). The USFWS's guidelines provide that, to constitute a take, a behavioral response must be biologically significant in that migration, breathing, nursing, breeding, feeding, or sheltering of an animal is disrupted (76 FR 54433). If a behavioral response includes a momentary change in behavior or moving a small distance, the impacts are not likely biologically significant to the population (76 FR 77782). Therefore, because a behavioral response or disturbance does not necessarily constitute Level B harassment, the actual amount of ancitipated Level B harassment is a small subset of the total estimated responses described below.

4.1 Polar Bear

As discussed in detail in Chapter 6, the types of oil and gas activities having the potential to impact and result in an incidental take of a polar bear include noise disturbance, temporary or permanent physical obstructions, facility development and operations, human and vessel encounters, and spills. The potential for incidental take caused by these activities is generally greater during summer and fall when more bears are found near coastal areas of activity. Polar bear sightings may also be greater near denning areas onshore during winter and spring. Sows with cubs are most likely to be sighted after emerging from dens in the spring; however, a concerted effort is made by oil and gas operators to avoid dens by identifying and mapping their locations and by compliance with USFWS restrictions on the proximity of oil and gas activity to an active or potential den site (see Chapter 10).

Estimates of the number of polar bear responses that may occur within the Petition area in 2016-2021, and the number of these interactions that might result in polar bear behavioral disturbances, some of which could potentially result in Level B incidental take under the MMPA, are provided below. These estimates are based on polar bear sighting reports provided by industry, and projected future oil and gas activity levels. This analysis assumes that the level of activity within the Petition area is correlated with the potential number of polar bear responses, and that an increase in the amount of onshore activity within polar bear habitat would likely increase the potential for interactions, thereby increasing the potential for incidental takes of polar bears.

Section 4.1.1 presents the results of a review of all reported polar bear observations from the geographical area of the Petition for 2008 to 2012 and an assessment of the portion of those observations that may have resulted in polar bear behavioral responses. The time period was extended back to 2006 for offshore activities, such as seismic surveys, shallow hazards surveys, and exploration drilling, because of small sample sizes in the period of 2008-2012. As discussed above, interactions that could potentially be considered takes under the MMPA are a subset of these behavioral responses. Section 4.1.2 provides projected estimates of the potential number of polar bear behavioral responses that might occur near oil and gas activities during the period of the Petition, based on future activity levels in comparison to 2008-2012 activity levels.

Oil and gas industry operators working in the Petition area provide reports of all polar bear sightings and summarize the sightings in annual reports to USFWS as required by conditions of their LOAs. Offshore operators also report the results of marine mammal monitoring efforts to NMFS and USFWS in the form of 90-day reports and comprehensive reports as required by ITRs, LOA, and IHA conditions. Observational reports from these documents provide data on the age/sex of the polar bear (if possible), number of bears, type of encounter, and any behavioral response (if observed) to the oil and gas activity. AOGA compiled all such reports that are available for the North Slope from 2008 to 2012 (and 2006 to 2012 for offshore activities). The reports were reviewed to summarize the number of polar bears observed by oil and gas operators during these past years and the documented behavioral responses of these polar bear observations. It is important to note that the same polar bear or group of polar bears can be seen (and reported) multiple times within a single day and/or on different days. Furthermore, non-industry related events (e.g. whale carcasses onshore) may cause spikes in polar bear sightings in the area.

4.1.1 Polar Bear Behavioral Responses during Past Activities

4.1.1.1 Polar Bear Responses during Past OCS Activities

Polar bear sightings and potential behavioral responses from oil and gas activities in the OCS were compiled from 90-day reports submitted by operators to NMFS and USFWS.

4.1.1.2 Seismic Surveys

Available 90-day monitoring reports indicate that seven seismic surveys were conducted from 2006 through 2012. Two of these surveys were ocean bottom cable surveys in open water conditions, two were 2D seismic surveys conducted in both open water and ice conditions, two were 3D seismic surveys conducted in open water conditions and one was a 2D survey conducted only in open water conditions. A total of 19 polar bears were observed during these survey programs. In the 90-day reports, no behavioral responses were noted or recorded by observers during the monitoring efforts for these programs.

4.1.1.3 Shallow Hazards Surveys

Available 90-day reports indicate that four shallow hazards surveys were conducted in the Beaufort Sea from 2006 to 2012. A total of 72 polar bears were observed during these surveys. No reactions or responses were recorded for most observed polar bears, and potential behavioral responses to project activities were recorded by observers. These responses were noted in fewer than 6 percent of the 72 observed bears and are considered behavioral responses for the purposes of this analysis.

4.1.1.4 Exploration Drilling

Thirty-five exploration wells have been drilled in Federal waters of the Beaufort Sea OCS from the 1980s to 2014. A single exploration drilling program was conducted in the Beaufort Sea OCS during the period from 2008 through 2012. This drilling program consisted of the top portion of a single well. A total of 104 polar bears (29 sightings) were observed during the drilling program. Thirty-nine of the polar bears (13 sightings) were observed from moving vessels, and 65 polar bears (16 sightings) were observed from stationary vessels. Only four of the polar bears (two sightings) were observed from the sound source vessels (drilling unit, anchor handler). Many polar bears were seen onshore. All of the sightings of polar bears in water involved single individuals. Group sizes of polar bears on ice or land ranged from 5 to nearly 20 animals feeding on a whale carcass.

The polar bears were noted as looking at the vessel when observed during about 25 percent of the observations, but this was not considered a behavioral response for the purposes of this analysis. No other types of responses or reactions were observed and reported.

4.1.1.5 Polar Bear Responses during Past Onshore / Coastal Activities

Polar bear sightings and potential behavioral responses to onshore and coastal oil and gas activities were compiled from annual reports and polar bear sighting forms prepared by North Slope operators. These polar bear sighting reports represent the most comprehensive data set regarding polar bear interactions with oil and gas industry activities on the North Slope.

Summary reports of polar bear observations from 2008 through 2012 were received from five operators in the ITR geographic region. Based on these reports, a total of 588 polar bear sightings, representing 941 individual bears, were recorded from 2008 through 2012 (Table 4-1). A single sighting report sometimes represents more than one bear. For instance, the sighting of a sow with two cubs would be reported as one sighting of three bears. These numbers also include repeated sightings of the same polar bear. A single polar bear may be sighted and reported multiple times during the year, or even multiple times in the same day by different operators or different observers.

Table 4-1. Polar Bear Sightings at North Slope Oil and Gas Units in 2008-2012

Year	Alpine	Badami	Endicott Liberty	Kuparuk	North Star	Milne Point	Nikaitchuq	Ooguruk	Prudhoe Bay	Point Thomson	All
2008	2	1	21	5	3	5	12	5	16	0	70
2009	2	3	39	6	4	5	8	3	37	25	132
2010	0	0	6	8	1	3	0	0	7	28	53
2011	4	0	76	1	8	0	28	3	1	1	122
2012	1	0	67	2	10	0	39	2	75	15	211
All	9	4	209	22	26	13	87	13	136	69	588

We reviewed information available for the 588 sightings (941 observed bears) in an effort to determine how many of the observed interactions may have resulted in polar bear behavioral responses. Interactions that could potentially be considered takes under the MMPA would be a subset of these behavioral responses.

For each observation, we estimated the shortest distance between the polar bear and the observer (or activity). Out of the total of 941 observed polar bears, 133 polar bears (14.2 percent of total) were at distances greater than 1,000 m (3,281 ft). Polar bear sightings that took place at distances greater than 1,000 m (3,281 ft) were not further analyzed in detail. This distance is greater than the setbacks required by agencies, including USFWS, for aircraft and vessel traffic, which were designed to avoid disturbances and incidental takes. There was no sighting distance recorded for 128 of the observed polar bears; however, a review of the observational data for these 128 polar bears indicate no or subtle behavioral responses occurred, and thus would likely not rise to the level of a take.

Observations of the remaining 680 polar bears, consisting of sightings within 1,000 m (3,281 ft) were reviewed for behavioral response. Two data fields in the observation reports were closely examined during this review: 1) initial and subsequent behavior of the polar bear, and 2) description of the encounter. The types of reported behavioral activities that were generally considered to represent evidence that the bear had exhibited a behavioral response are identified in Table 4-2. Each encounter was reviewed individually to determine which polar bears may have displayed a behavioral response[1]. The analysis indicates that a total of 32 (4.7 percent) of the 680 observed polar bears may have exhibited some type of behavioral response to the oil and gas activity, an average of 6.4 potential behavioral responses per year.

[1] Behavioral descriptors are inherently subjective and directly based on sightings recorded by observers. Some behaviors may fall under one or more categories and USFWS may categorize behaviors differently than the analysis presented here.

Table 4-2. Descriptors of Polar Bear Behavior from Observations on the North Slope in 2008-2012[1]

Polar Bear Behavior Descriptors in Observation Reports		
Descriptors Likely Representing Normal Behavior – Not Indicating a Response	**Descriptors Possibly Representing a Change in Behavior – Possibly Indicating a Response**	**Descriptors Representing a Change in Behavior – May Indicate a Response**
beachcombing, calm, crossing road, curious, difficulty, digging, eating, feeding, floating, foraging, hunting, laid down, laying down, lethargic, loitering, moving, moving with limited movement, passing by, playing, resting, searching for food, sleeping, sleepy, smelling, stationary, swimming, traveling, walking, walking on beach, wandering around	arrived at area, looking, running, sitting up, standing, standing up in water, walking around buildings, walking towards rig	aggressive, alert, avoid contact, changed activity, changed course of travel, departed/disappeared, left area, left island, skittish, swam away, swam (in a different direction)

[1] Behavioral descriptors are inherently subjective and directly based on sightings recorded by observers. Some behaviors may fall under one or more categories and USFWS may categorize behaviors differently than the analysis presented here.

4.1.2 Projected Polar Bear Behavioral Responses 2016-2021

The following section presents estimates of the number of polar bear behavioral responses that may occur within the geographic area of the Petition from oil and gas activities in 2016 to 2021. These estimates are based on the rates of polar bear observations and observed responses or reactions identified above in Section 4.1.1.1 and 4.1.1.2 and on possible future oil and gas activity levels as identified below.

4.1.2.1 Future OCS Oil and Gas Activities

AOGA expects combined levels of all OCS oil and gas activities to remain at similar levels to those experienced in 2006 through 2012.

The results of the analyses presented above in Section 4.1.1.1 indicate that OCS oil and gas activities from 2006 to 2012 may have resulted in behavioral responses by fewer than 3 percent of the observed polar bears. Given that the level of oil and gas activity in the OCS is expected to remain at levels similar to those experienced from 2006 to 2012, we project that oil and gas activities during the Petition period of 2016 to 2021 will result in a similar number (approximately one per year) of polar bear responses.

4.1.2.2 Future Onshore / Coastal Oil and Gas Activities

Past onshore and coastal oil and gas acreages of infrastructure were calculated to determine the historic level of increase of activity between 2007 and 2012. The total area of infrastructure of onshore and coastal oil and gas activities in 2007 was 18,129 acres (7,337 hectares) and increased 1.8 percent (327 acres [132 hectares]) to 18,456 acres (7,469 hectares) in 2012 (Table 4-4), resulting in an average annual increase of about 0.4 percent.

Table 4-3. Hectares (acres) of Onshore / Coastal Oil and Gas Infrastructure in 2007 and 2012

Type of Infrastructure	2007	2012	Difference	% Change
Gravels road and causeways	1,250 (3,089)	1,261 (3,116)	11 (27)	0.84%
Airstrips (gravel or paved)	124 (306)	130 (321)	6 (15)	4.56%
Offshore gravel pad/island	67 (166)	82 (203)	15 (37)	21.69%
Gravel pads	2,339 (5,780)	2,359 (5,829)	21 (52)	0.88%
Other affected area	831 (2,053)	861 (2,128)	30 (74)	3.60%
Gravel mines	2,726 (6,736)	2,777 (6,862)	51 (126)	1.87%
Total impacted area	7,337 (18,130)	7,469 (18,456)	132 (326)	1.80%

This average annual level of increase in infrastructure is expected to remain approximately the same over the Petition's time period. To include a margin of error to the uncertainty of future activity levels, we assume that the acreage of infrastructure would increase 0.5 percent per year over the time period of this Petition.

As indicated above in Section 4.1.2.2, human / polar bear interactions at onshore / coastal oil and gas infrastructure and activities may have resulted in about 32 polar bear behavioral responses from 2008 to 2012, an average of 6.4 polar bear behavioral responses per year. Assuming that polar bear / human interactions and polar bear responses are directly correlated with oil and gas activity levels and infrastructure acreages, a 0.5 percent per year increase in infrastructure over the Petition's time period would result in an average of seven potential behavioral responses per year.

4.1.2.3 Total Potential Polar Bear Behavioral Responses 2016-2021

The total projected potential polar bear behavioral responses associated with oil and gas activities in the geographic area of the Petition from 2016 to 2021 based on the above analyses are presented below in Table 4-4. It should be emphasized that these are only projected behavioral responses, many of which would not rise to the level of Level B take under the MMPA.

Table 4-4. Total Potential Polar Bear Behavioral Responses

Time Period	Oil and Gas Activity		
	OCS	Onshore / Coastal	All
2016-2017	1	7	8
2017-2018	1	7	8
2018-2019	1	7	8
2019-2020	1	7	8
2020-2021	1	8	9
2016-2021	5	36	41

4.2 Pacific Walrus

As discussed in Chapter 5, the Beaufort Sea is considered extralimital for Pacific walruses. Accordingly, only very small numbers of walruses are expected to be encountered within the area addressed by this Petition, and only during the open water season. Walruses have been encountered in limited numbers during offshore oil and gas activities in the Beaufort Sea (see Section 5.2.2). Prior to 1995, no more than five walruses were encountered during oil and gas monitoring activities (LGL and Greeneridge 1996). From 2006-2012, no more than 30 walruses were sighted (Beland et al. 2011; LGL et al. 2013). Although it seems that more walruses have been seen in recent years, this might be attributed to increased activity level and thus encounter rate. Although there have been occasional sightings of walruses hauled out on shore, there are no important foraging, haulout, or rookery habitats for this population within the Petition area Few, if any, takes have been documented in the past, or are expected during the five-year period of the proposed ITRs. The types of oil and gas activities that have the potential for an incidental take of walruses include noise disturbance, human and vessel encounters, and spills. A detailed description of these activities and their potential impact on walruses and their habitat is presented in Chapters 6 and 8.

5.0 STATUS, DISTRIBUTION, AND SEASONAL DISTRIBUTION OF SPECIES

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 Bear

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 threatened under the ESA. The USFWS determined that polar bear habitat, principally sea ice, is declining throughout the species' range, that this decline is predicted to continue for the foreseeable future, and that the predicted loss of sea ice threatens the species throughout all of its range (USFWS 2008a). Once a species is listed, the ESA requires the USFWS to prepare a recovery plan. As a result of a recent court order, there is currently no critical habitat designated for the polar bear.

