

Alaska Eskimo Whaling Commission

P.O. Box 570 • Barrow, Alaska 99723

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April 9, 2010

VIA ELECTRONIC MAIL at arcticeis.comments@noaa.gov

Mr. P. Michael Payne
Chief
Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Springs, MD 20190-3225

Re: Scoping Comments – Notice of Intent to Prepare an Environmental Impact Statement on Effects of Oil and Gas Activities in the Arctic Ocean (75 Fed. Reg. 6175)

Dear Mr. Payne:

Thank you for the opportunity to submit these scoping comments on the National Marine Fisheries Service's Notice of Intent with respect to offshore oil and gas activities in the Arctic Ocean. We appreciate the opportunity to provide NMFS with critical feedback from the potentially impacted local communities of America's Arctic.

These comments are submitted on behalf of the Alaska Eskimo Whaling Commission (AEWC.) As you know, AEWC is a non-profit organization representing the unique interests of Inupiat subsistence whaling captains in Northern coastal Alaska. AEWC represents the eleven bowhead whale subsistence hunting villages of Barrow, Nuiqsut, Kaktovik, Pt. Hope, Kivalina, Wales, Savoonga, Gambell, Little Diomed, Wainright and Pt. Lay. AEWC represents the unique interests of Inupiat whaling captains and their communities, who depend on the resources of the Beaufort and Chukchi Seas on the Outer Continental Shelf (OCS) to continue the subsistence practices that have provided for our families and sustained our communities since time immemorial.

As requested in the scoping notice, we would like to receive a copy of the Draft Environmental Impact Statement (DEIS) as soon as it becomes available. Our address is as follows:

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Alaska Eskimo Whaling Commission
P.O. Box 570
Barrow, Alaska 99723

For more than 30 years, the United States Government and the International Whaling Commission have insisted that decisions regarding our ability to take bowhead whales for food must be based on sound science. We have complied with this directive and have devoted very significant amounts of our community's limited resources to produce the science that our Government committed itself to provide to the International Whaling Commission. At the same time, our families and we endured food shortages because we were instructed to limit our take of bowhead whales until the scientific information was adequate to support a decision allowing us to increase our take of whales. Throughout these years, we have argued that decisions regarding industrial and commercial uses of the Arctic Ocean, where our food resources live, also must be based on sound science. We are very grateful to see that the new Administration has the same perspective.

For our hunters, this is more than a matter of fairness and equal justice. Our observations, proven correct time and again by scientific research, are that bowhead whales change their behavior when industrial activity is taking place in their usual habitat. Because of these changes in behavior, the whales become less available or completely unavailable to our hunters during the time the activity is occurring, due both to noise disturbance and to pollution in the water. We also are very concerned that some habitats might be abandoned altogether if industrial activity increases or if it is undertaken in a way that creates ongoing disturbance.

Because of these concerns, AEWC has been calling for a comprehensive management plan to regulate industrial activity in the Arctic Ocean. To this point in time, decisions have been made on a piecemeal basis without a complete understanding of how the Arctic ecosystem functions or what impacts industrial activities will have on marine mammals and the communities that depend on those resources for their subsistence livelihoods.

President Obama's recent announcement regarding the Draft OCS Oil and Gas Leasing Program 2010-2015 only underscores the critical importance of ensuring that oil and gas activities are regulated and managed effectively on the OCS. The Administration provided industry the opportunity to explore for oil and gas on active leases in the Beaufort and Chukchi Seas, but with that opportunity comes great responsibility. As President Obama stated:

So today we're announcing the expansion of offshore oil and gas exploration – but in ways that balance the need to harness domestic energy resources and the need to protect America's natural resources. Under the leadership of Secretary Salazar, we'll employ new technologies that reduce the impact of oil exploration. We'll protect areas vital to tourism,

the environment, and our national security. And we'll be guided not by political ideology, but by scientific evidence.

The decisions made by NMFS pursuant to the Marine Mammal Protection Act (MMPA) will carry out this promise that the President made to the Inupiat people and the rest of America. NMFS now carries the responsibility of regulating and managing industrial activity in the Arctic in order to carry out the Congressional mandates of protecting marine mammals and the subsistence activities of Alaskan Natives. The best and indeed the only way to ensure that this is done effectively is to develop and implement a comprehensive, science-based management regime for the Arctic Ocean *before* authorizing extensive industrial activities on the OCS. As President Obama stated, the county will be guided not by ideology but by science. Here, the science – and the resulting management plan – must come first.

The White House has jump started a process that would do just that – put science first in developing comprehensive management regimes for our nation's oceans. On December 9, 2009, the White House's Council on Environmental Quality (CEQ) and the Interagency Ocean Policy Task Force (Task Force) issued the Interim Framework for Effective Coastal and Marine Spatial Planning. As the Task Force states, the White House is embarking on a new path to develop Coastal and Marine Spatial Planning (CMSP), described as a:

comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process, based on sound science, for analyzing current and anticipated uses of ocean, coastal, and Great Lakes areas. CMSP identifies areas most suitable for various types or classes of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve critical ecosystem services to meet economic, environmental, security, and social objectives.

The Task Force specifically identified oil and gas leases as an “existing permitting process[]” that focuses “solely on a limited range of management tools and outcomes,” stating that the nation needed instead an “integrated, comprehensive, ecosystem-based, flexible, and proactive approach to planning and managing these uses and activities.”

The question that NMFS must now struggle with is whether this Administration will uphold the promises made to the people of this country. President Obama has provided to industry the opportunity to conduct certain exploration activities on active leases but only in a way that protects the environment based on sound science. At the same time, President Obama has declared that our country needs to implement comprehensive management plans for our Nation's oceans. The question now becomes whether these words will be put into action and whether the Administration will develop a science-based management plan to regulate industrial activity in the Arctic. Or, on the other hand, will the Administration continue the failed policies of the past, approving industrial activities on a piecemeal basis, which will only guarantee further conflict, scientific uncertainty and ultimately, as the Task Force articulated, “the potential loss of

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critical economic, ecosystem, social and cultural services for present and future generations.”

Decisions on industrial activity in the Arctic should be made only as part of the development of a comprehensive management plan for the Arctic. Our concern is that NMFS is again making long-term decisions without anywhere near complete information on the needs of the resources, the biological baseline, other foreseeable competing uses (including subsistence, shipping, commercial fishing, renewable energy, oil and gas and conservation) and changing conditions resulting from climate change and ocean acidification. As an example, NMFS is attempting to determine how many activities can be conducted in the Chukchi Sea before having a full understanding of how bowhead whales use the Chukchi during the fall migration. Moreover, NMFS lacks critical information including the long-term impacts to marine mammals of underwater noise associated with seismic, drilling and icebreaking activities.

AEWC and ICAS therefore strongly urge NMFS to coordinate its work on the DEIS with the work of the Task Force in developing a comprehensive, science-based Arctic CMS Plan. The Arctic is at a crossroads as climate change and ocean acidification change the environmental baseline at the same time that industry is demonstrating a much greater interest in oil and gas off Alaska's north coast. This will likely be our Nation's only opportunity to conserve the unique natural resources of the United States' Arctic region for future generations.

We recognize that the process we request requires time to develop and implement, however, that is the only responsible approach to management in the Arctic. Industry may desire quick access to the resources, but we simply do not have enough information or enough institutional structure in place currently to regulate effectively numerous multi-national oil companies operating simultaneously in the Beaufort and Chukchi Seas. To responsibly balance energy exploration and the interests of local subsistence communities, industrial activities must be slowly implemented over time, well monitored and then evaluated. We therefore encourage NMFS to view this as an iterative process whereby it considers authorizing only a limited number of activities and then revisits the decision, in conjunction with the development, implementation and evaluation of an Arctic CMS Plan. If NMFS insists upon authorizing industrial activity to move forward before an Arctic CMS Plan has been developed and implemented, those activities must be narrowly limited in time and place to ensure that adverse impacts to marine mammals and subsistence activities do not take place thereby foreclosing future management options.

With that goal in mind, we strongly urge NMFS to consider strict limitations on the number, scale/size, location and duration of industrial activities until such a management plan has been fully developed and implemented. AEWG has a long history of establishing limits on the number concurrent operations through the annual Conflict Avoidance Agreement (CAA) entered into between AEWG, the village whaling captains associations and offshore operators. A copy of the most recent CAA has been attached to this letter. Our whaling captains have spent many years and many long hours of negotiating with industry developing these limitations, and we strongly encourage NMFS

to adopt similar requirement since they have already been agreed to by the local impacted community and offshore operators.

The remainder of these comments respond to the specific questions presented in the scoping notice. 75 Fed Reg at 6177.

(1) Effects of oil and gas exploration on marine mammal behavior and use of habitat

We strongly encourage NMFS to base its decision on the best available science regarding bowhead whale and marine mammal reactions to underwater noise. As has been documented time and time again, bowhead whales, beluga whales and other marine mammals react to very low levels of underwater noise. Studies conducted by Richardson and others, as have been discussed in the 2008 Arctic Regional Biological Opinion, document bowhead whale deflection when received sound levels are at or perhaps lower than 120dB. More recently, we understand that monitoring activities from Shell's seismic activity in the Beaufort during 2007 and 2008 demonstrate that call detection rates drop significantly during airgun operation. Disruption of communication and migration patterns certainly meets the definition of "harassment" under the MMPA and therefore must be regulated by NMFS.

Because of the potential impacts to bowhead whales, we encourage NMFS to implement specific protections for areas that provide important habitat characteristics, including deferring industrial activity in these areas or implementing seasonal closures and restrictions. In particular, NMFS must provide proven protections for the following areas:

- critical feeding and resting grounds near Camden Bay in the mid-Beaufort; and
- critical feeding grounds in the eastern Beaufort and near Barrow Canyon in the western Beaufort.

NMFS should also focus on key behavioral characteristics and vulnerable members of the population, including feeding and resting during the migration, communication, and impacts to mothers and calves.

Our knowledge of bowhead whale use of the Chukchi Sea is currently inadequate to support informed decision-making. NMFS should require at least 2-3 more years of baseline data collection prior to authorizing any activities that could disrupt bowhead whales in the Chukchi. We are just now beginning to understand how bowhead whales use the Chukchi Sea, and we are far from understanding how the deflection and harassment associated with seismic, drilling and icebreaking activities in this area could impact the whales.

NMFS must also include a thorough, up-front discussion and analysis of the effectiveness of mitigation measures. In particular, the AEWG is concerned that NMFS has historically placed too much reliance upon MMOs in preventing impacts to marine

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mammals. MMOs may be ineffective because: 1) they can monitor only within a limited distance; 2) they are limited by adverse weather or sea conditions; and 3) they are limited by darkness.

Furthermore, as discussed above, bowhead whales react to industrial sounds at received levels as low as 120dB or lower. Mitigation measures must be designed to protect bowhead whales from sounds received at these levels. MMOs will be ineffective at monitoring the 120dB isopleth area because of its size, and therefore industry will have to rely upon other forms of monitoring as a part of an effective mitigation program. As an alternative, NMFS should give close consideration to seasonal restrictions in specific locations to ensure that bowhead whales are able to complete their spring and fall migrations. Without additional, proven techniques for monitoring the 120dB isopleth, exclusions areas and the accompanying shut-down and start-up procedures will not be effective at preventing impacts to bowhead whales.

NMFS should also give close consideration to the potential impacts resulting from increased vessel traffic and the possibility for ship strikes and other impacts to bowhead whales and marine mammals. NMFS should consider designating specific shipping lanes, implementing seasonal restrictions to protect marine mammals during their migration and establishing speed restrictions to prevent against strikes. We know from the experience with the North Atlantic right whale that vessel traffic poses a significant threat to large, slow-moving baleen whales such as the bowhead, and NMFS should get out in front on this issue before we see even more increases in vessel and shipping traffic.

(2) Effects of oil and gas exploration on the availability of species for subsistence uses

Bowhead whale reaction to underwater noise has been well documented by past studies, and bowhead whale deflection presents a serious threat to the subsistence activities of our communities. We strongly encourage NMFS to implement protective measures for critical subsistence use areas, including:

- areas used by the Village of Kaktovik in the eastern Beaufort;
- areas around Cross Island used by the Village of Nuiqsut;
- areas used by the Village of Barrow in the western Beaufort; and
- areas used by Wainright and Pt. Lay along the Chukchi Sea coast.

NMFS should consider deferring these areas from industrial activity or implementing seasonal closure and restrictions. We again reiterate our request that NMFS consider the measures established in the CAA, which have been specifically designed to prevent conflicts between industrial activities and the subsistence hunt.

We also encourage NMFS to give close consideration to the potential impacts to human health in local North Slope communities. Air pollution, water pollution, impacts to subsistence activities and interference in social structures and institutions can all have a major impact on the physical, mental and spiritual health of our people. NMFS should

conduct a health impact assessment in conjunction with the DEIS in close partnership with AEW, ICAS and other local Inupiat interests.

Throughout its work, NMFS must take into account principles of environmental justice and Executive Order 12898. NMFS must take into account the unique interests of local Inupiat communities and must fully evaluate any disproportionate impacts placed upon the Inupiat people. NMFS must endeavor to make information available in understandable and accessible terminology, and NMFS should also be sensitive to the burdens placed on local communities when multiple decisions are being made at the same time. Our people feel overwhelmed by having to participate in and comment on multiple decisions at the same time, and NMFS should look for ways to tailor its public participation process to address these concerns.

(3) Available new science on the Arctic ecosystem

We are still in the process of collecting adequate baseline information on the status of the Arctic ecosystem. NMFS must provide the public with a complete and up-front disclosure of existing data gaps on the existing baseline as well as the current ongoing research designed to provide missing information. NMFS must ensure that any industrial activity authorized in the Arctic does not substantially change the existing baseline conditions until such time as we have developed adequate information.

In particular, we strongly encourage NMFS to review closely the results of the satellite tagging study being conducted by Lori Quackenbush of the Alaska Department of Fish and Game with assistance from the North Slope Borough's Department of Wildlife Management and the whaling captains of AEW. All of the tagged whales have migrated through the Lease Sale 193 area, sometimes more than once in a single season. We also strongly encourage NMFS to review the results of the latest aerial surveys of the Chukchi Offshore Monitoring in Drilling Area program (COMIDA), which has identified heavy bowhead whale use in the Lease Sale 193 area.

(4) Available new technology for monitoring or obtaining seismic/drilling data

NMFS should reformulate this question and consider new technology to reduce the potential impacts of seismic and exploratory activities. For many years, our whaling captains have expressed grave concern over the potential impacts of discharge associated with exploratory drilling and other activities. NMFS must consider the availability and/or development of zero discharge technologies to protect against pollution and tainting of our subsistence food sources. NMFS should also explore the possibility of extended reach drilling, particularly in the Beaufort, and should take the lead on forcing industry to develop new technologies to prevent and mitigate impacts to marine mammals. AEW also strongly encourages NMFS to consider implementation of a full suite of monitoring technologies, including acoustic recorders, aerial monitoring, satellite tagging and on-board MMOs.

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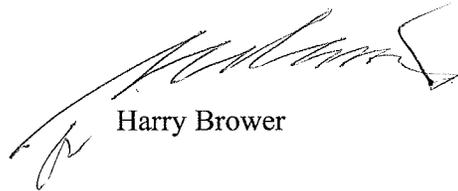
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In conclusion, we reiterate our request that NMFS proceed deliberately and with caution in reviewing and authorizing industrial activity in the Arctic. The stakes are very high both for our local communities and for the resources of the Arctic. There are gaps in our knowledge of how the Arctic ecosystem functions and the potential impacts of underwater noise. Climate change and ocean acidification are likely to create additional stresses on the existing baseline. All the while, President Obama has promised our people and the American public that these decisions would be made based on sound science and in a way that protects the environment and local communities.

AEWC looks forward to reviewing the DEIS and providing additional comment at the appropriate time. AEWEC requests that NMFS consult with AEWEC at the earliest possible time pursuant to the AEWEC-NOAA cooperative agreement, and we encourage NMFS to work closely with the AEWEC and our local community to ensure that the federal government fulfills the promises made to our people by President Obama and his Administration.

Sincerely,

A handwritten signature in black ink, appearing to read "Harry Brower", is written over the typed name. The signature is fluid and cursive, with a long horizontal stroke extending to the left.

Harry Brower

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Changes to 2009 Final CAA and Addendum are **highlighted and underlined**. Changes to Draft 1A of the 2010 CAA are shown in **blue**.

**2010 OPEN WATER SEASON
PROGRAMMATIC CONFLICT AVOIDANCE AGREEMENT**

BETWEEN

BP EXPLORATION (ALASKA), INC.

CONOCOPHILLIPS ALASKA, INC.

EXXON MOBIL CORPORATION

ION / GX TECHNOLOGY

PIONEER NATURAL RESOURCES ALASKA, INC.

SHELL OFFSHORE, INC

STATOIL

AND

**THE ALASKA ESKIMO WHALING COMMISSION
THE BARROW WHALING CAPTAINS' ASSOCIATION
THE KAKTOVIK WHALING CAPTAINS' ASSOCIATION
THE NUIQSUT WHALING CAPTAINS' ASSOCIATION
THE PT. HOPE WHALING CAPTAINS' ASSOCIATION
THE PT. LAY WHALING CAPTAINS' ASSOCIATION
THE WAINWRIGHT WHALING CAPTAINS' ASSOCIATION**

Final for Signature

March 1, 2010

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TITLE I – GENERAL PROVISIONS

SECTION 101. APPLICATION.

Titles I and II apply to all Participants.

Title III applies to those Participants who operate barge or transit vessels in the Beaufort Sea or Chukchi Sea.

Titles IV and V apply only to those Participants who engage in oil and gas operations.

Provisions that apply to a specific activity or are designated as specific to either the Beaufort Sea or Chukchi Sea apply only to Participants that engage in that activity or operate in that area, and provisions applicable to activities a Participant does not engage in or areas in which a Participant does not operate do not apply to that Participant.

SECTION 102. PURPOSE.

The purpose of this Agreement is to provide:

- (1) Equipment and procedures for communications between Subsistence Participants and Industry Participants;
- (2) Avoidance guidelines and other mitigation measures to be followed by the Industry Participants working in or transiting the vicinity of active subsistence hunters, in areas where subsistence hunters anticipate hunting, or in areas that are in sufficient proximity to areas expected to be used for subsistence hunting that the planned activities could potentially affect the subsistence hunt through effects on marine subsistence resources;
- (3) Measures to be taken in the event of an emergency occurring during the term of this Agreement; and
- (4) Dispute resolution procedures.

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SECTION 103. DEFINITIONS.

(a) Defined Terms.

For the purposes of this Agreement:

(1) The term “Agreement” means this 2010 Open Water Season Programmatic Conflict Avoidance Agreement and any attachments to such agreement.

(2) The term “at-sea oil and gas operations” does not include fixed platform developments located near shore (for example Northstar or Oooguruk).

(3) The term “barge” means a non-powered vessel that is pushed or towed, and the accompanying pushing or towing vessel, that is used solely to transport materials through the Beaufort Sea or Chukchi Sea. Such term does not include any vessel used to provide supplies or support to at-sea oil and gas operations.

(4) The term “Com-Center” means a communications systems coordination center established under Section 203.

(5) The term “geophysical activity” means any activity the purpose of which is to gather data for imaging the marine environment, sea floor, or subsurface, including but not limited to use of air guns, sonar, and other equipment used for seismic exploration or shallow hazard identification.

(6) The term “geophysical equipment” means equipment, such as air guns or sonar, employed on a vessel, towed array, or stationary source, that generate sound waves for the purpose of imaging the marine environment, sea floor, or subsurface. The term does not include vessel engines, generators, or depth finders.

(7) The term “Industry Participants” means all parties to this Agreement who are not Subsistence Participants.

(8) The term “Marine Mammal Observer / Inupiat Communicator” or “MMO/IC” means an observer hired by an Industry Participant for the purpose of spotting and identifying marine mammals in the area of that Industry Participant’s operations during the Open Water Season. The MMO/IC also serves as the on-board Inupiat communicator who can communicate directly with whaling crews.

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(9) The term “Near Shore Operations Support Vessels” means vessels (including aircraft) used to support related activities (such as supply, re-supply, crew movement, and facility maintenance) for near shore oil and gas operations by an Industry Participant.

(10) The terms “NSB” and “NSB DWM” mean the North Slope Borough and the North Slope Borough Department of Wildlife Management, respectively.

(11) The term “oil and gas operations” means all oil and gas exploration, development, or production activities (including, but not limited to, geophysical activity, exploratory drilling, development activities (such as dredging or construction), production drilling, or production, and related activities (such as supply, re-supply, crew movements, and facility maintenance) by or for any Industry Participant, including aircraft and vessels of whatever kind used in support of such activities, occurring in the Beaufort Sea or Chukchi Sea, whether occurring near shore or offshore, but does not include barge or transit vessel traffic by or for any Participant.

(12) The term “Open Water Season” means the period of the year when ice conditions permit navigation or oil and gas operations to occur in the Beaufort Sea or Chukchi Sea, as appropriate.

(13) The term “Participants” means all parties identified in this Agreement by name and whose representative(s) has signed the Agreement, and all contractors of such parties. When used alone the term includes both Industry Participants and Subsistence Participants.

(14) The term “Primary Sound Source Vessel” means a vessel owned or operated by or for an Industry Participant that (A) employs air guns or active sonar for imaging the subsurface environment, (B) is used to monitor any safety zone around a vessel described in subsection (A), (C) is engaged in ice-breaking, or (D) is the lead vessel in a group of barge or transit vessels.

(15) The term “Subsistence Participants” means the Alaska Eskimo Whaling Commission (AEWC) and its members, including the whaling captains’ associations identified on the cover of this Agreement, as well as any individual members of those associations.

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(16) The term “transit vessel” means a powered vessel that is used solely to transport materials through the Beaufort Sea or Chukchi Sea. Such term does not include a vessel used to provide supplies or other support to at-sea oil and gas operations.

(b) Geographically Limited Terms.

For the purposes of this Agreement:

(1) The term “Beaufort Sea” means all waters off the northern coast of Alaska from Point Barrow to the Canadian border.

(2) The term “Chukchi Sea” means all waters off the western and northern coasts of Alaska from Cape Prince of Wales to Point Barrow.

SECTION 104. TERM, SCOPE, AND LIMITATIONS.

(a) Term.

The term of this Agreement shall commence with the signing of this document by the Participants and shall terminate upon completion of the Nuiqsut, Kaktovik, Barrow, Wainwright, Pt Lay, and Pt. Hope Fall Bowhead Hunts or the Beaufort Sea Post Season Meeting required under Section 108(a) and Chukchi Sea Post-Season Meetings in Barrow, Wainwright, Pt. Lay, and Pt. Hope required under Section 108(b), whichever is later.

(b) Scope.

The Participants agree that, unless otherwise specified:

(1) The mitigation measures identified in this Agreement, which are intended to mitigate the potential impacts of oil and gas operations and barge and transit vessel traffic on **bowhead whales, including migrating bowhead whales**, and the Alaskan Eskimo subsistence hunt of **such bowhead whales**, are designed to apply to all activities of each Participant during the 2010 Open Water Season, whether referenced specifically or by category, and to all vessels and locations covered by this Agreement, whether referenced specifically or by category.

(2) This Agreement is intended to apply to all oil and gas operations and

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barge and transit vessel traffic during the 2010 Open Water Season in the Beaufort Sea or Chukchi Sea.

(3) Vessels and locations covered by this Agreement include those identified in the Agreement, as well as any other vessels or locations that are employed by or for the Industry Participants in the Beaufort Sea or Chukchi Sea during the 2010 Open Water Season.

(c) Limitations of Obligations.

The following limitations apply to this Agreement.

(1) No cooperation among the Participants, other than that required by this Agreement, is intended or otherwise implied by their adherence to this Agreement. In no event shall the signatures of any representative of the Alaska Eskimo Whaling Commission (AEWC), or of the Barrow, Nuiqsut, Kaktovik, Wainwright, Pt. Hope, or Pt. Lay Whaling Captains' Associations, or of any other Whaling Captains' Association be taken as an endorsement of any Arctic operations or Beaufort Sea or Chukchi Sea OCS operations by any oil and/or gas operator or contractor.

(2) Adherence to the procedures and guidelines set forth in this Agreement does not in any way indicate that any Inupiat or Siberian Yupik whalers or the AEWC agree that industrial activities are not interfering with the bowhead whale migration or the bowhead whale subsistence hunt. Such adherence does not represent an admission on the part of the Industry Participants or their contractors that the activities covered by this Agreement will interfere with the bowhead whale migration or the bowhead whale subsistence hunt.

(3) No member of the oil and gas industry or any contractor has the authority to impose restrictions on the subsistence hunting or any other activities of the AEWC, residents of the Villages of Nuiqsut, Kaktovik, Barrow, Wainwright, Pt. Lay, or Pt. Hope, or residents of any other village represented by the AEWC.

(4) In the event additional parties engage in oil and gas operations in the Beaufort Sea or Chukchi Sea during the summer or fall of 2010 the Participants shall exercise their good-faith efforts to encourage those parties to enter into this Agreement. Should additional parties enter into this Agreement at a date subsequent to the date of the signing of this document and before the termination of the 2010 bowhead whale subsistence hunting season, the AEWC will provide to all Participants a supplement to this document with the added signatures.

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(5) No Participant is responsible for enlisting additional parties to adhere to the terms and conditions of the Agreement. Similarly, **THE AEWIC IS NOT RESPONSIBLE FOR, OR A PARTY TO, ANY AGREEMENT AMONG THE INDUSTRY PARTICIPANTS** concerning the apportionment of expenses necessary for the implementation of this Agreement.

(6) In adhering to this Agreement, none of the Participants waives any rights existing at law. All Participants agree that the provisions of this document do not establish any precedent as between them or with any regulatory or permitting authority.

(7) **PARTICIPANTS' OBLIGATIONS SHALL BE SEPARABLE:** All Participants to this Agreement understand that each Participant represents a separate entity. The failure of any Participant to adhere to this Agreement or to abide by the terms and conditions of this Agreement shall not affect the obligation of other Participants to adhere to this Agreement and to proceed accordingly with all activities covered by this Agreement. Nor shall any Participant's adherence to this Agreement affect that Participant's duties, liabilities, or other obligations with respect to any other Participant beyond those stated in this Agreement.

SECTION 105. REGULATORY COMPLIANCE.

(a) United States Coast Guard Requirements.

The Participants shall comply with all applicable United States Coast Guard requirements for safety, navigation, and notice.

(b) Environmental Regulations and Statutes.

The Participants shall comply with all applicable environmental regulations and statutes.

(c) Other Regulatory Requirements.

The Participants shall comply with all applicable federal, state, and local government requirements.

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SECTION 106. DISPUTE RESOLUTION.

Subject to the terms of Section 104(c)(7) of this Agreement, all disputes arising between any Industry Participants and any Subsistence Participants shall be addressed as follows:

- (1) The dispute shall first be addressed between the affected Participant(s) in consultation with the affected village Whaling Captains' Association and the Industry Participant(s)' Local Representative.
- (2) If the dispute cannot be resolved to the satisfaction of all affected Participants, then the dispute shall be addressed with the affected Participants in consultation with the AEWC.
- (3) If the dispute cannot be satisfactorily resolved in accordance with paragraphs (1) and (2) above, then the dispute shall be addressed with the AEWC and the Participants in consultation with representatives of NOAA Fisheries.
- (4) All Participants shall seek to resolve any disputes in a timely manner, and shall work to ensure that requests for information or decisions are responded to promptly.

SECTION 107. EMERGENCY AND OTHER NECESSARY ASSISTANCE.

(a) Emergency Communications.

ALL VESSELS SHOULD NOTIFY THE APPROPRIATE COM-CENTER IMMEDIATELY IN THE EVENT OF AN EMERGENCY. The appropriate Com-Center operator will notify the nearest vessels and appropriate search and rescue authorities of the problem and advise them regarding necessary assistance. (See attached listing of local search and rescue organizations in Attachment I.)

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(b) Emergency Assistance for Subsistence Whale Hunters.

Section 403 of Public Law 107-372 (16 U.S.C. 916c note) provides that “Notwithstanding any provision of law, the use of a vessel to tow a whale, taken in a traditional subsistence whale hunt permitted by Federal law and conducted in waters off the coast of Alaska is authorized, if such towing is performed upon a request for emergency assistance made by a subsistence whale hunting organization formally recognized by an agency of the United States government, or made by a member of such an organization, to prevent the loss of a whale.” Industry participants will advise their vessel captains that, under the circumstances described above, assistance to tow a whale is permitted under law when requested by a Subsistence Participant. Under the circumstances described above, Industry Participants will provide such assistance upon a request for emergency assistance from a Subsistence Participant, if conditions permit the Industry Participant’s vessel to safely do so.

SECTION 108. POST-SEASON REVIEW / PRESEASON INTRODUCTION.

(a) Beaufort Sea Post-Season Joint Meeting.

Following the end of the fall 2010 bowhead whale subsistence hunt and prior to the 2011 Pre-Season Introduction Meetings, the Industry Participant that establishes the Deadhorse and Kaktovik Com Centers will offer to the AEWC Chairman to host a joint meeting with all whaling captains of the Villages of Nuiqsut, Kaktovik and Barrow, the Marine Mammal Observer / Inupiat Communicators stationed on the Industry Participants’ vessels in the Beaufort Sea, and with the Chairman and Executive Director of the AEWC, at a mutually agreed upon time and place on the North Slope of Alaska, to review the results of the 2010 Beaufort Sea Open Water Season, unless it is agreed by all designated individuals or their representatives that such a meeting is not necessary.

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(b) Chukchi Sea Post-Season Village Meetings.

Following the completion of 2010 Chukchi Sea Open Water Season and prior to the 2011 Pre-Season Introduction Meetings, the Industry Participants involved, if requested by the AEWG or the Whaling Captain's Association of each village, will host a meeting in each of the following villages: Wainwright, Pt. Lay, Pt. Hope, and Barrow (or a joint meeting of the whaling captains from all of these villages if the whaling captains agree to a joint meeting) to review the results of the 2010 operations and to discuss any concerns residents of those villages might have regarding the operations. The meetings will include the Marine Mammal Observer / Inupiat Communicators stationed on the Industry Participants' vessels in the Chukchi Sea. The Chairman and Executive Director of the AEWG will be invited to attend the meeting(s).

(c) Pre-season Introduction Meetings.

(1) Immediately following each of the above meetings, and at the same location, the Industry Participants will provide a brief introduction to their planned operations for the 2011 Open Water Season. Each Industry Participant should provide hand-outs explaining their planned activities that the whaling captains can review.

(2) Subsistence Participants understand that any planned operations discussed at these Pre-Season Introduction Meetings, and the corresponding maps, will represent the Industry Participant's best estimate at that time of its planned operations for the coming year, but that these planned operations are preliminary, and are subject to change prior to the 2011 Open Water Season Meeting.

(d) Map of Planned Industry Participant Activities.

The Industry Participants, jointly, shall prepare and provide the AEWG with a large-scale map of the Beaufort and Chukchi Seas showing the locations and types of oil and gas and barge and transit activities planned by each Industry Participant. This map will be for use by the AEWG and Industry Participants during the 2011 CAA Meeting.

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TITLE II -- OPEN WATER SEASON COMMUNICATIONS

SECTION 201. MARINE MAMMAL OBSERVERS / INUPIAT COMMUNICATORS.

(a) Marine Mammal Observer / Inupiat Communicator Required.

(1) In General. Each Industry Participant agrees to employ a Marine Mammal Observer / Inupiat Communicator (MMO/IC) on board each **primary sound source** vessel owned or operated by such Industry Participant in the Beaufort Sea or Chukchi Sea.

(2) Special Rule for Inside Beaufort Sea Barrier Islands. Industry Participants whose seismic acquisition operations are limited to an area exclusively within the barrier islands need employ an MMO/IC on its sound source vessel only.

(3) Near Shore Operations Support Vessels. Industry Participants are not required to employ an MMO/IC on Near Shore Operations Support Vessels.

(4) Sealift Operations. For Industry Participants conducting sealift operations in which two tugs towing barges are accompanied within ½ mile by a third light tug at all times, a MMO/IC is required to be employed on the light tug only.

(b) Duties of Marine Mammal Observer / Inupiat Communicator.

(1) Each MMO/IC is to be employed as an observer and Inupiat communicator for the duration of the 2010 Open Water Season on the vessel on which he or she is stationed.

(2) As a member of the crew, the MMO/IC will be subject to the regular code of employee conduct on board the vessel and will be subject to discipline, termination, suspension, layoff, or firing under the same conditions as other employees of the vessel operator or appropriate contractor.

(3) Once the source vessel on which the MMO/IC is employed is in the vicinity of a whaling area and the whalers have launched their boats, the MMO/IC's primary duty will be to carry out the communications responsibilities set out in this Title.

(4) At all other times, the MMO/IC will be responsible for keeping a lookout for

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bowhead whales and/or other marine mammals in the vicinity of the vessel to assist the vessel captain in avoiding harm to the whales and other marine mammals.

(5) It is the MMO/IC's responsibility to call the appropriate Com-Center as set out in Sections 202 and 203.

(6) The MMO/IC will be responsible for all radio contacts between vessels owned or operated by each of the Industry Participants and whaling boats covered under Section 207 of this Agreement and shall interpret communications as needed to allow the vessel operator to take such action as may be necessary pursuant to this Agreement.

(7) The MMO/IC shall contact directly subsistence whaling boats that may be in the vicinity to ensure that conflicts are avoided to the greatest possible extent.

(8) The MMO/IC will maintain a record of his or her communications with each Com-Center and the subsistence whaling boats.

SECTION 202. COM-CENTER GENERAL COMMUNICATIONS SCHEME.

(a) Reporting Positions for Vessels Owned or Operated by the Industry Participants.

(1) All vessels (other than barge and transit vessels covered under section 302) shall report to the appropriate Com-Center at least once every six hours commencing with a call at approximately 06:00 hours. Each call shall report the following information:

(A) Vessel name, operator of vessel, charter or owner of vessel, and the project the vessel is working on.

(B) Vessel location, speed, and direction.

(C) Plans for vessel movement between the time of the call and the time of the next call. The final call of the day shall include a statement of the vessel's general area of expected operations for the following day, if known at that time.

EXAMPLE: This is the Arctic Endeavor, operated by _____ for _____ at Chukchi Sea prospect. We are currently at ___'___ north ___'___ west, proceeding SE at ___ knots. We will proceed on this

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course for ___ hours and will report location and direction at that time.

(2) The appropriate Com-Center shall be notified if there is any significant change in plans, such as an unannounced start-up of operations or significant deviations from announced course, and such Com-Center shall notify all whalers of such changes. A call to the appropriate Com-Center shall be made regarding any unsafe or unanticipated ice conditions.

(3) In the event that the Industry Participant's operation includes seismic data acquisition, the operator reserves the right to restrict exact vessel location information and provide more general location information.

(b) Reporting Positions for Subsistence Whale Hunting Crews.

(1) All subsistence whaling captains shall report to the appropriate Com-Center at the time they launch their boats from shore and again when they return to shore.

(2) All subsistence whaling captains shall report to such Com-Center the initial GPS coordinates of their whaling camps.

(3) Additional communications shall be made on an as needed basis.

(4) Each call shall report the following information:

(A) The crew's location and general direction of travel.

EXAMPLE: This is _____. We are just starting out. We will be traveling north-east from _____ to scout for whales. I will call if our plans change.

(B) The presence of any vessels or aircraft owned or operated by any of the Industry Participants, or their contractors, that are not observing the specified guidelines set forth in Title V on Avoiding Conflicts.

(C) The final call of the day shall include a statement of the whaling captain's general area of expected operations for the following day, if known at the time.

(5) Any subsistence whale hunter preparing to tow a caught whale shall report to the appropriate Com-Center before starting to tow.

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EXAMPLE: This is Archie Ahkiviana. I am ___'___ north, ___'___ west. I have a whale and am towing it into _____.

(6) Each time a subsistence whaling camp is moved, it shall be reported promptly to the appropriate Com-Center, including the new GPS coordinates.

(7) Subsistence whale hunters shall notify the appropriate Com-Center promptly if, due to weather or any other unforeseen event, whaling is not going to take place that day.

(8) Subsistence whaling captains shall contact the appropriate Com-Center promptly and report any unexpected movements of their vessel.

(c) Responsibilities of Participants.

(1) Monitoring VHF Channel 16.

All vessels covered by Sections 207, 301, and 401 of this Agreement shall monitor marine VHF Channel 16 at all times.

(2) Avoidance of Whale Hunting Crews and Areas

It is the responsibility of each vessel owned or operated by any of the Industry Participants and covered by Sections 301 or 401 of this Agreement to determine the positions of all of their vessels and to exercise due care in avoiding any areas where subsistence whale hunting is active.

(3) Vessel-to-Vessel Communication

After any vessel owned or operated by any of the Industry Participants and covered by Sections 301 or 401 of this Agreement has been informed of or has determined the location of subsistence whale hunting boats in its vicinity, the Marine Mammal Observer / Inupiat Communicator shall contact those boats in order to coordinate movement and take necessary avoidance precautions.

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SECTION 203. THE COMMUNICATIONS SYSTEM COORDINATION CENTERS (COM-CENTERS).

(a) Chukchi Lead System Included in Com-Center Coverage.

In addition to the Beaufort Sea and Chukchi Sea, the communications scheme shall apply in the Chukchi Sea lead system, as identified and excluded from leasing in the current MMS Five-Year Leasing Program, 2008-2012.

(b) Set Up and Operation.

(1) Subject to the terms of Section 104(c) of this Agreement, the Industry Participants conducting operations in:

(A) the Beaufort Sea jointly will arrange for the funding of Com-Centers in Deadhorse and Kaktovik; and

(B) the Chukchi Sea jointly will arrange for the funding of Com-Centers in Barrow, Wainwright, Pt. Lay, and Pt. Hope.

(2) All six Com-Centers will be staffed by Inupiat operators. **GROUND TRANSPORTATION MUST BE PROVIDED FOR COM-CENTER OPERATIONS IN KAKTOVIK FOR POLAR BEAR AND BROWN BEAR SAFETY.** The Com-Centers will be operated 24 hours per day during the 2010 subsistence bowhead whale hunt. One Industry Participant in the Beaufort Sea and one Industry Participant in the Chukchi Sea, or their respective contractor, will be designated as the operator of the Com-Centers for that Sea, in consultation with the AEWC.

(3) Each Industry Participant shall contribute to the funding of the Com-Centers covering the areas in which it conducts oil and gas operations. The level of funding for the Com-Centers provided by each of the Industry Participants is intended to be in proportion to the scale of their respective activities, and shall be mutually agreed by the Industry Participants.

(4) The procedures to be followed by the Com-Center operators are set forth in subsection (d) below.

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(c) Staffing.

(1) Each Com-Center shall have an Inupiat operator (“Com-Center operator”) on duty 24 hours per day from August 15 until the end of the bowhead whale subsistence hunt in:

- (A) Kaktovik for the Kaktovik Com-Center;
- (B) Nuiqsut for the Deadhorse Com-Center;
- (C) Barrow for the Barrow Com-Center;
- (D) Wainwright for the Wainwright Com-Center.
- (E) Pt. Lay for the Pt. Lay Com-Center, which will be located in the Pt. Lay Whaling Captains’ Association building; and
- (F) Pt. Hope for the Pt. Hope Com-Center, which will be located in the Pt. Hope Whaling Captains’ Association building.

(3) All Com-Center staff shall be local hire.

(d) Duties of the Com-Center Operators.

(1) The Com-Center operators shall be available to receive radio and telephone calls and to call vessels as described below. A record shall be made of all calls from every vessel covered by Sections 207, 301, and 401 of this Agreement. **Information reported regarding whales struck, lost, landed, or the location of whales struck, lost, or landed, or the number of strikes remaining, shall be confidential and shall not be disclosed to anyone other than the AEW or the local Whaling Captains’ Association.** The record of all reporting calls should contain the following information:

- (A) Industry Participant Vessel:
 - (i) Name of caller and vessel.
 - (ii) Vessel location, speed, and direction.
 - (iii) Time of call.

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- (iv) Anticipated movements between this call and the next report.
 - (v) Reports of any industry or subsistence activities.
 - (B) Subsistence Whale Hunting Boat:
 - (i) Name of caller.
 - (ii) Location of boat or camp.
 - (iii) Time of call.
 - (iv) Plans for travel.
 - (v) Any special information such as caught whale, whale to be towed, or industry vessel conflicts with whale or whaler. Any report of the number of whales struck, lost, or landed, or of the number of strikes remaining, shall be kept confidential and shall not be disclosed by the Com-Center or any Com-Center operator to anyone other than the AEWG or the local Whaling Captains' Association. The location of whales struck, lost, or landed shall be kept confidential and shall not be disclosed except to the extent needed to avoid an Industry/Subsistence Whale Hunter conflict.
- (2) Report of Industry/Subsistence Whale Hunter Conflict. In the event an industry/subsistence whale hunter conflict is reported, the appropriate Com-Center operator shall record:
 - (A) Name of industry vessel.
 - (B) Name of subsistence whaling captain.
 - (C) Location of vessels.
 - (D) Nature of conflict.
- (3) If all vessels and boats covered by Sections 207, 301, and 401 of this Agreement have not reported to the appropriate Com-Center within one hour of the recommended time, that Com-Center operator shall attempt to call all non-reporting vessels to determine the information set out above under the Duties of

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the Com-Center operator.

(4) As soon as location information is provided by a vessel covered by Sections 207, 301, or 401 of this Agreement, the appropriate Com-Center operator shall plot the location and area of probable operations on the large map provided at the Com-Center.

(5) If, in receiving information or plotting it, a Com-Center operator observes that operations by Industry Participants might conflict with subsistence whaling activities, such Com-Center operator should attempt to contact the industry vessel involved and advise the Industry Participant's Local Representative(s) and the vessel operators of the potential conflict.

SECTION 204. STANDARDIZED LOG BOOKS.

The Industry Participants will provide the Com-Centers and Marine Mammal Observer / Inupiat Communicators with identical log books to assist in the standardization of record keeping associated with communications procedures required pursuant to this Agreement.

SECTION 205. COMMUNICATIONS EQUIPMENT.

(a) Communications Equipment to be Provided to Subsistence Whale Hunting Crews.

(1) In General. The Industry Participants will provide (or participate in the provision of) the communications equipment described in paragraphs (4) and (6) of this subsection and subsection (b) of this section.

(2) Beaufort Sea. The Industry Participants funding Com-Centers in Deadhorse and Kaktovik will fund the provision of communications equipment for the whaling captains of Kaktovik and Nuiqsut in the same proportion as they fund those Com-Centers.

(3) Chukchi Sea. The Industry participants conducting operations in the Chukchi Sea will coordinate with each other to participate in funding the provision of communications equipment for the whaling captains of Barrow, Wainwright, Pt. Hope, and Pt. Lay.

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(4) All-Channel, Water-Resistant VHF Radios.

These VHF radios are specifically designed for marine use and allow monitoring of Channel 16 while using or listening to another channel.

- (A) Kaktovik Subsistence Whaling Boats: 8
- (B) Kaktovik Base and Search and Rescue: 2
- (C) Nuiqsut Subsistence Whaling Boats: 12
- (D) Nuiqsut Base and Search and Rescue: 3
- (E) Barrow Base and Search and Rescue: 2
- (F) Wainwright Base and Search and Rescue: 2
- (G) Wainwright Subsistence Whaling Boats: 4
- (H) Pt. Hope Base and Search and Rescue: 2
- (I) Pt. Hope Subsistence Whaling Boats: 10
- (J) Pt. Lay Base and Search and Rescue: 2
- (K) Pt. Lay Subsistence Whaling Boats: 4

(5) Specific VHF Channels For Each Village.

The whaling boats from each of the villages have been assigned individual VHF channels for vessel-to-vessel and vessel-to-Com-Center communications as follows:

- (A) Nuiqsut whaling crews will use Channel 68.
- (B) Kaktovik whaling crews will use Channel 69.
- (C) Barrow whaling crews will use Channel 72.
- (D) Wainwright Whaling Crews will use Channel 12.

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(E) Pt. Lay Whaling Crews will use Channel 72.

(F) Pt. Hope Whaling Crews will use Channel 68.

(6) Satellite Telephones.

The satellite telephones are to be used as backup for the VHF radios. The satellite telephones for use on subsistence whaling boats are for emergency use only and should be programmed for direct dial to the nearest Com-Center.

A. Kaktovik Base Phones: 2

B. Kaktovik Subsistence Whaling Boats: 8

C. Nuiqsut Base Phones: 2

D. Nuiqsut Subsistence Whaling Boats: 12

E. Barrow Subsistence Whaling Boats: 2

F. Wainwright Subsistence Whaling Boats: 4

G. Pt. Lay Subsistence Whaling Boats: 2

(7) Distribution and Return of Equipment.

The distribution of the VHF radios and satellite telephone equipment to whaling captains for use during the 2010 fall bowhead subsistence whale hunting season shall be completed no later than August 15, 2010. All such units and telephone equipment provided under this Agreement, whether in this section or otherwise, will be returned promptly by the Subsistence Participants to the Industry Participant or the person providing such units and equipment at the end of each Village's 2010 fall bowhead whale subsistence hunt.

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(b) Communications Equipment on Vessels Owned or Operated by the Industry Participants and/or their Contractors.

The Marine Mammal Observer / Inupiat Communicators onboard source vessels owned or operated by the Industry Participants and/or their contractors will also be supplied with all-channel VHF radios. The MMO/ICs have been assigned Channel 7 for their exclusive use in communicating with the Com-Center. Such radios shall be returned upon the completion or termination of the MMO/IC's assignment.

(c) Radio Installation and User Training.

The Whaling Captains of Nuiqsut, Kaktovik, Wainwright, Pt. Lay, and Pt. Hope, with assistance from the Industry Participants, will be responsible for the installation of the VHF radio equipment. The Industry participants will provide (or participate in the provision of) on-site user training for the VHF **and satellite telephone** equipment on or before August 15, 2010, **if requested** and as scheduled by the Whaling Captains' Associations of Nuiqsut, Kaktovik, Barrow, Wainwright, Pt. Lay, and Pt. Hope, and the Industry Participant operating the Beaufort Sea Com-Centers or Chukchi Sea Com-Centers, as appropriate.

SECTION 206. INDIVIDUALS TO CONTACT.

Listed below are the primary contact names and phone numbers for each of the Participants.

(1) BP Exploration (Alaska), Inc.'s (BP) Local Representative

LOWRY BROTT will be BP's local representative on the North Slope during the Term of this Agreement and will be stationed at Northstar Island and will be available by telephone at (907)670-3520 and when Mr. Brott is not available, his alternate, Dan Ferriter, will be stationed at Northstar Island and will be available by telephone at the above number.

(2) ConocoPhillips' Local Representative

Jim Darnell (907) 265-6240
Heather Collins-Ballot (907) 265-6213
Field Rep TBD (Jeff Hastings, Fairweather)

(3) ENI's Local Representative

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TBD

- (4) Exxon Mobil's Local Representative

TBD

- (5) ION / GX Technology's Local Representative

TBD

- (6) PGS Onshore's Local Representative

CHUCK ROBINSON, Area Manager, will be PGS Onshore, Inc.'s local representative during the Term of this Agreement and will be available by telephone at (907) 569-4049.

- (7) Pioneer Natural Resources' (Pioneer) Local Representative

PAT FOLEY will be Pioneer's local representative during the Term of this Agreement and will be stationed in Anchorage and will be available by telephone at (907) 343-2110.

- (8) Shell Offshore Inc.'s (Shell) Local Representatives

BOB ROSENBLADT and PETER LITTLEWOOD will be Shell's local representatives on the North Slope during the Term of this Agreement and will be stationed at Barrow during Chukchi Sea operations and at Deadhorse during Beaufort Sea operations and will be available by telephone at (907) 770-3700.

- (9) STATOIL's Local Representative

TBD

- (10) The Village of Kaktovik

For purposes of this Agreement, the individuals to contact for the Village of Kaktovik will be: JOSEPH KALEAK at (907) 640-6213 or 640-6515, and FENTON REXFORD at (907) 640-2042 (Home) or (907) 640-6419 (Work).

- (11) The Village of Nuiqsut

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For purposes of this Agreement, the individuals to contact for the Village of Nuiqsut will be: **SAAC NUKAPIGAK** at (907) 480-6220 (Work); (907) 480-2400 (Home), and **HERBERT (Need last name and contact phone number)**

(12) The Village of Barrow

For purposes of this Agreement, the individuals to contact for the Village of Barrow will be: HARRY BROWER, JR. at (907) 852-0350 (Work), and EUGENE BROWER at (907) 852-3601.

(13) The Village of Wainwright

For purposes of this Agreement, the individuals to contact for the Village of Wainwright will be: ROSSMAN PEETOOK at (907) 763-4774, and WALTER NAYAKIK at (907)763-2915 (Work).

(14) The Village of Pt. Hope

For purposes of this Agreement, the individuals to contact for the Village of Pt. Hope will be: RAY KOONUK, SR. at (907) 368-2330 (Work), 368-2332 (Fax), ray.koonuk@tikigag.org (E-mail); CHESTER FRANKSON, SR. at (907) 368-2054 (Home).

(15) The Village of Pt. Lay

For purposes of this Agreement, the individuals to contact for the Village of Pt. Lay will be: JULIUS REXFORD (907) 833-4592 (Home), (907) 833-2214 (Work), (907) 833-2320 (Fax), THOMAS NUKAPIAK (907) 833-6467 (Home), (907) 833-3838

(16) The AEW

For purposes of this Agreement, the individuals to contact for the AEW shall be: HARRY BROWER, JR. at (907) 852-0350 (Work) and JANICE MEADOWS at (907) 852-2392.

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SECTION 207. SUBSISTENCE WHALE HUNTING BOATS.

The following is a list of the number of boats each of the Subsistence Participants plan to use:

(1) Boats Owned/Used by Whaling Captains of Nuiqsut (NWCA)

The subsistence whaling crews of the Village of Nuiqsut plan to use (12) twelve boats for subsistence whale hunting during the late summer and fall of 2010.

(2) Boats Owned/Used by Whaling Captains of Kaktovik (KWCA)

The subsistence whaling crews of the Village of Kaktovik plan to use (8) eight boats for subsistence whale hunting during the late summer and fall of 2010.

(3) Boats Owned/Used by Whaling Captains of Barrow (BWCA)

The subsistence whaling crews of the Village of Barrow plan to use (40) forty boats for subsistence whale hunting during the late summer and fall of 2010.

(4) Boats Owned/Used by Whaling Captains of Wainwright (WWCA)

The subsistence whaling crews of the Village of Wainwright plan to use (4) four boats for subsistence whale hunting during the fall of 2010.

(5) Boats Owned/Used by Whaling Captains of Pt. Hope (Pt. HWCA)

The subsistence whaling crews of the Village of Pt. Hope plan to use (10) ten boats for subsistence whale hunting during the late fall of 2010.

(6) Boats Owned/Used by Whaling Captains of Pt. Lay (Pt. LWCA)

The subsistence whaling crews of the Village of Pt. Lay plan to use (4) four boats for subsistence whale hunting during the fall of 2010.

If any additional boats are put in use by subsistence whaling crews, the industry Participants will be notified promptly through the Com-Center.

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TITLE III – BARGE AND TRANSIT VESSEL OPERATIONS

SECTION 301. IN GENERAL.

A Participant may employ barges or transit vessels to transport materials through the Beaufort Sea or Chukchi Sea during the term of this Agreement. Any Industry Participant who employs a barge or transit vessel to transport materials through the Beaufort Sea or Chukchi Sea during the term of this Agreement shall require the barge or transit vessel operator to comply with Sections 201 and 302 of this Agreement while providing services to that Industry Participant.

SECTION 302. BARGE AND TRANSIT VESSEL OPERATIONS.

(a) Reporting Positions for Barge or Transit Vessels Owned or Operated by industry Participants.

(1) All barge or transit vessels shall report to the appropriate Com-Center at least once every six hours commencing with a call at approximately 06:00 hours. Each call shall report the following information:

(A) Barge or transit vessel name, operator of vessel, charter or owner of vessel, and the project or entity the vessel is transporting materials for.

(B) Barge or transit vessel location, speed, and direction.

(C) Plans for barge or transit vessel movement between the time of the call and the time of the next call. The final call of the day shall include a statement of the barge or transit vessel's general area of expected operations for the following day, if known at that time.

EXAMPLE: This is the Arctic Endeavor, operated by _____ for _____ in the Chukchi Sea. We are currently at ____' ____ north ____' ____ west, proceeding SE at ____ knots. We will proceed on this course for ____ hours and will report location and direction at that time.

(2) The appropriate Com-Center also shall be notified if there is any significant change in plans, such as an unannounced start-up of operations or significant deviations from announced course, and such Com-Center shall notify all whalers of such changes. A call to the appropriate Com-Center shall be made regarding any unsafe or unanticipated ice conditions.

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Changes to 2009 Final CAA and Addendum are **highlighted and underlined**. Changes to Draft 1A of the 2010 CAA are shown in **blue**.

(b) Operator Duties.

All barge and transit vessel operators are responsible for the following requirements.

- (1) Monitoring VHF Channel 16. All barge and transit vessel operators shall monitor marine VHF Channel 16 at all times.
- (2) Avoidance of Whale Hunting Crews and Areas. It is the responsibility of each Industry Participant and barge or transit vessel operator to determine the positions of their barge or transit vessels and to exercise due care in avoiding any areas where subsistence whale hunting is active.
- (3) Vessel-to-Vessel Communication. After any barge or transit vessel owned or operated by any Industry Participant has been informed of or has determined the location of subsistence whale hunting boats in its vicinity, the Marine Mammal Observer / Inupiat Communicator shall contact those boats in order to coordinate movement and take necessary avoidance precautions.

(c) Routing Barges and Transit Vessels.

- (1) All barge and transit vessel routes shall be planned so as to minimize any potential conflict with bowhead whales or subsistence whaling activities. All barges and transit vessels shall avoid areas of active or anticipated whaling activity, as reported pursuant to Section 202.
- (2) Beaufort Sea. Vessels transiting east of Bullet Point to the Canadian border should remain at least five (5) miles offshore during transit along the coast, provided ice and sea conditions allow.
- (3) Chukchi Sea. Vessels should remain as far offshore as weather and ice conditions allow, and at all times at least five (5) miles offshore during transit.

(d) Vessel Speeds.

Barges and transit vessels shall be operated at speeds necessary to ensure no physical contact with whales occurs, and to make any other potential conflicts with bowhead whales or whalers unlikely. Vessel speeds shall be less than 10 knots in the proximity of feeding whales or whale aggregations.

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(e) Vessels Operating in Proximity of Migrating Bowhead Whales.

If any barge or transit vessel inadvertently approaches within 1.6 kilometers (1 mile) of observed bowhead whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the bowhead whales by taking one or more of the following actions, as appropriate:

- (1) reducing vessel speed to less than 5 knots within 900 feet of the whale(s);
- (2) steering around the whale(s) if possible;
- (3) operating the vessel(s) in such a way as to avoid separating members of a group of whales from other members of the group;
- (4) operating the vessel(s) to avoid causing a whale to make multiple changes in direction; and
- (5) checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.

(f) Sound Signature and Marine Mammal Sighting Data.

Industry Participants whose operations are limited exclusively to barge or vessel traffic will submit to the AEWC and NSB DWM sound signature data for each vessel over 5 net tons they are using and all marine mammal sighting data.

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TITLE IV – VESSELS, TESTING, AND MONITORING

SECTION 401. INDUSTRY PARTICIPANT VESSELS AND EQUIPMENT.

(a) List of Vessels and Equipment Required.

Each Industry Participant engaged in oil and gas operations shall provide a list identifying all vessels or other equipment (including but not limited to boats, barges, aircraft, or similar craft) that are owned and/or operated by, or that are under contract to the Industry Participants, for use in the Beaufort Sea or Chukchi Sea for oil and gas operations or for implementation of such Industry Participant's monitoring plan. Vessels and equipment used for oil and gas operations shall be listed in Attachment II, and vessels and equipment used for monitoring plans shall be listed in Attachment III.

(b) Only Listed Vessels and Equipment May Be Used.

(1) NONE OF THE INDUSTRY PARTICIPANTS INTENDS TO OPERATE ANY VESSEL OR EQUIPMENT NOT IDENTIFIED IN THE LISTS REQUIRED UNDER SUBSECTION (a) DURING THE TERM OF THIS AGREEMENT.

(2) Notwithstanding paragraph 1, if any Industry Participant decides to use different vessels or equipment or additional vessels or equipment, such vessels and equipment shall be used only for purposes identified in Attachments II or III; and the AEWC and the whaling captains of Nuiqsut, Kaktovik, Barrow, Wainwright, Pt. Hope, and Pt. Lay shall be notified promptly through the appropriate Com-Center, as identified in Section 203 of this Agreement, and in writing, of their identity and their intended use, including location of use.

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SECTION 402. SOUND SIGNATURE TESTS.

(a) Sound Source Verification Testing.

(1) Geophysical Equipment. For purposes of obtaining a sound signature for Industry Participants' geophysical equipment, the Industry Participants shall have initiated a test of all geophysical equipment within 72 hours of initiating or having initiated operations in the Beaufort Sea or Chukchi Sea. Such tests shall be conducted as set forth in section 402(b).

(2) Vessels. Industry Participants will conduct a sound source verification test for all vessels used for geophysical operations. Each participant shall establish a sound source verification range or industry participants may participate jointly in establishing a range for the Chukchi Sea and Beaufort Sea, or both. A separate range shall be used for the Chukchi Sea and Beaufort Sea, and vessels shall use the appropriate range for each sea in which they operate. For testing each vessel shall proceed through the range and record information on the date, time, vessel speed, vessel route, vessel load, weather conditions, and equipment operating on the vessel (all noise generating equipment on the vessel, other than geophysical equipment subject to separate testing under paragraph (1), shall be in operation while the vessel is proceeding through the range). The range should be established near a location where details on wind speed and direction are regularly monitored and archived.

(b) Mutual Agreement on Site for Testing; Advance Notice Required.

(1) In General. Each geophysical equipment sound signature test shall be conducted at a site mutually agreed upon by the Industry Participant conducting such test and the AEWC. Each Industry Participant conducting such sound signature test(s) will make a good faith effort to provide three (3) weeks advance notice to the AEWC and the NSB DWM of its intent to perform each test.

(2) Beaufort Sea Testing. For geophysical equipment sound signature tests conducted in the Beaufort Sea, the Industry Participant conducting such tests shall provide transportation for an appropriate number of representatives from: the AEWC, the whaling captains of the Villages of Barrow, Nuiqsut, and Kaktovik, and the NSB DWM to observe the sound signature tests.

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(3) Chukchi Sea Testing. For geophysical equipment sound signature tests conducted on vessels to be used in the Chukchi Sea, the Industry Participant(s) conducting such tests shall provide transportation for an appropriate number of representatives from: the AEWC, the whaling captains of the Villages of Barrow, Wainwright, Pt. Lay, and Pt. Hope, and the NSB DWM to observe the sound signature tests.

(c) Sound Signature Data to be Made Available.

(1) Within seven (7) days of completing the sound signature field tests for geophysical equipment and within 30 days of the end of the operating season for sound source verification ranges, each Industry Participant and/or its contractor conducting such test(s) will make all data collected during the sound signature test(s) available upon request to the AEWC and the NSB DWM and will provide the AEWC and the NSB DWM the preliminary analysis of that data, as well as any other sound signature data that is available and that the AEWC, the NSB DWM, and the Industry Participant agree is relevant to understanding the potential noise impacts of the proposed operations to migrating bowhead whales or other affected marine mammals.

(2) Once completed the final data analysis will be provided to the AEWC and the NSB DWM upon request. Final data from sound source verification ranges shall be provided to the NSB DWM and the AEWC no later than December 31, 2010.

(3) Any Industry Participant who prepares a model of the sound signature of its vessels and operations, whether before or after the Sound Signature Test, will provide copies of those models and any related analysis to the AEWC and the NSB DWM upon request.

SECTION 403. MONITORING PLANS.

(a) Monitoring Plan Required.

(1) Each Industry Participant agrees to prepare and implement a noise impact monitoring plan to collect data designed to determine the effects of its oil and gas operations on fall migrating bowhead whales and other affected marine mammals.

(2) The Monitoring Plans shall be designed in cooperation with the AEWC, the NSB DWM, NOAA Fisheries, the U.S. Minerals Management Service, and

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any other entities or individuals designated by one of these organizations.

(b) Beaufort Sea Monitoring Plans.

In the Beaufort Sea, the monitoring plans shall include an investigation of noise effects on fall migrating bowhead whales as they travel past the noise source, with special attention to changes in calling behavior, deflection from the normal migratory path, where deflection occurs, and the duration of the deflection.

(c) Chukchi Sea Monitoring Plans.

In the Chukchi Sea, the monitoring plans should focus on the identity, timing, location, and numbers of marine mammals and their behavioral responses to the noise source. **The monitoring plans will place emphasis on understanding impacts from industrial sounds on marine mammals.**

(d) Use of Prior Information and Peer Review Required.

(1) Prior impact study results shall be incorporated into the monitoring plans prepared by each Industry Participant.

(2) Each monitoring plan shall be subject to peer review by stakeholders at the 2010 Open Water Season Peer Review Meeting, convened by NOAA Fisheries. Draft plans will be submitted to the NSB DWM and AEWC by March 1, 2010. Peer review and acceptance of each monitoring plan through this process shall be completed prior to the commencement of each Industry Participants' 2010 operations in the Beaufort Sea or Chukchi Sea.

(e) Raw Data, Communication, and Summary Required.

(1) Each Industry Participant conducting site-specific monitoring will:

(A) make raw data, including datasheets, field notes, and electronic data, available to the NSB DWM at the end of the season.

(B) permit and encourage open communications among their contractors and the AEWC and NSB DWM.

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- (2) Each Industry Participant will submit a summary of monitoring plan results and progress to the AEWG and NSB DWM every two weeks during the operating season.

SECTION 404. CUMULATIVE NOISE IMPACTS STUDY.

Each Industry Participant further agrees to provide its monitoring plan and sound signature data, for use in a cumulative effects analysis of the multiple sound sources and their possible relationship to any observed changes in marine mammal behavior, to be undertaken pursuant to a Cumulative Noise Impacts Study.

The study design for the Cumulative Impacts Study shall be developed through a Cumulative Impacts Workshop to be organized by the North Slope Borough in the winter of 2009/2010. The results of this workshop will be presented at the 2010 Open Water Meeting.

TITLE V – AVOIDING CONFLICTS DURING THE OPEN WATER SEASON

Industry Participants are reminded that Sections 101(a)(5)(A) and (D) of the Marine Mammal Protection Act provide, among other things, that the Secretary can authorize the incidental taking of small numbers of marine mammals of a species or population stock if the Secretary finds, among other things, that the total of such takings during the authorized period **will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses.**

The following Operating Guidelines apply in the Beaufort Sea and Chukchi Sea, except as otherwise specified and in all cases with due regard to environmental conditions and operational safety. These Operating Guidelines are in addition to any permit restrictions or stipulations imposed by the applicable governmental agencies.