The worldwide abundance of polar bears is estimated to be between 22,000 and 32,000 animals (PBSG 2013). These estimates were derived from information gathered by the International Union for Conservation of Nature (IUCN) Polar Bear Specialist Group (PBSG). The worldwide abundance of polar bears during the development of the previous Petition was 20,000-25,000 animals (Aars et al. 2006). The PBSG identified 19 relatively discrete subpopulations, three of which may be found in the U.S. and surrounding waters in and adjacent to northern Alaska. The polar bear populations that occupy the area of activity addressed in this Petition include the SBS population, and to a lesser extent, the CS population. The CS population overlaps with the SBS population in some northwestern areas of Alaska, particularly between Point Hope and Barrow, which is outside this Petition's geographic area; however, the CS population may extend as far east as the Colville River Delta in the Beaufort Sea (Amstrup et al. 2005). The western boundary of the SBS population is reported to be near Point Hope, Alaska (Amstrup et al. 2005), which is also outside the geographic area addressed in this Petition. Only limited information is known about the Northern Beaufort Sea population, which overlaps with the SBS population in northwestern Canada. The reported western boundary for this population does not extend beyond the western border of Canada (Stirling et al. 2007), which is also outside the geographic area addressed here.

The potential polar bear interactions described in this Petition may occur with bears from either the SBS population or the CS population. Because the petitioned area overlaps with only a small portion of the CS population's range, we expect that the vast majority of the interactions (if not all) that occur will involve SBS bears and that a very small proportion, if any, of the interactions will involve CS bears. The relative proportions of the interactions that occur with each population will be small in relation its overall population size[2], and will have no more than a negligible impact on each population. Moreover, in the event that all interactions were to occur with a single population, those interactions would be small in relation to the size of the overall population (whether the SBS or the CS population) and would have no more than a negligible impact on the population. The remaining analyses in this Petition focus on the SBS population since all, or almost all, of the potential interactions are expected to occur with the SBS population.

[2] The CS polar bear population is estimated to be at least 2,000 bears (Walton et al. 2013; PBSG 2013). See Section 5.1.1.1 for information on the SBS population size.

5.1.1.1 Southern Beaufort Sea Population

Amstrup et al. (1986) estimated the size of the SBS subpopulation to be approximately 1,800 bears. A revised population assessment derived from capture-recapture data collected during 2001 to 2006 estimated 1,526 (95 percent Confidence Interval [CI] = 1,211 to 1,841) polar bears in the SBS population (Regehr et al. 2006). A decline in the population cannot be concluded as the two estimates cannot be statistically differentiated (Regehr et al. 2006). Although not statistically concluded, the status of the subpopulation 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 SBS polar bears may be experiencing a decline in nutritional status that may be related to changing sea ice conditions (Rode et al. 2013; Rode et al. 2007). More studies are required to address the status and trend of the population before firm conclusions can be made. As described above, the polar bear species (which includes the SBS population) was determined to be "threatened" primarily because of threats associated with projected future habitat loss resulting from the projected effects of climate change.

5.1.2 Distribution and Seasonal Distribution

Polar bears are unevenly distributed throughout the circumpolar Arctic and are most often located on the annual ice over the waters of the continental shelf where their main prey, ringed seals (*Phoca hispida*), are most abundant (Amstrup et al. 1986; Stirling and Derocher 2007; Pilfold et al. 2012). Polar bear distribution in most areas varies annually and seasonally with the extent of sea ice cover and availability of prey (Figure 5-1).

The SBS polar bear population is shared between Canada and Alaska. The population occurs between Point Hope, Alaska on the western boundary and Pearce Point, Northwest Territory, Canada (Amstrup et al. 1986; Amstrup and DeMaster 1988; Stirling et al. 1988; Amstrup et al. 2000).

The distribution of some polar bear populations during the open water and early fall seasons have changed in recent years. In the Beaufort Sea, only a small percentage of the polar bear population actually comes ashore, but in recent years, more are being found onshore (Schliebe et al. 2006; Regehr et al. 2010; Rode et al. 2012). This is likely related to the increasing numbers of bowhead whale (*Balaena mysticetus*) carcasses left by the Iñupiat hunters at Cross Island and Kaktovik, which provide a readily available food source for the bears in these areas (Schliebe et al. 2006), and may also result from the increased observations and reporting required by USFWS in MMPA ITRs. Durner et al. (2007) and Rode et al. (2013) suggest that the future distribution of polar bears may be linked to the loss of their preferred habitat, sea ice. Analyses from satellite tracking data of female polar bears and new spatial modeling techniques indicated the boundary between the Northern Beaufort and the SBS populations needs to be adjusted, probably expanding the area occupied by bears from the Northern Beaufort Sea and retracting that of the SBS (Amstrup et al. 2005; Aars et al. 2006). The boundary change is proposed and under consideration by members of the Polar Bear Management Agreement (Inuvialuit Game Council of Canada and the North Slope Borough of Alaska – USFWS 2010).

Each fall/winter, polar bears migrate south with the sea ice, then advance north with the retreat of sea ice in spring/summer. In the winter, polar bears den and feed on the sea ice and along the northern coastline (Amstrup and Gardner 1994); bears that don't stay onshore retreat with the ice during summer. Sea ice disappears from the Bering Sea and is greatly reduced in the Chukchi Sea in the summer, and polar bears occupying these areas move as much as several thousand km to stay with the pack ice (Garner et al. 1990). Sea ice provides a platform from which to hunt seals; to seek mates and breed; as a platform for maternity denning and as a platform on which to move to terrestrial maternal denning areas; and as a substrate on which to make long distance movements (Stirling and Derocher 1993).

Data from telemetry studies on female polar bears indicate that their movements are not random, nor do they passively follow ocean currents on the ice as previously thought (Mauritzen et al. 2003). 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 what information is available reflects movement data collected prior to the recent changes of ice conditions.

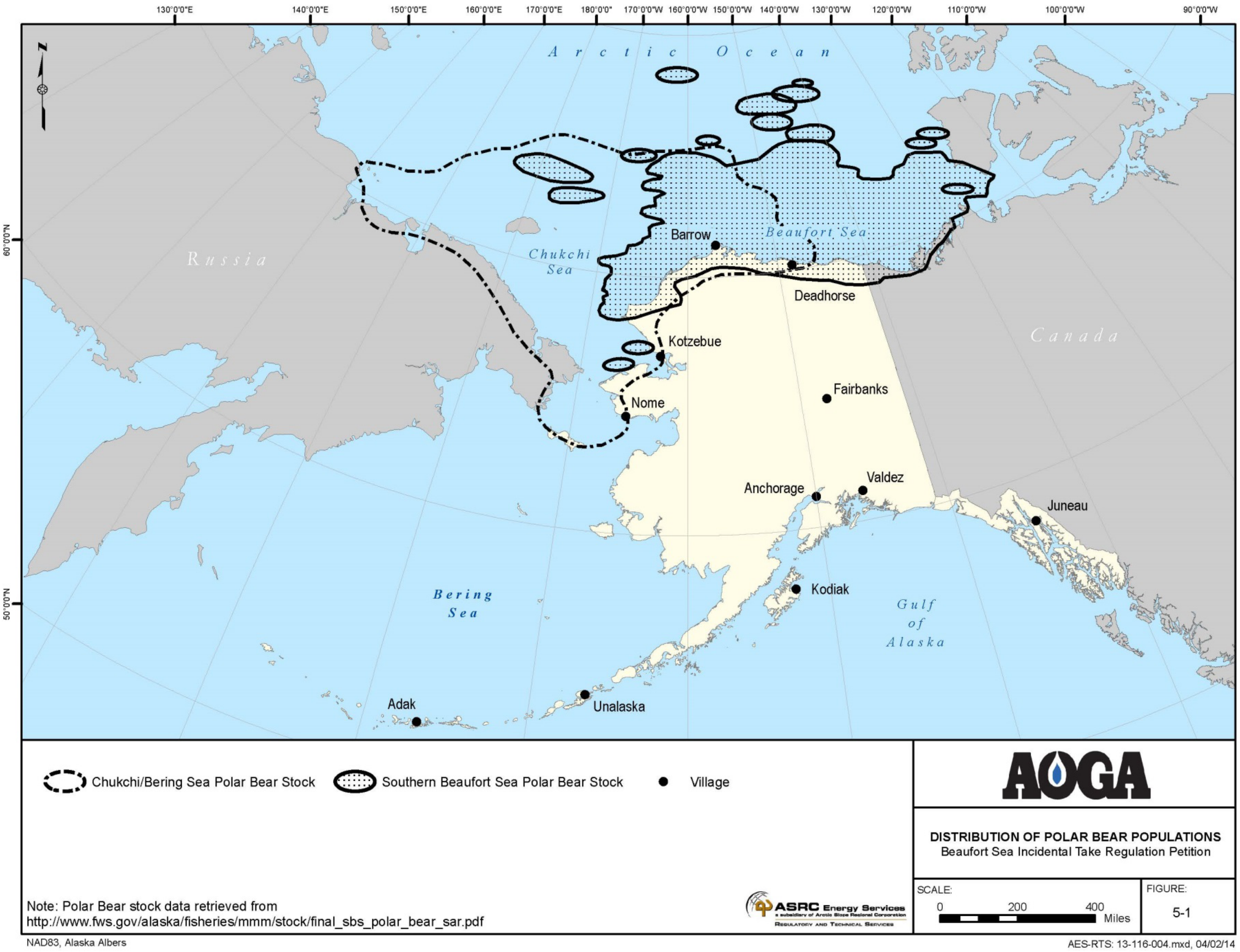

Figure 5-1. Distribution of Polar Bear Populations (USFWS 2010).

Radio collar studies indicate that male and female polar bears have similar activity areas on a monthly basis, but males may travel farther than females (Amstrup et al. 2000). Telemetry data from radio-collared females indicate some individuals occupy home ranges (or "multi-annual activity areas") which they seldom leave (Amstrup 2003). The size of a polar bear's home range is determined, in part, by the annual pattern of freeze-up and break-up 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 kilometers 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 149,000 square km (58,000 square mi) in the Beaufort Sea (Garner et al. 1990; Amstrup et al. 2000).

5.1.3 Feeding Ecology

Polar bears are carnivorous and are the top predator of the arctic marine ecosystem. Polar bears prey heavily on ice seals, predominantly ringed seals and, to a lesser extent, bearded seals (*Erignathus barbatus*). The relationship between ringed seals and polar bears is so close in some areas that ringed seal abundance may regulate polar bear densities, while polar bear predation regulates ringed seal density and reproductive success (Hammill and Smith 1991; Stirling and Øritsland 1995). In December 2012, NMFS listed certain subspecies and "distinct population segments" of ringed and bearded seals as threatened under the ESA (NMFS 2013a).

Over half the caloric content of a seal is located in the layer of fat between the skin and underlying muscle (Stirling and McEwan 1975). Polar bears show their preference for fat by quickly removing the fat layer from beneath the skin after catching a seal. On average, an adult polar bear needs approximately 2 kg (4.4 lb) of seal fat per day to survive (Best 1985). Polar bears hunt along pressure ridges in the fast ice and often break into seal birth lairs to take newborn pups (Stirling and Archibald 1977; Furgal et al. 1996).

Polar bears are opportunistic feeders and feed on a variety of other foods and carcasses including beluga whales (*Delphinapterus leucas*), arctic cod (*Arctogadus glacialis*), Canada geese (*Branta canadensis*) and their eggs, walruses, and bowhead whales (Smith 1985; Jefferson et al. 1993; Smith and Hill 1996; Derocher et al. 2000). Lunn and Stenhouse (1985) report possible cannibalism among polar bears. Derocher et al. (2004) and Rode et al. (2013) hypothesized that prey availability to polar bears may be altered due to 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 at Kaktovik and Cross Island; these discarded bowhead carcasses may provide a substantial proportion of the annual energy requirements for polar bears (Schliebe et al. 2006).

5.1.4 Reproduction

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). Mating occurs from April to June followed by a delayed implantation during September to December. Females give birth usually the following December or January (Harington 1968; Jefferson et al. 1993). 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).

In the Beaufort Sea, ringed seal densities are lower than in some areas of the Canadian High Arctic and Hudson Bay. As a possible consequence, female polar bears in the Beaufort Sea 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 over 20 years old have a very high rate of cub loss or do not successfully reproduce. The maximum reproductive age reported for Alaskan polar bears is 18 years (Amstrup and DeMaster 1988).

Regehr et al. (2007) determined that 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 ice-free period over the continental shelf (Regehr et al. 2010; Rode et al. 2013).

5.1.5 Denning

Pregnant female polar bears excavate dens in snow on land and on pack and shorefast sea ice in the fall-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 that create denning habitat (Harington 1968). The common characteristic of all denning habitat are 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. More recent research indicates dens are scattered throughout the Beaufort Sea region of Alaska, concentrated along rivers and coastline (Durner et al. 2010; USGS 2013). Of 22 terrestrial dens examined on the coastal plain of northern Alaska, 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) that were readily distinguishable from the surrounding terrain in summer and physically suited to catch snow in the early winter (Durner et al. 2003).

More than 80 percent of maternal dens found on land by radio telemetry in the Alaskan Beaufort Sea were within 10 km (6.2 mi) of the coast and over 60 percent were right on the coast or on coastal barrier islands (S.C. Amstrup, unpublished data cited in Feldhamer et al. 2003).

Fidelity to denning locales 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.

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, 1992; Smith et al. 2007).

Predicted declines and large seasonal swings in 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 between 1985 and 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 coastal areas may increase until autumn ice retreats far enough from the shore that it precludes offshore pregnant females from reaching the Alaska coast in advance of denning. Regehr et al. (2010) found polar bear breeding rates and cub litter survival declined with increasing duration of the ice-free period.

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 2008c). 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 upon 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; Robinson et al. 2012). 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 activity does not account for large percentage of the cub mortality.

Population age structure data indicate subadults (two to five 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 avoid serious injury may become too old and feeble to hunt efficiently and most are generally believed to die of old age.

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

As described in Section 5.1, polar bears are an ice-obligate species that rely 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 retreat of sea ice during the summers of 2007 and 2012 (National Snow and Ice Data Center 2013). The 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) is due in October 2014, but the 4th Assessment Report (IPCC 2007; http://www.ipcc.ch/ipccreports/ar4-syr.htm) observed that decreases in snow and ice extent are consistent with climate warming, and that satellite data since 1978 show that 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 Beaufort 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 SBS population of polar bears.

Many of these studies also suggest other factors could have caused or contributed to the reported changes in polar bear life history features, including changes in prey distribution and abundance, disease, readily available food sources, and hunting patterns. The carrying capacity of the Beaufort Sea is not known, which could have a major influence on any changes in polar bear life history. 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 in order to forecast the range-wide status of polar bears in the 21st century based on their ecological relationship to sea ice. These included the Polar Basin Divergent Ecoregion that encompasses the SBS subpopulation. Amstrup et al. (2007) incorporated projections of future sea ice in each ecoregion into two models of polar bear habitat and potential response. Under both modeling approaches, polar bear populations were forecast to decline throughout all of their range during the 21st century.