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SECTION 501. GENERAL PROVISIONS FOR AVOIDING INTERFERENCE WITH BOWHEAD WHALES OR SUBSISTENCE WHALE HUNTING ACTIVITIES.

(a) Routing Vessels and Aircraft.

(1) All vessel and aircraft routes shall be planned so as to minimize any potential conflict with bowhead whales or subsistence whaling activities. All vessels shall avoid areas of active or anticipated whaling activity (as reported pursuant to Section 202).

(2) Beaufort Sea. Vessels transiting east of Bullen Point to the Canadian border should remain at least five (5) miles offshore during transit along the coast, provided ice and sea conditions allow.

(3) Chukchi Sea. Vessels should remain as far offshore as weather and ice conditions allow, and at all times at least five (5) miles offshore during transit.

(b) Aircraft Altitude Floor and Flight Path.

(1) AIRCRAFT SHALL NOT OPERATE BELOW 1500 FEET unless the aircraft is engaged in marine mammal monitoring, approaching, landing or taking off, or unless engaged in providing assistance to a whaler or in poor weather (low ceilings) or any other emergency situations. Aircraft engaged in marine mammal monitoring shall not operate below 1500 feet in areas of active whaling; such areas to be identified through communications with the Com-Centers.

(2) Except for airplanes engaged in marine mammal monitoring, aircraft shall use a flight path that keeps the aircraft at least five (5) miles inland until the aircraft is directly south of its offshore destination, then at that point it shall fly directly north to its destination.

(c) Vessel Speeds.

Vessels shall be operated at speeds necessary to ensure no physical contact with whales occurs, and to make any other potential conflicts with bowhead whales or whalers unlikely. Vessel speeds shall be less than 10 knots in the proximity of feeding whales or whale aggregations.

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(d) Vessels Operating in Proximity of Migrating Bowhead Whales.

If any vessel inadvertently approaches within 1.6 kilometers (1 mile) of observed bowhead whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the bowhead whales by taking one or more of the following actions, as appropriate:

- (1) reducing vessel speed to less than 5 knots within 900 feet of the whale(s);
- (2) steering around the whale(s) if possible;
- (3) operating the vessel(s) in such a way as to avoid separating members of a group of whales from other members of the group;
- (4) operating the vessel(s) to avoid causing a whale to make multiple changes in direction; and
- (5) checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.

SECTION 502. GEOPHYSICAL ACTIVITY LIMITATIONS.

The following operating limitations are to be observed and the operations are to be accompanied by a monitoring plan as set forth in Section 403 and Attachment III of this Agreement. **The Industry Participants conducting geophysical activity operations agree to coordinate the timing and location of such operations so as to reduce, by the greatest extent reasonably possible, the level of noise energy entering the water from such operations at any given time and at any given location.**

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(a) Limitations on Geophysical Activity in the Beaufort Sea.

All geophysical activity in the Beaufort Sea shall be **conducted in accordance with the terms** set forth below.

(1) Kaktovik: No geophysical activity from the Canadian Border to the Canning River (146 deg. 4 min. W) from 25 August to close of the fall bowhead whale hunt in Kaktovik and Nuiqsut.¹ From August 10 to August 25, Industry Participants will communicate and collaborate with AEWG on any planned vessel movement in and around Kaktovik and Cross Island to avoid impacts to whale hunt.

(2) Nuiqsut:

A. Pt. Storkerson (~148 deg. 42 min. W) to Thetis Island (~150 deg. 10.2 min. W).

(i) *Inside the Barrier Islands*: No geophysical activity prior to August 5. Geophysical activity is allowed from August 5 until completion of operations²

(ii). *Outside the Barrier Islands*: No geophysical activity from August 25 to close of fall bowhead whale hunting in Nuiqsut. Geophysical activity is allowed at all other times.

b. Canning River (~146 deg. 4 min. W) to Pt. Storkerson (~148 deg. 42 min. W): No geophysical activity from August 25 to the close of bowhead whale subsistence hunting in Nuiqsut.

(3) Barrow: No geophysical activity from Pitt Point on the east side of Smith Bay (~152 deg. 15 min. W) to a location about half way between Barrow and Peard Bay (~157 deg. 20 min. W) from September 15 to the close of the fall bowhead whale hunt in Barrow.

¹ The bowhead whale subsistence hunt will be considered closed for a particular village when the village Whaling Captains' Association declares the hunt ended or the village quota has been exhausted (as announced by the village Whaling Captains' Association or the AEWG), whichever occurs earlier.

² Geophysical activity allowed in this area after August 25 shall include a source array of no more than 12 air guns, a source layout no greater than 8 m x 6 m, and a single source volume no greater than 880 in³.

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(b) Limitations on Geophysical Activity in the Chukchi Sea.

All geophysical activity in the Chukchi Sea shall be conducted in accordance with the terms set forth below.

(1) **Beginning September 15, and ending with the close of the fall bowhead whale hunt,³ if Wainwright, Pt. Lay, or Pt. Hope intend to whale, no more than two geophysical activities employing air guns will occur at any one time in the Chukchi Sea and air guns will not be used within 30 miles of any point along the Chukchi Sea. Industry Participants will contact the whaling captains' associations of each of those villages to determine if a village is attempting to whale and will notify the AEWG of any response.**

(2) Safe harbor will be at sites selected by the Industry Participants and the AEWG. Safe harbor sites will be agreed upon no later than **March 1** and shall be listed in Attachment IV.

(3) Any vessel operating within 60 miles of the Chukchi Sea coast will follow the communications procedures set forth in Title II of this Agreement. All vessels will adhere to the conflict avoidance measures set forth in Section 501 of this Agreement.

(4) If a dispute should arise, the resolution process set forth in Section 106 of this Agreement shall apply.

³ The bowhead whale subsistence hunt will be considered closed when village Whaling Captains' Associations of Wainwright, Pt. Lay, and Pt. Hope have each declared that (A) they do not intend to hunt, (B) their village hunt has ended, or (C) the village quota has been exhausted (as announced by the village Whaling Captains' Association or the AEWG), whichever occurs earlier.

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SECTION 503. DRILLING AND PRODUCTION.

The following operating limitations are to be observed and the operations are to be accompanied by a Monitoring Plan as set forth in Section 403 and Attachment III of this Agreement.

(a) Agreement to Jointly Propose Discharge Standards to the EPA.

The Participants agree to jointly develop and submit comments to the Environmental Protection Agency in support of applying to the Beaufort Sea and Chukchi Sea the discharge standards applicable to the Arctic waters off Norway.

(b) Sampling of Drilling Mud and Cuttings.

For all drilling operations, whether for exploration, development, or production, in the Beaufort Sea or Chukchi Sea habitat of the bowhead whale, the operator shall cooperate with the AEWG and North Slope Borough in the design and implementation of a program to monitor all discharged materials and impacts to migratory resources from any materials that might be discharged into the marine environment.

(c) Monitoring of Gray Water, Black Water, and Heated Water.

For all exploratory drilling operations in the Beaufort Sea or Chukchi Sea habitat of the bowhead whale, the operator shall cooperate with the AEWG and North Slope Borough in the design and implementation of a program to monitor the composition or temperature and the fate of all discharged materials and impacts to migratory resources from any materials dumped into the marine environment to assess the impacts of such discharges on water quality, the benthic environment, and prey species.

(d) Drilling Operations in the Beaufort Sea East of Cross Island.

No drilling equipment or related vessels shall be onsite at any offshore drilling location east of Cross Island from 25 August until the close of the bowhead whale hunt in Nuiqsut and Kaktovik. However, such equipment may remain within the Beaufort Sea in the vicinity of 71 degrees 25 minutes N and 146 degrees 4 minutes W., or at the edge of the Arctic ice pack, whichever is closer to shore.

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(e) Drilling Operations in the Beaufort Sea West of Cross Island.

No drilling equipment or related vessels shall be moved onsite at any location outside the barrier islands west of Cross Island until the close of the bowhead whale hunt in Barrow.

(f) Oil Spill Mitigation.

Unless otherwise agreed with the AEW, Industry Participants engaged in oil production or in drilling operations in the Beaufort Sea or Chukchi Sea agree to adhere to the AEW/NSB/Inupiat Community of the Arctic Slope oil spill contingency agreement.

SECTION 504. SHORE-BASED SERVICE AND SUPPLY AREAS.

Shore-based service and supply areas used by Industry Participants shall be located and operated so as to ensure compliance with the terms of this Agreement.

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TITLE VI – PARTICIPANTS

This Agreement shall be binding and effective when signed by the duly authorized representatives of the Participants. Signatures may be by facsimile on separate pages.

Harry Brower
Chairman, AEW
AEWC Commissioner for Barrow
Dated: _____

Ray Koonuk
AEWC Commissioner for Pt. Hope
Dated: _____

Julius Rexford
AEWC Commissioner for Pt. Lay
Dated: _____

Joe Kaleak
AEWC Commissioner for Kaktovik
Dated: _____

Isaac Nukapigak
AEWC Commissioner for Nuiqsut
Dated: _____

Rossman Peetook
AEWC Commissioner for Wainwright
Dated: _____

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Name:
BP Exploration (Alaska) Inc.
Dated: _____

Name:
Shell Offshore, Inc.
Dated: _____

Name:
ConocoPhillips Alaska
Dated: _____

Name:
Exxon Mobil Corporation
Dated: _____

Chuck Robinson
PGS Onshore, Inc.
Dated: _____

Name:
Pioneer Natural Resources Alaska
Dated: _____

Name:
ION / GX Technology
Dated: _____

Name:
Statoil
Dated: _____

Name:
ENI
Dated: _____

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Changes to Draft 1A of the 2010 CAA are shown in **blue**.

ATTACHMENT I

LOCAL SEARCH AND RESCUE ORGANIZATIONS - CONTACT PERSONS

(IN EMERGENCIES, ALWAYS DIAL 911)

North Slope Borough

Search and Rescue (Pilots)

Director Hugh Patkotak 852-2822 WK 852-4844 Home

Barrow Volunteer

Search and Rescue Station

852-2808 OFS

President Oliver Leavitt 852-7032 WK 852-7032 Home

Vice-Pres. Price Brower 852-8633 WK 852-7848 Home

Secretary Lucille Adams 852-0250 Wk 852-7200 Home

Treasurer Eli Solomon 852-2808 Wk 852-6261 Home

Coordinator Arnold Brower, Jr. 852-0290 WK 852-5060 Home

Director Jimmy Nayakik 852-0200 WK 852-JENS Home

Director Johnny Adams 852-0250 WK 852-7724 Home

Nuiqsut Volunteer

Search and Rescue Station

480-6613 (Fire Hall)

Kaktovik Volunteer

Search and Rescue Station

640-6212 (Fire Hall)

President Lee Kayotuk 640-5893 Wk 640-6213 Home

Vice-Pres. Tom Gordon 640-

Secretary Nathan Gordon 640-6925

Treasurer Don Kayotuk 640-2947

Fire Chief George T. Tagarook 640-6212 WK 640-6728 Home

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Changes to Draft 1A of the 2010 CAA are shown in **blue**.

Wainwright Volunteer Search and Rescue

President	Joe Ahmaogak Jr.	763-2826 Home
Vice President	John Hopson, Jr.	763-3464 Home
Secretary	Raymond Negovanna	763-2102 Home
Treasurer	Ben Ahmaogak, Jr.	763-3030 Home
Director	Artic Kittick	763-2534 Home
Director	John Akpik	Unlisted

Pt. Hope Volunteer Search and Rescue

Coordinator	Willard Hunnicutt, Jr.	368-2774 Work
Fire Chief	Willard Hunnicutt, Jr.	368-2774 Work (Note: Only contact for Pt. Hope)

North Slope Borough Disaster Relief Coordinator

Frederick Brower	852-0284 OFS
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ATTACHMENT II

VESSELS TO BE USED FOR AND IN SUPPORT OF INDUSTRY PARTICIPANTS' OPERATIONS AS IDENTIFIED IN SECTION 401(b)(1)(B)

[ALL VESSELS TO BE IDENTIFIED BY COMPANY]

NOTE:

**COPY OF PRESENTATION OF THE INDUSTRY PARTICIPANT ATTACHED
IDENTIFYING VESSELS TO BE USED FOR AND IN SUPPORT OF THE
INDUSTRY PARTICIPANTS' OPERATIONS.**

DRAFT 2– February 13, 2010

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Changes to Draft 1A of the 2010 CAA are shown in **blue**.

ATTACHMENT III

VESSELS TO BE USED FOR AND IN SUPPORT OF THE INDUSTRY PARTICIPANTS MONITORING PLANS AS IDENTIFIED IN SECTION 401(b)(1)(B)

[ALL VESSELS TO BE IDENTIFIED BY COMPANY]

NOTE:

**COPY OF PRESENTATION OF THE INDUSTRY PARTICIPANT ATTACHED
IDENTIFYING VESSELS TO BE USED FOR AND IN SUPPORT OF THE
INDUSTRY PARTICIPANTS' MONITORING PLAN.**

DRAFT 2– February 13, 2010

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Changes to Draft 1A of the 2010 CAA are shown in blue.

ATTACHMENT IV

SAFE HARBOR



Richard L. Ranger
Senior Policy Advisor

Upstream and Industry Operations

1220 L Street, NW
Washington, DC 20005-4070
USA
Telephone 202-682-8057
Fax 202-682-8426
Cell 202-494-1430
Email rangerr@api.org
www.api.org

April 7, 2010

Mr. P. Michael Payne
Chief, Permits, Conservation and Education Division
Office of Protected Resources, NMFS
1315 East-West Highway
Silver Spring, MD 20190-3225

Re: Comments: Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, RIN 0648-XU06

Via NMFS Electronic Comment Portal

Dear Mr. Payne:

The American Petroleum Institute (API) is pleased to comment on the National Marine Fisheries Service (NMFS) Request for Comments on the preparation of an Environmental Impact Statement (EIS) to analyze the environmental impacts of issuing Incidental Take Authorizations (ITAs) pursuant to the Marine Mammal Protection Act (MMPA). The purpose of this EIS will be to support the issuance of ITAs to the oil and gas industry for the taking of marine mammals incidental to offshore exploration activities in the Chukchi and Beaufort Seas off Alaska. API represents more than 400 member companies involved in all aspects of the oil and natural gas industry and has a strong interest in the development of the next offshore leasing program.

API's comments to this scoping process begin with the following premises:

- Global demand for energy will grow and, because existing and developing energy sources will struggle to keep up with demand, oil and gas resources will be needed for American consumers and the American economy for decades to come.
- The U.S. has vast oil and gas resources on the Outer Continental Shelf (OCS) that can and must play a critical role in meeting that future energy demand, in fueling the economy, and providing jobs. Reliable estimates indicate that a significant portion of these resources may be found in the OCS in the Chukchi and Beaufort Seas.
- Offshore development can occur in an environmentally responsible way.
- Americans do not have to choose between OCS development *or* the environment. The oil and gas industry possesses an unparalleled environmental record on the Outer Continental Shelf and in challenging cold water and Arctic operating environments, and continues to expand the role of technology and science in pursuit of environmental stewardship.

Access to new resource basins remains necessary

Given expected global economic and population growth, energy efficiency improvements alone will not be enough in the future for the U.S. More total energy will be needed both in the United States and globally. The U.S. Energy Information Administration (EIA) forecasts U.S. energy demand will grow by 9 percent between 2007 and 2030, with more than half of the energy demand expected to be met by oil and natural gas, as is the case today. In fact, EIA forecasts oil will continue to account for the largest share of our energy needs filling 34 percent of total energy demand and 87 percent of our transportation needs in 2030.

Resource estimates increase as areas are developed. For instance in the Gulf of Mexico, MMS estimates have increased over 200% since 1980. An accurate resource estimate is difficult until the industry starts developing an area. Companies do recognize the importance of continuing to explore for and develop known resource rich areas such as the Gulf of Mexico. The oil and gas industry stands ready to investment in these traditional resource basins. In fact, the lease sales held by the federal government in 2008 for the Chukchi Sea and Central and the Western Gulf of Mexico garnered over \$7 billion in bonus bids – including \$2.662 billion in bids for the still lightly explored Chukchi Sea. The value represented in these bonus bids demonstrates that when given the opportunity industry will continue to invest in the search for new American energy resources where it makes economic sense. Without additional investments in traditional oil and gas regions, and access to new promising regions like the Alaskan Outer Continental Shelf, our domestic supplies will decline and our dependency on foreign oil will increase.

Our nation's long term energy security will depend upon diversity of sources of supply. It is important to remember that U.S. domestic production is mostly made up of modest amounts from hundreds of thousands of wells in thousands of oil and gas fields, both onshore and offshore. With the exception of a few very large fields discovered many decades ago, all of our current production comes from fields that can be characterized as only a few weeks or months of supply. Thus, each discovery makes a proportional contribution to supplies over 10, 20, or in some cases, 50 or more years. The U.S. needs a constant supply of new discoveries to replace declining production from existing and end-of-life wells to meet our nation's growing demand for energy. Otherwise production will eventually fall, creating a potential supply/demand imbalance that could have adverse impacts on imports and prices for American businesses, consumers and homeowners.

Policymakers intended the OCS to provide energy supplies.

The Outer Continental Shelf Lands Act (OCSLA) explicitly recognizes the importance of OCS oil and natural gas production. The OCSLA declares that it is "...*the policy of the United States that...the Outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs.*" Further, the 1978 amendments to the OCSLA found that "... *increasing reliance on imported oil is not inevitable, but is rather subject to significant reduction by increasing the development of domestic sources of energy supplies...*"

The oil and natural gas industry plays an important role in the U.S. economy and in states well beyond traditional oil and gas-producing regions. For instance in its study entitled, “The Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy: Employment, Labor Income and Value Added,” PricewaterhouseCoopers found the economic impact of the oil and natural gas industry reaches all 50 states and the District of Columbia. The industry supports more than 9 million American jobs and makes a total value-added contribution to the national economy of more than \$1 trillion, or 7.5 percent of the U.S. gross domestic product, in 2007, the most recent year for which data was available.¹

If recent events have taught us anything, it is that our nation must develop energy supplies right here in America. Oil and natural gas will be an essential part of this nation’s energy future for decades to come. For too many years important resources have been purposefully placed off limits to oil and gas exploration and development. OCS exploration and development enhances our economy by providing needed domestic energy, creating jobs and generating local, state and federal revenue. The federal OCS is home to huge, untapped resources of oil and natural gas that are crucial to keeping our economy and our country going strong. Currently in the United States., approximately 25 percent of crude oil and 15 percent of natural gas production comes from offshore areas.

The inventory provisions of the Energy Policy Act of 2005 should be implemented.

A key provision of the Energy Policy Act calls for a resource assessment of all OCS areas. Debate over the proper role of OCS lands has been hampered by the lack of the most up-to-date information about energy resources contained in areas currently off-limits. For example, assessments of areas that have been off limits for a decade or more—the Atlantic and Pacific coasts and portions of the Eastern Gulf—reflect old data. Conducting seismic surveys would provide MMS with accurate multi-dimensional images that would help predict where resources lie and help inform the American public as to the scope of these resources.

Seismic surveys can be conducted in an environmentally safe manner. Scientific research has not shown that seismic activities harm marine mammals. In its 2004 report, “*Marine Mammal Populations and Ocean Noise – Determining when Noise Causes Biologically Significant Effects*,” the National Research Council concluded that “no scientific studies have conclusively demonstrated a link between exposure to sound and adverse effects on a marine mammal population.” Additionally, MMS has implemented general instructions, including mitigation measures in the deepwater Gulf of Mexico, to minimize any possible effects of seismic surveys on marine species.

Area there specific areas/subareas that should be excluded because they are particularly sensitive?

API believes that it is vitally important that decisions on areas to be included or withheld from lease sales should be based on peer-reviewed science, objective assessment of risk, and public discussion. It is our

¹ “The Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy: Employment, Labor Income and Value Added”, PricewaterhouseCoopers, September 8, 2009.

position that the present restriction on the ‘polynya’ area nearest to the Alaskan shoreline is sufficient to achieve a compromise for protection of marine life of concern inhabiting the Beaufort and Chukchi Seas. Through stipulations on leases it issues, MMS currently has the authority to protect already designated sensitive areas and the ability to designate such as “no activity zones” in order to provide further protection. For areas not already designated as sensitive, API and its member companies support a full and open public process and science-based selection criteria before any areas are removed from leasing consideration.

Current resource estimates may understate OCS supply potential.

The undiscovered federal OCS resources that could be recovered with today’s sophisticated technology are estimated to be 420 tcf of natural gas and 77 billion barrels of oil. These numbers are equivalent to the oil resources of Canada and Mexico combined and almost three times the natural gas resources of these two countries. In the Alaskan OCS, current estimates forecast additional resources of 122 tcf of natural gas and 25 billion barrels of oil, or some 29 percent of the natural gas resource endowment and 32.4 percent of the crude oil resource endowment on the entirety of the OCS. The importance of these undiscovered resources in the Alaska region cannot be overlooked in light of today’s tight supply/demand balance.

These estimates may be conservative since the areas are largely unexplored and the estimates have not benefited from the use of new seismic and computer modeling technology. Generally, the more an area is explored, the more its resource estimates increase. For example, between 1995 and 2003, U.S. Geological Survey estimates of oil resources in the Central and Western Gulf of Mexico increased by over 400% (6.32 billion barrels to 33.39 billion barrels) while natural gas resource estimates in the area more than doubled (88.1 Tcf to 180.2 Tcf). Additionally, discoveries in the eastern portion of the Central Planning Area and in the small portion of the Sale181 area leased since 2001, indicate that additional recoverable resources should extend well into other portions of the Eastern Gulf.

The oil and natural gas industry is a business that involves a long lead time for bringing projects to production. In a great many cases, today's production is a result of tremendous technological developments, and it results from investments made several years ago. Natural gas is being produced from subsurface formations thought impracticable or impossible to produce fifteen or twenty years ago because tiny pore spaces in the formation rock prevented the gas from flowing into the wells. Natural gas and oil are being produced from formations in the Gulf of Mexico once thought to be too far offshore, or too deep to be developed. Natural gas is now being produced from coal beds and seams in several regions of the country using technology that did not exist a generation ago. In other cases, successful new development of resources that have been known about, like North Dakota’s Bakken Shale, has resulted from analysis of geologic data on a decades-old producing area, identification of untapped resources, and application of the new drilling and completion technology necessary to exploit them.

Today's investments will be necessary to produce oil and natural gas several years from now. Invest today in new agricultural technologies, get higher yields in several years. Invest today in medical technology research, produce a life saving product several years from now. Invest in development of fuel efficient



vehicles, have affordable fuel efficient vehicles several years from now. Likewise, our nation must invest in our own domestic oil and natural gas supplies so that we have them several years from now. Energy solutions are long-term. We will continue to rely on oil and natural gas in the long-term, so we need to make decisions now that provide us with the resource in the long-term.

Potential Alaskan OCS Resources Are an Important Element of the U.S. Supply Picture

As noted, Alaska's OCS has world-class oil and gas potential, holding an estimated 25 billion barrels of oil and 122 trillion cubic feet of natural gas. Exploring for oil and gas offshore Alaska is not new. A total of 30 wells have been drilled in the Beaufort Sea and five wells drilled in the Chukchi Sea. Although some discoveries of oil and natural gas were made, development of these discoveries was not economically viable at that time. Since 2005, the federal government has held several OCS lease sales in Alaska, and bonus payments to the federal treasury have exceeded \$3 billion for ten-year leases in the Beaufort and Chukchi Seas. Companies acquiring those leases have painstakingly prepared environmentally responsible plans of exploration and have invested hundreds of millions of dollars in equipment, support vessels, baseline studies and workforce training. Yet, to date not a single exploration well has been drilled in these leases, due in large part to permitting delays and litigation.

Environmental Analyses

API strongly encourages the NMFS to conduct environmental analyses for all planning areas. For those areas which already have existing work done, we recommend a tiered approach to supplement that work. This is important because when companies make investments or bids on leases, it may take years to develop those leases once acquired. In addition, in many instances, it takes years of prior investment and analysis of an area before leases are identified to bid on. Long term business decisions are made on the assumption that leases will be available, permits will be issued and oil and gas exploration and development will be allowed to occur. In addition, API questions why the scope of the planned EIS is described as being limited to the issuance of incidental take authorizations for seismic surveys and exploration drilling. The notice does not mention other activities such as construction associated with offshore oil and gas development in the event resources are discovered through the exploration activities the notice discusses. Reasonably foreseeable types of offshore development activities have been described in connection with USFWS development of regulations for the issuance of ITAs for the polar bear and the walrus. API requests that the scope of the EIS extend to cover such reasonably foreseeable activities as winter season drilling from bottom-founded structures in shallower waters of the OCS, construction, facility installation and the laying of gathering lines and pipelines.

Oil Spill Prevention and Preparedness

Technology has allowed the offshore oil and natural gas industry to explore safely while protecting our oceans. Industry has developed specialized equipment, such as blowout preventers and subsurface safety valves to safeguard the ocean. Industry standards are designed to ensure that both the design of the platform and the equipment protect the ocean waters.

Industry's performance during Hurricanes Katrina and Rita in 2005 demonstrated the environmental protection built into offshore operations. MMS estimates during this time period that 3,050 of the 4,000 Gulf platforms and 22,000 of the 33,000 miles of pipelines were in the direct paths of the storms. Even though about 115 platforms were destroyed and over 50 others were damaged, there was no loss of life and no significant oil spills from industry's OCS facilities. In fact, design standards were further strengthened by industry following these two hurricanes to further attest to industry's commitment to offshore safety and oil spill prevention.

Spill prevention is the key to the protection of the ocean and marine environment. Well planning and engineering, drilling practices and standards, the design of offshore rigs and other facilities, and the training of personnel all play a critical role in achieving prevention of oil spills. Over the years the ability to monitor and measure temperatures, pressures and other conditions occurring downhole where the drill bit is advancing has been another area of continuous improvement in engineering, technology and operational performance. Today around the world, drilling engineers on site use sophisticated instrumentation to observe well conditions on a real time basis. Drilling engineers and operations professionals on the rigs are in constant communication with supporting shore-based teams of engineers and technicians who provide insights and experience from other drilling situations to help address situations that may be encountered.

Alaska Clean Seas (ACS) has conducted numerous training exercises over the last several years in broken ice conditions. The ACS Technical Manual, which is available on their web site at www.alaskacleanseas.org, provides numerous tactics that can be used in ice conditions. The under ice response tactics have been utilized in actual spill events. The events were small and in inland lakes. ACS has also conducted numerous projects with In-Situ burning for use in broken ice conditions and viscous oil pumping. Most of these reports are located on the MMS web site.

Marine Mammals

API strongly encourages NMFS to carry out a balanced and objective review of scientifically sound and peer-reviewed literature that examine the effects from oil and gas operations in the marine environment on marine mammals that inhabit that environment. The EIS to be prepared should avoid speculation about potential effects, and should describe effects with reference to documented incidents or scientific or technical reports, and risk-based analysis. In particular, any determinations reached in the EIS as to the criteria for a recommended exclusion zones for seismic operations in the marine environment should be scientifically supportable with reference to peer-reviewed findings in the literature. The document should also examine the evidence in the literature showing seismic has not affected the health or reproductive fitness of marine mammal populations. While numerous subjects remain for additional scientific research on marine mammal populations, the studies to date are very consistent in their conclusions on this topic. The EIS should consider the weight of evidence from over 50 years of offshore exploration monitoring that indicates that routine seismic surveys do not result in population-level impacts for any marine mammal species. With the application of risk-based mitigation measures, seismic surveys have, and will continue to be undertaken with little or no impact to marine mammals and to marine life in general.

The EIS should summarize or describe the content of mitigation measures, lease operations requirements set forth in NTL's, and explain their implications for operational compliance by MMS lessees and operators. Marine seismic exploration is carefully regulated by the federal government and managed by the operator to avoid causing marine mammals to change their behavior in ways that might be harmful. Regulations require operators to:

- Have trained marine mammal observers onboard to watch for mammals
- When starting, use a ramp-up procedure to gradually increase the sound level being produced, which allows animals to leave the area if the sound is uncomfortable
- Stop any operations if a marine mammal is likely to enter a "safety zone" around the operation and wait to restart operations until the zone is all-clear for at least 30 minutes

API recommends that the EIS should also contain, on a region by region basis, a complete compilation of all biological stipulations, NTL's, and mitigation measures in effect, along with summary information on whether or not these measures have appeared to work, and whether or not any direct studies have been conducted to verify their effectiveness. For example, over a 1000 platforms have been removed by use of explosives under appropriate permits and thus far there is not a single reported incident of marine mammal injury or death. API recommends that the EIS consider the effectiveness of the many mitigation measures that are now customary.

In the case of Alaska, there should also be a detailed summation of the Conflict Avoidance Agreement that is required between industry and the native groups to minimize conflict and impacts on subsistence hunting activities such as those carried out seasonally for bowhead whales.

Recognizing the Importance of Research

The government has played a leading role in performing scientific studies. Since 1973, federal agencies have performed more than 5,000 scientific studies on the environmental effects of offshore oil and gas activities. For example, the National Academy of Sciences has produced three reports focused directly on environmental science for offshore oil and gas, two with particular focus on Alaska. The Minerals Management Service's OCS Environmental Studies Program has spent more than \$600 million (more than \$1 billion in inflation adjusted dollars) on scientific studies of offshore oil and gas – about half of that directed specifically to Alaska. Money is not a perfect measure for the applicability or credibility of the information, but it provides a metric of effort and breadth that many people will understand.

The industry also has a role to play. Oil and gas companies have worked on major scientific programs that supplement the research by government agencies. In the last 10 years, the industry has published studies on the environmental effects of and best management practices for pollution prevention technology, emissions from offshore platforms that include produced waters, drilling discharges, air emissions, the effects of sound on marine life that includes whales and fish, weather and oceanographic studies, and improved design standards for severe weather multi-year acoustic monitoring in both the Chukchi and Beaufort Seas. In addition, ongoing studies of the Arctic marine environment include: distribution and ecology of fish species present in Arctic waters; population, distribution, migration patterns and feeding

and foraging of marine mammals; research into social systems, subsistence uses and traditional knowledge of the indigenous peoples of the region; and physical oceanography and meteorology. Industry has supported the development of scientific knowledge about the Arctic and the Arctic marine environment through sharing of data, long term monitoring projects, collaborative funding, and logistical assistance to government researchers.

Failure to expand access will affect all Americans.

The US Energy Information Administration (EIA) forecasts that by 2025, demand for oil will increase by 39% and demand for natural gas by 34%. The EIA also estimates that oil and natural gas will provide nearly two-thirds of the energy consumed in 2025. Diminished access to domestic energy supplies, particularly in the form of natural gas has already had an impact on a number of important sectors of the economy. For example,

- More than 2.8 million US manufacturing jobs have been lost since 2000.
- Since 2002, 36% of the US fertilizer industry—which depends on natural gas—has been shut down or mothballed.
- Farmers paid \$6 billion more for energy in 2003 and 2004.
- The US chemical industry’s natural gas costs increased by \$10 billion since 2003, with \$40 billion in business lost to overseas competitors who pay far less for natural gas.
- Chemical companies closed 70 facilities in the United States in 2004 and have tagged at least 40 more for shutdown. Of the 120 chemical plants being built around the world with price tags of \$1 billion or more, only one is in the U.S.

The stakes are high, and the cost of restricting or denying access to U.S. energy resources consequential not just for the nation’s energy supply portfolio, but for the economy as a whole, for federal revenues, and for jobs. A recently concluded study commissioned by the National Association of Regulatory Utility Commissioners found that that maintaining traditional energy exploration and production moratoria on Federal resources onshore and offshore would result in an alternative domestic energy future that “...significantly alters the cost and availability of domestic oil products and natural gas in all economic sectors and regions of the country.” According to the study, if moratoria were maintained from 2009-2030, model projections show that²:

- Cumulative domestic oil and natural gas production would decrease by 21% and 10%, respectively
- The average natural gas price would decrease by 28% and average gasoline price would increase by 8.4%
- The cumulative net present value (NPV) of consumer purchases of electricity and natural gas would increase by \$325 Billion

² J. Ratafia-Brown, R. Irby and K. Perry, *Analysis of the Social, Economic and Environmental Effects of Maintaining Oil and Gas Exploration and Production Moratoria on and beneath Federal Lands*, Science Applications International Corporation (SAIC) and Gas Technology Institute (GTI), prepared in coordination with The NARUC Moratoria Study Group, 2010.



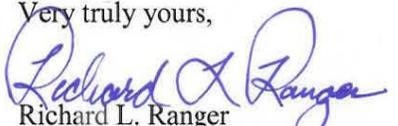
- The cumulative national real disposable income would decrease by \$1.163 Trillion (\$4,000 per capita)
- The cumulative oil imports from OPEC countries would increase by 4.1 Billion barrels
- The cumulative national payments to OPEC countries would increase by \$607 Billion (\$295 Billion NPV)

Every day we delay development of the energy resource endowment on federal OCS lands is another day that we are depriving Americans of the jobs that can be generated through development. It is another day that federal, state and local governments go without the enormous revenues oil and natural gas exploration generates. And it is another day that we watch our energy security erode. The resource potential available in Alaska is first order world class. Industry's ability to operate safely and in an environmentally responsible manner in the Arctic has been demonstrated for five decades. Alaskan oil and gas operations have been a proving ground for technologies that have steadily reduced both the footprint and the impacts of exploration and production activities the industry undertakes.

The oil and natural gas industry has proven itself to be a critical partner in the development of Alaska, and in expanding our knowledge of an Arctic environment that is as fragile as it is remote and challenging. API encourages timely completion of this EIS.

Thank you for considering these comments. If you need additional information, please contact Richard Ranger at 202.682.8057.

Very truly yours,


Richard L. Ranger
Senior Policy Advisor, Upstream

From ▶ [jean public <jeanpublic@yahoo.com>](mailto:jeanpublic@yahoo.com)

Sent Saturday, February 27, 2010 6:38 pm

To sheyna.wiscom@urscorp.com , Arcticeis.Comments@noaa.gov , americanvoices@mail.house.gov , info@taxpayer.net , media@cagw.org

Cc info@emagazine.com , info@starmagazine.com , today@nbc.com

Subject public comment on federal register Fw: THE OIL COMPANIES SHOULD BE ENCOURAGING SO

america does not want oil and gas activities in the beaufort and chukchi sea.

1. you are killing locals who depend on clean water and animals.
2. oil companies have proved they are sloppy and negligent. they let maintenance on a pipeline go for 17 years until it polluted hundreds of acres. that shows you cannot trust these sloppy,negligent profiteers in this fragilei area.
3. they will decimate the area. it takes 100 years for this area to recover from an oil spill
4. this is bush crap. we elected obama who needs to stop the bush crap continuing. bush was the most anti american president we have ever had. he dcimated the middle and lower economic class for his rich friends and oil buddies.

jean public 8 winterberry court whitehouse station nj 08889

Subject:PUBLIC comment ON FEDERAL REGISTER - THESE PERMITS SHOULD BE DENIED

Date:Mon, 08 Feb 2010 19:52:53 -0500

From:bk1492@aol.com

To:ARCTICEIS-COMMENS@NOAA.GOV, MICHAEL.PAYNE@NMFS.GOV, Michael.Payne@noaa.gov, SHEYNA_WISDOM@URSCORP.COM

CC:AMERICANVOICES@MAIL.HOUSE.GOV, COMMENTS@WHITEHOUSE.GOV, INFO@EMAGAZNE.COM, INFO@STARMAGAZINE.COM

References:<8CC76CFCA460981-15D0-25BCC@webmail-d091.sysops.aol.com>
IN NO WAY SHOULD THIS KILLING OF THESE SPECIES BE CONSIDERED "INCIDENTAL".
IN FACT THIS IS A MAJOR ASSAULT ON THE SPECIES IN THIS AREA. NO OIL COMPANY EXEC CARES ONE BIT ABOUT WHAT THEY KILL IN THIS AREA AND THIS AREA IS VITAL FOR ALASKA NATIVES. THERE IS NO ENVIRONMENTAL JUSTICE IN THIS ACTION JUST TAKINGS AFFECTING THE PEOPLE WHO RELY ON THESE NATURAL RESOURCES IN THIS ACTION. THESE PERMITS NEED TO BE DENIED.
JEAN PUBLIC 15 ELM ST FLORHAM PARK NJ07932

Center for Regulatory Effectiveness

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April 9, 2010

via email (arcticeis.comments@noaa.gov) and
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Mr. P. Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Hwy.
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CRE Comments on Scoping in Response to the Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, (75 Fed. Reg. 6175, Feb. 8, 2010)

Dear Mr. Payne:

Following are the comments of the Center for Regulatory Effectiveness ("CRE") on matters that should be considered in the preparation of this EIS.

NOAA, with MMS as a cooperating agency, plans to prepare a new Draft Environmental Impact Statement (DEIS) on the above subject. A Draft Programmatic EIS ("DPEIS") was previously prepared and made available for public comment in February 2007. That DPEIS incorporated much of the information and analysis from a Programmatic Environmental Assessment ("PEA") completed by NOAA and MMS in 2006.

We have reviewed the comments on the 2007 DPEIS and have attempted to avoid duplicating comments made at that time by other interested parties. In particular, due to our familiarity and experience with the requirements of the Information Quality Act ("IQA") and its guidance, we have included comments on the need to comply with the "utility," "objectivity," and independent, external, peer review requirements of the IQA and its guidance that were not addressed in either the DPEIS or previous comments.

I. A Supplemental or Revised Draft EIS Is More Appropriate Than a New Draft

The former Draft Programmatic EIS ("DPEIS") was withdrawn and NOAA has given notice of intent to prepare a new Draft EIS.¹ Very substantial effort was involved in preparation

¹ There is no explanation in the *Federal Register* notices for why this is planned as an EIS rather than a programmatic EIS, as previously. It appears that this should be a programmatic EIS because it will encompass numerous potential individual permit actions.

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of the previous draft EIS and its record. Ordinarily, deficiencies in a draft EIS or changes in the proposed action warrant a revised or supplemental draft, not a wholly new NEPA effort. The NEPA regulations provide only for supplemental drafts, and make no mention of withdrawal and preparation of a new draft. 40 CFR 1502.9(c)(1).² Historically, the few withdrawals of draft EISs that have occurred have been due to agency abandonment of the proposed action or passage of a much longer period of time since release of the DEIS than is involved here -- on the order of six to seven years. Assuming there is significant new information or some substantial change in the proposed action, the record established as the basis for the prior DPEIS process, and those parts of its analysis that are not affected by the new information or the changes in the proposed action should not be discarded; rather, the DPEIS should be supplemented.

Preparation of a wholly new DEIS will make it difficult for stakeholders and the public to sort out the revisions and to determine what changes are significant or are regarded as significant from the agency's point of view. A supplemental draft could explain the significant changes that have been made to the database supporting the DPEIS and to the analysis of impacts and alternatives, thereby greatly assisting the comments process. Alternatively, a revised DEIS (rather than a supplemental DEIS), should contain a similar explanation of the significant revisions.

II. MMS Should Continue to Be a Joint Lead Agency for the EIS rather than a Cooperating Agency.

Consistent with the CEQ regulations (40 CFR 1501.5(b)), the 2007 DPEIS was prepared by both NOAA and MMS as joint lead agencies. The Notice of Intent to prepare a new DEIS states that NOAA is the only lead agency and MMS is now a "cooperating agency." No explanation for this change is given. This change in the status of MMS appears to diminish its role in the process.

This change in the MMS role is not warranted. The key factors in determining a lead agency or agencies are legal responsibility for the proposed action and expertise that can contribute to the NEPA process. 40 CFR § 1501.5(c). MMS as well as NOAA has permitting responsibilities for the covered oil and gas exploration activities, and must comply with its statutory authority for such permitting under the Outer Continental Shelf Lands Act ("OCSLA"). NOAA, in turn, has responsibility for incidental harassment authorizations under the Marine Mammal Protection Act in connection with the MMS permits. However, neither authority is more pertinent to the EIS than the other. The exploration permits and IHAs go hand-in-hand.

With regard to expertise, MMS has expertise on key subjects such as the levels of exploration activity that can be expected in the future, technical aspects of seismic exploration and exploratory drilling, technical feasibility/practicability and safety, and economic and social impacts of oil and gas exploration and production. MMS is likely to have more expertise than NOAA on one of the two most prominent factors stated by NOAA as a basis for preparation of a new DEIS -- "changes in projections of level of activity." MMS is also responsible under the

² Agencies "[s]hall prepare supplements to either draft or final environmental impact statements if: (i) the agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts."

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OCSLA for conducting environmental studies, ensuring that oil and gas activities do not cause undue environmental harm, ensuring technical feasibility and safety, and ensuring that other Federal laws are not violated. Indeed, the OCSLA provides that MMS will utilize the capabilities of the Department of Commerce (which includes NOAA), rather than vice versa. 43 U.S.C. §1346(f).³

A weakening of the MMS role in preparing the EIS might be viewed by some as politically motivated, and any such perceptions should not be allowed to tinge public perceptions concerning the objectivity of the NEPA analysis. The conclusion one might draw from the change in leadership is that marine mammals are regarded as more important than domestic oil and gas exploration and production, when the correct view should be that both are important and should be reconciled if possible, but that in the end Congress and the courts have been of the view that the "primary purpose" of the OCSLA is to ensure expeditious and orderly development of the OCS for energy purposes, consistent with other Federal laws. (See section VII, below, on the need for expeditious completion of the EIS).

MMS should be restored to the position of a joint lead agency. We are hereby requesting designation of MMS as a lead agency pursuant to the CEQ regulations, 40 CFR § 1501.5(d).⁴

III. NOAA and MMS Should Promptly Issue a *Federal Register* Notice of Data Availability Detailing the "new information" Asserted in the NOI to Warrant Starting Over the NEPA Process.

The NOI indicates that a decision to restart the NEPA process is warranted by "new information" that includes "scientific study results [and] changes in projections of level of activity." Particularly if there are significant new scientific study results, stakeholders will need adequate time to review and analyze those studies, and a limited comment period on the DEIS might not provide adequate time. (The original comment period on the withdrawn draft EIS was only about four weeks.) Moreover, simply in the interests of government openness and transparency, the details of this new information (including both the new scientific information and the changes in projected level of activity) should be provided as soon as possible through a *Federal Register* notice of data availability. Such action would also help expedite the EIS process.

IV. The EIS Must Have Regulatory "Utility" under the Information Quality Act ("IQA") by Analyzing Effects and Alternatives in Accordance with the Applicable Regulatory Standards.

The IQA (also called the Data Quality Act, or DQA) was enacted in 2000 as a supplement to the information dissemination and quality provisions of the Paperwork Reduction

³ In preparing the 2006 Programmatic Environmental Assessment that preceded the DPEIS and which provided much of the information for the DPEIS, NOAA was a cooperating agency while MMS was the lead agency.

⁴ "Any Federal agency, or any State or local agency or private person substantially affected by the absence of lead agency designation, may make a written request to the potential lead agencies that a lead agency be designated." 40 CFR § 1501.5(b).

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Act ("PRA") of 1995. 44 U.S.C. § 3516, note.⁵ The basic stated purpose of the Act was to maximize and ensure the quality, including the "objectivity," and "utility," of information disseminated by federal agencies. In accordance with the Act, OMB issued government-wide guidelines.⁶

Those IQA guidelines define "utility" as referring to "the usefulness of the information to its intended users, including the public." 67 Fed. Reg. 8452, 8459 2d col., Feb. 22, 2002. An EIS, which is undoubtedly an information dissemination subject to the IQA,⁷ is intended to provide useful information to regulatory decisionmakers.⁸ Therefore, it cannot have "utility" for that purpose if it is not prepared so as to provide information that is useful for applying the pertinent regulatory standards. For example, EIS alternatives that cannot meet the regulatory standards lack utility, as does scientific information that is not useful for applying those standards.

As some commenters on the 2007 DPEIS have noted, the DPEIS was deficient in not clearly and completely stating the applicable regulatory standards, and then providing information that was in accordance with those standards. The DPEIS correctly cited and quoted the incidental harassment provisions of the Marine Mammal Protection Act ("MMPA") in stating that the Secretary of Commerce shall issue incidental harassment authorizations if he finds that such an authorization "will have a negligible impact on such species or stock, and ... will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses" 16 U.S.C. § 1371(a)(5)(A)(i) and (D)(i) (emphasis added). However, the DPEIS did not refer to the MMPA regulations defining "negligible impact" as "an impact from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." 50 CFR §216.103 (emphasis added).⁹

⁵ The IQA is also sometimes cited as section 515 of Pub. L. 106-554 (which is not a precise citation).

⁶ The OMB guidance implementing the IQA and the underlying and incorporated statute, the Paperwork Reduction Act of 1995 ("PRA"), is legally binding on the agencies. 44 U.S.C. § 3506(a)(1)(B) states that "[t]he head of each agency shall be responsible for ... complying with the requirements of this subchapter and policies established by the Director."

⁷ See the definitions of "Information dissemination product" and "Dissemination" in the OMB guidelines. 67 Fed. Reg. at 8460. See also the June 10, 2002, letter from OIRA to the agencies at 33-34. Available at http://www.whitehouse.gov/omb/assets/omb/inforeg/iqg_comments.pdf. Environmental organizations, including ones that commented on the 2007 DPEIS, such as NRDC and EarthJustice, have submitted IQA petitions seeking correction of EISs. See, e.g., the petition for correction filed by EarthJustice on behalf of NRDC and the Greater Yellowstone Coalition to BLM and the Forest Service seeking correction of a final EIS, available at <http://www.fs.fed.us/qoi/documents/2008/EarthJustice.pdf>.

⁸ See the CEQ regulations § 1502.1.

⁹ The term "stock" is not defined in the MMPA regulations at 50 CFR §§ 216.1 *et seq.* In general, a marine "stock" is a species subpopulation that ranges in a particular ocean area and is likely to have some minor differences from other stocks of the same species in other ocean areas in terms of morphology, genetics, feeding and migration patterns, etc.

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The requirements for analysis of (1) "reasonably expected" or "reasonably likely" adverse impacts, (2) on the "species or stock," (3) "through effects on annual rates of recruitment or survival" are highly significant. Information on impacts, or potential/speculative impacts, that are transient and do not adversely affect species or stocks through recruitment or survival, and effects on individual or small numbers of mammals or impacts that do not affect the viability of the species or stock, is not relevant and lacks "utility" for the EIS and making the pertinent regulatory decisions. Nevertheless, quite likely as a result of not fully and clearly referencing the appropriate regulatory standards, the previous draft EIS, and both NGO and other federal agency commenters, provided information on minor impacts that they described as "potential" or that "may" or "could" occur. Such speculative impacts are not relevant under the regulatory standard of "reasonably likely" or "reasonably expected." A clear example is the repeated emphasis on the possibility that acoustic exploration methods might result in "avoidance" behavior by some mammals, or other temporary or occasional impacts on individual or small numbers of mammals that have no discernable relevance for determining negligible impacts on the species or stock through effects on annual rates of recruitment or survival, or availability of the species or stock for subsistence purposes.

The focus of the MMPA regulations on "reasonably expected" or "reasonably likely" adverse impacts is consistent with NEPA and the CEQ regulations and case law, which require an EIS to focus on "reasonably foreseeable," "probable," "anticipated," or "sufficiently likely" significant environmental effects.¹⁰

The assessment of cumulative effects is likely to be particularly sensitive to the requirement for a focus on "reasonably foreseeable significant" or "reasonably likely" effects on species or stocks through effects on recruitment or survival, and on the availability of the species for subsistence takes. The noise from exploration activities will be very transitory, and even then will occur mainly during only a small portion of the year (the "open water" season). Other sources of noise that might affect marine mammals, from sources such as icebreakers, other support craft, long-range commercial transport ships, or cruise ships, will also be transitory and usually non-localized, therefore making it highly likely that any assessment of cumulative effects will be very speculative rather than "reasonably foreseeable," "reasonably expected," "reasonably likely," or "probable."

In order to comply with the IQA and its guidelines, the EIS must have "utility" in the sense of providing information that is useful to the intended regulatory decisionmakers, who must employ the regulatory standards. Information on environmental impacts, and the analysis of alternatives in terms of those impacts, based on speculation or mere possibility is contrary to the MMPA regulations, the IQA, and NEPA.

¹⁰ CEQ regulations at 40 CFR § 1508.8(b). *And see, e.g., Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 356 (1989); *Ground Zero Center for Non-Violent Action v. U.S. Dept. of the Navy*, 383 F.3d 1082, 1089 (9th Cir. 2004) ("reasonably foreseeable" and "probable"); *Friends of Yosemite Valley v. Norton*, 348 F.3d 789, 800 (9th Cir. 2003); *Churchill County v. Norton*, 276 F.3d 1060, 1071, 1072 (9th Cir. 2001) ("reasonably foreseeable," "probable," and "reasonable to anticipate"); *City of Dallas, Tex. v. Hall*, 562 F.3d 712, 719 (5th Cir. 2009) ("reasonably foreseeable" and "sufficiently likely to occur").

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The IQA guidelines also require "objectivity" in information disseminated to the public, and they define "objectivity" (as should be evident from its common meaning) as requiring an absence of bias.¹¹ The CEQ NEPA regulations also require objectivity and scientific integrity in analyzing "reasonably foreseeable significant effects,"¹² and the MMPA regulations require that incidental take authorizations be based on "the best scientific evidence available."¹³ Moreover, since the independent, external peer review required by the IQA guidelines (discussed below) must be devoid of policy bias, the peer reviewers cannot be asked to review scientific information and analyses that are influenced by policy bias.

Despite these requirements for objectivity and scientific integrity, the 2007 DPEIS introduced policy bias into its analysis of alternatives by applying a policy of precaution when there was a lack of sufficient information, rather than simply describing accurately the available information and its sufficiency or insufficiency with regard to "reasonably foreseeable significant adverse effects" as required by the CEQ regulations.¹⁴ For example, the DPEIS stated, in its analysis of the potential impacts of noise on whales, that because there is a lack of agreement and controversy in the scientific community on this subject, "our analyses are protective in that we have attempted to err on the side of overestimating potential effects rather than underestimating, and then building in mitigation measures to reduce such potential effects." DPEIS at III-127.¹⁵

Employing a precautionary policy approach to the analyses of effects in the EIS in order to substitute for incomplete or lack of evidence would be contrary to the mandatory "objectivity" standard of the IQA and its guidelines, and to the CEQ regulatory requirements for "scientific integrity," treatment of incomplete or unavailable information, and analysis of "reasonably foreseeable significant adverse effects."

V. The Scientific Information and Assessments in the Draft EIS Must Undergo Independent, External, Expert Peer Review, along with Adequate Opportunities for Public Participation, under the IQA Guidance.

Many of the conflicting views among stakeholders with regard to the EIS appear to be based on differing interpretations of the scientific evidence, in addition to the application of differing regulatory standards.

¹¹ 67 Fed. Reg. at 8459 3d col.

¹² The CEQ regulations state that in analyzing the alternatives to the proposed action in the EIS, which CEQ considers "the heart of the environmental impact statement," agencies "shall . . . objectively evaluate" the alternatives. 40 CFR § 1502.14. See footnote 16, below, regarding "scientific integrity."

¹³ 40 CFR § 216.102(a) and 216.104(c).

¹⁴ 40 CFR § 1502.22 ("Incomplete or unavailable information."). Acknowledging and explaining uncertainties and lack of information, rather than substituting policy positions for such uncertainties and lack, is an essential aspect of scientific objectivity.

¹⁵ See also, *e.g.*, the DPEIS at III-100 ("we believe that a precautionary approach . . . is warranted"), III-101 ("Where there is uncertainty on the status of the affected population . . . the analyses should be protective."), and III-106 ("This assumption errs on the side of caution Lacking more detailed knowledge . . . a cautious analysis is prudent.").

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Independent external peer review could help resolve the scientific controversies. The IQA peer review guidelines require independent, external peer review of drafts of "influential scientific information" and all "highly influential scientific assessments" that are to be disseminated to the public. 70 Fed. Reg. 2664, 2670 1st & 3d cols. "Highly influential scientific assessments" require a higher degree of review rigor and public participation.¹⁶

"Influential scientific information" disseminated to the public is defined as "scientific information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions . . ." 70 Fed. Reg. at 2675 1st col. A "scientific assessment" differs from "scientific information," and is defined as "an evaluation of a body of scientific or technical knowledge, which typically synthesizes multiple factual inputs, data, models, assumptions, and/or applies best professional judgment to bridge uncertainties in the available information. These assessments include, but are not limited to, ... ecological risk assessments ... or exposure assessments." *Id.* A "scientific assessment" is "highly influential" if the line agency or OMB determines that it "(i) Could have a potential impact of more than \$500 million in any year, or (ii) Is novel, controversial, or precedent-setting or has significant interagency interest."¹⁷ The assessment of acoustic impacts on marine mammals that will be incorporated into, and lies at the heart of, this EIS, appears to satisfy all of these "highly influential" factors, but if not the \$500 million threshold in (i), then certainly the "novel, controversial, or precedent-setting" and "has significant interagency interest" factors in (ii).

The EIS could be interpreted as incorporating both influential scientific information and highly influential scientific assessments with regard to different scientific issues. While some information such as stock populations and growth or decline rates, and technological feasibility of certain mitigation alternatives, could be regarded as "influential scientific information," assessment of the reasonably likely degree of impact, if any, of seismic exploration, exploratory drilling, and other noise sources on marine mammal species and stocks, and availability for subsistence takes, will surely qualify as "highly influential scientific assessment(s)."

The OMB IQA peer review guidance sets out different requirements for influential scientific information and highly influential scientific assessments, although the requirements for "highly influential scientific assessments" incorporate and are supplemental to those for "influential scientific information." In the case of both, there are requirements for independence of peer reviewers, absence of conflicts of interest, compliance with the basic IQA quality standards such as utility and objectivity, and including in the charge to the peer reviewers information concerning the requirements of the IQA and its guidance and admonitions against allowing any policy bias to influence the review. The main differences lie in the degree of public participation and transparency the agency must provide for. The provisions for public participation in highly influential scientific assessments state:

5. Opportunity for Public Participation: Whenever feasible and appropriate, the agency shall make the draft scientific assessment available to the public for

¹⁶ The CEQ regulations also emphasize the need for ensuring scientific accuracy, stating that "[a]gencies shall ensure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements." 40 CFR §1502.24.

¹⁷ 70 Fed. Reg. 2675 3d col.

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comment at the same time it is submitted for peer review (or during the peer review process) and sponsor a public meeting where oral presentations on scientific issues can be made to the peer reviewers by interested members of the public. When employing a public comment process as part of the peer review, the agency shall, whenever practical, provide peer reviewers with access to public comments that address significant scientific or technical issues. To ensure that public participation does not unduly delay agency activities, the agency shall clearly specify time limits for public participation throughout the peer review process.

70 Fed. Reg. at 2676 2d col. (emphasis added). In the case of this EIS, it is undoubtedly "feasible and appropriate" to make the draft EIS available for comment, and a public comment process will necessarily be a part of the peer review, since the public will be commenting on the draft EIS that incorporates the draft highly influential scientific assessment.

A necessary component of effective public participation will be posting of a draft charge to the peer reviewers and providing an opportunity for the public to comment on the draft charge. Any peer review will be influenced to a great degree by the specific wording of the charge to the reviewers. The charge is one of the most critical parts of the peer review process, and public participation with regard to the charge, and transparency in posting both the draft and final charge prior to the peer review, is needed for meaningful fulfillment of the public participation requirements. The preamble to the final OMB IQA peer review guidelines states that "[i]n general, an agency conducting a peer review of a highly influential scientific assessment must ensure that the peer review process is transparent by making available to the public the written charge to the peer reviewers" 70 Fed. Reg. at 2665. In addition, the public should have an opportunity to confirm that the charge contains the information required by the IQA guidelines to be provided to the peer reviewers with regard to the need for objectivity. The guidelines state:

Peer reviewers shall be charged with reviewing scientific and technical matters, leaving policy determinations for the agency. Reviewers shall be informed of applicable access, objectivity, reproducibility and other quality standards under the Federal laws governing information access and quality.

70 Fed. Reg. at 2675. In explaining this requirement, the preamble to the final guidelines states:

[T]he charge should make clear that the reviewers are not to provide advice on the policy (e.g., the amount of uncertainty that is acceptable or the amount of precaution that should be embedded in an analysis). Such considerations are the purview of the government.¹⁸

¹⁸ 70 Fed. Reg. at 2669 1st col. (footnote omitted). The statement that "[s]uch considerations are the purview of the government" is clearly a reference to any statutory discretion allowed an agency in making a final regulatory determination based on the scientific information or analysis; it does not in any way negate the requirements for "objectivity," "scientific integrity," and consideration of "reasonably foreseeable significant adverse effects" in the EIS scientific analysis informing a regulatory decision.

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With regard to selection of the peer reviewers, the guidelines state that "[a]gencies shall consider requesting that the public, including scientific and professional societies, nominate potential reviewers." *Id.* 1st col.

As an important accessory to the public participation requirements, the IQA peer review guidelines require that agencies publish their peer review agendas and detailed peer review plans, and that they "shall establish a mechanism for allowing the public to comment on the adequacy of the peer review plans. [And] [a]gencies shall consider public comments on peer review plans." 70 Fed. Reg. at 2676-77.

The NOAA peer review agenda and plans already include a plan for a peer review of "Proposed Noise Exposure Criteria for Marine Mammals."¹⁹ That upcoming assessment is described as follows:

The National Marine Fisheries Service (NMFS) will be proposing new acoustic criteria to replace current criteria to determine what constitutes an acoustic 'take' as defined under the Marine Mammal Protection Act. These criteria will identify exposure levels and durations that may produce temporary or permanent shifts in hearing sensitivity of marine mammals, as well as significant behavioral modification.²⁰

The peer review plan for this assessment contains an agency determination that the document is a "highly influential scientific assessment" (a "HISA"), but its provisions concerning public participation are not adequate under the OMB guidelines, and the timeframe appears outdated and unrealistic. For example, the plan does not provide for a public meeting where the public can provide scientific comments to the reviewers, does not provide that written comments will be given to the reviewers, and does not provide a clear mechanism for commenting on the peer review plan. The plan does, however, acknowledge that the peer review requirements apply to NEPA documents in stating that the public will have an opportunity to comment on the draft assessment by filing comments during the "Comment period on NEPA documents." However, such an opportunity for comment is not adequate under the peer review requirements for "highly influential scientific assessments" because it appears that such comments would be made to the agency rather than to the peer reviewers, and there would be no opportunity for comments at a public meeting with the reviewers.

Since this planned assessment and peer review appears to be generic -- that is, applicable to all marine mammals in all marine and coastal areas -- it cannot take the place of a peer review of the influential and highly influential scientific information in the upcoming draft EIS, which will focus on specific marine and coastal areas and the species and stocks available in those areas. Thus, there is no need to await preparation of a draft of this generic criteria document, and peer review of that draft. The draft EIS and peer review of the draft EIS can inform the generic document and its peer review at a later time.

¹⁹ Available at http://www.cio.noaa.gov/Policy_Programs/prplans/ID43.html.

²⁰ It is noteworthy that this description appears to conflict with the MMPA in some of the same respects as the withdrawn DPEIS because it refers, for example, to "temporary" "shifts in hearing sensitivity" as well as "behavioral modification" without reference to the statutory and regulatory standards for incidental harassment, which focus on impacts on species and stocks.

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The current peer review plan for the generic noise criteria document currently appears to be solely a NOAA plan. In view of their cooperating roles in developing the EIS, NOAA and MMS should consult on a peer review plan for the supplemental or revised draft EIS and publish that plan for public comment in both of their IQA peer review agendas. In view of the lack of attention to this aspect of the review to date, they should also publish a *Federal Register* notice of availability when the new peer review plan is posted.

VI. The EIS Must Consider the Economic Benefits of Oil and Gas Exploration Activities

The withdrawn DPEIS did not consider the beneficial economic and social effects of reasonably foreseeable increased oil and gas production that will result from exploration activities in the Chukchi and Beaufort Seas, and from the exploration activities themselves (e.g., jobs, better data, improvements in exploration techniques). The revised or supplemental draft should. NEPA is directed at "major Federal actions significantly affecting the quality of the human environment."²¹ The CEQ regulations explicitly address the need to consider economic impacts in their definitions of the "human environment" and the "effects" that must be considered in an EIS.

The CEQ regulatory definition of "Human environment" states:

"Human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. (See the definition of "effects" (Sec. 1508.8).) This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.

40 CFR §1508.14 (emphasis added).

The definition of "effects" in the CEQ regulations also covers economic effects that are both direct and indirect. The definition states that "effects" includes "indirect effects, which are caused by the action and are later in time or farther removed in distances, but are still reasonably foreseeable," and that "effects" includes "economic" and other "social" effects. 40 CFR §1508.8.

VII. The EIS Must Be Completed Expeditiously, with Definite Time Limits

The current EIS process has been going on for almost five years, and now it is starting over again. A PEA was begun in 2005 and completed in 2006. The first notice of intent for this EIS was issued in 2006, and the DPEIS was completed and issued for public comment in 2007. A new notice of intent was issued just this February 2010. The delays involved have been lengthy, and the re-start of the whole process rather than preparing a supplemental or revised DPEIS is very unusual. One has to wonder when the EIS will be completed.

²¹ 42 U.S.C. § 4332(2)(C).

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The oil and gas companies and their support organizations must plan well in advance in order to take advantage of the short open water seasons in the Chukchi and Beaufort Seas. Oil and gas exploration is going on around the world, and the availability of the specialized vessels, specialized equipment, and expert personnel required must be allocated and committed to. The development of the actual exploration plan and submission of applications for the necessary permits are complex projects. If the current EIS is not completed in a timely manner, with a time frame that allows for commitment of resources to planning sufficiently in advance, much time and money, and the potential for timely new discoveries, could be wasted.

Both the Outer Continental Shelf Lands Act ("OCSLA") and the CEQ NEPA regulations express the intent that permitting and the EIS process should proceed expeditiously. The OCSLA states, as one of its first formal declarations of policy, that the outer Continental Shelf is "a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development. . . ." 43 U.S.C. §1332(3) (emphasis added). This "primary purpose" of the OCSLA has been emphasized repeatedly in federal court opinions.²² The CEQ NEPA regulations also emphasize the need to avoid or reduce delay. A whole section of the regulations, titled "Reducing Delay," CFR § 1500.5, details ways for reducing delay, which include "[e]stablishing appropriate time limits for the environmental impact statement process." 40 CFR § 1500.5(e). Section 1501.8 of the CEQ regulations also encourages agencies to set time limits for the EIS process, and provides that they "shall" set time limits if an applicant requests, and that an agency may "[d]esignate a person (such as the project manager or a person in the agency's office with NEPA responsibilities) to expedite the NEPA process." Sec. 1501(b)(3).