5.2 Pacific Walrus

5.2.1 Population Status and Trend

The Pacific walrus is not listed as threatened or endangered under the ESA or classified as depleted or a strategic stock under the MMPA (Angliss and Outlaw 2008), although the USFWS has designated it as a “candidate” species under the ESA. Pacific walruses are found throughout Arctic waters, typically associated with the offshore pack ice (USFWS 2007). The walrus stock is found throughout the northern Bering and Chukchi Seas, occasionally moving into the East Siberian and Beaufort Seas (USFWS 2013a). Estimates of the pre-exploitation population of the walrus range from 200,000 to 250,000 animals (Angliss and Outlaw 2008). Over the past 150 years, the population has been depleted by over-harvesting and then periodically allowed to recover (Fay et al. 1989; USFWS 2013a).

The current size of the walrus population is unknown, but the best available minimum population estimate, based on aerial surveys between the U.S. and Russia is 129,000 walruses (95 percent CI = 55,000-507,000) (Speckman et al. 2011). This is considered an underestimate because some areas known to be important to walruses were not surveyed due to poor weather (Speckman et al. 2011; USFWS 2013a). Between 1975 and 1990, aerial surveys were also carried out by the U.S. and Russia at five-year intervals, producing population estimates ranging from 201,039 to 234,020 animals. These are considered conservative population estimates and are not useful for detecting trends (Hills and Gilbert 1994; Gilbert et al. 1992). Efforts to survey the walrus population have been intermittent due to unresolved problems with survey methods that produced population estimates with unacceptably large confidence intervals (Gilbert et al. 1992; Gilbert 1999).

5.2.2 Distribution and Seasonal Distribution

The Pacific walrus inhabits the moving pack ice over the shallow waters of the continental shelf of the Bering and Chukchi seas. Walruses summering in the Chukchi Sea are very widespread, and they occur across the pack ice from Wrangel Island to the coast of Alaska (Estes and Gilbert 1978) although recently concern has increased about the number using coastal haulouts (Kavry et al. 2008; Garlich-Miller et al. 2011). Walrus are rare in the Alaskan Beaufort Sea east of Point Barrow. Walrus migrate north and south following the annual advance and retreat of the pack ice. The distribution of walrus is shown on Figure 5-2.

Adult male walruses remain in the Bering Sea year round, while females, pups, and juveniles summer in the Chukchi Sea. Pacific walrus use 21 major haulout sites in Alaska (USFWS 2013b). An unusually light ice year in 2007 resulted in walruses that summered in the Chukchi Sea hauling out between Point Lay and Point Barrow. Walruses retreated to the shoreline after the pack ice retreated north of the shallow OCS waters (Ireland et al. 2008). There are currently no known haulout sites from Point Barrow to Demarcation Point on the Beaufort Sea coast (USFWS 2013b).

The migration pattern varies annually. During winter, large concentrations of walrus 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 pack 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. Recently coastal haulouts along the Alaska and Russian coasts have increased dramatically, from hundreds to greater than 100,000 (Kavry et al. 2008; Garlich-Miller et al 2011; Jay et al. 2011).

Walrus sightings in the Beaufort Sea have consisted solely of widely scattered individuals and small groups. While walrus have certainly been encountered and are present in the Beaufort Sea, there were only five sightings of walrus between 146º and 150º West longitude during MMS and LGL Research Associates (LGL) aerial surveys conducted from 1979 to 1995 (LGL and Greeneridge 1996). Aerial and vessel surveys conducted by LGL between Harrison Bay and Kaktovik in 2006 and 2007 reported no walrus in 2006 and fewer than 15 in 2007 (Ireland et al. 2008). More recent industry monitoring surveys have reported a combined total of less than 30 walrus sightings from 2006-2012 (LGL et al. 2013). These results confirm that walruses are very uncommon in the Beaufort Sea.

5.2.3 Feeding Ecology

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 obtained from bottom sediments along the shallow continental shelf, typically at depths of 80 m (262 ft) or less (Fay 1982). They can eat more than 50 clams during a single seven-minute dive to the seafloor and consume 35 to 50 kg (77 to 110 lb) of food per day. Pregnant and nursing walruses consume even more food (Fay 1985; Born et al. 2003).

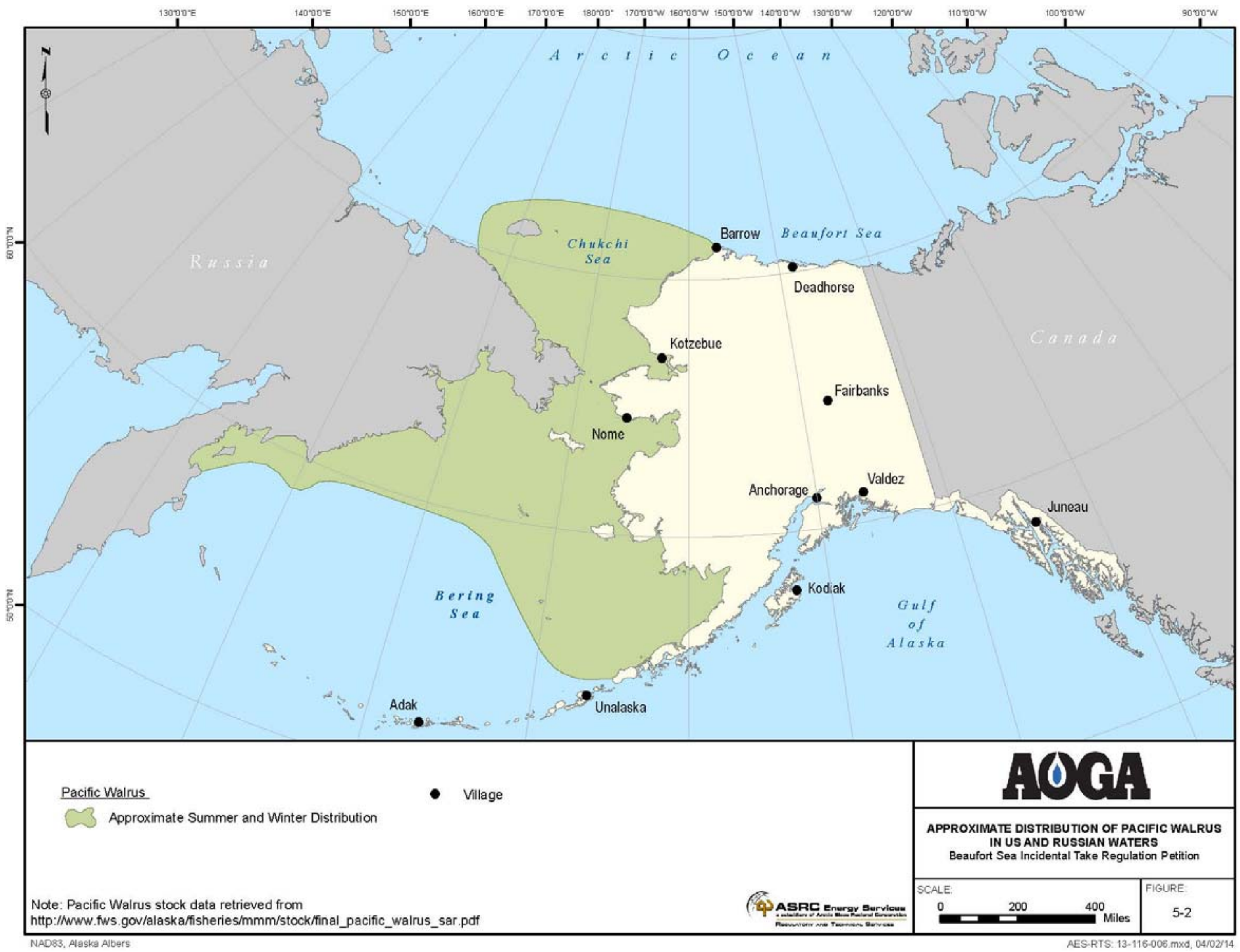

Figure 5-2. Approximate Distribution of Pacific Walrus in U.S. and Russian Waters (USFWS 2010).

Walruses also feed on a variety of benthic invertebrates, including worms, snails, shrimp, and some slow moving fish (Jefferson et al. 1993). 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). Since the walrus feed on benthic invertebrates, which are distributed in patches, this continually moving ice facilitates their feeding 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; Bornhold et al. 2005). 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

Male walruses reach sexual maturity between 8 and 10 years, but usually do not breed until age 15 (Fay 1985). Females reach sexual maturity around six to eight years of age (Fay 1985).

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 lb) at birth and are usually weaned by age two (Fay 1982). Females give birth to one calf every two or more years (Fay 1982).

5.2.5 Survival

Although the reproductive rate described in the previous section is much lower than other pinnipeds, some walrus may live to age 35 to 40 and remain reproductively active until age 26 (Fay 1982; Born 2001).

Walrus 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 documentation of such events exists. Rock slides are a hazard to walruses on terrestrial haulouts and occasionally result in mortality (USFWS 2008d).

Serious injury and death can result from intra-specific interactions, mainly involving strikes with tusks and trampling. Skin lacerations and subcutaneous hemorrhages resulting 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 abortion, injury, and death during stampedes at crowded haulouts and has been observed at Wrangel Island in the Chukchi Sea and the Punuk Islands in the Bering Sea (USFWS 2008d).

5.2.6 Climate Change

The specified geographic area to which the proposed ITR applies (the Beaufort Sea) is outside of the primary habitat of the Pacific walrus. Only widely scattered individuals and small groups are present and then only during open water periods. Accordingly, there is no present evidence or prediction that the consequences of climate change, particularly sea ice recession, pose a direct threat to the abundance, distribution or significant behaviors of Pacific walrus that infrequently inhabit the Southern Beaufort Sea region.

The USFWS conducted a status review of the Pacific walrus in 2011 and concluded that its listing as threatened or endangered under the ESA is warranted but was precluded by higher priority actions. The status review analyzed the potential future impacts of climate change on Pacific walruses and concluded that walrus responses to low-ice years may include an increased use of coastal haulouts and a shift in habitat use patterns (Garlich-Miller et al. 2011).

As discussed earlier in this section, sea ice plays an important role in the life history of the Pacific walrus. As detailed in Section 5.1.7, sea ice is more frequently disappearing from the continental shelf of the Chukchi Sea. Jay and Fischbach (2008) hypothesize that when the sea ice recedes 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 minimum sea ice extent in the summers of 2007 and 2013 (National Snow and Ice Data Center 2013), the Chukchi Sea shelf contained little ice for approximately 80 days and several thousand walruses hauled out on the shores of northwestern Alaska, which had not been previously documented (Jay and Fischbach 2008; Garlich-Miller et al. 2011).

During fall 2007, tens of thousands of female and young walruses began using resting areas along the northern coast of Chukotka, after sea ice was no longer available. A few thousand mortalities were reported at this location, apparently from trampling due to disturbances that caused adults to stampede into the water (Jay and Fischbach 2008).

As more walruses haul out on land instead of sea ice, nearshore prey populations may be subjected to greater predation pressure. Today, it is unknown whether more concentrated foraging by walrus 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 walrus and the prey upon which they depend.

6.0 ANTICIPATED IMPACT ON SPECIES

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

This section provides an overview of the potential impacts of proposed oil and gas exploration activities expected to occur in the Beaufort Sea region from 2016 to 2021. Anticipated effects on polar bears and walruses are limited to include temporary and localized changes in behavior, with no long-term consequences or detectable effects at the population level. The footprint of these activities is small compared to the ranges of polar bears and walruses in the region. Industry will implement mitigation measures to minimize any potential impacts to these species (see Section 10.0 Mitigation Measures).

The following sections provide an overview of acoustic terminology, a discussion of the general effects of sound on wildlife, a description of factors associated with oil and gas activities (e.g. noise, drilling, facilities, and humans), and the potential impacts of oil and gas associated activities on polar bears and walruses.

6.1 Polar Bear

6.1.1 Noise

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

6.1.1.1 Noise Background

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water. The disturbed particles of the media 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.

The intensity of sound is characterized by decibels (dB). 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 a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus: 60 dB + 60 dB = 63 dB, and 80 dB + 80 dB = 83 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.

Because the decibel is a relative measure, any absolute value expressed in dB is meaningless without the appropriate reference. The metric that describes the change in pressure (amplitude) is the pascal (Pa), approximately equivalent 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. It is possible to convert between the reference pressures, in this instance 26 dB. However, the efficiencies of sound generation and reception in air and water differ greatly, so simply adding a constant to the underwater sound pressure level (SPL) will not allow a reasonable assessment of how the sound is perceived by the receiver.

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighting system that reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called "A" weighting, and the decibel level measured is called the A weighted sound level (dBA). Sound levels to assess potential noise impacts on wildlife, airborne or underwater, are not weighted and measure the entire frequency range of interest.

Hertz (Hz) is a measure of how many times each 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. When 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/brain as a tonal pitch of 100 Hz. Sound frequencies between 20 and 20,000 Hz (or 20 kHz) 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 for each species in the text below.

As sound propagates out from the source, there are many factors that change the amplitude. These 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 propagation including these factors is called the transmission loss (TL). Transmission loss parameters vary with frequency, temperature, wind, sea conditions, source and receiver depth, water chemistry, and bottom composition and topography.

Table 6-1 summarizes commonly used terms to describe underwater sounds. Two common descriptors are the instantaneous peak 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 time period.

Table 6-1. Definition 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 micro Pascal (μPa) and for air is 20 μPa (approximate threshold of human audibility).
Sound Exposure Level, SEL	Sound exposure level is the total noise energy produced from a single noise event and is the integration of all the acoustic energy contained within the event. SEL incorporates both intensity and duration of a noise event. SEL is expressed in dB re 1 μPa^2 and is also described as "energy-based" measure that may become more utilized during the period of this Petition.
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 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 m^2. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure 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 Hz to 20,000 Hz (or 20 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 to 20,000 Hz. This pressure is expressed in this Petition as dB re 1 μPa.

Term	Definition
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 comprise that portion of waveform containing 90 percent of the sound energy for one impulse.
A-Weighting Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

6.1.1.2 Potential Effects of Noise on Wildlife

General effects of noise on wildlife may range from direct effects, such as physical injury to the auditory system, to indirect effects, such as change in habitat use. Noise may directly affect reproductive physiology or energetic consumption as individuals incur energetic costs or lose mating or foraging opportunities by repeatedly reacting to or avoiding noise. Animals may also be forced to retreat from favorable habitat in order to avoid aversive anthropogenic noise levels. Though the direct effects of noise on wildlife may be the most obvious, noise may also have indirect effects on population dynamics through changes in habitat use, courtship and mating, reproduction and parental care, and possibly migration patterns. Excessive noise may also affect mortality rates of adults by causing hearing loss, a serious hazard in predator-prey interactions. Other effects of noise on wildlife may be more subtle, such as those affecting heart rate or communication. In species that rely on acoustic communication, anthropogenic noise may adversely affect individual behavior by making signal detection difficult and thus altering the dynamic interaction between the producers and perceivers of communicative signals.