NOAA and MMS should set time limits for this EIS, particularly in view of the delays that have occurred so far and the expectations for continuing exploratory activities in the Arctic, and should formally designate an official to be responsible for expediting the process and ensuring that the time limits are met. The designation and identity of this person should also be made public.

Thank you for considering these comments.

Respectfully,

/s/

Jim J. Tozzi
Member, CRE Advisory Board

cc: Chief, Environment Division, Offshore Energy & Minerals Management, MMS

²² See *State of California ex rel. Brown*, 668 F.2d 1290, 1315 (D.C. Cir. 1981); *Natural Res. Def. Council v. Hodel*, 865 F.2d 288, 302 (D.C. Cir. 1988); *Center for Biological Diversity v. U.S. Dept. of the Interior*, 563 F.3d 466, 472 (D.C. Cir. 2009).



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
ALASKA OPERATIONS OFFICE
Room 537, Federal Building
222 West 7th Avenue, #19
Anchorage, AK 99513-7588

April 8, 2010

Michael Payne, Chief
Permits, Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Re: EPA Comments on the Notice of Intent to Prepare an EIS on the Effects of Oil and Gas Activities in the Arctic Ocean, EPA Project # 10-012-NOA

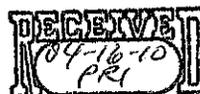
Dear Mr. Payne,

We have reviewed the Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) on the **Effects of Oil and Gas Activities in the Arctic Ocean**. We are submitting scoping comments in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act (Enclosure 1).

Section 309 of the Clean Air Act specifically directs EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Our review of the draft EIS prepared for the proposed project will consider not only the expected environmental impacts of the project, but also the adequacy of the EIS in meeting the public disclosure requirements of NEPA. The scoping comments that follow are provided to apprise the National Marine Fisheries Service (NMFS) of issues that EPA believes to be significant and warrant explicit treatment in the EIS. In providing these comments it is our goal to improve the proposed project and to have the issues addressed in the draft EIS. We have enclosed a copy of *EPA's Section 309 Review: The Clean Air Act and NEPA* which provides further elaboration of our EIS review responsibilities (Enclosure 2).

Overall, EPA encourages the development of an EIS that fully evaluates and compares a full range of reasonable alternatives and comprehensively discusses the direct, indirect, and cumulative impacts of the project, including any subsequent exploration and development activities and associated infrastructure. We are also utilizing this opportunity to identify potential regulatory actions that may need to be considered in the EIS impact analysis. Finally, we are including several EPA documents that we believe will be useful in the development of the EIS (Enclosure 3).

We appreciated the opportunity to discuss the issues concerning this proposed EIS with you at our offices on March 25, 2010. EPA has permitting authorities and jurisdiction over oil



and gas activities in the Arctic Ocean and look forward to being an active participant in this EIS process.

According to the NOI, the National Marine Fisheries Service is preparing to develop an EIS that will analyze the environmental impacts of issuing Incidental Take Authorizations (ITA) pursuant to the Marine Mammal Protection Act (MMPA) for oil and gas related offshore exploration activities, in federal and state waters of the Arctic coast of Alaska. Since seismic survey operations and exploratory activities have the potential to adversely impact marine mammals and other marine resources, ITA's would be required in order to legally harass marine mammals. The Minerals Management Service (MMS) is a cooperating agency on the EIS. NMFS and MMS previously initiated a similar project in 2007 but halted that process due to the anticipated availability of new information. During that previous NEPA process, EPA submitted formal scoping comments as well as comments on the previous Draft Programmatic EIS. We resubmitted hard copies of these comments to you at our March 25 meeting and request that they be incorporated into the record for this process as well.

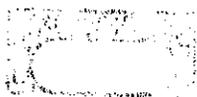
We appreciate the opportunity to participate early in the process for this EIS. Should you have any questions regarding our comments please contact me at (907) 271-6324, or by electronic mail at curtis.jennifer@epa.gov.

Sincerely,



Jennifer J. Curtis, NEPA Reviewer
Environmental Review and Sediments Management Unit

Enclosures



ENCLOSURE 1

EPA REGION 10 DETAILED SCOPING COMMENTS FOR THE NMFS EFFECTS OF OIL AND GAS ACTIVITIES IN THE ARCTIC OCEAN EIS

Regulatory Role of EPA

Under Section 402 of the Clean Water Act (CWA), EPA has the National Pollutant Discharge Elimination System (NPDES) authority to regulate wastewater discharges relating to oil and gas activities in the nearshore and Outer Continental Shelf (OCS). Prior to issuance of NPDES discharge permits for these actions, EPA is required to comply with the Ocean Discharge Criteria (40 CFR 125 Subpart M) for preventing unreasonable degradation of ocean waters; consult with USFWS and NMFS to ensure that any action it authorizes is not likely to jeopardize the continued existence of any species listed under the ESA, or result in the destruction or adverse modification of critical habitat required by a listed species; and conduct its own NEPA analysis for the discharges subject to New Source Performance Standards. In addition, we regulate air emissions in the OCS under Clean Air Act (CAA) Title V and Prevention of Significant Deterioration (PSD) permit programs.

Because EPA's regulatory actions apply to oil and gas activities, including exploration, and because indirect and cumulative impacts potentially exist, we request that NMFS consider our regulatory activities associated with oil and gas activities in this EIS, as well as the environmental impacts from these activities. We also recognize the usefulness of the EIS analyses to EPA's Ocean Discharge Criteria Evaluations and Biological Evaluations for the permit actions and/or EPA's NEPA compliance responsibilities. As such we look forward to continued coordination with your agency to identify the scope of analyses for this EIS.

Incorporation of Comments from Previous EIS Process

During the previous EIS process in 2007, numerous agencies, members of the public, and other stakeholders participated in a thorough scoping process and reviewed the draft Programmatic EIS. Although the project description may have changed since then, we believe that many of the substantive comments submitted at that time remain valid and may be relevant to the current project. We recommend that NMFS review all applicable comments, including EPA's comment letters, and consider those in the development of the draft EIS, as appropriate.

Programmatic Nature of the EIS

NEPA regulations require the development of EISs for cumulative or connected actions as well as for regional planning or new Federal programs (40 CFR 1502.4(b)). NEPA encourages the use of the programmatic or policy EISs to eliminate repetitive discussion of similar issues (40 CFR 1500.4(i)). Generally, a programmatic EIS is a broad-based evaluation that examines a program to be implemented on a large-scale. NEPA regulations further suggest that the broad, program-oriented issue analyses found in a programmatic EIS may then be incorporated by reference where appropriate in future NEPA analyses that focus on specific subsequent Federal actions.

In addition, Section 9(a) of the NOAA NEPA implementing procedures states: "CEQ encourages agencies to use program, policy, or plan EISs, (i.e., programmatic EISs) to eliminate repetitive discussion of the same issues (40 CFR 1500.4(i)). A programmatic environmental review should analyze the broad scope of actions within a policy or programmatic context by defining the various programs and analyzing the policy alternatives under consideration and the general environmental consequences of each. Specific actions that are within the program or under the policy should be analyzed through project-specific environmental review documents. A project-specific EIS or EA need only summarize the issues discussed in the broader statement with respect to the specific action and incorporate discussion from that environmental review by reference. The principal discussion should concentrate on the issues specific to the subsequent action."

Based on the NOI, it appears that NMFS will not be conducting site-specific analyses or decisions for this project. As such we believe this EIS may be programmatic in nature and should be identified as a programmatic EIS.

Purpose and Need

The Purpose and Need statement in the EIS should reflect the broader public purpose and need for the project, with a focus on the purpose and need for NMFS' action, decision(s) and analysis consistent with the implementing regulations for NEPA (40 CFR 1502.13). We believe this approach is in compliance with the NMFS' NEPA implementation procedures under NAO 216-6. Given the nature of this project (programmatic issuance of ITAs specific to oil and gas exploration and seismic activities in the Arctic), a concise statement is of critical importance to setting up the analysis of alternatives, which could range from too tightly focused to too broad, depending on how the statement is written. Given the uncertainty of the range, duration and frequency of future ITAs, the EIS will need to clearly explain the need of the proposed project.

Alternatives

Alternatives Criteria Development

The EIS should identify specific criteria that were used to (1) develop the range of reasonable alternatives, (2) eliminate alternatives considered, and (3) select the agency preferred alternative. These criteria should be based on factors such as conservation of important marine resources, maintaining biodiversity, project feasibility, economics, effectiveness, and subsistence activities. The alternatives criteria should also incorporate substantive issues identified during the public scoping process and tribal consultations. The EIS should discuss the rationale and basis for how these criteria were developed.

Alternative evaluation criteria should be identified early in the alternatives development process and be developed in conjunction with agencies, affected communities, and other stakeholders. Once the full range of alternatives is developed, the alternatives should be screened using the previously established criteria to eliminate those that are not reasonable or would not meet the purpose and need. We recommend that NMFS consider a multi-step process that will reduce the initial list of alternatives to a final list that will undergo full evaluation in the draft EIS. Alternatives should be evaluated on each level based on the evaluation criteria determined from the project purpose, need, goals, and objectives.

Range of Reasonable Alternatives

The draft EIS should include a range of reasonable alternatives that meet the stated purpose and need for the project and that are responsive to the issues identified during the scoping process and through tribal consultation. This will ensure that the draft EIS provides the public and the decision-maker with information that sharply defines the issues and identifies a clear basis for choice among alternatives as required by NEPA. The Council on Environmental Quality (CEQ) recommends that all reasonable alternatives be considered, even if some of them are outside the capability or the jurisdiction of the agency preparing the EIS for the proposed action. For this project, we believe NMFSs should consider various ranges, timing, and alternative components.

Also, the environmental impacts of the proposal and alternatives should be presented in comparative form (such as a table), thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public. The potential impacts of each alternative should be quantified to the greatest extent possible. It would also be useful to list the impacts of each alternative action and corresponding mitigation measures. EPA strongly encourages the development, identification and selection of alternative(s) that will minimize environmental and resource impacts.

In our May 14, 2007, letter on the previous draft PEIS, we expressed concerns with the limited range of resource scenarios that were considered in developing the eight action alternatives evaluated in the EIS. We again recommend that NMFS not only consider the current levels of estimated industry interest but also a broader range of exploration scenarios, given that industry estimates are not always reflective of actual activity into the future.

Environmental Effects

The issuance of oil and gas-related ITAs by NMFS may result in a variety of environmental effects, including impacts to endangered and other protected species, impacts to other species and impacts to subsistence activities. As a result, the proposed EIS analysis should disclose what such effects would be and describe appropriate and/or required mitigation measures. This would involve delineation and description of the affected environment, resources at risk, direct impacts to resources, and mitigation measures for the impacts.

Air Quality

EPA has identified certain air quality related issues associated with oil and gas projects. Below is a list of general air-related scoping comments regarding and oil and gas activities in the Arctic.

Existing Conditions

Air quality in the project area is regulated by EPA and the State of Alaska. EPA encourages NMFS to work closely with EPA and ADEC on identifying and evaluating indirect and cumulative air quality impacts associated with this project.

ADEC is responsible for issuing onshore air quality permits as well as those within state waters. This includes Prevention of Significant Deterioration (PSD) Construction Permits or Title V Air Quality Operating Permits. EPA issues the same permits for oil and gas activities in

the OCS. We recommend that NMFS work with EPA and ADEC to identify existing and proposed air quality permits in the Arctic that may affect the project area and incorporate this information into the existing environment and environmental effects sections of the EIS.

The EIS should provide an appropriate discussion of ambient air conditions (baseline or existing conditions) in the project area and discuss the National Ambient Air Quality Standards (NAAQS). The EIS should estimate emissions of criteria pollutants for the project area and discuss the timeframe for release of these emissions over the lifespan of the project, if applicable. Also, the document should include analysis of the potential impacts to air quality (including indirect and cumulative impacts) from the project and in the project area. The EIS should clearly specify emission sources and quantify these emissions. Such an evaluation may be necessary to disclose the potential impacts from temporary or cumulative degradation of air quality. Specifically, the EIS should include:

- Detailed information about ambient air conditions and NAAQS.
- A detailed project emission inventory (if the project will result in any emissions), including data on emissions of criteria pollutants from the proposed project and timeframe for release of these emissions over the lifespan of the project.
- Specific information about pollutant from mobile sources, stationary sources, and ground disturbance. This source specific information should be used to identify appropriate mitigation measures and areas in need of the greatest attention.
- An Equipment Emissions Mitigation Plan that identifies actions to reduce diesel particulate, carbon monoxide, hydrocarbons, and NO_x associated with construction and operation activities.

Air Modeling Protocol

Should impacts to air quality be identified as a potential impact from this project, we recommend that NMFS document the approach used to analyze and predict air quality impacts in an Air Quality Modeling Protocol and fully vet this approach with the EPA Region 10 Office of Air, Waste, and Toxics and the Alaska Department of Environmental Conservation (ADEC) air quality program. Such a protocol will provide a “roadmap” for how the air analysis will be conducted and the results be presented. It should describe the model that will be used for analysis, including model settings, modeling boundaries, and important model inputs such as meteorology, background data and emission inventories. The protocol should also generally describe the standards and thresholds to which the air impact results will be compared. EPA suggests that NMFS work with ADEC to obtain written concurrence on the protocol prior to proceeding with the air quality analysis.

Specific Emissions

Impacts to air include release of both toxic and nontoxic pollutants during seismic activities, exploration drilling and waste management. Toxic gases that occur in the producing formations, especially hydrogen sulfide and poly-aromatic hydrocarbons, may be emitted from active operations. In addition, criteria air pollutants, such as particulates, ozone, carbon monoxide, etc., associated with diesel engines that power the operation will be released. Identified below are potential impacts to air associated both oil and gas activities. These impacts represent pathways for air contamination with possible subsequent impacts caused by deposition

of pollutants to soil, in addition to impacts on human health and the environment. It is emphasized that site-specific factors (e.g., activities, environmental setting, etc.) determine potential and actual impacts at individual sites. EPA believes that all potential direct, indirect and cumulative impacts to air quality need to be disclosed and evaluated in the EIS.

Vessel Traffic

We recommend that the EIS address emissions from marine vessels associated with the project, as well as cumulative impacts from other sources of air contaminants in the area. The opacity of smoke from marine vessel emissions is regulated by the State of Alaska within three miles of the coast. We recommend that the air analysis in the EIS incorporate information from studies being conducted by the National Park Service (NPS) and ADEC. The NPS is conducting opacity studies on cruise ships in Glacier Bay National Park, and it hopes to expand these studies to examine gaseous pollutants. ADEC is conducting studies on gaseous and particulate pollutants from cruise ships in Juneau, Alaska. The EIS should examine how the quantity of pollution emitted is a product of the fuels used by such cargo vessels, the ships operation, and the extent of preventative maintenance. Finally, we recommend that the use of low sulfur fuel be considered as a possible mitigation measure in the EIS (similar to that being considered by the cruise ship industry).

Exploration and Development Drilling

Hydrogen Sulfide Emissions from Active Operations

Hydrogen sulfide often occurs as a natural contaminant in oil and gas formations. Uncontrolled releases during drilling may threaten human health. Typically, drill rigs are evacuated when hydrogen sulfide is detected in ambient air near the rig.

Fugitive Dust Emissions

Road construction, site clearing, transportation on dirt roads to and from various project sites, and onsite mixing of muds generate fugitive dust. Such emissions may need to be considered if the project will involve any onshore activities.

Machinery Exhaust Emissions

Operation of heavy machinery and equipment during site preparation as well as running the rig and other machinery during drilling operations will be accompanied by the emission of fossil fuel combustion exhausts. Such exhausts will include oxides of nitrogen, oxides of sulfur, ozone, carbon monoxide, and particulates.

Production

Depending on the scope of analysis, the following production emissions may also need to be considered in the EIS.

Emissions from Gas Flaring

The intentional and unintentional production of natural gas often necessitates flaring. Flaring of gas will result in the release of carbon monoxide, nitrogen oxides, and, if the gas is sour, sulfur dioxide. Additional emissions may include products of incomplete combustion.

Volatilization of Petroleum Fractions

Crude oil generally contains some fractions that will volatilize at ambient temperatures and pressures. Storage of crude in open tanks as well the accumulation of waste oil and grease in reserve pits may allow the release of volatile organic compounds (VOCs) to the air. Further, fugitive leaks from pipes, closed tanks, and treatment equipment may contribute to the release of VOCs to the air. Such releases may be of particular concern in areas that are not in attainment of ambient air standards for ozone.

Machinery Exhaust Emissions

Operation of production equipment such as pumps, separator motors, heater treaters, generators, and boilers may result in the release of fossil fuel combustion emissions. Such exhaust will include oxides of nitrogen, oxides of sulfur, ozone, carbon monoxide, and particulates. Typical industry practice is to utilize fuel sources produced on site, such that machinery exhausts may contain greater amounts of particulates than from refined fuels. Additional emissions may include products of potential LNG production facilities, as well as vessels and equipment during well and structure abandonment and removal operations.

Volatilization During Evaporation and Landfarming

By design, evaporation pits for produced water or other waste release water and VOCs to the air. This also may occur during spraying or otherwise applying produced water or other wastes to the soil for landfarming or road spreading.

Air Toxics

There is substantial concern for human health from projects that result in air toxics emissions and particulate matter from mobile sources, particularly diesel exhaust. The *National Air Toxics Assessment* (<http://www.epa.gov/ttn/atw/nata>) asserts that a large number of human epidemiology studies show increased lung cancer associated with diesel exhaust and significant potential for non-cancer health effects. Also, the Control of Emissions of Hazardous Air Pollutants from Mobile Sources Final Rule (66 FR 17230, March 29, 2001) lists 21 compounds emitted from motor vehicles that are known or suspect to cause cancer or other serious health effects. Similar pollutants may be emitted from equipment other than motor vehicles that are associated with oil and gas exploration activities.

EPA recommends that the EIS disclose whether air toxics emissions would result from project activities, discuss the cancer and non-cancer health effects associated with air toxics and diesel particulate matter, and identify sensitive receptor populations and individuals that may be exposed to these emissions.

For each alternative, EPA recommends:

- Disclosure of all locations at which emissions would increase near sensitive receptors because of project construction, increased traffic, including increased diesel traffic, and increased loads on engines.
- An assessment or accounting (qualitative or modeled depending on the severity of existing and projected conditions) of all the factors that could influence the degree of adverse impact on the population because of the activities listed above (e.g., distances to human activity centers and sensitive receptor locations; amount, duration, and location of emissions from construction, diesel, and other vehicles, etc.)
- For identified receptor locations, we recommend that analysis be conducted for air toxics and particulate matter, and that mitigation measures be included.

For more information about mitigation measures and air toxics, please contact our Air office at 206-553-2770.

Water Quality

Water quality impacts are one of EPA's primary concerns. The EIS should describe the current condition of waters in the project area and disclose which waters may potentially be affected by the proposed project, the nature of potential impacts, and specific pollutants likely to impact those waters, if applicable. Potential short- and long-term water quality impacts may be caused by a variety of activities associated with seismic and exploratory operations, including wastewater discharges from vessels and other infrastructure, and deposition of air emissions on water.

If applicable, the EIS should document the project's consistency with applicable wastewater permitting requirements (as required by NPDES and/or ADPES programs) and should discuss specific mitigation measures that may be necessary or beneficial in reducing adverse impacts to water quality.

Protected Species

The proposed project will impact protected species listed (or proposed for listing) under the Endangered Species Act (ESA) and protected by the Marine Mammal Protection Act (MMPA), their habitats, as well as state sensitive species. The EIS should identify such species in the project area and describe the critical habitat for the species. The EIS should also identify any impacts the project will have on the species and their critical habitats and how the proposed project will meet all requirements under ESA and MMPA, including consultation requirements. The selected alternative should promote the protection and recovery of declining populations of species.

For listed species like the bowhead whale, the EIS should insure that action alternatives would not threaten the viability of populations. Appropriate evaluations should be developed prior to the EIS and their results summarized and disclosed in the document (40 CFR 1502.25(a)). By doing this, the EIS will demonstrate that ESA and MMPA procedures are being followed and that listed species and their habitats are being protected.

Indirect and Cumulative Impacts

The EIS should identify and evaluate potential consequences of the proposed project “outside” the project area boundaries. Because the project may result in indirect impacts, the draft EIS should evaluate impacts to other wildlife and aquatic resources in other areas, as applicable.

CEQ’s definition of *cumulative impact* is “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions”. The cumulative impacts analysis should therefore provide the context for understanding the magnitude of the impacts of the alternatives by analyzing the impacts of other past, present, and reasonably foreseeable projects or actions and then considering those cumulative impacts in their entirety. The EIS should include and analyze present and reasonably foreseeable projects and actions proximate to the project area, such as North Slope on-shore oil and gas activities, and reasonably foreseeable oil and gas development and production activities, both on- and offshore. Where adverse cumulative impacts may exist, the EIS should disclose the parties that would be responsible for avoiding, minimizing, and mitigating those adverse impacts.

The EIS should clearly identify the resources that may be cumulatively impacted, the time over which impacts are going to occur, and the geographic area that will be impacted by the proposed project. The focus should be on resources of concern; those resources that are at risk and/or are significantly impacted by the proposed project before mitigation. In the introduction to the *Cumulative Impacts Section*, identify which resources are analyzed, which ones are not, and why. For each resource analyzed, the EIS should:

- Identify the current condition of the resource as a measure of past impacts. For example, the percentage of species habitat lost to date.
- Identify the trend in the condition of the resource as a measure of present impacts. For example, the health of the resource is improving, declining, or in stasis.
- Identify the future condition of the resource based on an analysis of the cumulative impacts of reasonably foreseeable projects or actions added to existing conditions and current trends. For example, what will the future condition of the watershed be?
- Assess the cumulative impacts contribution of the proposed alternatives to the long-term health of the resource, and provide a specific measure for the projected impact from the proposed alternatives.
- Disclose the parties that would be responsible for avoiding, minimizing, and mitigating those adverse impacts.
- Identify opportunities to avoid and minimize impacts, including working with other entities.

EPA has issued guidance on how we are to provide comments on the assessment of cumulative impacts, *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, which can be found on EPA’s Office of Federal Activities home page at: <http://www.epa.gov/compliance/resources/nepa.html>. The guidance states that in order to assess

the adequacy of the cumulative impacts assessment, five key areas should be considered. EPA tries to assess whether the cumulative effects analysis:

- Identifies resources if any, that are being cumulatively impacted;
- Determines the appropriate geographic (within natural ecological boundaries) area and the time period over which the effects have occurred and will occur;
- Looks at all past, present, and reasonably foreseeable future actions that have affected, are affecting, or would affect resources of concern;
- Describes a benchmark or baseline; and
- Includes scientifically defensible threshold levels.

Finally, below are additional resources that may be helpful in the NMFS' evaluation of cumulative impacts for this EIS.

Canter, L. W., and Kamath, J. (1995). Questionnaire checklist for cumulative impacts. *Environmental Impact Assessment Review*, 15(4): 311-339. Online: <http://www.sciencedirect.com/science/journal/01959255>

Council on Environmental Quality (CEQ). (1997). Considering cumulative effects under NEPA. Online: <http://ceq.eh.doe.gov/nepa/ccenepa/ccenepa.htm>.

National Research Council (2003). Cumulative effects of oil and gas activities on Alaska's North Slope. Online: <http://darwin.nap.edu/books/0309087376/html/R1.html>

Resource Scenarios

EPA believes that the EIS should consider various scenarios for oil and gas exploration within the project area, and these scenarios should include transportation and infrastructure options to access areas of high potential oil and gas for exploration. For the various scenarios, the EIS should identify and evaluate the direct, indirect and cumulative impacts associated with seismic and other exploration activities, as well as any reasonably foreseeable future activities (i.e. development, production, distribution to market and abandonment activities). The cumulative effects analysis should also evaluate the past, present and reasonably foreseeable future actions associated with on-shore areas, such as on-shore support and processing facilities, port development, and other infrastructure, as well as potential pipeline and transportation systems, if applicable. It should also consider other commercial and industrial activities that have taken place or are likely to occur in the Beaufort and Chukchi Seas.

Monitoring and Mitigation

As discussed above, the proposed project has the potential to impact various marine mammals, other protected species and possibly fish. Predicting the severity of these impacts and devising effective mitigation measures remains an imprecise science. Monitoring is a necessary and crucial element in identifying and understanding the consequences of actions. In this case, comprehensive monitoring is needed to evaluate population changes that may be occurring not only from the proposed project, but natural and cumulative factors. We recommend that the draft EIS describe a monitoring program designed to assess both impacts from the project and the effectiveness of measures utilized to mitigate such impacts.

Clear monitoring goals and objectives should be identified such as what questions are to be answered; what parameters are to be monitored; where and when monitoring will take place; who will be responsible; how the information will be evaluated; what actions (contingencies, adaptive management, corrections to future actions) will be taken based on the information; and how the public can get information on mitigation effectiveness and monitoring results.

Greenhouse Gas Emissions

CEQ recently released draft guidance for the consideration of greenhouse gas emissions (GHG) emissions in NEPA documents, which can be viewed at: http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf. We recommend that NMFS consider this guidance when considering the potential climate change impacts to the project, as well as evaluating GHG emissions from the project, if applicable.

Traditional Knowledge

EPA acknowledges the need to provide meaningful public and tribal involvement in the preparation of an EIS and recommends the identification and integration of Traditional Knowledge (TK) into the EIS analysis, as appropriate. At a minimum, we recommend that NMFS consider the extensive, previously collected TK regarding the climate, ecological processes, and resource presence and use on the North Slope gathered over the last few decades in the EIS. One such resource is *Impacts and Benefits of Oil and Gas Development to Barrow, Nuiqsut, Wainwright, and Atkasuk Harvesters*, Braund, S.R. and Associates, July, 2009. In addition, we recommend that NMFS undertake a concerted and focused effort to work with elders, hunters, subsistence resource commissions (such as the Alaska Eskimo Whaling Commission and the Walrus Commission), local village whaling associations, and other resource users to identify local and traditional knowledge that may be pertinent to the proposed project.

Consultation with Federally-Recognized Tribal Governments

Presidential Executive Order (EO) 13175 Consultation and Coordination with Indian Tribal Governments (November 6, 2000; FR Vol. 65; No. 218) recognizes the unique legal relationship the United States has with tribal governments. The EO requires all federal agencies to establish regular and meaningful consultation and collaboration with tribal officials and to strengthen the United States government-to-government relationships with tribal governments. In our May 14, 2007, comment letter we identified that the draft PEIS did not discuss or document the consultation process used by NMFS/MMS to formally consult and/or coordinate on a government-to-government basis with federally-recognized tribal governments that could have been affected by the previous project. We recommend that NMFS engage any potentially affected tribal governments in meaningful consultation and fully disclose the process and decisions resulting from that process in a standalone section of the EIS.

Also, consistent with the July 28, 1999, memorandum from the Council on Environmental Quality (CEQ) to Heads of Federal Agencies, NMFS should consider inviting potentially affected tribal governments to participate in the EIS development process as cooperating agencies. This would provide for the establishment of a mechanism for addressing intergovernmental issues throughout the EIS development process.

Tribal Consultation Plan

We recommend NMFS develop a Tribal Government-to-Government Consultation Plan which would outline the process for working effectively with tribal governments during the EIS development process. This plan would be useful in determining the best timing for conducting the consultation meetings which would avoid conflict with subsistence seasons, which vary depending on the community. This plan should be developed in collaboration with affected tribal governments.

Consultation Process

The EIS should document the tribal consultation and coordination process by providing a chronology with the dates and locations of meetings with tribal governments, results of the meetings, and a discussion of how the tribal governments' input was used to develop the EIS. The consultation and coordination with tribal governments should continue throughout the EIS development phase. Additional attention should be given to schedule meetings and program decision points in the EIS process to avoid conflicts with subsistence and other traditional activities whenever possible.

As you are aware, the July 28, 1999, CEQ Memorandum to Heads of Federal Agencies addresses the designation of non-Federal agencies, such as Alaska Tribal governments, to be cooperating agencies in the implementation of NEPA. We recommend NMFS invite affected Tribal governments to participate in the EIS as a cooperating agency. This would provide for the establishment of a mechanism for addressing inter-governmental issues throughout the EIS development process.

Environmental Justice and Public Participation

The draft EIS should clearly disclose what efforts were taken to ensure effective public participation in the scoping process and throughout the development of the EIS. In addition, since low income, minority and/or tribal communities could be impacted by the proposed project, the draft EIS should disclose what efforts were taken to meet environmental justice requirements consistent with EO 12898 (*Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*). We recommend that this should include the following:

- A description of the methodology and criteria utilized for identifying low income and people of color communities, if appropriate; the sources of data utilized for these analyses, and the references utilized for establishing the criteria.
- A comprehensive accounting of all impacts on low income or minority communities, including (but not limited to) cumulative and indirect impacts, exposure pathways unique to the impacted communities, historic exposures, and impacts to cultural, historic and protected resources. In addition, the draft EIS needs to determine if the impacts to these communities will be disproportionately higher than those on non-low income or minority communities. For such a determination, the EIS must identify a reference community, provide a justification for utilizing this reference community, and include a discussion of the methodology for selecting the reference community.

- The EIS should demonstrate that communities, if any, bearing disproportionately high and adverse effects have had the opportunity for meaningful input into the decisions being made about the project. The draft EIS should describe what was done to inform the communities about the project and the potential impacts it will have on their communities (notices, mailings, fact sheets, briefings, presentations, exhibits, tours, news releases, translations, newsletters, reports, community interviews, surveys, canvassing, telephone hotlines, question and answer sessions, stakeholder meetings, and on scene information), what input was received from the communities, and how that input was utilized in the decisions that were made regarding the project.

Extra care should also be given to schedule meetings and decision points in the EIS process to avoid conflicts with subsistence and other traditional activities whenever possible. Communities have also expressed that they would like to hear from decision-makers after the process is completed, this closes a loop in the public involvement process. We also recommend that particular attention be given to consideration of the dependence of local communities on local and regional subsistence resources, access to those resources, and perception of the quality of those resources, as well as how project information is disseminated to the community, particularly at the end of the NEPA process. Various EJ assessment tools are available at: <http://www.epa.gov/compliance/resources/policies/ej/index.html#tools>.

In our previous comments we expressed two specific EJ concerns—the effects of multiple, overlapping and fast-tracked planning processes that have occurred on the North Slope in recent years and increasing concerns from local residents regarding human health impacts from proposed oil and gas exploration, development and production activities in the Arctic. We believe that these two issues should continue to be the forefront for agencies' consideration when proposing any activities in the Arctic.

Health Risk or Impact Analysis

Consistent with Sections 4321 and 4331 of NEPA, and the goals of Executive Orders 12898 and 13045, if human health could be impacted by the proposed project, we believe NMFS should undertake a screening process to determine which aspects of health (including, but not limited to public, environmental, mental, social, and cultural health) could be impacted. Depending on the results of the screening, an analysis of health effects, such as a health risk assessment (HRA) or Health Impact Assessment (HIA), may need to be conducted in order to determine the direct, indirect and cumulative impacts to health. This analysis will likely need as much time to complete as the draft EIS, so early screening is essential to ensuring a timely analysis. EPA recommends that NMFS partner directly with local, state, tribal and federal health officials to conduct the appropriate analysis, and to determine appropriate and effective mitigation of health impacts.

Scope of health assessment in EIS

Health effects from oil and gas projects or programs are often more far-reaching than is commonly recognized by project proponents and non-health agencies that are considering resource development decisions or policy. Contaminant exposure or cancer risks are common areas for impact assessment; however numerous other health impacts that could occur as a result of a new project, program or policy are often overlooked.