In assessing potential effects of noise, 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 temporary threshold shifts (TTS, temporary loss in hearing) or permanent threshold shifts (PTS, loss in hearing at specific frequencies or deafness). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage.
- ***Zone of masking –*** the area within which the noise 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 noise 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). However, temporary behavioral effects are often simply evidence that 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 noise. Marine mammals as a group have functional hearing ranges of 10 Hz to 180 kHz, with best

thresholds near 40 dB (Ketten 1998; Southall et al. 2007). Hearing capabilities of the species included in this Petition are discussed further below.

In addition, habituation of animals to their environment also is a significant factor in assessing potential impacts of noise. 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). No study takes place without subjects habituating to their environments. More predictable sources of disturbance can lead to greater habituation in situations than less predictable ones. Situations in which similar noise-producing activities occurring in the same habitat at frequent intervals may therefore affect locally breeding wildlife less than less-frequent or less-predictable activities (National Research Council [NRC] 2003).

6.1.1.3 Hearing Abilities of Polar Bear

There is limited information on the hearing of polar bears. The noise levels required to cause TTS or PTS have not been determined for polar bears; however, they are likely beyond the sounds produced by oil and gas activity, except close to the source of underwater seismic airguns. Polar bears are not known to communicate underwater and studies have not been conducted to determine the effects, if any, on polar bear from underwater noise.

Nachtigall et al. (2007) measured the in-air hearing of three polar bears using evoked auditory potentials. Measurements were not obtainable at 1 kHz and best sensitivity was found in the range from 11.2 to 22.5 kHz. Behavioral testing of hearing indicates that they can hear down to at least 14 Hz and up to 25 kHz, with the best sensitivity between 8 and 14 kHz (Owen and Bowles 2011).

6.1.1.4 Description of Noise Sources

Sources of sound in the area of activity are comprised of multiple sources, including physical noise, biological noise, and man-made noise. Physical noise includes wind, atmospheric noise, earthquakes, waves and currents, and ice. Biological noise includes sounds produce by marine mammals, fish, and invertebrates. Man-made noise consists of air and vessel traffic, seismic surveys, icebreakers, supply ships, drilling, and noise from operations at production facilities. In the arctic environment, wind has the greatest influence on the overall ambient noise levels, due to its effect on the ice and water. In addition, calls of bearded seals in the spring significantly contribute to ambient noise levels. Ice cover at the ocean surface can alter the underwater noise characteristics dramatically. The factors influencing acoustic properties include type and degree of ice cover; whether it is shorefast pack ice, moving pack ice, or at marginal ice zone; chemical characteristics of the ice itself; and decreased air temperatures that can result in cracking of rigid ice (NRC 2003).

Underwater ambient noise levels in the Beaufort Sea region were measured to be between 95 and 110 dB re 1 μPa between 20 and 1,000 Hz (Greene 1997, 1998; Greene et al. 2001; Burgess and Greene 1999; LGL et al. 2007). In-air ambient noise levels measured by Blackwell et al. (2004a, 2004b) near Northstar were approximately 65 dB re 20 μPa.

During the open water season, industry sound sources can include production facilities, geotechnical and geophysical surveys, exploratory drilling, and vessel and aircraft traffic. During the ice-covered season, noise sources can include production facilities, ice road and ice pad construction, vibroseis, exploratory drilling, and on-ice vehicle and aircraft traffic. Noise sources can be categorized into either stationary or mobile sources. Stationary sources include construction, maintenance, repair, and remediation activities; operations at production facilities; flaring excess gas; and drilling operations from onshore or offshore facilities. Mobile sources include vessel and aircraft traffic, open water seismic exploration; winter vibroseis programs; geotechnical surveys; ice road construction and associated vehicle traffic, including tracked vehicles and snowmobiles; dredging; and icebreakers.

Construction

Construction activities may generate both underwater and airborne noise. Greene et al. (2008) measured underwater and airborne noise during construction of a gravel island at Northstar. The study measured noise from ice road construction, heavy equipment operations (ditchwitch machine, gravel trucks, and backhoe), augering, and pile driving (vibratory and impact). Underwater sound levels from construction ranged from 103 dB re 1 µPa at 100 m (328 ft) for augering to 143 dB re 1 µPa at 100 m (328 ft) for pile driving. Most of the energy of these sounds was below 100 Hz. Airborne sound levels from these activities ranged from 65 dB re 20 µPa at 100 m (328 ft) for the bulldozer and 81 dB re 20 µPa at 100 m (328 ft) for the pile driving. Most of the energy for in-air levels was also below 100 Hz.

Drilling

Noise from drilling operations varies with drilling equipment type, support vessels, and types of support activities. Richardson et al. (1995) and NRC (2003) provide a limited summary of drilling noise. Based on the results of drillship sounds from the *Northern Explorer II* and a support vessel recorded in the 1980s, the aggregate broadband source level for a drillship and support vessel is 175 dB re 1 µPa at 1 m based on precautionary interpretation of the third-party measurement data (Greene 1987; Miles et al. 1987). More recent measurements of drilling sounds in the Beaufort Sea in the absence of nearby vessel noise revealed a broadband source level of 181 dB re 1 µPa at 1 m (Austin et al. 2013). Auxiliary noise is also created during drilling operations from supply vessels and aircraft. Underwater and airborne drilling noises from Northstar were measured by Blackwell et al. (2004b). They found that underwater noise levels increased between the bands of 60 and 250 Hz and 650 to 1,400 Hz. Airborne noise levels were indistinguishable over the typical production island sounds.

Seismic

As discussed in Section 2.2.2, seismic reflection profiling uses sound to derive information about geological structures beneath the surface of the earth. The amount of acoustic energy released is directly proportional to the operating pressure and number of airguns. A review of literature on airgun acoustics by NRC (2003) reported a maximum output peak SPL of 260 dB re 1 µPa at 1 m (3.3 ft) 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.

Vessel Traffic

Vessel traffic is a major contributor to underwater noise (Richardson et al. 1995; NRC 2003). Noise is created primarily by propeller cavitation, but other machinery (e.g., diesel engines, generators, pumps, fans, etc.) also contribute to the overall noise level. Vessel noise 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 to 180 dB re 1 µPa at 1 m (3.2 ft), with components extending to 100 kHz, but usually peaking between 50 and 150 Hz.

Dredging

Dredges can be a strong source of continuous noise in the coastal region. Underwater noise from dredging is strongest at low frequencies, but because low frequencies attenuate rapidly in shallow water, dredge noise is typically undetectable at ranges beyond 20 to 25 km (12.4 to 15.5 mi) (Richardson et al. 1995). Broadband source levels range from 150 to 170 dB re 1 μPa at 1 m (3.3 ft), with most of the energy below 1,000 Hz.

Icebreakers

Icebreaking ships produce louder and more variable sounds than typically produced by vessels of similar size or power, causing substantial increases in noise levels out to at least 5 km (3.1 mi) during icebreaking activities (Richardson et al. 1995). The primary source of increased noise is the propeller cavitation during alternating periods of ramming and backing. Broadband source levels have been measured to be approximately 180 dB re 1 μPa at 1 m (3.3 ft), with dominant tones at 50 Hz.

Production Islands

Blackwell et al. (2004b) measured underwater and airborne noise from Northstar during production operations. Underwater broadband levels were similar with and without production, but there was a peak between 125 and 160 Hz that could be from production. Noise sources from the production islands include generators, turbines, vehicles, pumps, and general human activity. Most mechanical noise is below 500 Hz, but traffic noise is typically up to 1,500 Hz. Airborne sound levels will vary depending on the amount of activity.

6.1.1.5 Potential Impacts on Polar Bear

Stationary Sources

Noise from stationary sources, including drilling, may result in several types of responses in polar bears. It may attract bears to the area, as they are known to be curious. Attracting the bears to a facility could result in a human encounter, which could result in unintentional harassment, lethal take, or intentional deterrence. Conversely, noise may act as a deterrent to keep bears from coming into the area. Although this would reduce the number of potential human encounters, it may also deter females from denning in the area if the noise and habitat were coincident. However, polar bears have been known to den in close proximity to industrial activities. For example, two polar bears denned near Flaxman Island without any observed impact to the polar bears (MacGillivray et al. 2002). It is also possible that human disturbance may have caused a polar bear to abandon a den due to rolligon traffic, however, this impact could not be confirmed (USFWS 2006). This type of event has occurred very infrequently and will likely continue to be infrequent due to the extensive measures the oil and gas industry undergoes to identify dens prior to any construction activities (see Chapter 10).

Vessel Traffic

During the 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, but the presence of the vessel is likely to cause a disturbance, rather than the airborne noise. Due to 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.

Oil and gas activities during the open water season are generally limited to vessel-based exploration activities. There is a potential that polar bears on ice floes could encounter a vessel, but the presence of the vessel is more likely to cause the disturbance to a polar bear, rather than the airborne noise generated by the vessel. Moreover, most vessel activity would occur south of the sea ice used by polar bears. Due to the solitary nature and widespread distribution of the polar bear, disturbance from vessel traffic would be short-term, localized, and temporary and limited to a few individuals. Therefore, the anticipated impact on the polar bear SBS and CS populations is anticipated to be negligible.

Little information is available on the effects of seismic activity on polar bears. Monitoring during seismic surveys have documented the presence of polar bears and reported that polar bears typically reacted to the vessels by moving away (either on ice or in the water) (USFWS 2008c). The most likely response would be short-term, temporary behavioral avoidance of seismic vessels. There has never been more than a temporary behavioral disturbance recorded for polar bears exposed to seismic operations in the Alaskan Arctic. Marine mammals that show behavioral avoidance of seismic vessels are unlikely to incur auditory impairment (USFWS 2008c). Furthermore, implementation of the mitigation measures during seismic surveys to shut down when a marine mammal enters the safety zone of 190 dB re 1 μPa rms would further reduce the likelihood a polar bear would be injured from seismic surveys (see Chapter 10). Therefore, the anticipated impact from seismic noise is anticipated to be negligible on the SBS and CS populations.

Aircraft Traffic

Behavioral reactions of polar bears to aircraft depend on distance and type of aircraft. Polar bears often run away from aircraft passing at low altitudes. Routine aircraft traffic may result in short-term, temporary disturbance to a few individual polar bears, but the impact, if any, on the SBS 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 (Amstrup 1993). Although the snow attenuates some aircraft noise (Blix and Lentfer 1992), it is possible that repeated overflights may cause polar bears to abandon or depart their dens. However, 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.

6.1.2 Physical Obstruction

There is a limited chance that physical obstructions caused by oil and gas activities would have an impact on polar bears. Physical obstructions have the potential to impact polar bears by displacing animals; however, if this were to occur, it would likely be temporary and localized and have a negligible impact, if any. Most oil and gas facilities are located further inland where polar bears are found infrequently (USFWS 2006). Offshore and coastal facilities are most likely to be approached by polar bears.

The Endicott Causeway and West Dock facilities have the greatest potential to interfere with polar bear movements because the facilities extend continuously from the coastline to offshore facilities (USFWS 2006). However, polar bears have little or no fear of man-made structures (Stirling 1988) and can easily climb and cross gravel roads and causeways. Bears have frequently been observed crossing existing roads and causeways in the oilfields. Offshore production facilities, such as Northstar, have been approached by polar bears, but due to the design (i.e., continuous sheet pile walls around the perimeter) the bears have limited ability to gain direct access to the facilities (USFWS 2006).

Physical obstructions may present a small-scale, local obstruction to polar bears; however, it is anticipated that this will have no more than a negligible impact on individual polar bears and a negligible impact, if any, on the SBS and CS populations.

6.1.3 Human Encounters

AOGA anticipates that the small number of human encounters from oil and gas activities is likely to have a temporary impact on individual polar bears and a negligible impact, if any, on the SBS and CS populations. Encounters with humans can be dangerous for both polar bears and oil and gas industry personnel. Human encounters could potentially result in harassment, increased stress, or (rarely) death of polar bears. Since the ITRs went into effect in 1993, thousands of sightings have been reported by industry

Human encounters are more likely to occur during fall and winter periods when greater numbers of bears are found in the coastal environment searching for food and denning habitat (Amstrup and Gardner 1994). Offshore units such as Prudhoe Bay, Endicott-Liberty and Northstar typically document higher numbers of polar bear sightings than onshore facilities. Endicott-Liberty, Northstar, and Prudhoe Bay units reported between four and 158 sightings of polar bears annually from 2008 to 2012 at each facility. Some of these sightings are very likely repeated observations of the same animals resulting in a lower actual number of bears at these facilities. These sightings were comprised mostly of single adult and sub-adult bears and fewer sows with cubs. Polar bear sightings have generally increased since the inception of the incidental take regulations. The USFWS attributes this pattern in part to increased monitoring efforts throughout the years (USFWS 2006). Development of future offshore and nearshore production facilities could potentially increase polar bear-human encounters.

There is also the potential for oil and gas activities to disturb polar bear dens. The oil and gas 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 Forward Looking Infrared (FLIR) surveys around the oil fields. These dens, monitored by the USFWS, represent only a small percentage of the total active polar bear dens located in the Southern Beaufort Sea (USFWS 2006). LOA conditions require oil and gas operations to avoid known polar bear dens by 1.6 km (1 mi). From 2006 to 2010, two previously unknown maternal dens were encountered by the oil and gas industry during project activities (Durner et al. 2010). The oil and gas industry reports unknown dens to the USFWS who then establishes mitigation measures, such as the 1.6 km (1 mi) exclusion zone, to minimize the potential disturbance from oil and gas activities (see Chapter 10).

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. Personnel are instructed to leave an area when bears are seen in the vicinity.

6.1.4 Spills

In a recent analysis of a potential very large oil spill (VLOS) in the Chukchi Sea, BOEM found that the chance of such a spill occurring during oil and gas exploration activities is very low (BOEMRE 2011a). Further, in the recent Point Thomson EIS, the U.S. Army Corps of Engineers (USACE) conducted a detailed analysis of spill occurrences and the future likelihood of a catastrophic discharge event and their potential impacts to marine mammals (USACE 2012). Both BOEM and the USACE concluded events such as a VLOS are highly unlikely to occur (BOEMRE 2011a; USACE 2012). USFWS cannot authorize takes from a large oil spill (nor are any such takes requested in this petition); however, this section is included to acknowledge the very low likelihood of impacts from a VLOS on polar bears.

Although there have been no known oil spills that have impacted polar bears, the potential impacts that oil, fuel, and waste product spills could have on polar bears and other marine mammals is 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.

Oil, production waste, and non-hydrocarbon spills, if encountered by bears, have the potential to directly impact them. The indirect effects of oil spills on polar bear habitat are discussed in Chapter 8. Operational spills may occur during transfer of fuel, refueling, handling of lubricants and liquid products, and general maintenance of equipment. Polar bears may be impacted by external contact with oil, ingestion of oil, or inhalation of fumes. Polar bears could encounter oil spills during open water and ice-covered seasons in the offshore or onshore habitat (USFWS 2006).

Effects on experimentally oiled captive bears have included acute inflammation of the nasal passages, marked epidermal responses, anemia, anorexia, biochemical changes indicative of stress, renal impairment, and death (USFWS 2006; Øritsland et al. 1981). Oiling could cause significant thermoregulatory problems by reducing the insulation value of the pelt (Øritsland et al. 1981; Hurst and Øritsland 1982). In experimental oiling, many effects did not become evident until several weeks after exposure to oil (USFWS 2006).