Data Collection

In order to appropriately evaluate health, specific health data are required that may not be routinely collected as part of the scoping process. In order to ensure that the necessary data are available for this evaluation, it is important to involve public health professionals in the NEPA process. This should occur early in the process, such as before or during project scoping and/or prior to submitting permit applications.

Public health data and expertise for prospective health impact analysis, or for providing input on health issues, may be available from local and state health departments, tribal health agencies, or federal public health agencies such as the U.S. Centers for Disease Control and Prevention's National Center for Environmental Health, U.S. Agency for Toxic Substances and Disease Registry, or Indian Health Service.

Methods and Tools

a. Health Impact Assessment (HIA)

The framework known as Health Impact Assessment (HIA) is a combination of procedures, methods and tools that enables systematic analysis of the potential positive or negative effects of a policy, plan, program or project on the health of a population and the distribution of those effects within the population.¹ HIA identifies appropriate actions to manage or mitigate negative effects. HIA is currently the only widely accepted methodology or framework used to provide decision-makers with information about how a specific policy, project or program may affect human health.

The World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention support the use of HIA as a tool to address health impacts when policies, programs or projects are being developed. Many other countries have successfully used HIA for these purposes. The International Finance Corporation, a member of the World Bank Group, has adopted HIA as the standard for evaluating health and requires it of any projects for which it provides funding.

b. Guidelines and Resources

Guidelines for conducting HIA are available from various sources.² WHO has links to many of these at: <http://www.who.int/hia/about/guides/en/>. The International Finance Corporation has developed detailed guidelines for conducting HIA. A draft version of these guidelines can be found at:

http://www.ifc.org/ifcext/sustainability.nsf/Content/PublicComment_HealthImpactAssessment.

Historical and Cultural Resources

Section 106 of the National Historic Preservation Act (NHPA) of 1966 requires Federal agencies to take into account the effects of their undertakings on historic properties. Since the

¹ This definition is from the International Association for Impact Assessment (IAIA), which modified from the World Health Organization's Gothenberg consensus statement (1999).

² EPA does not endorse or recommend use of any single or particular guidance on HIA. These references are provided as general information and to assist permitting agencies with identifying additional resources on HIA.

Arctic coast is recognized for frequent historical use by the Iñupiat, if NMFS determines that this project may directly or indirectly affect the coast, the State Historic Preservation Officer (SHPO) may need to be consulted. NMFS should also plan to involve the public and local governments, as well as identify other potential consulting parties.

The 1992 amendments to NHPA also place major emphasis on consultation with tribal governments. Consultation must respect tribal sovereignty and the government-to-government relationship between the Federal and tribal governments, as discussed above. Consultation for tribal cultural resources is required under Section 106. Tribal governments must be consulted about actions on or affecting their lands or resources on the same basis and in addition to the SHPO even if not certified by National Park Service. The EIS should evaluate the historic extent and condition of the environment to adequately address impacts to cultural resources of concern to tribal governments. Potential impacts to resources of concern to the tribes may include (but are not limited to) impacts to cultural resource areas, archaeological sites, traditional cultural properties of landscapes, sacred sites, and environments with cultural resources significance. The EIS should disclose the historical and traditional significance of the project area, the importance of ethnobotanical, hunting, fishing, and gathering uses of the area by Alaska Natives, any long term traditional ecological management of the area, and any significant historical events that took place there. The tribal government(s) must be specifically engaged and consulted with in accordance with Section 106 of the NHPA.

EPA recommends that NMFS initiate consultation with the potentially affected tribal government(s) specific to their interests and concerns about traditional and cultural resources. The scope of impacts to these resources should include the direct, indirect, and cumulative impacts to:

- Sacred sites
- Traditional cultural properties or landscapes
- Hunting, fishing, gathering areas (including impacts to ecosystems that support animals and plants that are or once were part of the Tribes and tribal descendants= traditional resource areas)
- Access to traditional and current hunting, fishing and gathering areas and species
- Changes in hydrology or ecological composition of springs, seeps, wetlands and streams, that could be considered sacred or have traditional resource use associations
- Travel routes that were historically used, and travel routes that may be currently used
- Historic properties, districts or landscapes

To determine whether the area of potential effect would be eligible for the National Register of Historic Places, the perspectives of the tribal government(s) should be considered. Such considerations should include the list above as well as significant events that may have taken place in the past (tribal wars, establishment of trade routes, etc.).

EPA further recommends that a Record of Decision (ROD) not be completed until the 106 consultation process has been fully completed. If adverse effects to traditional cultural properties, sacred sites, or other areas of cultural resource concern are identified, any Memorandum of Agreement (MOA) developed to resolve these concerns under Section 106

should be addressed in the ROD. Unless there is some compelling reason to do otherwise, the Section 106 MOA should be fully executed before the ROD is issued, and the ROD should provide for implementation of the terms of the MOA.

ENCLOSURE 2

EPA'S SECTION 309 REVIEW: THE CLEAN AIR ACT AND NEPA

EPA's Section 309 Review: The Clean Air Act and NEPA

Office of Federal Activities (2251A)

Quick Reference Brochure

ENVIRONMENTAL REVIEW AND THE CLEAN AIR ACT

The Clean Air Act, a law to prevent pollution of a single environmental medium, contains an unusual provision. That provision is Section 309, which authorizes the Environmental Protection Agency (EPA) to review certain proposed actions of other federal agencies in accordance with the National Environmental Policy Act (NEPA) and to make those reviews public. If the proposing agency (the "lead" agency) does not make sufficient revisions and the project remains environmentally unsatisfactory, EPA may refer the matter to the President's Council on Environmental Quality for mediation. (See **Highlight A.**)

HIGHLIGHT A: Section 309 of the Clean Air Act

(a) The Administrator shall review and comment in writing on the environmental impact of any matter relating to duties and responsibilities granted pursuant to this Act or other provisions of the authority of the Administrator, contained in any (1) legislation proposed by any Federal department or agency, (2) newly authorized Federal projects for construction and any major Federal agency action (other than a project for construction) to which Section 102(2)(C) of Public Law 91-190 [*] applies, and (3) proposed regulations published by any department or agency of the Federal government. Such written comment shall be made public at the conclusion of any such review.

(b) In the event the Administrator determines that any such legislation, action, or regulation is unsatisfactory from the standpoint of public health or welfare or environmental quality, he shall publish his determination and the matter shall be referred to the Council on Environmental Quality.

[*] NEPA (42 USC 4332(2)(C) et seq.)

Section 309 originated in 1970, the year in which landmark national legislation created new agencies and new requirements for restoring and protecting the environment. Besides NEPA and its creation of CEQ, the National Oceanic and Atmospheric Administration (NOAA) and EPA were established, and, at the end of 1970, the Clean Air Act was passed. At that time, many issues of environmental consequence were brewing (see **Highlight B**), one of which--the proposed supersonic transport aircraft (SST)--became a crucial test of NEPA. (See **The National Environmental Policy Act** section, below.)

The lead agency for the SST project, the Department of Transportation (DOT), chose not to disclose EPA's comments on the NEPA-required environmental impact statement (EIS) before having issued its final decision, construing NEPA to contain no explicit public disclosure requirements. Although later CEQ regulations under the Act would clarify this ambiguity, the Congress had a vehicle at hand in which to make its point: the draft Clean Air Act. Senator Edmund Muskie, sponsor of Section 309, said to the Senate when submitting the conference report, that as soon as EPA has completed its review of a proposed action, it must make its written comments public, and "not when the environmental impact agency decides the public should be informed." (116 *Cong. Rec.* S-20602, Dec. 18, 1970)

HIGHLIGHT B: When NEPA Was New: 1970-1971 Issues

- o Trans-Alaska oil pipeline and the North Slope-Valdez route
- o Supersonic transport aircraft
- o Cross-Florida Barge Canal
- o Clearcutting "areas of scenic beauty" in national forests
- o Tennessee-Tombigbee Waterway
- o Dredging and filling in wetlands
- o Calvert Cliffs (MD) nuclear power plant

To correct another ambiguity of NEPA, Section 309 places the requirement to review EISs upon EPA because NEPA "does not assure that Federal environmental agencies will effectively participate in the decision-making process. It is essential that mission-oriented Federal agencies have access to environmental expertise in order to give adequate consideration to environmental factors." (*Sen. Rept.* No. 91-1196, 91st Cong., 2d Sess. 43, 1970) Consequently, EPA has reviewed most of the approximately 25,000 draft and final EISs produced since the passage of NEPA.

Section 309 confers upon EPA broad review responsibilities for proposed federal actions. (See **Highlight C.**) The EPA Administrator has delegated responsibility of national program manager to the Office of Federal Activities (OFA), and to the ten EPA Regional Administrators for review of regional specific actions. OFA has developed a set of criteria for rating draft EISs. The rating system provides a basis upon which EPA makes recommendations to the lead agency for improving the draft. If improvements are not made in the final EIS, EPA may refer the final EIS to CEQ. (See sections on **The National Environmental Policy Act and Referrals**, below.)

HIGHLIGHT C: Materials Which EPA Reviews Under Section 309 Authority

- o Proposed legislation
- o Proposed regulation
- o Environmental assessment (EA)
- o Environmental impact statement (EIS), draft and final
- o Any proposal that the lead agency maintains does not require an EIS but that EPA believes constitutes a major federal action significantly affecting the environment so as to require an EIS.

Figure 1: EPA's Criteria for Sec. 309 Review of Impact Statements

Rating Environmental Impacts:

LO--Lack of Objections

EC--Environmental Concerns--Impacts identified that should be avoided. Mitigation measures may be required.

EO--Environmental Objections--Significant impacts identified. Corrective measures may require substantial changes to the proposed action or consideration of another alternative, including any that was either previously unaddressed or eliminated from the study, or the no-action alternative).

Reasons can include:

- o violation of a federal environmental standard;
- o violation of the federal agency's own environmental standard;
- o violation of an EPA policy declaration;
- o potential for significant environmental degradation; or,
- o precedent-setting for future actions that collectively could result in significant environmental impacts.

EU--Environmentally Unsatisfactory--Impacts identified are so severe that the action must not proceed as proposed. If these deficiencies are not corrected in the final EIS, EPA may refer the EIS to CEQ

Reasons, in addition to impacts identified, can include:

- o substantial violation of a federal environmental standard;
- o severity, duration, or geographical extent of impacts that warrants special attention; or,
- o national importance, due to threat to national environmental resources or policies.

Rating Adequacy of the Impact Statement:

1 (Adequate)--No further information is required for review.

2 (Insufficient Information)--Either more information is needed for review, or other alternatives should be evaluated. The identified additional information or analysis should be included in the final EIS.

3 (Inadequate)--Seriously lacking in information or analysis to address potentially significant environmental impacts. The draft EIS does not meet NEPA and/or Section 309 requirements. If not revised or supplemented and provided again as a draft EIS for public comment, EPA may refer the EIS to CEQ.

(See Selected Publications, below: *EPA's Policy and Procedures for the Review of Federal Actions Impacting the Environment.*)

Annually, OFA and its regional counterparts review about 500 EISs and some 2000 other actions (see Figures 1 and 2). Among the variety of proposed actions that may be reviewed, besides that for which an agency provides an impact statement, are: legislation proposed by a federal agency; a proposed agency regulation; the renewal of an action originally approved before the enactment of NEPA; a proposal for which an agency has determined that no impact statement is needed, whether or not the agency has published a Finding of No Significant Impact (FONSI); and, an action that is actually a segment of either a program or a reasonably expected succession of actions that could result in a cumulative negative impact on human health or welfare or the environment.

In addition to conducting environmental reviews, OFA develops guidance materials and provides training courses on NEPA and Section 309 requirements for EPA regional staff, and promotes coordination between EPA offices and other federal agencies.

THE NATIONAL ENVIRONMENTAL POLICY ACT AND CEQ

The National Environmental Policy Act (NEPA, 42 *USC* 4321 et seq.) was enacted on January 1, 1970 in recognition of the widening influence on the human and natural environment that individual federal agency actions can exert. With its stated purpose (see **Highlight D**) and with heightened public awareness of environmental quality questions, NEPA makes its goals and policies "supplemental to those set forth in existing authorities of Federal agencies" (NEPA, Section 105). In this way, the agencies' authorizing statutes were amended to include NEPA requirements.

Title I of NEPA requires the federal government to use all practicable means to preserve and maintain conditions under which human beings can coexist with the natural world in productive harmony. Section 102 directs federal agencies to lend appropriate support to initiatives and programs meant to anticipate and prevent degradation of world environmental quality. Further, this section requires federal agencies to incorporate environmental considerations in their decision-making, using a systematic, interdisciplinary approach.

Title II of NEPA establishes the Council on Environmental Quality (CEQ, or the Council). Two months after enactment of NEPA, the President issued Executive Order 11514 authorizing CEQ to guide the Sec. 102 process. Under this order, the Council immediately published guidelines, followed in 1978 by regulations (40 *CFR* Parts 1500-1508) requiring all Federal agencies to issue NEPA regulations consistent with CEQ's. Advisory to the President, CEQ conducts studies, prepares the annual Environmental Quality Report to Congress, and reviews EISs. Moreover, CEQ mediates interagency disputes concerning environmental analyses of matters of national importance. (See Referrals section, below.)

As evidence of compliance with the NEPA Section 102 provisions for a proposed major action that could significantly affect the environment, CEQ requires the lead agency to prepare a detailed written statement addressing NEPA concerns, i.e., an EIS (40 *CFR* Part 1501). The lead agency may first prepare an environmental assessment (EA), which is a concise public document (40 *CFR* Part 1501.3) that determines whether an EIS or a FONSI (40 *CFR* Part 1501.4(e)) should be prepared. An EA is not necessary, however, if the agency has decided at the outset to prepare an EIS.

For review, the lead agency provides the EIS to those federal agencies having statutory jurisdiction or special expertise, as well as to appropriate other federal, state, and local agencies; Indian tribes, when the proposed action might impact tribal lands; and, the interested or affected public (40 *CFR* Part 1503.1). Once the EIS is final, the lead agency must file it formally, simultaneously making it available to the public, together with the reviewers' comments and the lead agency's responses to those comments (40 *CFR* Part 1506.9). The CEQ regulations designate EPA the official recipient of all final EISs, which responsibility the EPA Administrator delegates to OFA.

HIGHLIGHT D: The Purposes of NEPA

The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

(PL 91-190, 42 *USC* 4321 et seq.)

REFERRALS TO THE COUNCIL ON ENVIRONMENTAL QUALITY

The "predecision referrals" provision (40 *CFR* Part 1504) enables any federal agency under NEPA to refer another agency's final EIS to CEQ during the 30-day waiting period before a lead agency can proceed with the action. On the other hand, Section 309 authorizes EPA to refer to CEQ a broader range of federal activities, not only actions for which EISs are prepared. The CEQ regulations (40 *CFR* 1504.1(b)) implement Section 309 of the Clean Air Act, acknowledging that EPA has been assigned more extensive review and referral authority than the other agencies (see **Highlight C**).

Within 25 days after the lead agency has made the final EIS available to the public, the referring agency must provide early notification to that agency about its intention, and make its referral in writing to CEQ. The lead agency, once it has received written notification from CEQ, is to respond in writing within 25 days. During that same period, other agencies and the public may submit written comments to CEQ. Then CEQ may publish Findings and Recommendations; mediate between the disputing agencies; hold public meetings or hearings; refer irreconcilable disputes to the Executive Office of the President for action; or, conclude either that the issue is not of national importance or that insufficient information has been submitted upon which to base a decision.

In the time since the referral process was formally established in 1973, agencies have referred a total of 24 proposed federal actions to CEQ. Of these, EPA was responsible for 15, of which one was referred jointly with the Department of the Interior (DOI). (See **Figure 2** for EPA regional environmental review offices.) So far, in no case has CEQ made a formal referral to the Office of the President. Most often, CEQ has issued Findings and Recommendations. In a few cases the lead agency has withdrawn the proposal, and in three cases CEQ determined that the issue was not a matter of national importance.

In 1989, CEQ upheld EPA's Section 309 referral authority. At issue was a DOI Bureau of Reclamation proposal to renew longterm water contracts for irrigation operations of the Friant Unit in the Central Valley Project of California. The reason for referral was that no EIS had been prepared on the contract renewals, which individually and in the aggregate were likely to result in unsatisfactory environmental effects. In response, DOI questioned EPA's right to challenge the agency's decision that no EIS was needed. In rejecting that argument, CEQ established a precedent, that is, affirmed that EPA may identify a major federal action significantly affecting the environment, even though the lead agency disagrees.

Figure 2: EPA'S REGIONAL SECTION 309 REVIEWERS

REGION 1 : (617) 918-1051
Office of Environmental Review
JFK Federal Bldg.
Boston, MA 02203-0001

REGION 2 : (212) 637-3504
Envir. Planning & Protection
290 Broadway
New York, NY 10007-1866

REGION 3 : (215) 814-2705
Envir. Programs Branch
1650 Arch Street
Philadelphia, PA 19106

REGION 4 : (404) 562-9611
Office of Envir. Assessment
61 Forsyth Street
Atlanta, GA 30303

REGION 5 : (312) 886-9750
Federal Activities program
77 West Jackson Blvd.
Chicago, IL 60604-3507

REGION 6 : (214) 665-7451
Office - Planning & Coordination
1445 Ross Avenue, Suite 1200
Dallas, TX 75270-2733

REGION 7 : (913) 551-7148
Environmental Review
726 Minnesota Avenue
Kansas City, KS 66101

REGION 8 : (303) 312-6228
Ecosystem Protection Program
999 18th Street, Suite 500
Denver, CO 80202-2466

REGION 9 : (415) 744-1584
Office of Federal Activities
75 Hawthorne Street
San Francisco, CA 94105

REGION 10 : (206) 553-8574
Ecosystems & Communities
1200 Sixth Avenue
Seattle, WA 98101

SELECTED PUBLICATIONS

Caldwell, Lynton K., *Science and the National Environmental Policy Act; Redirecting Policy Through Procedural Reform*. University of Alabama Press, c1982.

Congressional Record, vol. 166, p. S-20602 (Dec. 18, 1970).

Healy, Martin, "The Environmental Protection Agency's Duty to Oversee NEPA's Implementation: Section 309 of the Clean Air Act," *Environmental Law Reporter*, 3 ELR 50071 (1973).

Liroff, Richard, "The Council on Environmental Quality," *Environmental Law Reporter*, 3 ELR 50051 (1973).

Policies and Procedures for the Review of Federal Actions Impacting the Environment. U. S. Environmental Protection Agency, Office of Enforcement, Office of Federal Activities, Pub. No. 1640 (rev. 1984).

Procedures for Implementing the Requirements of the Council on Environmental Quality on the National Environmental Policy Act. U. S. Environmental Protection Agency, 40 *CFR* Part 6.

Rand, Sally and Tawater, Mark Steven, *Environmental Referrals and the Council on Environmental Quality*. Washington, D. C., Environmental Law Institute, 1986.

Regulations For Implementing the Procedural Provisions of the National Environmental Policy Act. U. S. Executive Office of the President, Council on Environmental Quality, 40 *CFR* Parts 1500-1508 (reprint, as of July 1, 1986). Contents include: the National Environmental Policy Act of 1969, as amended in 1975; the Clean Air Act, Section 309; and, Executive Order 11514, as amended by Executive Order 11991.

Senate Report No. 91-1196, 91st Congress, 2nd Session, p. 43 (1970).

ENCLOSURE 3

EPA RESOURCE DOCUMENTS





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 10
1200 Sixth Avenue
Seattle, WA 98101

May 14, 2007

Reply to
Attn. of: ETPA-088

Ref: 07-013-NOA

Mr. P. Michael Payne, Ph.D., Chief of Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Re: Draft Programmatic Environmental Impact Statement for Seismic Surveys in the Beaufort and Chukchi Seas, Alaska

Dear Mr. Payne,

The U.S. Environmental Protection Agency (EPA) has reviewed the **draft Programmatic Environmental Impact Statement (PEIS) for the Seismic Surveys in the Beaufort and Chukchi Seas, Alaska (CEQ No. 20070119)**. Our review has been conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act.

The National Marine Fisheries Service (NMFS) and Minerals Management Service (MMS) have jointly prepared the subject draft PEIS in order to describe and analyze the potential significant impacts on marine mammals, other Arctic marine life, and native subsistence lifestyles by proposed offshore oil and gas seismic surveys off Alaska. This document also addresses a number of mitigation measures that have been identified as alternatives for potentially reducing impacts on identified affected environments, particularly marine mammals and the endangered bowhead whale. This PEIS will be used for issuing: (1) permits for oil and gas exploration in the Arctic Ocean by MMS, and (2) Incidental Harassment Authorizations (IHAs) to the seismic industry by NMFS to take marine mammals incidental to oil and gas seismic surveys in the Arctic Ocean. Since sounds generated by seismic survey operations and related activities have the potential to adversely impact marine mammals and other marine resources, IHAs would be required in order to legally harass marine mammals, incidental to conducting seismic surveys.

The draft PEIS identifies eight action alternatives and the no action alternative. Analyzed alternatives range from issuance of MMS permits with and without mitigation measures. Specifically, the alternatives include different combinations of safety and exclusion zones for preventing injury (180/190 dB), limiting behavioral harassment (160 dB) and limiting impacts on feeding and migrating bowhead cow calf pairs (160 dB/120 dB, respectively). An alternative to protect feeding and migration areas through specific restrictions to further reduce impacts to

various aggregations of bowhead and gray whales has also been analyzed. At this time, MMS and NMFS have not identified a preferred alternative. Alternative 2, which would approve seismic surveys as proposed, with existing Alaska OCS exploration permit stipulations and guidelines, is the proposed action.

EPA appreciates the decision of NMFS/MMS to develop an EIS for this proposed action. We recognize the challenges that NMFS/MMS faced in preparing this draft PEIS, especially with the lack of scientific data and the high levels of uncertainty associated with the impacts of concurrent seismic and high-resolution surveys on marine resources, particularly the endangered bowhead whale. The draft PEIS acknowledges the uncertainties regarding existing environmental conditions, environmental effects of alternatives (including cumulative effects) and mitigation measures to reduce adverse impacts. The paucity of data regarding the distribution, abundance and habitat use of important biological and subsistence resources in the area, such as the bowhead, creates uncertainty regarding conclusions in the draft PEIS. There are additional layers of uncertainty regarding the probabilities of quantities, locations, and types of seismic surveys that may occur because the hypothetical scenario described in the document used numerous assumptions based on limited past activity and industry speculation.

Although the draft PEIS makes a credible attempt to identify data gaps and uncertainties in the alternatives analyses, EPA is concerned that, overall, the depth and breadth of uncertainties presented in the document result in the lack of adequate support for many of the document's alternatives and conclusions. EPA has assigned a rating of **EC-2 (Environmental Concerns-Insufficient Information)** to this draft PEIS. Please find enclosed a copy of the EPA rating system used in conducting our environmental review. This rating and a summary of our comments will be published in the *Federal Register*. EPA's primary concerns regarding the draft PEIS and our corresponding recommendations for the final PEIS are discussed in further detail in the Attachment.

EPA appreciates the opportunity to review and provide comments on the NMFS/MMS draft PEIS for Seismic Surveys in the Beaufort and Chukchi Seas, Alaska. If you have any questions or comments concerning this review, please contact me at (206) 553-1601. Please also feel free to contact Jennifer Curtis in our Alaska Operations Office at (907) 271-6324 or curtis.jennifer@epa.gov.

Sincerely,

/s/

Christine B. Reichgott, Manager
NEPA Review Unit

Enclosure

ATTACHMENT

EPA Detailed Comments on NMFS/MMS Draft Programmatic Environmental Impact Statement for Seismic Surveys in the Beaufort and Chukchi Seas, Alaska

Range of Alternatives

Currently the draft PEIS analyzes eight action alternatives providing issuance of permits without mitigation (proposed action), as well as seven alternatives with various degrees and types of mitigation. Each action alternative is based on the assumption that up to six seismic surveys could occur within both the Beaufort and Chukchi project areas. This assumption appears to be based solely on interest expressed by industry and activity in the Beaufort and Chukchi in recent years. EPA encourages consideration of additional alternatives that may allow varying numbers (specifically fewer and greater numbers of surveys), particularly with the increased interest in oil and gas exploration in the Outer Continental Shelf (OCS) off northern Alaska and the imprecise nature of industry estimates. Such alternatives were not analyzed in the draft PEIS. At this stage of the NEPA process, there is an opportunity to reevaluate, modify or consider additional reasonable alternatives to avoid, minimize and/or mitigate for potential adverse impacts to resources in the Beaufort and Chukchi.

EPA Recommendations for Selection of a Final Preferred Alternative

Of the existing alternatives, EPA concurs with NMFS/MMS identification of Alternatives 3 and 8 as the most protective of biological resources and subsistence activities among existing alternatives. We encourage the selection of one of these two alternatives as the Preferred Alternative, particularly if no more protective alternatives are additionally considered. The selection of a more protective alternative is especially critical given the lack of data regarding impacts to marine mammals and other marine species when concurrent surveys are anticipated. EPA's review of the draft PEIS indicates that, even with the selection of Alternative 3 or 8, there would likely be adverse impacts that should be avoided in order to provide protection of the environment and subsistence resources.

Coordination with Other NEPA Activities

The Draft PEIS for Seismic Surveys in the Beaufort and Chukchi Seas has been developed within the same timeframe as several other NEPA processes being undertaken on the North Slope by NMFS, MMS, and other federal agencies. As we stated in our comment letter to MMS on the Lease Sale 193/Seismic Survey DEIS, EPA is concerned that the overlapping schedules of the different NEPA documents, and the relatively short timelines assigned to developing and finalizing the documents, will make it very difficult for NMFS/MMS to obtain, evaluate and incorporate the most up-to-date information in each document. EPA recommends that NMFS and MMS coordinate and synchronize the schedules of the various NEPA efforts and allow for ample time for public review and input, for their ongoing NEPA efforts in order to provide for public participation and maximize the use and effectiveness of new, updated information and input from agencies, tribes and the public into each document. EPA also recommends that

NMFS/MMS describe how the comments that were received have been considered for each document in the final PEIS, as applicable.

Cumulative Impacts

Also similar to the MMS 193 Lease Sale, EPA is concerned that the Draft EIS does not adequately analyze potential cumulative impacts on Alaska's offshore ecosystem and the local communities who depend on healthy ecosystems for their social, cultural and subsistence way of life. An expanded analysis and discussion regarding potential cumulative effects from past, present and reasonably foreseeable future OCS and non-OCS related activities within the larger project area should be included in the final PEIS. In particular, an expanded discussion of present and reasonably foreseeable future non-OCS activities, which include the expected significant increase in non-energy related minerals exploration and development in northern Alaska, and their potential impacts should be included for the cumulative case in the final PEIS. Mineral exploration and development activities that are currently underway and expected to increase in northwestern Alaska over the next several years are relevant to the cumulative analysis (e.g., expansions to the Red Dog Mine, coal extraction on Arctic Slope Regional Corporation land and hard rock mining activities in South NPR-A). Additional discussion regarding increased marine vessel traffic, including large-volume cargo vessels, and land use alterations that are likely to result from onshore hard rock mining activity and future development of oil and gas resources in the NPR-A should be included in the Final EIS.

Fuel Spill Probabilities and Risk

In the draft PEIS, NMFS/MMS used probability assumptions to determine the likelihood of a fuel spill. EPA is concerned that throughout the document, the reference to a "small" or "low" probability of a fuel spill or release, and the projected quantity per event (5 gallons per refueling activity) causes confusion to the reader, and in general does not accurately reflect the potential for larger fuel spills to occur and cause significant adverse, and potentially irreversible, impacts to environmental and subsistence resources. NMFS/MMS should consider the possibility of complete failure of containment, and potential impacts from that scenario, impacts that could be compounded by the inability to clean up oil spills in broken ice and other hazardous conditions in the Beaufort and Chukchi Seas. EPA recommends that NMFS/MMS incorporate a more comprehensive approach to oil spill risk and the adverse impacts that could result from survey and associated support vessels and activities.

Endangered Species Act

EPA is concerned with data gaps regarding the three species of endangered cetaceans (bowhead whale, fin whale, and humpback whale) that occur within or near the project area. Of particular concern is the lack of data regarding the bowhead whale, given its endangered status and the critical role it plays in the subsistence lifestyle of Alaska Natives in the Arctic. The draft PEIS identifies significant uncertainties about the details of many cumulative effects on the bowhead population in the project area. The final PEIS needs to provide additional information to support conclusions regarding potential adverse impacts to the bowhead whale as a result of seismic and high-resolution surveys, and the effectiveness of mitigation measures to avoid or

minimize adverse impacts. The final PEIS should also provide additional explanation of how input from local residents and affected tribes regarding bowhead whale distribution and behavior (with and without industrial activities in the area) was evaluated and used during the NEPA process and how the input was factored into the selection of a preferred alternative.

Additionally, the U.S. Fish and Wildlife Service is currently considering comments submitted in response to the proposed rule to add the polar bear to the list of threatened and endangered species. A decision regarding listing the polar bear may occur during preparation of the final PEIS. EPA recommends that the final PEIS incorporate the best available current information on the regulatory status of the polar bear, including potential designation of any new critical habitat areas, and the implications for survey activities in the Beaufort and Chukchi Seas.

Adaptive Management and Monitoring

Section IV of the draft PEIS broadly discusses the monitoring measures that will be employed in each of the action alternatives, as well as the evaluation of monitoring efforts attempted during the 2006 Open Water Season. This section does not identify the development of any adaptive management strategies that could be applied should mitigation activities and stipulations not adequately protect and conserve subsistence and other resources. EPA recommends the development and integration of an adaptive management program to protect resources that are not adequately safeguarded under existing mitigation measures and stipulations.

Tribal Consultation

The draft PEIS does not discuss or document the consultation process used by NMFS/MMS to formally consult and/or coordinate with Alaska tribal governments that could be potentially affected by this project on a government-to-government basis. The draft PEIS includes an abbreviated section (V. Consultation and Coordination) that describes the scoping process for the draft PEIS, and participation in the 2006 Open Water Meeting, as well as a distribution list for the documents. EPA recommends that the final PEIS include a separate section that addresses NMFS/MMS's tribal consultation obligations and activities undertaken during preparation of the draft and final PEIS.

Presidential Executive Order (EO) 13175 Consultation and Coordination with Indian Tribal Governments (November 6, 2000; FR Vol. 65; No. 218) recognizes the unique legal relationship the United States has with tribal governments. The EO requires all federal agencies to establish regular and meaningful consultation and collaboration with tribal officials and to strengthen the United States government-to-government relationships with Indian tribes. The scheduled public meetings in the various communities meetings do not fulfill the tribal consultation responsibilities described in E.O. 13175. Formal consultation must take place with the interested tribal governments potentially impacted by this project. The opportunity for effective consultation should be created to allow for meaningful tribal input. In addition to documenting the tribal consultation process that was completed during the preparation of the draft and final PEIS, the final PEIS should include a discussion of how comments that were heard during consultation were considered during the preparation of the draft PEIS and in the selection of the

preferred alternative in the final PEIS. If consultation was offered, but not accepted by the tribal governments, that information should be provided in the documents.

In addition to the whaling communities identified throughout the draft PEIS, the proposed project could affect traditional trade and cultural practices of other communities that utilize and obtain subsistence and other traditional resources through barter and trade with the whaling communities. Tribal governments that may be impacted, either directly and indirectly, by this action should also be invited to consult with NMFS/MMS. For instance, there may be impacts to the trade and bartering activities that occur with bowhead meat, bone, and baleen throughout the year with non-whaling Native communities.

Public Participation

The draft PEIS does not include a summary of comments that were received and evaluated during the public scoping period, the scoping comments or a reference for obtaining and reviewing comments. EPA recommends that information from comment letters and meetings that have occurred more recently be included in this document in order to disclose and discuss continuing issues and concerns or new issues and concerns that have been communicated during the development of this analysis. The final PEIS should include a section that discloses and discusses public comments that were received during the scoping period and responses to comments that were received during the public comment period on the draft FEIS. The section should be organized and formatted such that it is easy for the reader to see the individual comments, the responses to comments, and determine how NMFS/MMS considered individual during the preparation of the final PEIS and the Preferred Alternative.

Additionally, NMFS/MMS should consider interspersing the various tables, maps and figures from Section VIII into the discussion sections of the document in order to assist the public in its review, and to improve readability. The quality of several of the figures should also be refined to ensure clarity for the reader.

Environmental Justice

As also stated in EPA's comments on Lease Sale 193, EPA's primary concerns with the issue of environmental justice during this NEPA process and in discussions in the draft PEIS focus on the effects of multiple, overlapping and fast-tracked planning processes that have occurred over the past several months, and increasing concerns from local residents regarding human health impacts from proposed oil and gas exploration, development and production activities in the area.

EPA recognizes that the enormous amount of information that has been prepared in various NEPA documents for oil and gas activities in the Alaska Arctic over the past several months has put a strain on local communities' abilities to adequately review and respond to proposed activities that directly affect their quality of life and, in particular, their subsistence way of life. In recent months, public input has been solicited for the Beaufort Sea Oil and Gas Lease Sale 202 EA and Finding of No Significant Impact, the MMS OCS 5-Year Program for 2007-2012 and the accompanying 5-Year Program Draft EIS, the NOI for a Programmatic EIS for seismic

activities in the Chukchi and Beaufort Seas, an NOI for a Supplemental EIS for the Northeast National Petroleum Reserve-Alaska (NPR-A) Integrated Activity Plan, and Lease Sale 193 Draft EIS. The public review and comment periods have at times occurred during critical whaling and other subsistence activity seasons when many of the key individuals in the communities were likely unavailable, and they have all occurred in such rapid succession that thoughtful and meaningful reviews, which the agencies ask for and expect, have undoubtedly been constrained. More importantly, it is understandable that the pressure to review, comment on and ultimately live with the rapid pace of industrial activities creates stress and other adverse impacts to individuals living in the area. EPA recommends that the NMFS/MMS consider any requests by local residents to extend review and comment deadline, and to coordinate future deadlines and meetings so that conflicts with subsistence and other traditional activities are minimized, if not avoided.

A second concern relative to environmental justice results from the recurring comments from local residents and North Slope Borough (NSB) officials about recognized and potential human health impacts from onshore and offshore oil and gas activities on the North Slope. It is our understanding that on several occasions, MMS and other federal agencies have been asked by NSB officials to engage in meaningful discussions and consultation about environmental health concerns of local residents. EPA understands the challenges associated with studies of impacts from oil and gas activities on community and individual human health and the evaluation of potential mitigation for impacts. However, EPA continues to encourage NMFS/MMS to foster and participate in focused dialogue with local residents in order to better understand the types of concerns regarding human health that are in the communities and work with communities to explore potential ways to analyze and mitigate adverse impacts. EPA considers the analysis of human health impacts from proposed oil and gas activities part of the NEPA process, and we would be interested in assisting MMS in their efforts.





**UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration**

National Marine Fisheries Service

P.O. Box 21668

Juneau, Alaska 99802-1668

RECEIVED
OWW-135

MAY 30 2006

May 23, 2006

Michael F. Gearheard, Director
Office of Water
United States Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Dear Mr. Gearheard,

The National Marine Fisheries Service (NMFS) has reviewed the Final Ocean Discharge Criteria Evaluation for the Arctic NPDES General Permit for Oil and Gas Exploration (Permit No.: AKG280000). The purpose of the evaluation is to analyze the effects of the U.S. Environmental Protection Agency (USEPA) issuing a National Pollutant Discharge Elimination System (NPDES) general permit for effluent discharges associated with oil and gas exploration activities in the Outer Continental Shelf (OCS) areas designated as the Beaufort and Chukchi Seas, Hope Basin and Norton Basin Areas of Coverage off northern Alaska, as well as all Alaska state waters contiguous with the OCS areas. The permit will be in effect from 2006-2011. It is estimated that a total of 21 exploration wells and 12 delineation wells will be drilled in the Beaufort Sea; 2 exploration wells and 2 delineation wells will be drilled in the Chukchi Sea; and that no exploration or delineation wells will be drilled in Hope Basin or Norton Sound during the period of this permit, based on the information provided in the MMS FEIS for the OCS Oil and Gas Leasing Program (2002-2007), under the effective period of this general NPDES permit.

The permit covers exploratory drilling operations conducted from drill barges, jack-up rigs, drilling ships, or semi-submersible rigs to identify the location of producing formations. The permit does not cover developmental or production operations. The major waste streams from drilling operations are drilling fluids, also called drilling mud, and drilling cuttings. The most toxicologically important constituents of drilling muds are aromatic compounds and heavy metals. The NPDES permit incorporates a standard acute toxicity test using the mysid *Mysidopsis bahia*. Under these permits, discharge of muds with a LC₅₀ of less than 30,000 ppm SPP (suspended particulate phase) is prohibited. The discharge of muds and cuttings contaminated by diesel oil or diesel oil spots or "pills" is prohibited by this permit and can not be discharged.

USEPA has determined that the action is not likely to adversely affect any species listed under the Endangered Species Act (ESA) or designated critical habitat of such species, and requests concurrence from NMFS. NMFS concurrence is primarily based upon the Final Ocean Discharge Criteria Evaluation of the Arctic NPDES General Permit for Oil and Gas Exploration dated January 24, 2006, and the documents quoted in this letter. Species under NMFS ESA jurisdiction that could be affected by this action include blue-, bowhead-, fin-, humpback, northern right-, sperm-, and sei whales, and Steller sea lions.



Critical habitat is only designated for Steller sea lions and consists of major rookeries, haulouts and buffer areas, and three special aquatic foraging areas, including the Shelikof Strait, Bogoslof, and Seguam Pass areas (50 CFR part 226.203).

Some impacts may be measurable, but their effects may be minimal and/or short-term in duration; therefore, they may not require avoidance or mitigation. Adverse impacts that are reduced by mitigation below the "significance thresholds" that are incorporated into the permit, or that are demonstrated to be acceptable because the risk of the impact occurring is small, are considered "nonsignificant." Impacts to NMFS' ESA species may occur from direct exposure to pollutants, or indirectly, through bioaccumulation in the food chain.

The bowhead whale has the greatest potential to be impacted by oil development since the majority of their habitat is in the area of the Arctic oil and gas exploration, specifically the Beaufort and Chukchi seas. They are distributed in seasonally ice-covered waters of the arctic and near-arctic, typically between 54°N and 75°N latitude in the western Arctic Basin. The majority of the Western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea through the Chukchi Sea in the spring (March through June) and into the Canadian Beaufort Sea, where they spend much of the summer (mid-May through September) before returning again in the fall (September through November) (Braham et al.; Moore & Reeves as cited in NOAA, 2002a). The bowhead whale subsistence-hunting area near Barrow in an area of the Chukchi Sea has been removed from leasing consideration in the MMS 5-Year Offshore Oil and Gas Leasing Program for 2002-2007.

The direct effects to bowhead whales will be insignificant or nonexistent. If it is assumed that a deposition depth of 1 cm (0.4 in) would be detrimental to benthic organisms, a worst-case scenario calculation indicates that less than 0.0001 percent of the total area proposed for exploration would potentially be adversely impacted. Additionally, it is likely that whales will avoid the activity occurring in the drilling areas and thus avoid contact with the 100 m mixing zone.

Indirect impacts to bowhead whales may occur through bioaccumulation. The consumption of contaminated prey items by cetaceans could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Benthic organisms within 100 m of a discharge will likely experience temporary sublethal effects with some lethal effects on immature stages due to trace metals. Research on the chemical toxicity of drilling muds has indicated that larval stages and planktonic organisms are the most sensitive of the Alaskan species that have been evaluated. It is unlikely that organisms would be exposed for periods of time typically used to determine acute toxicity since drilling mud discharges are episodic with durations of only a few hours. Additionally, recovery of the affected benthic organisms likely would occur within 4 months (Currie and Isaacs, 2004) to 2 years after the termination of discharges.

The area impacted by oil development that may contribute to bioaccumulation that would have potential impacts to bowhead whales is less than 0.0001 percent of the total area, even in a worst case scenario. Additionally, studies have shown that bowhead whales are sensitive to noise from offshore drilling platforms and seismic survey operations (Richardson and Malme 1993, Richardson 1995). The majority of bowhead whales exposed to recordings of drillship noise in the Area of Coverage oriented away from the noise source. Noise levels eliciting an avoidance response were estimated to extend 4-11 km (2-6 nmi) from a drillship (Richardson et al., 1990, p. 156). This is 100 times greater than the affected area due to the discharge (100 m). Recent studies conducted for a monitoring program for the Northstar project (a drilling facility in the Beaufort Sea) found that in one of the three years of monitoring efforts, the southern edge of the bowhead whale fall migration path may have been slightly adjusted to 2-3 miles further offshore during periods when sound levels were recorded at higher levels (Richardson et al. 2004). It is likely that whales will avoid the activity occurring in the drilling areas and thus avoid contact with prey residing within the more concentrated portions of the plume during discharge. Based on the limited extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the impacts from the discharge will be insignificant. Based on the information given in the assessment, NMFS concurs in EPA's determination that the issuance of this permit may affect but is not likely to adversely affect the bowhead whale.

Additional endangered species are the blue, fin, humpback, northern right, sperm, and sei whales, and Steller sea lions. Effects from oil development on these species would be less than the bowhead whale, primarily due to less time spent in the Chukchi and Beaufort Seas. In the North Pacific, blue whales seldom enter the Bering Sea and are only rarely seen as far north as the Chukchi Sea (ADFG 1994). Fin whale summer distribution extends from central Baja California into the Chukchi Sea, while their winter range is restricted to the waters off the Pacific coast of North America. Humpbacks are widely distributed in all oceans, though they are less common in Arctic waters. Only a small portion of the humpback whale summer habitat area is included in the permit area. The North Pacific right whale population is thought to be very small, perhaps in the tens of animals (NMFS 2002b). They have not been observed outside the southeastern Bering Sea at least through October (NOAA, 2003b). Critical habitat for North Pacific right whales is in the process of being designated, but does not include any of the Chukchi or Beaufort Sea. In the North Pacific, sperm whales are distributed widely, with the northernmost boundary extending from Cape Navarin (62°N) to the Pribilof Islands (Angliss and Lodge 2003). The distribution of sperm whale indicates that male sperm whales are the only sex that frequent Alaskan waters and that sperm whales are normally distributed outside of the action area. Sei whales are common in the southwest Bering Sea to the Gulf of Alaska, and offshore in a broad arc between about 40°N and 55°N (Environment Canada 2004a; WWF 2005). It is possible that oil and gas operations could impact the habitat and food supply of the sei whale, however the action area is located in the Beaufort Sea and Chukchi seas which are located north of sei whale habitat and could possibly impact only a small portion of their overall habitat and prey. The habitat of the

Steller sea lion is located from the central Bering Sea south through the Aleutian Islands and further south through the Pacific coast. It is possible that oil and gas operations could impact the habitat and food supply of the Steller sea lion; however the action area includes the Beaufort Sea and Chukchi sea which are located north of Steller sea lion habitat and could possibly impact only a small portion of their overall habitat and prey. Critical habitat has been designated for the endangered Steller sea lion, but none is located within or near the NPDES permit area.

Due to the limited use of the permit area by NMFS ESA species, the limited extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species or the endangered Steller sea lions. Based on the information given in the assessment, NMFS has determined the impacts from the discharge will be insignificant, and concurs in EPA's determination that the issuance of this permit may affect but is not likely to adversely affect NMFS ESA species. Based on the information given in EPA's assessment, there will be no effect on Steller sea lion critical habitat, or potential Northern Pacific right whale critical habitat, since they are not present in the permit area.

Reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) take of a listed species occurs, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered, or (4) a new species is listed or critical habitat designated that may be affected by the action.

Sincerely,



Robert D. Mecum
Acting Administrator, Alaska Region

CC: Mike Lidgard - EPA, Seattle
Sonia Vidanage - EPA, Seattle

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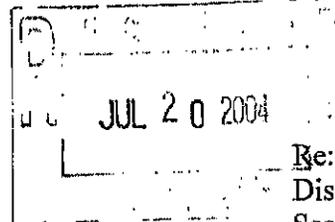
United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
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July 15, 2004

Michael F. Gearheard
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101



Re: NPDES
Discharges, Beaufort
Sea, Alaska

Dear Mr. Gearheard:

This responds to your request for information addressing biological resources pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). This information is being provided for use in evaluating the U.S. Environmental Protection Agency's (EPA's) proposed reissuance of the general National Pollutant Discharge Elimination System (NPDES) permit for oil and gas exploration facilities on the outer continental shelves (OCS) of the Beaufort and Chukchi Seas, North Slope, Alaska.

The proposed project sites are within the summer ranges of the spectacled eider (*Somateria fischeri*) and Steller's eider (*Polysticta stelleri*) which are both listed as threatened under the Act. Because some listed eiders stage in the Beaufort and Chukchi Seas while migrating to and from North Slope breeding areas, impacts from discharge/effluent to their food supply, primarily mollusks and crustaceans, could occur.

Based on the limited amounts and spatial distribution of proposed drilling, the Service concludes that this project is not likely to adversely impact listed species. Although impacts to eider prey species are likely, areas that could be covered in discharge would be small in relation to the feeding habitat available. Therefore, preparation of a biological assessment or further consultation under section 7 of the Act regarding these projects is not necessary at this time. This conclusion applies only to endangered and threatened species under our jurisdiction. It does not preclude the need to comply with other environmental legislation or regulations such as the Clean Water Act.

Thank you for your cooperation in meeting our joint responsibilities under the Act. If you need further assistance, please contact Jonathan Priday at (907) 456-0499.

Sincerely,

Ted Swem
Branch Chief
Endangered Species



Final Ocean Discharge Criteria Evaluation
of the
Arctic NPDES General Permit for Oil and Gas Exploration
(Permit No.: AKG280000)



January 24, 2006

Finalized By:

**U.S. Environmental Protection Agency
Region 10, Office of Water and Watersheds
Seattle, WA**

Prepared By:

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ABBREVIATIONS

AAC	Alaska Administrative Code
ACC	Alaska coastal current
ACMP	Alaska Coastal Management Plan
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AO	Arctic oscillation
API	American Petroleum Institute
AWQC	Alaska water quality standards
BAF	Bioaccumulation factor
BMP	Best management practice
BOD	Biochemical oxygen demand
BPT	Best Practicable Control Technology Currently Available
CFR	Code of Federal Regulations
CMF	Consumption of marine fish
CMP	Coastal Management Plan
COD	Chemical oxygen demand
CWA	Clean Water Act
CZMP	Coastal Zone Management Plan
DDT	Dichlorodiphenyltrichloroethane
EA	Environmental Assessment
EC₄₀	Effect concentration to 40% test organisms
EC₅₀	Effect concentration to 50% test organisms
EFH	Essential Fish Habitat
ELG	Effluent limitation guidelines
EOP	End of pipe
EPA	USEPA
ESA	Endangered Species Act
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FR	Federal Register
GP	General permit
LC₅₀	Lethal concentration to 50% test organisms
LOEC	Lowest observable effect concentration
MLLW	Mean lower low water
MMS	Minerals Management Service
MZ	Mixing zone
NOAA	National Oceanic and Atmospheric Administration
NOEC	No observable effect concentration
NOEL	No observable effect level
NOI	Notice of intent
NPDES	National Pollutant Discharge Elimination System
OCS	Outer Continental Shelf

ABBREVIATIONS (cont.)

ODCE	Ocean Discharge Criteria Evaluation
OOC	Offshore Operators Committee
PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated Biphenyls
PPA	Pollution Prevention Act
QAP	Quality assurance plan
ROC	Retention on cuttings
SBF	Synthetic-based drilling fluid
SPP	Suspended particulate phase
TOC	Total organic carbon
TSS	Total suspended solids
UOD	Ultimate oxygen demand
U.S.	United States
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WBF	Water-based drilling fluid

UNITS

ac	acres
bbbl	barrel
bbbl/day	barrels per day
bbbl/h	barrels per hour
°C	degrees Celsius
cm	centimeters
cm/s	centimeters per second
colonies/100 mL	colonies per 100 milliliters
°F	degrees Fahrenheit
fm	fathoms
ft	feet
ft/mi	feet per mile
ft/s	feet per second
g	grams
gal	gallons
g/day	grams per day
g/L	grams per liter
g/mL	grams per milliliter
gpd	gallons per day
h	hour
ha	hectares
in	inches
kg	kilograms
kg/L	kilogram per liter
kg/m³	kilograms per cubic meter
km	kilometers
km²	square kilometers
kn	knots
L	liters
lb	pounds
lb/bbl	pounds per barrel
lb/gal	pounds per gallon
L/h	liters per hour
m	meters
m²	square meters
mg/cm²	milligram per square centimeter
mgd	million gallons per day
mg/kg	milligram per kilogram
mg/L	milligrams per liter
m³/h	cubic meters per hour
mi	miles
m/km	meters per kilometer
mL	milliliter
mm	millimeter

UNITS (cont.)

m/s	meters per second
nmi	nautical miles
ppm	part per million
ppt	part per thousand
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µm	micrometers
v/v	volume component per total volume

1.0 INTRODUCTION

1.1. PURPOSE OF EVALUATION

The U.S. Environmental Protection Agency (USEPA) intends to issue a National Pollutant Discharge Elimination System (NPDES) general permit for effluent discharges associated with oil and gas exploration activities in the Outer Continental Shelf (OCS) areas designated as the Beaufort and Chukchi Seas, Hope Basin and Norton Basin Areas of Coverage off northern Alaska, as well as all Alaskan state waters contiguous with the OCS areas (Figure 1-1). A copy of the general permit is provided in Appendix C. Section 403(c) of the Clean Water Act (CWA) requires that NPDES permits for such ocean discharges to be issued in compliance with USEPA's Ocean Discharge Criteria for preventing unreasonable degradation of ocean waters. The purpose of this Ocean Discharge Criteria Evaluation (ODCE) report is to identify pertinent information and concerns relative to the Ocean Discharge Criteria and exploratory petroleum drilling in these waters.

USEPA's Ocean Discharge Criteria (40 CFR Part 125, Subpart M) set forth specific determinations of unreasonable degradation that must be made prior to permit issuance. Unreasonable degradation of the marine environment is defined (40 CFR 125.121[e]) as follows:

Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities;
Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; or
Loss of aesthetic, recreational, scientific, or economic values, which are unreasonable in relation to the benefit derived from the discharge.

This determination is to be made based on consideration of the following 10 criteria (40 CFR 125.122):

1. The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged;
2. The potential transport of such pollutants by biological, physical, or chemical processes;
3. The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain;
4. The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas,

migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism;

5. The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs;
6. The potential impacts on human health through direct and indirect pathways;
7. Existing or potential recreational and commercial fishing, including finfishing and shellfishing;
8. Any applicable requirements of an approved Coastal Zone Management Plan;
9. Such other factors relating to the effects of the discharge as may be appropriate;
10. Marine water quality criteria developed pursuant to Section 304(a)(1).

If the Regional Administrator determines that the discharge will not cause unreasonable degradation of the marine environment, an NPDES permit may be issued. If the Regional Administrator determines that the discharge will cause unreasonable degradation of the marine environment, an NPDES permit may not be issued.

If the Regional Administrator has insufficient information to determine, prior to permit issuance, that there will be no unreasonable degradation of the marine environment, an NPDES permit will not be issued unless the Regional Administrator, on the basis of the best available information, determines that:

- such discharge will not cause irreparable harm to the marine environment during the period in which monitoring will take place,
- there are no reasonable alternatives to the onsite disposal of these materials, and
- the discharge will be in compliance with certain specified permit conditions (40 CFR 125.122).

“Irreparable harm” is defined as “significant undesirable effects occurring after the date of permit issuance which will not be reversed after cessation or modification of the discharge” (40 CFR 125.121[a]).

1.2. SCOPE OF EVALUATION

Offshore oil and gas activities can be categorized into exploratory, developmental, and production operations. Exploratory drilling operations are conducted from drill barges, jack-up rigs, drilling ships, or semi-submersible rigs to identify the location of producing formations. Development operations are conducted on platforms from which multiple wells are drilled after a

commercially exploitable reserve has been identified. Production operations ensue during and after developmental drilling.

This document evaluates the impacts of waste discharges as provided for by the Arctic NPDES general permit proposed for offshore oil and gas exploration in the Beaufort and Chukchi Seas, Hope Basin and Northern Norton Basin. Rather than covering a geographic area defined by specific State and Federal lease sale tracts, the area of coverage includes the following: federal waters of the Beaufort Sea and Chukchi Sea, Hope Basin and Norton Basin planning basins as defined by Minerals Management Service (MMS) (see MMS, 2002) and state waters contiguous to the landward boundary of the MMS planning basins (Figure 1-1). The "state waters" under consideration in this ODCE typically extend from the coastal baseline defined as part of the 403(c) program to three miles offshore.

The permit will authorize discharges from exploratory operations in all areas offered for lease by MMS and Alaska Department of Natural Resources (ADNR) including past and future lease sales within the Beaufort Sea, Chukchi Sea, Hope Basin, and Norton Basin. This method of defining the Area of Coverage will insure that all areas potentially leased during the term of this general permit will be covered. While the MMS planning basins (i.e., Beaufort Sea, Chukchi Sea, Hope Basin and Norton Basin Planning Areas) and contiguous State waters are generally larger than the areas offered for lease by MMS and ADNR, discharges under this general permit would occur in only those areas ultimately offered for lease.

This document relies extensively on information provided in the Final Environmental Impact Statements (FEIS) for MMS Multiple Lease Sale 186, 195 and 202 (MMS, 2003); the Environmental Assessment (EA) for Sale 195 (MMS, 2004a); MMS OCS Reports (MMS, 2004b, 2005a, 2005b); Final Finding for ADNR Lease Sales in the Beaufort Sea (ADNR, 1999); FEIS for MMS Sale 57 (MMS, 1982); USEPA's guidance documents for oil and gas exploration discharges (Avanti Corp., 1993; USEPA, 1985, 1993a, 2000a, 2000b); and the previous ODCE for this general permit (USEPA, 1995). Where appropriate, the reader will be referred to these publications for more detailed information concerning certain topics. The information presented here is a synthesis of these documents, along with the inclusion of discharge modeling results and findings published in the scientific literature.

1.2.1. Beaufort Sea Area of Coverage

The general permit applies to the entire Beaufort Sea Planning Area (Barrow eastward to the Alaska, USA and Yukon, Canada border) including contiguous State waters (Figure 1-1); however, for the term of the proposed permit MMS and ADNR will likely only consider leasing the areas identified in the MMS 2002 planning area (OCS Lease Sales 186, 195 and 202) and the ADNR 1999 area wide lease sale. For purposes of this document and because no additional leasing will likely occur outside these and current lease sale boundaries, the area of current leases and new leases from MMS Sales BF, 124, 144, 170, 186, 195 and 202 and ADNR 1999 lease sale will be considered as the Beaufort Sea Area of Coverage for this ODCE.

The Beaufort Sea Planning Area extends from the U.S./Canadian boundary in the Beaufort Sea (approximately 141° W) westward to Icy Cape in the Chukchi Sea (161° W). It extends about 260 kilometers (km) [140 nautical miles (nmi)] offshore with water depths ranging from 0 to about 1,500 meters (m) [4,921 feet (ft)]. The Beaufort Sea Area of Coverage includes approximately 5.58 million hectares (ha) [13.8 million acres (ac)] of the Beaufort Sea Planning Area and contiguous State waters (Figure 1-1).

Five biologically sensitive areas have been identified in the Beaufort Sea, all of which are located shoreward of the 10-m isobath. These areas are the Salt Marshes; Harrison Bay/Colville River Delta; Thetis Island; Simpson Lagoon; and the Boulder Field. These areas are either important feeding grounds for indigenous fish and bird species or, like the Boulder Field, comprise unique biological communities.

Four areas have been proposed as deferral areas for MMS Sales 186, 195 and 202 within the Beaufort Sea Area of Coverage. Future lease sale configurations may include or omit these areas. The following describes the proposed deferral areas:

- the Barrow deferral: an area located in the western portion of the proposed sale area consisting of 26 whole or partial blocks, approximately 138,000 ac, for protection of Barrow subsistence-use zones and wildlife areas;
- the Nuiqsut deferral: an area located off of Cross Island consisting of 30 whole or partial blocks, approximately 162,000 ac, for protection of Nuiqsut subsistence-use zones and wildlife areas;
- the Kaktovik deferral: an area located off of Barter Island consisting of 28 whole or partial blocks, approximately 121,000 ac, for protection of the Native Village of Kaktovik's traditional known subsistence-whaling areas; and
- the Eastern deferral: an area located east of Kaktovik consisting of 60 whole or partial blocks, approximately 283,000 ac, adjoining an area that the state of Alaska has deferred in recent state sales for the protection of bowhead whales and environment.

Additionally, ADNDR has identified the following areas and time periods as sensitive areas that require special consideration when proposing leasing activities:

- the Boulder Patch in Stefansson Sound, year round;
- the Canning River Delta, January-December;
- the Colville River Delta, January-December;
- the Cross, Pole, Egg, and Thetis Islands, June-December;
- the Flaxman Island waterfowl use and polar bear denning areas, including the Leffingwell Cabin national historic site located on Flaxman Island;
- the Jones Island Group (Pingok, Spy, and Leavitt Islands) and Pole Island are known polar bear denning sites, November-April;
- the Sagavanirktok River delta, January-December; and
- Howe Island supports a snow goose nesting colony, May-August.

1.2.2. Chukchi Sea Area of Coverage

The general permit applies to the entire Chukchi Sea Planning Area (Point Hope northward to Barrow) including contiguous State waters (Figure 1-1); however, for the term of the proposed permit MMS will likely only consider leasing the areas identified in the MMS 2002 planning area (Special Interest Sale). There are no current lease sales in the Chukchi Sea by either MMS or ADNR. Additionally, ADNR has not proposed any lease offerings in the Chukchi Sea. Since the area of MMS Special Interest Sale does not identify the particular lease blocks that may be available for sale, the entire MMS Chukchi Sea Planning Area will be considered as the Chukchi Sea Area of Coverage for this ODCE.

The Chukchi Sea Area of Coverage includes approximately 13.76 million ha (34 million ac) (Figure 1-1). The Chukchi Sea Area of Coverage extends from Icy Cape westward to Point Hope. It extends about 416 km (260 nmi) offshore in water depths ranging from 10 m (32 ft) to about 70 m (230 ft).

The bowhead whale subsistence-hunting area near Barrow in an area of the Chukchi Sea has been removed from leasing consideration in the MMS proposed final 5-Year Offshore Oil and Gas Leasing Program for 2002-2007.

1.2.3. Hope Basin Area of Coverage

The general permit applies to the entire Hope Basin Planning Area (Cape Prince of Whales northward to Point Hope) including contiguous State waters (Figure 1-1); however, for the term of the proposed permit MMS will likely only consider leasing the areas identified in the MMS 2002 planning area (Special Interest Sale). There are no current lease sales in the Hope Basin by either MMS or ADNR. Additionally, ADNR has not proposed any lease offerings in the Hope Basin. Since the area of MMS Special Interest Sale does not identify the particular lease blocks that may be available for sale, the entire MMS Hope Basin Planning Area will be considered as the Hope Basin Area of Coverage for this ODCE.

The Hope Basin Area of Coverage includes approximately 16.06 million ha (6.5 million ac) (Figure 1-1). The Hope Basin Area of Coverage extends from Point Hope southward to Cape Krusenstern (67° N). It extends about 204 km (110 nmi) offshore in water depths ranging from 10 m (32 ft) to about 70 m (230 ft).

1.2.4. Norton Sound Area of Coverage

The general permit applies to the entire Norton Sound Planning Area northward of latitude 64.5° N to Cape Prince of Whales including contiguous State waters (Figure 1-1); however, for the term of the proposed permit MMS will likely only consider leasing the areas identified in the MMS 2002 planning area (Special Interest Sale). There are no current lease sales in the Norton Sound by either MMS or ADNR. Additionally, ADNR has not proposed any lease offerings in

the Norton Sound. Since the area of MMS Special Interest Sale does not identify the particular lease blocks that may be available for sale, the entire MMS Norton Sound Planning Area will be considered as the Norton Sound Area of Coverage for this ODCE.

The Norton Sound Area of Coverage includes approximately 10.12 million ha (25 million) (Figure 1-1). The Norton Sound Area of Coverage extends from the Cape Prince of Wales southward to Yukon Delta (63°N). It extends about 593 km (320 nmi) offshore in water depths ranging from 7.62 m (25 ft) to about 198 m (650 ft).

The Yukon-Kuskokwim River Delta is considered a vulnerable coastal area which is a critical habitat for North America's largest run of king salmon. Approximately one-third of this delta region comprises the Clarence Rhode National Wildlife Refuge. The delta is also critical to Native Alaskan Tribes subsistence harvest.

1.2.5. Duration of Activity

Ice is present much of the year in the Beaufort and Chukchi seas but drilling can take place year-round in very shallow waters. It is expected that exploratory wells will be drilled from a moveable platform resting on the seafloor when ice is not present in these water bodies. An ice or gravel island could be constructed to allow drilling to continue during the winter months (MMS, 2002; ADNR, 1999).

In deeper waters, it is likely that drillships or floating platforms anchored to the seafloor would be used and drilling would be limited to a short period in the summer months. Also, icebreakers could provide support in the vicinity of the drilling rig to control sea ice (MMS, 2002).

1.3. OVERVIEW OF REPORT

The evaluation focuses on sources, fate, and potential effects of exploratory drilling rig discharges on various groups of aquatic life. The types and projected quantities of discharges are detailed in Section 2.0. Anticipated amounts or volumes of wastes, approximate chemical composition, and chemical concentrations are also given.

Following discharge, the fate of the wastes is examined in Section 3.0, which covers dilution, dispersion, and persistence of discharged constituents in relation to influential receiving water properties, including water depth, ice coverage, currents, wind, and waves. Section 3.0 also provides estimates of the vertical and horizontal coverage and deposition of the discharges. This information is needed to assess aquatic toxicity and food chain accumulation questions, and the probability of burying benthic infaunal invertebrates or otherwise modifying their habitat chemically or physically (e.g., via grain size changes).

An overview of aquatic communities and important species, including threatened and endangered species, and potential biological and ecological effects is presented in Section 4.0. The means by which drilling mud discharges could impact human health, mainly subsistence, are presented in Section 5.0. Section 6.0 provides information on tribal resources other than

subsistence that may be affected by this action. Commercial fisheries are discussed in Section 7.0 and coastal zone management is discussed in Section 8.0. Section 9.0 discusses the compliance of expected exploratory drilling discharges with Alaska water quality criteria and Section 10.0 summarizes the findings of this report. All figures for this evaluation are presented in Appendix A; tables are found in Appendix B.

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2.0 COMPOSITION AND QUANTITIES OF MATERIALS DISCHARGED

2.1. TYPES OF DISCHARGES FROM DRILLING ACTIVITIES

This document evaluates the impacts of waste discharges as provided for by the Arctic NPDES general permit proposed for offshore oil and gas exploration (i.e., drilling activities). Production activities and produced water discharges are not discussed in this document because they are not authorized by this permit.