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 2006). In April 1988, a large adult male polar bear was found dead on a barrier island north of Prudhoe Bay. The cause of death was determined to be poisoning from ingestion of a mixture that included ethylene glycol and Rhodamine B dye (USFWS 2006). In September 2012, two polar bears were found dead on a barrier island east of Prudhoe Bay. According to a newsletter published by the USFWS, samples from the bears and nearby soil and driftwood indicated the presence of Rhodamine B dye and acetic acid, but the cause of death and source of the chemicals is unknown (USFWS 2013c). Although some hazardous substances are used during oil production activities, these substances, if spilled, would most likely be spilled on land where oil and gas industry procedures require immediate clean up.

It is likely that polar bears swimming in or walking adjacent to an oil spill will 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, 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, localized spills on land or in the water are typically cleaned up quickly and pose little to no threat to polar bears. Large spills, however, may pose a potentially more serious threat to polar bears. Historically large spills associated with Alaskan 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). The probability of a large oil spill (> 1,000 bbl) occurring on the North Slope is low. To date, only one major oil spill has occurred on the North Slope. In March 2006, approximately 5,054 bbl of crude oil was released onto the snow-covered tundra from the GC2 transit pipeline in Prudhoe Bay. The spill covered about 2 acres (0.8 hectares) of the snow-covered tundra. A Tundra Treatment Plan was developed and implemented to remove the hydrocarbons and to minimize the potential for long-term damage to the tundra. The site is currently being successfully re-vegetated and rehabilitated. Other mitigation measures discussed in Chapter 10 will also be implemented to reduce the likelihood and impact of a spill.

BOEM released the Final Programmatic Environmental Impact Statement (FPEIS) for Oil and Gas Leasing Programs in June 2012, which contains a broad assessment of spill probabilities and response techniques for OCS oil and gas activities (BOEM 2012). This is discussed in more detail in Section 10.3.

6.1.5 Summary of Anticipated Impacts

Impacts on polar bears by oil and gas industry activity during the past 45 years have been negligible, 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.

Although there are limited specific data regarding the hearing of polar bear, the long-term consequences of all effects of oil and gas activity in the action area are reliably known to be no more than localized, short-term, and temporary changes in behavior with no effect on recruitment or survival of the SBS population. Accordingly, it may be logically inferred that noise impacts from oil and gas activity, as a subset of all effects, have not had more than a negligible adverse impact on the SBSpopulation.

The majority of actual incidental take to polar bears are expected to result from direct human encounters. 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 encounters on polar bears. With over 45 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 industry activities on polar bears can be minimized and, at most, have been negligible (USFWS 2006; USFWS 2008a; USFWS 2013d). With the implementation of effective mitigation measures, oil and gas 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 SBS and CS populations.

Due to the solitary nature of polar bears, their widespread distribution, the small number of polar bears being incidentally harassed, and the measures taken by industry to mitigate the potential for incidental harassment, it is anticipated that physical obstructions, facility development and operations, noise, human encounters, and spills will only result in a small number of incidental takes of polar bears, and the impact will be temporary, short-term, and localized to the immediate area of activity. As such, it is anticipated that incidental takes will have no more than a negligible impact on individual polar bears and a negligible impact on the SBS and CS populations.

6.2 Pacific Walrus

6.2.1 Noise

The following sections discuss the potential noise impacts on walrus. The noise sources discussed in Section 5.1.1 are also applicable for walrus.

6.2.1.1 Hearing Abilities of Walrus

Walruses hear sounds both in air and in water. Kastelein et al. (1996) tested the in-air hearing of a walrus from 125 Hz to 8 kHz and determined the best sensitivity was between 250 Hz and 2 kHz. Walruses were able to hear at all frequency ranges tested. Kastelein et al. (2002) tested the underwater hearing and determined that the best sensitivity was at 12 kHz. Their best range of hearing was between 1 and 12 kHz. Most of the noise sources discussed, other than the very high frequency seismic profiling, would be audible to walruses; however, the noise levels required to cause TTS or PTS have not been determined for walrus.

6.2.1.2 Potential Impacts on Pacific Walrus

Stationary Sources

Noises produced from stationary sources, including drilling, are within the hearing range of the walrus and could result in disturbance to a small number of walruses. However, because walrus are rarely observed in the vicinity of these facilities, the likelihood of disturbance is low. Furthermore, in the few instances where walrus have been observed near Northstar and Endicott, there is no indication that they avoided the noise. Therefore, noise from stationary sources is anticipated to disturb no more than a few individuals with no impact to the population.

Vessel Traffic

The behavioral response of walrus to vessel traffic is extremely variable. Richardson et al. (1995) reviewed various studies on walrus reactions to ships and boats and reported that some studies reported no reaction, while other studies showed that high-frequency noise from outboards may be more disturbing than low frequency noise from diesel engines. Richardson et al. (1995) summarized that walrus response to ships depend strongly on distance and ship speed, as well as previous exposure to hunting. Females with young are typically more wary than adults, and walruses in open water are less responsive than those on ice.

Walruses in water appear to be even less readily disturbed by vessels than walruses hauled out on land or ice (Fay et al. 1984). 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 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.

The mobile source most likely to result in noise exposure of walrus is seismic surveys that take place during the open water season. Airgun arrays may be audible several km (mi) from the source and source levels of the array may be loud enough to cause hearing damage in walruses in proximity to the source. However, seismic survey operators employ monitoring programs that require shut down of airgun arrays if a walrus enters the safety zone of 180 dB re 1 μPa rms (see Chapter 10). Implementation of this mitigation would minimize the potential for walrus to be injured during seismic surveys. Furthermore, because open water seismic activities typically occur in ice-free areas where walrus are not typically found, the likelihood of noise disturbance from this activity is considered extremely low and would be limited to no more than a few individuals. Therefore, impacts, if any, to the population are expected to be negligible.

Underwater noise from vessel traffic has the potential to mask sounds of walruses very close to the source, when walrus are present in the region. However, due to the low numbers of walruses observed in the area, impacts, if any, from vessel traffic would be limited to no more than a few individuals and would have no more than a negligible impact, if any, to the population.

Aircraft Traffic

The behavioral response of walruses to aircraft traffic also varies with distance, type of aircraft, flight pattern, age, sex, and group size. Richardson et al. (1995) reviewed 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 haulout. In general, small herds on a haulout 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 the aircraft is flying low, passes overhead, or causes abrupt changes in sound. The greatest potential impact of aircraft is when the disturbance causes a stampede into the water by all of the walrus at a haulout site, which may result in the crushing of calves.

Most aircraft traffic in the area of activity normally occurs inland and at altitudes that are unlikely to affect walrus. Additionally, there are no rookeries located in the area of activity and generally there is a low occurrence of walruses in the Beaufort Sea. Therefore, aircraft traffic would have no more than a negligible impact, if any, on the individual or walrus population.

6.2.2 Physical Obstruction

It is unlikely that walruses would be negatively impacted by a physical obstruction caused by oil and gas activities. There have been no recorded instances of take of walrus within the activity area from a physical obstruction. Small numbers of walruses have been observed to haul out on Northstar Island and Endicott (USFWS 2006; BPXA 2008). There is no evidence that these animals were disrupted or displaced by oil and gas activities. It is unlikely that stationary offshore facilities and artificial islands would affect the movement of walrus. In the event that walruses are encountered on a stationary facility, the oil and gas industry will record and report the interaction.

6.2.3 Human Encounters

Human encounters with walruses are rare in the Beaufort Sea. Aerial and vessel surveys conducted by LGL between Harrison Bay and Kaktovik in 2006 and 2007 reported no walrus in 2006 and fewer than 15 in 2007 (Ireland et al. 2008). Industry reports from vessel and aerial based surveys from 2008 to 2012 reported less than 30 total walrus sightings. In the event that an individual or small group of walrus is encountered on a stationary facility the oil and gas industry will record and report the interaction and implement the necessary precautions to minimize any effect on walrus. Vessels that encounter walruses typically divert around the animals wherever practical and make every effort to avoid disturbing the animals. Close approaches to walruses are prohibited. Given the small number of walruses in the Beaufort Sea, human encounters are expected to have no more than a negligible impact on individual walruses and a negligible impact, if any, on the Alaskan stock.

6.2.4 Spills

USFWS cannot authorize takes from a large oil spill. This section is included to acknowledge the very low likelihood of impacts from a VLOS on walruses. As discussed previously, the chance of a VLOS occurring from oil and gas activities in the Chukchi and Beaufort Seas is very low (BOEMRE 2011a; USACE 2012), however, impacts on walruses from such an unlikely event remain a serious concern. Depending on the quantity, season, and other characteristics of a spill, there is the potential for walruses to be impacted by external contact with oil or contaminants, ingestion of oil, or inhalation of fumes.

Onshore oil spills would not impact walruses unless the spill moved into the offshore environment or near a haulout area (USFWS 2006). Little is known about the effects of oil or other chemical compounds on walrus; 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, irritate or damage sensitive membranes in the nose, eyes, and mouth (USFWS 2006). If ingested, it can damage red blood cells, suppress immune systems, strain the liver, spleen and kidneys and interfere with the reproductive system of animals (Australian Maritime Safety Authority [AMSA] 2002). Walrus 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).

Given the small number of walruses present in the Beaufort Sea, the low probability of a large oil or production waste spill, and the measures that will be taken to mitigate the impact of any spill, it is anticipated that oil and production waste spills will have no more than a negligible impact, if any, on individual walrus or the Alaska walrus stock as a whole.

6.2.5 Summary of Anticipated Impacts

It is unlikely that oil and gas activities will result in any noise, physical obstructions, human encounters, or oil and production waste spills that would have a negative impact on more than a very few individual walruses. Walrus are not present in the region of activity during the ice-covered season and occur infrequently in the region during the open water season.

As with polar bears, although there is limited specific data regarding the effects of noise on walruses, the long-term consequences of all effects of oil and gas activity in the action area are reliably known to be no more than localized, short-term and temporary changes in behavior with no effect on recruitment or survival of the Pacific walrus. Indeed, adverse impacts to walruses within the Petition area have not been observed. Accordingly, it may be logically inferred that noise impacts from oil and gas activity, as a subset of all effects, have not had more than a negligible adverse impact, if any, on Pacific walruses.

Available information shows that no more than a very small number of walruses, if any, will be encountered during the five-year period of the proposed regulations. The likelihood of incidental takes of walruses in the Beaufort Sea is extremely low; any potential response from walrus encounters will be short-term and localized, with no more than a negligible impact on individual animals and a negligible impact on the Alaska stock of Pacific walrus. To date, there have been no recorded instances in which oil and gas activity has caused more than a temporary, short-term impact on a few walruses in the Beaufort Sea. The limited potential for incidental take during the period of the proposed regulations will be further mitigated by implementation of management measures required by USFWS (Chapter 10).

7.0 ANTICIPATED IMPACT ON SUBSISTENCE

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

7.1 Subsistence Species Synopsis

Subsistence hunting is considered integral to the way of life of northern Alaska communities. The subsistence harvest provides food, clothing, and materials that are used to produce arts and crafts. These subsistence products have substantial material and economic importance, since the subsistence goods would have enormous replacement costs if alternatives had to be purchased. However, the subsistence way of life also has important cultural and socio-economic benefits. Subsistence harvest activities express and reproduce central cultural values, including respect for and generosity with the foods of the natural world, as shown in the widespread patterns of sharing, trading, and bartering of subsistence foods.

The annual cycle of subsistence harvests shows effort directed at a wide array of resources, at strategic times and places when animals are abundant and may be harvested efficiently. In this sense, the composition of the subsistence harvest represents an ecological adaptation to available resources. All of the subsistence resources are important at some time of the annual cycle, even though certain resources provide much greater quantities of food. The three communities in the area of activity, Barrow, Nuiqsut, and Kaktovik, have a particularly high level of reliance on marine mammals, especially bowhead whales. Caribou are also an important food resource, along with fish and birds. Polar bears and walruses are also important subsistence resources. Though harvested infrequently, they contribute small quantities of food and important byproducts. Polar bears are primarily hunted for their fur, which is used to craft cold weather gear such as boots, mitts, and coats. Their meat is also consumed (MMS 1990). Walrus provide meat as a food resource, and ivory as a valuable byproduct used to manufacture traditional arts and crafts (MMS 1990).

7.1.1 Polar Bear

Historically, polar bears have been killed for subsistence and handicrafts by Alaska Native hunters and for recreation by others (non-Alaska natives). The harvest quotas of the SBS population are shared by the Iñupiat of Alaska and Inuvialuit of Canada under the Polar Bear Management Agreement of 1988 (Snow et al. 2013). Based on skins shipped from Alaska, an average of 120 polar bears were taken annually by natives between 1925 and 1953. Trophy hunting from aircraft was initiated in the 1950s, and as a result, the annual harvest rate by natives and sport hunters more than doubled to an average of 260 polar bears each year between 1961 and 1972 (Amstrup et al. 1986; Schliebe et al. 1998). After enactment of the MMPA in 1972, the annual subsistence harvest of polar bears decreased, ranging from 29 to 181 between 1973 and 1984 (Amstrup et al. 1986). From 1990 to 2007, the total number of harvested polar bears from Beaufort Sea communities has ranged between 29 and 368 animals. However, the harvest of polar bears continues to play an important role in Iñupiat communities where they utilize parts of the bears to make traditional handicrafts and clothing (Nelson 1981). USFWS has concluded that the continuing subsistence harvest of polar bears by native Alaskans is sustainable and is not a present threat to the SBS population. According to USFWS, the number of unreported kills of polar bears from the SBS population since 1980 is thought to be negligible.

7.1.2 Pacific Walrus

The walrus has cultural and subsistence significance to the Iñupiat of the North Slope, but harvests east of Barrow are uncommon, as this is outside of the common range of the species. Alaskan communities harvest few walruses in the southern Beaufort Sea along the northern coast of Alaska, including Barrow, Nuiqsut, and (rarely) Kaktovik. Small numbers of walruses migrate through the area annually and are harvested seasonally (ADNR 2009). Current harvest estimates (including those killed in fisheries) do not exceed estimated recruitment levels (USFWS 2014).

7.2 Subsistence Harvests by Community

7.2.1 Kaktovik

Kaktovik, located on Barter Island, is approximately 145 km (90 mi) west of the Canadian border and 447 km (278 mi) southeast of Barrow with a population of approximately 250. The village is on the northern edge of ANWR. Like other coastal communities, Kaktovik relies on maritime resources other than walruses and polar bears, primarily bowhead whales, but hunters also take caribou and fish. Bowhead whales, fish, and caribou comprise approximately 64 percent, 13 percent, and 11 percent of the total annual harvest (by edible pounds), respectively (NMFS 2013b). Other marine mammal species comprise a very small percentage of the overall harvest.

Polar Bear

Polar bears are primarily harvested during fall and winter on the pack ice and along open leads. Bears may be pursued seaward of the barrier islands for 16 km (10 mi) or more (MMS 2003). Compared to other North Slope communities, the overall harvest of polar bears is relatively low. The polar bear harvest by Kaktovik from 2008 through October 2012 averaged two polar bears per year (Table 7-1). This is close to the average of 1.8 polar bears for the period 2004 to 2008.

Walrus

Walruses rarely occur near Kaktovik and thus are rarely harvested. However, boat crews hunting for seals in open water (currently July and August) along the coast east and west of the village occasionally harvest walrus. Kaktovik hunters did not harvest any walrus from 2004 to 2012, as summarized in Table 7-2.

7.2.2 Nuiqsut

Nuiqsut is located approximately 29 km (18 mi) south of the Nechelik Channel entrance, which is the head of the Colville River at the Beaufort Sea, and 219 km (136 mi) southeast of Barrow with a population of approximately 410. Nuiqsut is an inland community, but the community maintains an active whaling and marine mammal harvest pattern, accounting for 31.8 percent of subsistence foods. Caribou and fish are very important, representing by edible pounds 58 percent and 30 percent, respectively. The use of polar bears and walruses for subsistence is relatively low (MMS 2003).

Polar Bear

Most polar bear hunting occurs from September through April from Nuiqsut. The overall harvest of polar bears is lower than Barrow and Kaktovik. The annual polar bear harvest for Nuiqsut from 2008 through October 2012 averaged one (Table 7-1), higher than the average of 0.4 bears per year reported for the period 2004-2008.

Table 7-1. Subsistence Polar Bear Harvests Reports by Year and Village

Village	Calendar Year					
	1987-2007[1]	2008[1]	2009[1]	2010[1]	2011[1]	2012[2]
Kaktovik	47	3	3	0	0	4
Barrow	368	11	8	6	12	4
Nuiqsut	29	0	1	0	0	4

[1] Polar bears reported and tagged as harvested and tagged by Alaska Native subsistence hunters in accordance with the Marine Mammal Marking, Tagging, and Reporting Rule (50 CFR 18.23). Source: USFWS 2012
[2] Source for 2012 (through October 27): USFWS 2013c

Table 7-2. Subsistence Walrus Harvests Reports by Year and Village

Village	Calendar Year					
	1989-2007	2008	2009	2010	2011	2012
Kaktovik	2	0	0	0	0	0
Barrow	447	24	10	2	4	0
Nuiqsut	0	0	0	0	0	0

Walrus reported as harvested and tagged by Alaska Native subsistence hunters in accordance with the Marine Mammal Marking, Tagging, and Reporting Rule [50 CFR 18.23].
Source: USFWS 2012

Walrus

Walruses are occasionally harvested by Nuiqsut hunters during the open water season from June to early October. Hunts have occurred throughout the entire coastal range, from Cape Halkett to Anderson Point, but walruses are seldom encountered for harvest. No tagged walruses were reported from Nuiqsut hunters for the years 2004 to 2012, as shown in Table 7-2 (USFWS 2012).

7.2.3 Barrow

Barrow is the economic, transportation and administrative center for the NSB with a population of approximately 4,350. Located on the Chukchi Sea coast, Barrow is the northernmost community in the U.S. The majority of the annual subsistence harvest by edible pounds for Barrow is composed of caribou and bowhead whales (22 percent and 39 percent, respectively; Alaska Department of Fish and Game [ADFG 2001]). Walruses comprise approximately nine percent of the annual harvest (by edible pounds), and polar bears account for approximately 2.2 percent of the annual subsistence harvest (by edible pounds) for Barrow (ADFG 2001).

Polar Bear

Barrow residents hunt polar bears on the sea ice or along leads from October to June. In 1989, 2.2 percent of the total subsistence harvest (by edible pounds) for Barrow was composed of polar bears (ADFG 2001). Since it is a large community, Barrow often has the highest number of polar bear takes on the North Slope. The polar bear harvest for Barrow from 2008 through October 2012 averaged 8.2 per year (Table 7-1). This is a reduction from the reported annual average of 13.6 bears for the period 2004 to 2008. The reason for this decline is unknown.

Walrus

Barrow residents hunt walrus from boats, during the marine mammal hunts west and southwest of Point Barrow to Peard Bay, generally no more than 24 to 32 km (15 to 20 mi) from the community (MMS 2003). Most walrus hunting occurs from June through September, and peaks in August, when the landfast ice breaks up and hunters can access the walruses by boat as they migrate north on the retreating pack ice (MMS 1990). The average annual walrus harvest for Barrow from 2008 to 2012 was eight animals (Table 7- 2). This is less than the reported average of 22.6 walruses taken annually for the period 2004 to 2008. The reason for this decline is unknown.

7.3 Summary of Anticipated Impacts

The impact of oil and gas exploration, development, and production on the availability of polar bears and walruses for subsistence harvest has been, and is anticipated to remain, negligible. Polar bears are hunted primarily during the ice-covered period. Oil and gas activities during the period of the proposed ITR are expected to have a negligible impact, if any, on the distribution, movement, and numbers of polar bears in this area. Oil and gas activities are also expected to have a negligible impact on the distribution, movement, and numbers of walruses in the region. Mitigation and regular communication between the industry and native communities will further reduce the likelihood of interference with subsistence harvest. All operators work with the communities to reduce the interference of activities on the availability of these animals for subsistence uses, as discussed in more detail in Chapter 10.

8.0 ANTICIPATED IMPACT ON HABITAT

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 Bear

Though there is the potential for oil and gas activities to impact polar bear habitat, the documented impacts by the oil and gas industry during the past 45 years have been negligible. Given the mitigation measures in place and their likely continued use in the future, the low level of oil and gas activities occurring in polar bear habitat and the temporary and localized nature of many of the oil and gas activities, it is anticipated that oil and gas industry will have a negligible impact on polar bear habitat.

As described in Chapter 5, habitats that are important to polar bears include pack ice, landfast ice, and coastal areas. Open water by itself is not considered to be a habitat type frequently used by polar bears, because life functions such as feeding, reproduction, or resting do not occur in open water (USFWS 2008a). However, open water is a fundamental part of the marine system that supports seal species, the principal prey of polar bears, and seasonally refreezes to form the ice needed by the bears (USFWS 2008a).

8.1.1 Noise

The primary potential impacts from noise on polar bear habitat are impacts on prey, the bearded seal, ringed seal, and spotted seal (*Phoca largha*). As discussed in Section 5.1, anthropogenic noise may affect marine mammals in various ways, from small behavioral changes to physical injury. Noise associated with oil and gas activities has the potential to result in disturbance of the seals on which polar bears prey. The primary source of noise disturbance to these species would be from the air and vessel traffic associated with exploration activities, including supply boats, seismic survey operations, icebreakers, and aircraft. Secondary sources would be drilling and production operations, although most of this noise is relatively low frequency and at low sound levels.

The vessel and aircraft traffic could potentially cause behavioral disturbance of the seals hauled out on the ice. However, the numbers of seals potentially affected is expected to be small due to the low number of disturbance events and the relatively dispersed distribution of seals in the area of activity. Furthermore, seals in the region are likely habituated to industrial noise. Blackwell et al. (2004a) reported that ringed seals exhibited tolerance to industrial noise associated with construction activities, including pile driving, at Northstar.

Noise from seismic surveys could also result in temporary disturbance to seals. Similar to vessel traffic, seismic activities are likely to result in startle responses near the sound source, but the disturbance is likely to be limited to a few seals in the localized area due to their scattered distribution. Furthermore, mitigation programs that require shut down of seismic activity if a marine mammal enters the 190 dB safety zone would reduce the numbers of seals that may be impacted by seismic noise (see Chapter 10). In addition, Moulton et al. (2002) and other studies (Moulton and Lawson 2002; Miller et al. 2005; Ireland et al. 2008) report that the distribution of ringed seals did not change after seismic operations.

8.1.2 Facility Development and Operations

Facility development and operation has the potential to cause some degradation and fragmentation effects on polar bear habitat. As discussed in Chapter 6, the operation of existing facilities represents a small scale, local obstruction to polar bears and the anticipated impact of these facilities on polar bear foraging and breeding habitat is considered no more than negligible. The majority of existing facilities are located inland where polar bears are found infrequently (USFWS 2006). Areas of landfast ice adjacent to existing offshore production facilities, including Northstar, the Salt Water Treatment Plant on the West Dock Causeway, and the Endicott production island, provide marginal hunting habitat due to their low seal densities (USFWS 2006). Furthermore, these facilities do not impact the adjacent landfast ice habitat used by ringed seals (Williams et al. 2001, 2002). Since pack ice is in constant motion by the winds and tides, structures are not constructed on this type of ice.

The development of future facilities, particularly offshore and nearshore coastal facilities may have a potential local impact on polar bear foraging or denning habitat. As more permanent structures are built, there is a potential to reduce the amount of habitat that may be utilized by polar bears. Female polar bears tend to select secluded areas for denning, presumably to minimize disturbance during the critical period of cub development (USFWS 2008a). Terrestrial denning sites have specific prominent features (e.g., coastal bluffs, river banks, and abandoned pads), which help to accumulate snow for den excavation and expansion (Harington 1968; Durner et al. 2003). Over 80 percent of maternal dens on land were within 10 km (6.2 mi) of the coast and over 60 percent were on the coast or coastal barrier islands (Schliebe et al. 2006). While direct disturbance may cause abandonment of occupied dens before their cubs are ready to leave (USFWS 2008a), the consistent features and distance from the coast of potential denning areas have enabled the USFWS to map potential denning habitats along the coast for avoidance by industrial activities. Therefore, activities such as expansion of the network of roads, pipelines, well pads, and infrastructure associated with oil and gas activities are expected to have a negligible effect on denning habitat.

The potential effects of human activities are greater in areas where there is a high concentration of dens. The oil and gas industry makes a concerted effort to locate, monitor, and avoid known polar bear denning habitat around existing and future facilities. This habitat is also monitored by the USFWS, and mitigation measures require oil and gas operations to avoid known polar bear dens by 1.6 km (1 mi).

The operation of existing facilities is not anticipated to impact polar bear habitat. There is a potential for future development or for expansion of existing facilities to impact polar bear habitat; however, the USFWS will evaluate these impacts through a requested LOA and apply suitable conditions. The oil and gas industry also maintains best practices in mitigating the potential impacts of operation and development on polar bear habitat. Mitigation techniques that have been instituted, and will be modified as necessary, have proven to be highly successful in providing for polar bear conservation in Alaska (Chapter 10).

8.1.3 Spills

The possibility of spills from oil and gas activities and the subsequent potential impacts on polar bears are a concern (USFWS 2006). Oil spills can have an indirect effect on polar bears by altering their feeding, breeding, or resting habitat as well as the availability and distribution of prey species.

The potential impact of a larger spill on polar bear habitat would depend on multiple factors, including the time of year, environmental conditions, the magnitude of the spill, the origin of the spill, and the success of clean-up efforts. Oil spills in the fall or spring during the formation or break-up of sea ice present a greater risk because of difficulties associated with clean up during these periods, and the presence of bears in the prime feeding areas over the continental shelf (USFWS 2008a). 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 break-up if bears were present (USFWS 2008a). During the autumn freeze-up 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 2008a).

The main potential impact oil spills may have on polar bear habitat is through the reduction of suitable foraging habitat and prey availability. However, the biology of the polar bear and its prey greatly minimizes the potential population impacts from an oil spill. For instance, polar bears and their prey are widespread in low densities in the Beaufort Sea occurring in many different habitats in the sea ice. Ringed seals use shorefast ice, pack ice, and offshore pack ice, which cover a broad geographic area. Similarly, polar bears, often solitary, inhabit these ice types, traveling long distances in search of prey. Polar bears have also been reported to adapt to changing prey conditions by switching to other seal species including bearded seals (Iverson et al. 2006; Stirling and Parkinson 2006). Consequently, these and other life history features of polar bears and their prey would greatly reduce the potential for any impacts on polar bears from oil spills in their habitat. Any impacts would be localized to a small amount of habitat relative to that available in the Beaufort Sea.

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. Small spills, if any, are expected to be localized and cleaned up quickly, minimizing potential impact on the habitat. In the 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.

8.2 Pacific Walrus

Proposed oil and gas activities on the North Slope and in the Beaufort Sea are not expected to impact the habitat of walruses. Habitat important to the walrus is located outside of the area of activity addressed in this Petition. During summer months, the walrus inhabits the moving pack ice over the shallow waters off the continental shelf of the Bering and Chukchi seas. Walruses are rare in the Alaskan Beaufort Sea east of Point Barrow. Recent light ice years in 2007, 2011, and 2013 resulted in walrus haulouts between Point Lay and Point Barrow in the Chukchi Sea. Walruses retreated to the shoreline after pack ice retreated north of the shallow OCS waters (Ireland et al. 2008; Clarke et al. 2011). There was no evidence of walruses moving into the Beaufort Sea during these unusual events, suggesting that walruses are not likely to shift their distribution from the Chukchi Sea to the Beaufort Sea during years of light ice conditions.

8.2.1 Noise

There is little information on how or if noise from oil and gas activities affects the prey of walrus. As reviewed in NRC (2003), cephalopods (octopods and squid) and crabs have statocysts that may detect low-frequency sounds. 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 allow detection of potential predators, prey, and the activity of tides and currents (Discovery of Sound in the Sea 2008). They accomplish this with special sensory organs known as chordotonal organs, a type of internal mechanoreceptor. These organs sense pressure, movement, and tension. They detect cues generated from vibrations that may be associated with sound. However, because there are no important feeding grounds in the area of activity, noise from oil and gas activities is not expected to impact prey species comprising walrus feeding habitat.

8.2.2 Spills

Spills near or around Barrow may indirectly affect the walrus by 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 due to smothering and toxicity (USFWS 2006). Some polynuclear aromatics, that are carcinogenic and toxic, may also become concentrated in the food chain (Etkin 1997). However, little or no contamination of benthic food organisms and bottom feeding habitats of walrus would be expected to occur, because little oil would likely reach offshore feeding areas. Given the small number of walruses using the Beaufort Sea and the small proportion of total available habitat affected by a spill, the probability of oil or waste products having more than a negligible impact on important feeding areas from an oil and gas industry oil spill is very low. Mitigation measures undertaken by industry and highlighted in Chapter 10 would assist in further reducing any impact on the benthic environment.

8.3 Climate Change

The Council on Environmental Quality (CEQ) has issued guidance under NEPA indicating that climate change is a reasonably foreseeable impact of GHG emissions. As acknowledged in prior chapters of this Petition, USFWS has determined that climate change poses a threat to the survival of the polar bear species throughout its range because of the resulting modification (recession) of Arctic sea ice habitat upon which the polar bear is dependent. In addition, the USFWS has found that climate change poses an indeterminate potential threat to Pacific walrus, albeit primarily in areas outside of the area specified for the proposed ITR (USFWS 2011). This section summarizes information regarding the potential contribution of the activity described in this Petition to GHG emissions and climate change, and the potential for climate change to alter the environmental consequences of oil and gas activities in a manner adverse to the North Slope habitat of polar bear and Pacific walrus.

8.3.1 GHG Emissions

GHG emissions are currently regulated by the Clean Air Act and by Alaska law under the PSD and Title V air permit requirements. USEPA published emission factors for various types of fuel to be used in GHG emission calculations. There are also programmatic GHG emissions estimates, such as the estimated contribution of OCS oil and gas activities to GHG emissions analyzed in the EIS for the 2012-2017 OCS Leasing Program.

The underlying oil and gas activities, and the use of the produced hydrocarbons by consumers for energy, are sources of GHG emissions; however, it is not possible to meaningfully assess the contribution of such activities to global climate change in general, and in the Arctic in particular, for several reasons.

- The activity to which this proposal relates will be occurring in the future, from August 2016 to August 2021. It is an added and important element of significant complexity and speculation to attempt to predict what North Slope GHG emissions sources will exist during this time period, what regulatory programs may exist at that time, and what emissions may result from the existing sources as authorized under then-existing regulatory programs. To the extent that new requirements regulating GHG emissions are enacted, any activities subject to these programs will, in the future, perform project-specific and site-specific air emissions analyses and modeling, and GHG emissions reduction and mitigation measures appropriate to the location, activity, and equipment will be developed as warranted.
- Current science and modeling cannot link individual actions that contribute to atmospheric carbon levels to specific responses of species or specific impacts to their habitats. Accordingly, the available scientific information does not enable us to establish a connection, let alone to assess the relative extent of the connection, between specific sources and locations of GHG emissions, and specific impacts to polar bears or walruses arctic habitats.

- The USFWS is evaluating the effect of incidental take. It does not have the authority under the MMPA to regulate GHG emissions.
- The impacts of GHG emissions from energy consumption are well outside the scope of this proposed ITR and the authority of federal agencies implementing the MMPA.
- The same or more GHG emissions would result from domestic consumption of oil and gas without North Slope oil and gas activity. Oil and gas is projected to remain a significant energy source during the five-year period of proposed regulations, and for the foreseeable future thereafter. Were oil and gas activity on the North Slope curtailed, most of the lost production would be replaced by a combination of imports, fuel switching, and increased onshore production, not by reductions in energy needs or consumption of oil. Any projected decrease in GHG emissions resulting from a reduction in North Slope oil and gas production due to conservation measures would be offset by increases in GHG emissions resulting from transportation of foreign oil via tanker to domestic markets.

8.3.2 Effects of Climate Change on Oil and Gas Activities

It is not possible to predict from existing information the specific locations or extent of climate change on oil and gas activities for the Petition period. However, changing environments on the North Slope are expected to be a greater topic of discussion during the period of these regulations than during past regulatory periods.

Continuing recession of sea ice is likely to affect the distribution and abundance of polar bears throughout their range and a potential increased presence in nearshore areas (as discussed in Section 5.1.7), thereby creating the potential for more frequent bear-human encounters (USFWS 2008a). Because of the many uncertainties associated with the pace and effects of climate change, it is not possible to precisely or reliably predict to what extent an increase in interactions with polar bears may arise during the five-year period of the proposed ITR. However, with over 45 years of documented experience in conducting oil and gas operations within polar bear habitat, it is reliably expected that with proper training, management, and monitoring under the proposed ITR, the potential for adverse effects to polar bears and stocks from oil and gas activities will be minimized. Based upon the anticipated level of activity during the five-year period, the wide distribution and low onshore density of polar bears, it is still reasonably expected that the number of incidental takes will be small and that such takes will involve non-lethal, short-term changes in behavior that do not have more than a negligible impact on individual bears or on the SBS and CS polar bear populations.

Changes to weather and the related effects upon infrastructure and coastlines is not expected to alter the potential for incidental interactions or the expected intensity of such interactions with Pacific walruses in offshore open water areas. Pacific walruses are very uncommon in the specified area and are not known to use coastal beaches or uplands of the North Slope where affected infrastructure may be located.

9.0 ANTICIPATED IMPACT OF HABITAT LOSS OR MODIFICATION ON SPECIES

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

Chapter 8 discussed the anticipated impact of oil and gas activity upon the habitat of polar bears and Pacific walruses. The chapter identified several potential losses or modifications to polar bear or walrus habitat that could result from oil and gas exploration or production activities in the proposed area of activity. For the polar bear, based on the broad geographic distribution, low density, and high mobility of polar bears; the small proportion of the total area of habitat potentially affected by oil and gas activities; and the short-term, temporary, and localized nature of oil and gas activities; combined with existing and future mitigation measures, we conclude that the oil and gas industry will have no more than a negligible effect on polar bear habitat. Further, we conclude that oil and gas activities will have no more than a negligible impact, if any, on the habitat of the walrus, as the Beaufort Sea is considered extralimital for the walrus.

Consequently, it is anticipated that due to the negligible loss of habitat as a result of oil and gas activities, there will be no more than a negligible impact on the SBS and CS polar bear populations or the Alaska stock of Pacific walruses.

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." Currently, there is no ESA critical habitat designated for either the polar bear or the walrus.

10.0 MITIGATION MEASURES

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.

This section describes mitigation measures that have been used in the past and may continue to be used to reduce impacts on polar bears and walruses. 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. These measures will be approved by the appropriate regulatory agencies before implementation.

10.1 Mitigation Measures

The following section lists the actions and measures the oil and gas industry has historically used to and may continue to implement in the future to reduce impacts or the risk of impacts on polar bears and walruses. Each operator will continue to coordinate with USFWS and others to develop and implement any additional measures, if needed:

- Operators designate a qualified individual or individuals to observe, record, and report the effects of their activities on polar bear and walrus.
- Operators develop a polar bear and walrus interaction plan and works with the USFWS to approve the plan prior to beginning any activities. Plans must be filed with USFWS and retained on site. The plans identify 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
  - Polar bear and walrus observation and reporting procedures
  - Polar bear and walrus avoidance and encounter procedures
- Operators must minimize the effect on subsistence uses. Each operator, to the extent practicable, will use methods and conduct activities to minimize 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 required by USFWS, a Plan of Cooperation will be developed by the operator to ensure activities will not interfere with subsistence hunting and adverse effects on the availability of polar bear or walrus will be minimized.
- Aircraft will maintain a minimum altitude as based on peer-reviewed science from hauled out walruses, to the extent practicable.

- Trained Protected Species Observers (PSOs) may be used for some marine activities. PSOs may be required to monitor impacts of activities on polar bear and walrus.
- When required by USFWS, operators will identify the location of potential polar bear dens when conducting activities during the denning season in the coastal areas of the Beaufort 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 of 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.
- USFWS will be allowed to, in its discretion, place an observer on site to monitor impacts of activities on polar bears.
- Offshore seismic exploration mitigation measures may include the following:
    - Space activities to maintain a minimum distance as based on peer-reviewed science between activities to mitigate impacts to resting, feeding, and migrating walruses.
    - Maintain an exclusion zone at and below the surface of the water within a radius defined by USFWS.
    - Monitor the exclusion zone using trained PSOs for avoidance and take behaviors.
    - For multiple airgun arrays, ramp up procedures may be implemented.

10.2 Spill Prevention

The Alaska Department of Environmental Conservation (ADEC) Division of Spill Prevention and Response (SPAR) is responsible for regulating oil and hazardous substance spills by preventing, responding to, and ensuring the cleanup. Each operator is required to submit a contingency plan that outlines their methods for preventing, responding to, and ensuring the cleanup. The following text summarizes the mission of SPAR from the ADEC website (http://www.dec.state.ak.us/spar/about.htm):

> ***Prevention –*** ensures spill prevention through the review and approval of prevention plans for oil terminals, pipelines, tank vessels and barges, railroads, refineries, and exploration and production facilities; the underground storage tank spill prevention program; technical assistance to industry and the public; risk reduction measures; inspections; and education in proper spill prevention and response methods.
>
> ***Preparedness –*** ensures response preparedness through the review and approval of oil discharge contingency plans; inspections; spill drills and exercises; partnerships with local communities and other state and federal agencies; pre-positioning of response equipment for local use; maintenance of statewide and regional spill response plans; and implementation of the Incident Command System for spill response.
>
> ***Response –*** ensures an effective response through the identification and rapid abatement of dangerous acute human exposures to hazardous substances; timely characterization and remediation of chronic health exposure risks from hazardous substance releases; mitigation of the effects of spills on the environment and cultural resources; and restoration of property value and usability through adequate cleanup.

The oil and gas industry considers spill prevention a vital part of typical operations. Regular maintenance, inspections, and accurate record keeping by trained personnel are integral. Details of each operators' prevention programs are located in the contingency plans approved by ADEC. Contingency plans typically include, but are not necessarily limited to, details on the following:

- Prevention training programs
- Substance abuse policy
- Medical programs
- Security programs
- Well control and emergency shutdown procedures
- Fluid transfer procedures
- Operating requirements for exploration and production facilities
- Storage tank requirements
- Description of secondary containment
- Facility piping corrosion program
- Leak detection system monitoring
- Discharge detection procedures

To provide an example of the prevention techniques, the following text provides information on prevention of a well blowout. Operators apply a rigorous multi-layer well control management system that has proven successful in preventing escalation of a well control incident to a blowout situation. These measures result in an extremely low probability of an uncontrolled well release. Mitigation measures are taken to ensure that oil is not released into the environment. Preventive layers are as follows:

- ***Layer I***. Layer I includes proper well planning, risk identification, training, routine tests and drills on the rig (e.g., blowout preventer [BOP] tests, pit drills, and trip drills), which build a strong foundation.
- ***Layer II.*** Layer II includes early kick detection and timely implementation of kick response procedures. Continuous monitoring including the use of a Real Time Operations Center provides early kick detection. When a kick is detected, the general response is to immediately shut down the pumps, perform a flow check, shut in the well, and kill the well.
- ***Layer III.*** Layer III involves the use of mechanical barriers, including, but not limited to, BOPs, casing, and cement. Testing and inspections are performed to ensure competency.
- ***Layer IV.*** Layer IV represents relief well drilling, which would be implemented if a blowout were to occur, despite the first three layers of protection. Contingency plans include dynamic surface control measures and the methods of drilling a relief well.

10.3 Spill Response

The history of offshore operations around the world confirms that large spills are extremely rare events. As reported by NRC (2003), only 1 percent of the oil discharges in North American waters are related to the extraction of petroleum, and only a fraction of this is from drilling operations. There has never been an oil spill caused by a blowout from offshore exploration and production drilling in state and federal waters off Alaska or in the Canadian Arctic. Using the BOEM classification of a large spill, there have been only four large spill incidents (greater than or equal to 1,000 bbl) from U.S. exploration or production platforms since 1974 (Anderson et al. 2012). Wells will be thoroughly evaluated and designed to employ advanced multiple well-control barriers and systems. Rigorous planning, continuous downhole monitoring, and multi-layer control systems ensure that the probability of an exploration blowout remains extremely unlikely.

From 1982-2013, a total of 39 exploration wells have been drilled within the Chukchi and Beaufort seas of Alaska's OCS (BOEM 2013). No large spills have occurred on Alaska's OCS from exploration drilling. The historical spill record from all 39 Chukchi and Beaufort Sea Exploration wells reveals a combined total spill volume of 26.7 bbl with an estimated 24 bbl recovered (MMS 2008; BOEMRE 2011b). Based on this, the most likely spill event would be small and confined to a relatively small area of impact during exploration drilling operations. Any possible adverse effects upon polar bears and walruses would be short-term and mitigated through containment and recovery actions.

BOEM released the Final SEIS for the Chukchi Sea Lease Sale 193 in 2011, which includes a thorough assessment of spill probabilities and trajectories (BOEMRE 2011a). Appendices B and D of the Final SEIS provide a discussion of oil spill types, their behavior, spill models and estimates, and a VLOS simulation for the Chukchi Sea. The analyses used a hypothetically large volume spill over a long duration to estimate the probabilities that oil generating from a certain area would contact a certain resource or land area over different time periods. BOEM further acknowledged that that the chance of a VLOS occurring is very low based on historical OCS records (BOEMRE 2011a).

BOEM also released the FPEIS for Oil and Gas Leasing Programs in June 2012, which contains a broad assessment of spill probabilities and response techniques for OCS oil and gas activities (BOEM 2012). Using historically high volumes of oil and long durations of release, BOEM provided catastrophic discharge scenarios for OCS program areas and determined that the type of drill rig, timing of drilling, and rig availability to drill a relief well were the primary factors affecting the duration of a very large spill in the Beaufort Sea (BOEM 2012). Based on historical large spills and hypothetical analyses, the probability of a very large spill occurring is very low. BOEM has recently implemented enhancements to oil spill safety, inspection, and prevention program through research, regulations, and Notices to Lessees.

Smaller spills (< 500 bbl) have historically occurred from pipeline, vehicle, or gravel pad activities and are typically caused by leaks or faulty equipment (BLM 2005). From 1989-2009, 16 percent of spills were approximately 1 gallon, 54 percent were approximately 5 gallons, 82 percent were approximately 1 bbl, and 98.5 percent were less than 25 bbl (BLM 2012). The mean size is 2.8 bbl. The estimated rate for small crude spills on the North Slope is 178 spills per billion bbl produced (BLM 2005). Using this estimated spill rate, a mean spill volume of 3 bbl, and the maximum amount of resources (bbl), BLM estimated a total spill volume of 426 bbl over the production life of the northeast NPR-A (BLM 2012). In October 2013, BOEM released a report detailing small North Slope spill occurrences from 1971 to 2011 and used statistical modeling to estimate future potential spills based on several production variables (Robertson et al. 2013). Small spills are generally restricted to a small area of tundra and winter spills can be cleaned up before reaching the tundra (BLM 2005). Thus, a small spill event would likely be confined to a small area of impact and effects to polar bears and walruses mitigated through containment and recovery actions.

10.3.1 Oil Fate and Behavior in Arctic Waters

Spill response in ice conditions is different than spill response in open water. However, experience has shown that low temperatures and ice can enhance spill response and reduce the potential for environmental impacts under certain conditions. For example:

- Low air and water temperatures generally lead to higher oil viscosity and greater oil equilibrium thicknesses that result in reduced spreading rates and smaller impacted area. These beneficial effects greatly reduce the potential for direct oil contact with natural resources, while providing an opportunity for much higher oil encounter/removal rates using mechanical recovery and controlled in situ burning operations.
- Evaporation rates are reduced in cold temperatures and ice. As a result, the lighter and more volatile components remain for a longer time, thereby enhancing the ease with which the oil can be ignited.
- The regional presence of ice dampens wave action and often limits the fetch over which winds might otherwise create larger fully developed waves.
- During ice conditions, responders may operate with short-boom extensions and skimmers to maneuver among ice pieces and intercept oil in open areas.
- Ice can serve as a natural barrier to the spread of oil and help concentrate it for recovery with stationary skimmers dipped into discrete pockets of oil. The natural containment of oil against ice edges leads to thicker oil films that enhance the effectiveness of controlled in situ burning.

10.3.2 Spill Response Techniques

10.3.2.1 Detection and Monitoring

Tracking of an oil spill can be accomplished through airplane and helicopter surveys, FLIR surveys, GPS, digital cameras, and possibly unmanned aerial vehicles. In addition, tracking buoys and various types of radar reflectors can be launched from vessels on location at the beginning of a spill and at appropriate intervals thereafter to help track the oil. Specialized ice-strengthened beacons have been used successfully for many years to track ice movements over an entire winter season throughout the polar basin.

Techniques for detecting and tracking oil under ice include drilling holes and trenches in ice, using Autonomous Underwater Vehicles (AUVs), or surface operated, portable Ground Penetrating Radar (GPR). Several GPR systems are capable of detecting and mapping oil under the ice surface. Alaska Clean Seas (ACS) acquired a GPR system in 2006 and personnel are trained on its use and readings.

10.3.2.2 Open Water Offshore Response

Mechanical Containment & Recovery

Oil skimmers are widely used to collect oil at the water surface and transfer it to a storage container. Skimmers are the most efficient method for recovering thick oil slicks. When safety considerations permit, mechanical recovery tactics include the use of broad-swath, open-apex booms to intercept oil and funnel it to skimming vessels equipped with large skimmers. Mechanical recovery is the first line of oil spill response widely accepted within the U.S. and abroad.

Controlled In Situ Burning

Controlled in situ burning provides a unique way to eliminate oil quickly, efficiently, and safely. Oil slicks contained to a thickness greater than 3 millimeter (mm) (<1 in) by fireproof booms, ice, or a shoreline can be ignited to burn oil off the water surface. On average, about 80 to 95 percent of oil volume is eliminated as gas, 1 to 10 percent as soot, and 1 to 10 percent remains as a residue. Residue is much less toxic than the original oil as most of the toxic components have low molecular weight and burn off first. Concentration of combustion products in the air is short lived and carefully monitored. Igniters can be deployed from a helicopter, eliminating the need for personnel or equipment exposure. In open water and light-ice conditions, controlled in situ burning with fire booms provides a valuable alternative strategy to mechanical recovery.

Relatively small burn areas can yield high elimination rates. For example, a 9.3 square m (100 square ft [ft^2]) pool could burn at 10 bbl of oil per hour (boph) or more, and an 743 square m (8,000 ft^2) pool (only 30.5 m [100 ft] in diameter) could burn on the order of 1,000 boph or more. The consensus of research on spill response with controlled in situ burning of oil on open water and with solid and broken ice is that burning is a highly effective technique, with removal rates of 85 to 95 percent or more in most situations.

Dispersants as a Possible Future Arctic Response Option

Dispersants reduce the oil/water interfacial tension, thereby decreasing the energy needed for an oil slick to break into small particles and mix into the water column. Specially formulated products containing surface-active agents are sprayed (at concentrations of 1 to 5 percent by volume of the oil) from aircraft or boats onto an oil slick. Dispersed oil droplets are then colonized by bacteria and biodegrade naturally. Dispersants are used to rapidly remove large volumes of oil from the water surface therefore providing greater protection to birds and marine mammals, which otherwise may come into contact with surface oil. Dispersing oil rapidly decreases oil concentration and prevents an oil slick from reaching the shore.

There is growing evidence from scientific testing that dispersants could play a significant role in future Arctic spill response plans. The application of chemical dispersants is recognized worldwide as an environmentally acceptable and highly efficient means of rapidly eliminating spilled oil offshore under the right conditions. Furthermore, numerous laboratory and field studies have demonstrated that a decision to use dispersants can provide a clear net environmental benefit compared to the impacts of not using the dispersant. Dispersants may provide a valuable response option when strong wind and sea conditions make mechanical cleanup and controlled in situ burn techniques unsafe and/or ineffective. Under these conditions the treatment of spilled oil with chemical dispersants is actually enhanced by the mixing energy provided by breaking waves that hinder other response operations. This advantage, combined with the potential to treat large areas quickly with aerial application systems, makes dispersants an essential tool for most offshore oil spill response organizations.

10.3.2.3 Broken Ice Offshore Response

As ice concentrations increase, the containment lost through ice interference with conventional open water booms is replaced by the natural containment provided by the close proximity of individual ice floes. Even relatively thin ice can provide an effective barrier to oil spreading.

Light ice concentration may be addressed by use of Ice Deflection or Ice Management Techniques. Using vessels as physical barriers or prop wash from an icebreaker allows deflecting ice away from the spill site, thus creating a relatively open space where open water strategies can be used.

Mechanical Response in Broken Ice

As ice concentrations increase beyond very open drift conditions (10 to 30 percent), response strategies generally move toward smaller, more maneuverable vessels with side arms to continue to recover oil at reduced encounter rates for some time after operations with the larger systems have ceased. Continued operations with containment boom may become impractical. At this point, mechanical recovery can then continue with over-the-side skimmers (e.g., brush and rope mop) to access pockets of oil trapped between ice cakes and floes or in leads. In high ice concentrations, ice acts as a natural barrier preventing oil from spreading and maintaining it at a thickness suitable for mechanical recovery.

Controlled In Situ Burning in Broken Ice

Heavy ice concentrations can actually aid controlled in situ burning. The ice tends to dampen waves, reduce surface spreading, and increase slick thickness. Under these conditions, there is an increased potential for the accumulation of oil on water at thicknesses that can support sustained combustion. In this case, igniters can be deployed from a helicopter eliminating the need for personnel exposure to a dynamic ice field.

Dispersants in Broken Ice

Recent tests have demonstrated that dispersants are efficient even in cold waters. While ice floes tend to dampen the waves and decrease energy input needed for the dispersion, icebreaker prop wash can be used to break oil into small droplets and mix them into water column. This energy input is so powerful that the efficiency of oil dispersion is far greater than in the natural breaking wave conditions, even for weathered oils. The size of oil droplets dispersed with the prop wash is smaller than that of naturally dispersed oil, which facilitates natural biodegradation.

10.3.2.4 Response to Oil in Solid Ice

Oil under solid ice occupies a much smaller area than it would if allowed to spread on the water surface. Oil can be exposed through the use of icebreakers, drilling holes, or cutting trenches in the nearshore ice. Once oil is exposed, vacuum pumps, skimmers, and controlled in situ burning can be used in procedures similar to the broken ice scenario.

If oil is released onto the surface of solid stable ice, snow and ice berms and trenches are used to prevent oil from spreading. Vacuum tracks, sorbents, or manual cleanup can be used for the cleanup. Personnel from ACS are highly experienced in nearshore and solid ice clean up. A comprehensive manual of various response techniques can be found on ACS' website at: http://www.alaskacleanseas.org/.

10.3.2.5 Nearshore Response

Response to offshore spills aims at recovering oil in the ocean and preventing it from reaching the shore. In the nearshore, shallow draft boats, as well as deflection and exclusion booms, are used to protect sensitive shoreline areas and collect oil in the designated locations. Then oil is collected using skimmers, vacuum tracks, sorbents, and manual labor.

Landfast ice that forms at the first signs of cold weather and is last to melt provides invaluable protection to the nearshore areas. It acts as a natural barrier concentrating oil and preventing it from reaching the shore. Mechanical response and in situ burning can be conducted at the ice edge using conventional techniques.

10.3.2.6 Spring Recovery

When oil accumulates under ice during the freeze-up, it can get quickly encapsulated into an ice sheet, which isolates oil from the environment. This protects wildlife from coming into contact with oil and prevents oil from weathering. Tracking buoys may be frozen into contaminated ice to monitor its location. In the springtime, when ice starts to melt, pools of encapsulated oil penetrate through the brine channels and form pools on top of the melting ice. Controlled in situ burning with ignition from helicopters can be used to treat these pools of oil. If a large amount of oil becomes exposed, mechanical recovery can be used in procedures similar to the broken ice scenario.

10.3.3 Wildlife Management

During oil spill response, every effort is made to minimize the potential for environmental damage and prevent wildlife from coming into contact with oil. A wildlife management plan will be developed and implemented, which may include wildlife monitoring, hazing, wildlife capture and stabilization, maintenance of subsistence levels, etc. These activities are conducted in close collaboration with the incident Unified Command, which includes Federal, State, and Local representatives. The USFWS is also included in this collaboration.

In 2010, Alaska Clean Seas formed an informal working group for Marine Mammal Response on the North Slope. The workgroup's mission is to *enhance communications, identify and improve capabilities, and develop/improve procedures with organizations responsible for marine mammal response on the North Slope of Alaska* (ACS 2012). Participants in the workgroup include the USFWS, NMFS, ADEC, NSB, Alaska Sealife Center, Alaska Zoo, Pet Stop, Alaska Clean Seas, Alaska Chadux, and other industry representatives. Since its formation, the workgroup has conducted animal handling, transport, cleaning, and stabilization simulations during spill response drills (ACS 2014).

The oil and gas industry may follow the guidance of Annex G of the Alaska Regional Response Team (ARRT) Wildlife Protection Guidelines for Alaska (2010) and the USFWS Oil Spill Response Plan for Polar Bears in Alaska (USFWS 1999) in responding to an oil spill that could affect polar bears or their habitat. These policy documents both outline a three-tier strategy characterized by the following:

- ***Primary response*** for protecting polar bears from an oil spill is to prevent the oil from reaching sensitive areas such as denning sites, feeding sites, or areas where animals are concentrated. Known den sites should be avoided by all personnel at all times to minimize disturbance;
- ***Secondary response*** is to deter or haze polar bears from the area of the oil slick or contaminated habitat. This response is appropriate under all circumstances and may be incorporated with primary response activities. The degree of risk associated with the animal actually contacting oil before secondary response strategies are initiated should be considered. If the spill occurs when polar bears are believed to be present, an aerial survey should be conducted to locate potentially affected animals; and
- ***Tertiary response*** is the treatment of polar bears contaminated with oil. The components of tertiary response are the capture, handling, transport, treatment, holding, and release of polar bears. The tertiary response involving capture of polar bears may only be undertaken by the USFWS or with their authorization.

10.3.4 Ongoing Research and Development of New Technologies

Oil companies spend millions of dollars every year to advance oil spill response capability in arctic and ice-infested waters. Some of the ongoing arctic research and development projects include the following:

- Use of icebreaker prop wash to facilitate oil dispersion in broken ice; recent tests have shown high effectiveness of this technique.
- New formulation of a dispersant that is more efficient under cold temperatures and on viscous oils. It is more viscous than conventional dispersants and will float on the water surface together with a slick rather than dissolving into the water column.
- A Joint Industry Project (JIP) has been formed to address stakeholders concerns by studying the effect of dispersed oil on arctic marine organisms specific to the Beaufort and Chukchi seas. This research will provide comprehensive information that will facilitate the Net Environmental Benefit Analysis by comparing the effect of use of dispersants to other response techniques.
- Ice deflection: a series of tests were conducted to demonstrate how vessels can be used to deflect ice away from the response operations and create an open water area where conventional response techniques can work with greater efficiency.
- Assess feasibility of Nuclear Magnetic Resonance Radar to detect oil under ice.
- Assess the feasibility of using Unmanned Aerial Systems (UAS) to monitor ice movement and surface oil slicks using varying optics capabilities
- A comprehensive JIP managed through SINTEF Norway (a Scandinavian research organization), took place from 2006-2009 and aimed at developing improved arctic spill response techniques. Follow-up programs and projects are expected, but some of the completed projects included:
  - Feasibility of using airborne radar with sufficient power and resolution to detect and map oil trapped under ice from a low-flying helicopter. This project also evaluated the capabilities of different remote sensing systems such as laser fluorosensor, GPR, ultraviolet/infrared (UV/IR), side-looking airborne radar (SLAR), radar satellites, and enhanced marine radar to detect and map oil in a variety of ice conditions.
  - Improve the efficiency of mechanical recovery in broken ice. Improve, “winterize,” and test in the field state-of-the-art skimmer designs.
  - Analyze weathering of oil in ice and snow and evaluate feasibility of controlled in situ burning under variable response conditions.
  - Use of herders to facilitate controlled in situ burning. “Herder” is a chemical similar to dispersant that reduces surface tension of water. When applied in small quantities around the edges of a slick, it makes an oil slick contract and increases its thickness several fold. Controlled in situ burning can then be used on this herded slick. Recent tests show that herders work well in calm water and may be used in a broken ice field where ice concentration prevents use of booms, but is not high enough to contain oil to a desired thickness.
  - Analyze dispersant “window of opportunity” and develop new application equipment that would allow targeted application of dispersant between ice floes avoiding spraying dispersant on clean ice.
  - Develop a Generic Arctic Spill Response Guide summarizing available information on feasibility of response techniques.
  - Conduct field tests to validate JIP findings in a real arctic environment in broken ice.

11.0 MONITORING AND REPORTING

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 section lists the monitoring and reporting measures the oil and gas operators may undertake to increase the knowledge of the species and monitor potential impacts of activities.

11.1 Monitoring

- Monitoring plans are site specific and dependent on location and timing of activity relative to the habitat (den sites, travel corridors, and food sources).
- Monitoring plans document when and how polar bears and walruses are encountered, the number encountered, and their behavior.
- All sightings of polar bears and walruses must be recorded for all exploration, development, and production activities, including seismic. To the extent possible, group size, age, sex, reaction, duration of interaction, and closest approach to activity will be recorded.
- Polar bear monitors will be required if polar bears are known to frequent the area or known polar bear dens are present.

11.2 Reporting

- Each operator must submit an "after action monitoring report" to the USFWS Alaska Regional Director, Marine Mammals Management Office for exploratory and development activities within 90 days of completion of the activity. For production activities, each operator will submit an annual report for the preceding year's activities. The reports must include the following information:
  - Dates and times of activities
  - Dates and locations of polar bears and walruses activities related to monitoring activities
  - Results of monitoring activities including take estimates, as applicable
  - Dates and locations of polar bear and walrus activities related to operation activity when the sightings occurred
- In the event a bear is observed, the operator must submit a report within 24 hours to the USFWS Alaska Regional Director, Marine Mammals Management Office.

12.0 COORDINATION OF RESEARCH EFFORTS

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.

To minimize the potential for impacts to the species, stocks, and subsistence use of polar bears and walruses, all oil and gas activities will be conducted in accordance with all federal, state, and local regulations. Additionally, all operators will continue to cooperate with USFWS and other appropriate federal agencies (i.e., BOEM, BLM, NMFS), the State of Alaska, NSB, the potentially affected communities, and other monitoring programs to coordinate research opportunities and assess all measures than can be taken to eliminate or minimize any impacts from these activities.

The operators may also cooperate with marine mammal researchers in the Beaufort Sea area in sharing data on polar bears and walruses and other marine mammal species that occur in the project area. This information will also be shared with other relevant governmental and private groups conducting studies. At their discretion, the operators will also continue to support research to further the knowledge of the species and interactions with oil and gas activities. Recent research activities supported by operators include:

- Acoustic monitoring of construction and operation noise associated with oil and gas exploration and production, both underwater and airborne.
- Hearing studies on polar bears.
- Acoustic monitoring of marine mammals.
- Aerial (manned and un-manned) surveys and vessel surveys to determine distribution and abundance of species both onshore and offshore.
- Satellite tagging of species to determine distribution and behavior.
- FLIR surveys to identify den sites.

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