Oil and gas drilling generates a wide range of waste materials related to the drilling process, equipment maintenance, and personnel housing. These materials are commonly discharged directly from the drilling rig or platform into the receiving water. The major discharges are drilling muds (fluids) and drilling cuttings. Other discharges may include sanitary and domestic wastes, desalination unit wastes, boiler blowdown, test fluids, deck drainage, blowout preventer fluids, uncontaminated ballast and bilge water, excess cement slurry, non-contact cooling water, fire control system test water, and excess cement slurry at the sea floor.

The major waste streams are those streams with the greatest volumes and amounts of pollutants. The major waste streams from drilling operations are drilling fluids, also called drilling mud, and drilling cuttings due to their volume and composition. A discussion of drilling fluids and cuttings is provided in Section 2.2. The remaining waste streams are miscellaneous waste. These are waste streams that are generated in relatively small volume and contain low pollutant levels, yet significant enough to be of regulatory concern. Miscellaneous wastes generated from drilling operations are deck drainage, domestic and sanitary waste. Section 2.3 discusses these waste streams. The remaining waste streams are considered minor wastes and are discussed in Section 2.4.

2.2. DRILLING FLUIDS AND CUTTINGS

During exploration drilling, drilling fluid (or drilling "mud") circulates down the bore hole and back to the surface, carrying drill cuttings (earthen material) with it. The drill cuttings are separated from the drilling fluid on the exploratory vessel and discharged or disposed. The processed drilling fluid is then returned to the mud tanks for recirculation to the well.

Drilling fluid is required in the wellbore to: (1) to cool and lubricate the drill bit; (2) remove the rock fragments, or *drill cuttings*, from the drilling area and transport them to the surface; (3) counterbalance formation pressure to prevent formation fluids (i.e. oil, gas, and water) from entering the well prematurely, and (4) prevent the open (uncased) wellbore from caving in (Berger and Anderson, 1992; Souders, 1998). Drilling fluids are specifically formulated to meet the physical and chemical conditions of each particular well site. Therefore, different properties may be required of the drilling fluid, depending upon the drilling conditions. For example, a higher-density fluid may be needed in high-pressure zones, and a more temperature-resistant fluid may be desired in high-temperature conditions.

While drilling fluid may be a gas or foam, liquid-based fluids (called *drilling muds*) are used for approximately 93 percent of wells (API, 1997). In addition to liquid, drilling muds usually contain bentonite clay that increases the viscosity and alters the density of the fluid. Drilling mud may also contain additional additives that alter the properties of the fluid. The most significant additives are described later in this section. The American Petroleum Institute (API) environmental guidance document "Waste Management in Exploration and Production Operations," (API E5) considers the three general categories of drilling fluid (muds) to be water-based, oil-based, and synthetic-based. Synthetic-based muds are used as substitutes for oil-based muds, but also may be an advantageous replacement for water-based muds in some situations. Water-based muds are used most frequently. The base is salt water for offshore wells. The primary benefit of water-based muds is cost; they are the least expensive of the major types of drilling fluids, and in general they are less expensive to use since the resultant drilling waste can be discharged onsite provided these wastes pass regulatory requirements (USEPA, 1999a). The significant drawback with water-based muds is their limited lubricity and reactivity with some shales. In deep holes or high-angle directional drilling, water-based muds are not able to supply sufficient lubricity to avoid sticking of the drill pipe. Reactivity with clay shale can cause the destabilization of the wellbore. In these cases, oil-based and synthetic muds are needed.

In 1993, EPA estimated that about 15 percent of wells drilled deeper than 10,000 feet used some oil-based muds (USEPA, 1993b). Oil-based muds are composed primarily of diesel oil or mineral oil and are therefore more expensive than water-based muds. This higher cost, which includes the added burden of removing the oil from drill cuttings, and the required disposal options make oil-based muds a less frequently used option. Oil-based muds are well suited for the high temperature conditions found in deep wells because oil components have a higher boiling point than water, and oil-based muds can avoid the pore-clogging that may occur with water-based muds. Also oil-based muds are used when drilling through reactive (or high pressure) shales, high-angle directional drilling, and drilling in deep water. These situations encountered while drilling can slow down the drilling rate, increase drilling costs or even be impossible if water-based muds are used. In cases when oil-based muds are necessary, the upper section of a well generally is drilled with water-based muds and the conversion is made to oil-based mud when the situation requires it. It is predicted that since the industry trend is toward deeper wells, oil-based muds may become more prominent. However, because oil-based muds and their cuttings can not be discharged this may not be the case.

Since about 1990, the oil and gas extraction industry has developed many new oleaginous (oil-like) base materials from which to formulate high performance drilling fluids. A general class of these fluids is called synthetic materials, such as the vegetable esters, poly alpha olefins, internal olefins, linear alpha olefins, synthetic paraffins, ethers, linear alkylbenzenes, and others. Other oleaginous materials have also been developed for this purpose, such as enhanced mineral oils and non-synthetic paraffins. Industry developed synthetic-based fluids with these synthetic and non-synthetic oleaginous materials as the base fluid to provide the drilling performance characteristics of traditional oil-based fluids based on diesel and mineral oil, but with the potential for lower environmental impact and greater worker safety through lower toxicity, elimination of polyaromatic hydrocarbons (PAH), faster biodegradability, lower bioaccumulation

potential and in some drilling situations decreased drilling waste volume (FR 66086, December 16, 1996).

Drilling muds typically have several additives. The following is a list of the more significant additives:

- Weighting materials, primarily barite (barium sulfate), may be used to increase the density of the mud in order to equilibrate the pressure between the wellbore and formation when drilling through particularly pressurized zones. Hematite (Fe_2O_3) sometimes is used as a weighting agent in oil-based muds (Souders, 1998).
- Corrosion inhibitors such as iron oxide, aluminum bisulfate, zinc carbonate, and zinc chromate protect pipes and other metallic components from acidic compounds encountered in the formation.
- Dispersants, including iron lignosulfonates, break up solid clusters into small particles so they can be carried by the fluid.
- Flocculants, primarily acrylic polymers, cause suspended particles to group together so they can be removed from the fluid at the surface.
- Surfactants, like fatty acids and soaps, defoam and emulsify the mud.
- Biocides, typically organic amines, chlorophenols, or formaldehydes, kill bacteria that may produce toxic hydrogen sulfide gas.
- Fluid loss reducers include starch and organic polymers and limit the loss of drilling mud to under-pressurized or high-permeability formations (USEPA, 1987).

2.2.1. Number and Types of Exploratory Wells

The types of wells that may be drilled under this permit include exploration wells and delineation wells. An exploration well is a well that is drilled into a previously undrilled or noncommercial trap to test for the presence of a new hydrocarbon accumulation. A delineation well is a well that is drilled at a distance from a discovery well to determine the physical extent, reserves and likely production rate of a new oil or gas field. The following sections describe the number of each type of well that may be drilled during the effect of the Arctic NPDES general permit.

2.2.1.1. Beaufort Sea

Since it is not known the exact number of each type of well that will be drilled from new leases in the Beaufort Sea Area of Coverage during the effect of this permit (i.e., 2006-2011), they have been estimated for this evaluation from historical data, the MMS FEIS for Lease Sales 186, 195,

and 202 (MMS, 2003, 2004a), and the ADNR 1999 Lease Sale (ADNR, 1999). Activities on the leases could extend over a period of 25 to 40 years.

Based on historical exploration well data since 1960 (ADNR, 1999), 31 wells have been drilled in federal waters of the Beaufort Sea and 401 have been drilled under State leases for the North Slope (both onshore and offshore). While the number and type of exploratory wells that may be drilled in State waters has not been estimated in ADNR's lease offering, it can be estimated from historical trends (ADNR, 1999, Figure 5.3) that 5-10 wells will be drilled each year from exploration activities in the North Slope of which only a small fraction, maybe 1-2 wells, will be drilled offshore. The percent of these wells that has resulted in discovery is 13.2 percent. Therefore, it is estimated that 10 exploration wells and one delineation well will be drilled in State waters under this permit.

Exploratory drilling for Lease Sale 186 is expected to continue through 2009 with delineation wells drilled through 2010. It is estimated that a total of six exploration wells and six delineation wells will be drilled over this period (MMS, 2003) and approximately six exploration wells and six delineation wells will be drilled during the permit period.

Exploratory drilling for the areas covered under Lease Sale 195 is expected to begin in 2007 and continue until 2013, with delineation wells drilled through 2014. It is estimated that a total of six exploration wells and six delineation wells will be drilled over this period (MMS, 2003) and approximately four exploration wells and four delineation wells will be drilled during the permit period.

Exploratory drilling for the areas covered under Lease Sale 202 is expected to begin in 2010 and continue until 2018, with a total of six exploration and five delineation wells expected to be drilled over this period (MMS 2003). It is expected that one exploration well and one delineation well will be drilled during this permit period.

In summary, it is estimated that a total of 21 exploration wells and 12 delineation wells will be drilled in the Beaufort Sea under the effective period of this general NPDES permit.

2.2.1.2. Chukchi Sea

Since it is not known the exact number of each type of well that will be drilled from new leases in the Chukchi Sea Area of Coverage during the effect of this permit (i.e., 2006-2011), they have been estimated for this evaluation from the FEIS for the Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007, which includes Chukchi Sea Area Lease Sales 193 and 203 (MMS, 2002). These two lease sales exclude nearshore tracts, the Chukchi Polynya, and tracts near Barrow. It is estimated that a total of 6 to 24 exploration and delineation wells will be drilled during the life of these leases. It is expected that approximately 2 exploration wells and 2 delineation wells will be drilled at Lease Sale 193 and no exploration or delineation wells will be drilled at Lease Sale 203 during the period of this permit.

2.2.1.3. Hope Basin

It is expected that no exploration or delineation wells will be drilled during the period of this permit based on the information provided in the MMS FEIS for the OCS Oil and Gas Leasing Program (2002-2007).

2.2.1.4. Norton Sound

It is expected that no exploration or delineation wells will be drilled during the period of this permit based on the information provided in the MMS FEIS for the OCS Oil and Gas Leasing Program (2002-2007).

2.2.2. Control of Discharge

The permit incorporates the effluent limitations required by the effluent limitation guidelines (ELGs) in 40 CFR 435, Subpart A, which apply to drilling fluids and cuttings. Additionally, the permit incorporates an end-of-pipe whole effluent toxicity limit of a minimum 96-hour LC₅₀ of 30,000 parts per million (ppm) suspended particulate phase (SPP) on discharged drilling fluids. This limit is a technology-based control on toxicity, as well as toxic and nonconventional pollutants. The 30,000 ppm SPP limitation is based upon the Agency's evaluation that it constitutes an economically and technically achievable level of performance and is both technologically feasible and economically achievable and reflects BAT level of control (USEPA, 1993a) on a national basis. Before promulgation of the guideline, this criterion has been used by USEPA, Region 10 in evaluating the case-by-case mud discharge authorizations.

2.2.3. Composition of Drilling Fluids

Traditional water-based drilling fluids (drilling muds) have water or a water miscible fluid as the continuous phase and the suspending medium for solids. They are composed of a complex mixtures of clays, barite, and specialty additives used primarily to remove rock particles from the hole created by the drill bit. The composition of drilling mud can vary over a wide range from one hole to the next, as well as during the course of drilling a single hole when encountering different formations. Table 2-1 shows the formulations for eight generic muds; concentration ranges account for the variability in the environment (e.g., drilling formations).

Synthetic-based drilling fluids are a subset of non-aqueous drilling fluids, i.e., those which have a water-immiscible fluid, such as an oleaginous (oil-like) material as the continuous phase. Synthetic-based drilling fluids include vegetable esters, poly alpha olefins, internal olefins, linear alpha olefins, synthetic paraffins, ethers, linear alkyl benzenes, and others (USEPA, 1999b). Based on data provided by the American Petroleum Institute, typical synthetic-based drilling fluids have a formulation consisting of 47 percent by weight synthetic-based drilling fluid, 33 percent solids, and 20 percent water (Baker-Hughes Inteq as cited in USEPA, 1999b).

2.2.3.1. Barite

Barite is the principal weighting agent of both water-based drilling muds and synthetic-based drilling fluids. Barite is mostly barium sulfate, which is 59 percent barium by weight. Barite is a naturally occurring mineral, is readily available and inexpensive, and is characterized by high specific gravity [4.1 to 4.3 grams per milliliter (g/mL)], low water solubility (0.03 ppm in seawater), low Mohs' hardness (2.5 – 3.5), and chemical inertness. As shown in Table 2-1, barite concentrations in drilling fluids can range from 25 to 450 pounds per barrel (lb/bbl).

2.2.3.2. Metals

The presence of potentially toxic trace elements in drilling fluids and adhering to cuttings is a major concern. Barite is a mineral composed of barium sulfate and is known to have trace contaminants of several toxic heavy metals such as mercury, cadmium, arsenic, chromium, copper, lead, nickel, and zinc (USEPA, 1999b). In order to control the concentration of heavy metals in drilling fluids, EPA promulgated regulations applicable to the offshore subcategory of the oil and gas industry in 1993 (40 CFR Part 435, Subpart A) requiring that stock barite meet the maximum limitations of 3 mg/kg for cadmium and 1 mg/kg for mercury. Table 2-2 presents the metals concentrations in so-called "clean" barite that were the basis for the cadmium and mercury limitations in the offshore rule.

Drill pipe dope (which is known to contain 15 percent copper and 7 percent lead), and drill collar dope (which can contain 35 percent zinc, 20 percent lead, and 7 percent copper), may also contribute trace metals to the muds and cuttings discharge.

2.2.3.3. Specialty Additives

Specialty additives to drilling fluids include a wide variety of substances, ranging from simple inorganic salts to the complex polymers associated with synthetic-based drilling fluids. Among the additives used in large enough quantities to result in significant mass loadings to the environment are spotting materials, lubricants, zinc compounds, and materials added to prevent loss of circulation. Variation in metal concentrations has been attributed to the addition of authorized specialty additives, variations in base mud components (i.e., chrome-free lignosulfonate replacing chrome-containing lignosulfonate), incidental contamination from pipe dope, and possibly to differences in laboratory analyses and sample sources.

2.2.3.4. Spotting Compounds

Spotting compounds are used to help free stuck drill strings. Some of these (e.g., vegetable oil or fatty acid glycerol) are easily broken down in the environment. The most effective and,

consequently, most frequently used compounds are oil-based. The discharge of muds and cuttings contaminated by diesel oil or diesel oil spots or "pills" is prohibited by this permit.

A concentrated pill of the spotting agent is pumped downhole and up the annular space between the borehole and drill pipe. After working to free the stuck pipe the pill is then pumped back to the surface. The discharge of residual amounts of mineral oil pills was authorized in recent permits provided that the mineral oil pill and at least a 50 barrel buffer of drilling fluids on both sides of the pill is removed from the system and not discharged. The residual mineral oil content cannot exceed 2 percent (v/v).

Mineral oils can contribute potentially toxic organic pollutants to drilling muds to which they are added. These data show that the concentration of organic pollutants in the drilling muds is roughly proportional to the amount of mineral oil added. Table 2-3 presents the chemical analyses of three different mineral oils (Battelle, 1984). Alkylated biphenyls were detected in all three mineral oils; naphthalene, fluorene, phenanthrene, alkylated benzenes, alkylated naphthalenes, alkylated fluorenes, alkylated phenanthrenes, alkylated biphenyls, and alkylated dibenzothiaphenes were detected in one or more of the oils. Naphthalene is the only one of the individual compounds detected for which Federal marine water quality criteria exist.

2.2.3.5. Lubricants

Lubricants are added to the drilling mud when high torque conditions are encountered on the drill string. These can be vegetable, paraffinic, or asphaltic-based compounds such as Soltex. When needed, these lubricants are used to treat the entire mud system [roughly 32,000 liters (L) or 8,453 gallons (gal)] and are discharged into receiving waters along with the muds. This can result in a 746-1,493 kilograms (kg) [1,650-3,300 pounds (lb)] mass loading of the substances into the environment for each treatment of the system. Mineral oils, mentioned above, may also be used as lubricants and may, therefore, contribute to organic pollutant loading.

2.2.3.6. Zinc Carbonate

Zinc carbonate is used as a sulfide scavenger when formations containing hydrogen sulfide are expected to be encountered during drilling. Typically the entire mud system is treated with zinc carbonate to achieve mud concentrations of zinc between 1.5 and 5.5 kilograms per cubic meter (kg/m^3) [0.01-0.05 pounds per gallon (lb/gal)], resulting in 240-940 kg (520-2,080 lb) of zinc in the mud system. The zinc sulfide and unreactive zinc compounds are discharged with the drilling mud into the environment, thus contributing to the overall loading of zinc.

2.2.3.7. Other Materials

In cases when circulation of the mud system is lost, combinations of cellophane, mica, and walnut hulls, or other inert substances such as vegetable and polymer fibers, flakes, granules, and glass or plastic spheres may be added to the mud in one of two methods. The entire system can be treated with typically 0.2 to 2.0 kg (0.5-5.0 lb) per barrel (bbl) of mud, which results in 220 to 2,200 kg (1,000 to 10,000 lb) of additives to the system. Alternatively, a pill of 15,899-31,797 L (4,200- 8,400 gal) containing 57-170 grams per liter (g/L) of additive (0.5-1.4 lb/gal) can be sent downhole. When drilling resumes, the additives are separated from the drilling muds by screening and discharged into the environment along with the cuttings.

2.2.4. Composition of Drilling Cuttings

Only very limited data are available on the physico-chemical characteristics of drilling cuttings, mostly from the Georges Bank program and CENTEC (1984) analysis of three sets of drilling cuttings from three different wells, all at depths greater than 10,000 ft. Washing of drilling cuttings has some effect on the physical properties, but has no noticeable effects on the metals content. Available conventional, metals, and organic water quality data for drilling cuttings is provided in Table 2-4.

2.2.5. Quantity Discharged

2.2.5.1. Rate of Discharge During Well Operation

The discharge rate of drilling fluids (muds) and cuttings during well drilling operations is quite variable. Drilling fluids are separated from the drill cuttings on the exploratory vessel and reused in the wellbore. The volume of rock cuttings produced from drilling is primarily a function of the depth of the well and the diameter of the wellbore. It has been estimated that between 0.2 bbl and 2.0 bbl (8.4 and 84.0 gal) of total drilling waste are produced for each vertical foot drilled (USEPA, 1987).

Each exploratory and delineation well in the Beaufort Sea Area of Coverage is expected to produce about 255 bbl of drilling muds and 1,520 bbl of drill cuttings (MMS, 2002). Approximately 565 bbl of drilling muds and 1,970 bbl of drill cuttings (MMS, 2002) are expected to be produced by each exploratory and delineation well in the Chukchi Sea Area of Coverage. There are no estimates of discharge rates for the Hope Basin and Norton Sound Area of Coverage since it is not predicted that any wells will be drilled in these areas. Additionally, ADNR has not estimated discharge rates for discharge to State waters. Therefore, the MMS discharge rates are used to estimate the quantity of drilling fluids and cuttings discharged under this general permit.

It is estimated that 90 percent of the wells drilled will use water-based drilling fluids. For drilling depths of 7,000 ft, it is assumed that 80 percent of the water-based drilling muds will be recycled and the remaining "spent mud" will be discharged at the exploration site. All of the cuttings would be discharged at the exploration site (MMS, 2003).

Based on the relatively shallow water depths in the area of permit coverage, an estimated 10 percent of wells drilled in the U.S. are assumed to use synthetic-based drilling fluids (USEPA, 1999b). Synthetic-based drilling fluids are prohibited from being discharged in bulk and are considered to be a valuable commodity rather than a waste regardless of whether they are used or unused (USEPA, 1999b). Thus, they are generally reused in drilling operations and discharged only as a contaminant attached to drill cuttings, known as retention on cuttings (ROC).

2.2.5.2. Estimated Quantity Discharged

2.2.5.2.1. Beaufort Sea

Under the current permit (1995-2005), 1,086-11,399 bbl drilling fluids and cuttings were discharged on a monthly average with a total 29,151 bbl based on discharge monitoring reports. Individual discharge values are provided in Table 2-6. Lease Sales 186 and 195 are expected to produce about 1,040 dry short tons of dry drilling mud and 6,300 dry short tons of cuttings per sale (MMS, 2003). Lease sale 202 is expected to produce 935 dry short tons of dry drilling mud and 5,775 dry short tons of cuttings per sale (MMS, 2003).

MMS lease sales are estimated to produce a total of 5,610 bbl drilling mud and 33,440 bbl drill cuttings while ADNDR lease sales are estimated to produce 2,475 bbl of dry drilling mud and 16,720 bbl of drill cuttings. This would result in a total discharge of 8,085 bbl drilling mud and 50,160 bbl drill cuttings in the Beaufort Sea Area of Coverage under this general permit.

2.2.5.2.2. Chukchi Sea

MMS lease sales are estimated to produce a total of 2,260 bbl drilling mud and 7,880 bbl drill cuttings. Due to the fact that there are no current operating leases in the Chukchi Sea, no estimate is available for the amount of drilling muds and cuttings expected to be discharged in contiguous State waters due to future exploratory oil and gas exploration.

2.2.5.2.3. Hope Basin

Due to the fact that there are no current operating leases in the Hope Basin, no estimate is available for the amount of drilling muds and cuttings expected to be discharged in the Hope Basin or contiguous State waters due to future exploratory oil and gas exploration.

2.2.5.2.4. Norton Sound

Due to the fact that there are no current operating leases in Norton Sound, no estimate is available for the amount of drilling muds and cuttings expected to be discharged in Norton Sound or contiguous State waters due to future exploratory oil and gas exploration.

2.2.6. Summary

There are three general categories of drilling fluid (muds) water-based, oil-based, and synthetic-based. Water-based muds are used most frequently because it is the least expensive. Oil-based muds are composed primarily of diesel oil or mineral oil, but result in lower volumes of waste discharge. Synthetic-based fluids provide the drilling performance characteristics of oil-based fluids, but have less environmental impact due to lower toxicity, elimination of PAH, faster biodegradability, lower bioaccumulation potential, and, in some drilling situations, decreased drilling waste volume.

The types of wells that may be drilled under this permit include exploration wells and delineation wells. It is estimated that 21 exploration wells and 12 delineation wells will be drilled in the Beaufort Sea Area of Coverage and 2 exploration wells and 2 delineation wells will be drilled in the Chukchi Sea Area of Coverage. No exploration wells or delineation wells are expected to be drilled in the Hope Basin or Norton Sound Areas of Coverage.

Components of concern in drilling fluids include trace metals and specialty additives used with generic and synthetic-based drilling mud systems. The majority of trace metals will remain bound to particulates in the whole mud. Specialty additives could be a source of trace metals (e.g., zinc) and petroleum hydrocarbons. Mass loadings of the additives depend on the concentrations, frequency of usage, and conditions encountered during the drilling.

It is estimated that 8,085 bbl drilling muds and 50,160 bbl drill cuttings will be discharged in the Beaufort Sea Area of Coverage and 2,260 bbl drilling mud and 7,880 bbl drill cuttings will be discharged in the Chukchi Sea Area of Coverage. No estimate is available for the amount of drilling muds and cuttings expected to be discharged in the Hope Basin, Norton Sound or contiguous State waters due to future exploratory oil and gas exploration.

2.3. MISCELLANEOUS DISCHARGES

There are three exploration discharges associated drilling wastes which are a relatively small but significant category of waste from the oil and gas extraction industry are deck drainage, sanitary waste and domestic waste. Because of their nature, these waste streams are the most likely to contain constituents of concern. The following paragraphs provide a discussion of each of these discharges.

2.3.1. Deck Drainage

Deck drainage refers to any waste resulting from platform washing, deck washing, spillage, rainwater, and runoff from curbs, gutters, and drains, including drip pans and wash areas. This could also include pollutants, such as detergents used in platform and equipment washing, oil, grease, and drilling fluids spilled during normal operations.

Deck drainage occurs when water from rainfall or from equipment cleaning comes in contact with oil-coated surfaces; the water becomes contaminated and must be treated and disposed. Oil and grease are the primary pollutants identified in the deck drainage wastestream (USEPA, 1993a). In addition to oil, various other chemicals used in drilling operations may be present in deck drainages. The chemicals may include drilling fluids, ethylene glycol, lubricants, fuels, biocides, surfactants, detergents, corrosion inhibitors, cleaners, solvents, paint cleaners, bleach, dispersants, coagulants, and any other chemical used in the daily operations of the facility (Dalton, Dalton, & Newport, 1985).

2.3.1.1. Characteristics of Untreated Deck Drainage

Untreated deck drainage can contain oil and grease in quantities ranging from 12 to 1,310 milligrams per liter (mg/L). Ranges for other pollutant quantities in untreated deck drainage are provided in Table 2-5.

2.3.1.2. Control and Treatment Technology

The major factors in the performance of control and treatment technology are salt content, solid content, chemical content, oil content, temperature, oil density, oil viscosity and wax content, and oil droplet size (USEPA, 1993a). A typical facility is equipped with drip pans and gutters to collect deck and drilling flow drainage. The drainage is collected in a sump where the water and oil are separated by a gravity separation process. Oil in the sump tank is recovered and transferred to shore via pipeline or reinjected to the formation. The water from the sump is discharged to the ocean via a skim pile. Skim piles remove that portion of oil which quickly and easily separates from water. They are constructed of large diameter pipes containing internal baffled sections and an outlet at the bottom. During the period of no flow, oil will rise to the quiescent areas below the underside of inclined baffled plates where it coalesces. Due to the differences in specific gravity, oil floats upward through oil risers from baffle to baffle. The oil is collected at the surface and removed by a submerged pump. These pumps operate intermittently and will move the separated oil to a sump tank.

2.3.1.3. Estimated Quantity Discharged

Deck drainage discharges are not continuous discharges and they vary significantly in volume. At times of platform washdowns, the discharges are of relatively low volume and are anticipated. During rainfall events, very large volumes of deck drainage may be discharged in a very short period of time. Deck drainage is a concern particularly in areas with high precipitation; however, the low Arctic temperatures prevent high volumes of deck drainage since operations occur mainly in the winter months and precipitation drainage is expected to occur only during summer months. Under the current permit, discharge quantities varied from 12 to 78,193 gallons per day (gpd) (Individual discharge values are provided in Table 2-6.). While it is expected that only small quantities (less than 300 gpd) of deck drainage would occur during the effective period of this permit, it is possible that higher quantities (~75,000 gpd) may occur as shown by past discharges. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of deck drainage quantities discharged.

2.3.2. Sanitary and Domestic Waste

While some platforms discharge sanitary and domestic wastes separately, many combine these waste streams prior to discharge. Therefore, this section will discuss sanitary waste, domestic waste and the combined waste. Sanitary waste is human body waste discharged from toilets and urinals. It consists of secondary treated chlorinated effluent. Domestic waste (gray water) refers to materials discharged from sinks, showers, laundries, safety showers, eyewash stations, and galleys. Gray water can include kitchen solids, detergents, cleansers, oil and grease. Domestic waste also includes solid materials such as paper and cardboard which must be disposed of properly. Domestic waste is sometimes reused to make drilling mud rather than being discharged directly into receiving waters.

2.3.2.1. Characteristics of Sanitary and Domestic Wastes

The concentration of sanitary wastes varies widely with time, occupancy, platform characteristics and operational situation. Pollutants of concern in untreated sanitary waste include biochemical oxygen demand (BOD), total suspended solids (TSS), coliform, and residual chlorine. Typical concentrations of these pollutants in treated effluent are 30 mg/L, 40 mg/L, 180 colonies per 100 milliliters (colonies/100 mL) and 1.7 mg/L, respectively (USEPA, 1993a).

Pollutants of concern with untreated domestic waste include BOD and TSS. Typical concentrations of these pollutants in treated effluent are 195 and 140 mg/L, respectively (USEPA, 1993a).

2.3.2.2. Control and Treatment Technology

There are two alternatives to handling of sanitary wastes from offshore facilities. The wastes can be treated at the offshore location or they can be retained and transported to shore facilities for treatment. Due to remote areas of operation and storage limitations, most offshore facilities usually treat and discharge sanitary wastes at the source. The treatment systems presently in use may be categorized as physical/chemical and biological.

It is often necessary to utilize macerators with domestic wastes to prevent the release of floating solids. Chlorination is not necessary since these wastes do not contain coliforms. Additionally, the permit prohibits the discharge of foam and garbage.

The NPDES permit controls these discharges as follows:

- BOD and TSS must have an average monthly concentration less than 30 mg/L, an average weekly concentration less than 45 mg/L and a maximum daily average concentration less than 60 mg/L.
- Coliform counts must be less than 200 colonies/100 mL on a daily basis and 100 colonies/100 mL on an average monthly basis.
- Chlorine residual concentrations must be less than 1.0 mg/L in Federal waters and in State waters when a mixing zone is authorized, and less than 0.0075 mg/L within State waters when no mixing zone is authorized.
- Sanitary and domestic wastes within State waters are limited to 2,500 gpd per rig. There is no limit on the quantity of sanitary and domestic wastes in Federal waters.

2.3.2.3. Estimated Quantity Discharged

The volume of sanitary wastes varies widely with time, occupancy, platform characteristics, and operational situation. Discharge of sanitary waste from an Alaskan offshore oil rig is usually less than 600 gpd based on discharge monitoring reports. Individual discharge values are provided in Table 2-6.

The volume of domestic waste discharged has been estimated to range from 50 to 100 gal per person per day (USEPA, 1993a). Discharge of domestic waste from an Alaskan offshore oil rig is usually less than 6,000 gal per day based on discharge monitoring reports. Individual discharge values are provided in Table 2-6.

Combined sanitary and domestic waste discharge rates of 868 to 75,150 gpd have been reported for Arctic Alaska platforms based on discharge monitoring reports. Individual discharge values are provided in Table 2-6. It is estimated that discharges of sanitary and domestic wastes will be less than 6,000 gpd per rig for the effective period of this permit.

2.4. MINOR DISCHARGES

The term "minor" discharges is used to describe all point sources originating from offshore oil and gas drilling operations other than drilling fluids, drill cuttings, deck drainage, and sanitary and domestic wastes. The following sections identify these discharges followed by a brief description.

2.4.1. Blowout Preventer Fluid

The blowout preventer is a device designed to contain pressures in the well that cannot be contained by the drilling mud. It may be located on the sea floor or on the drilling platform and is designed to maintain the pressure in the well that cannot be controlled by the drilling mud. Fluid on the blowout preventer may be discharged in small quantities when the blowout preventer is actuated on the hydraulic equipment, usually during testing of the blowout preventer device. Generally, this may occur on a weekly basis. The general permit prohibits the discharge of free oil in this waste stream.

The primary constituents of blowout preventer fluid are oil (vegetable or mineral) or an antifreeze solution (ethylene glycol and water). The volume of blowout preventer fluid discharge has been estimated to range from 67 to 314 bbl/day (USEPA, 1993a). It is estimated that discharges of blowout preventer fluid will be less than 325 bbl/day, when discharged. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of blowout preventer fluid quantities discharged.

2.4.2. Desalination Unit Waste

Desalination Unit Waste is wastewater, residual high-concentration brine, associated with the processes, distillation or reverse osmosis units, used in creating freshwater from seawater. The concentrate is similar to sea water in chemical composition; however, anions and cations concentrations are higher. The general permit prohibits the discharge of free oil in this waste stream.

Discharge from desalination units may vary greatly depending on the freshwater needs of the rig. Under the current permit, discharge quantities varied from 174 to 140,000 gpd based on discharge monitoring reports; individual discharge values are provided in Table 2-6. It is estimated that discharges from the desalination unit will be less than 140,000 gallons per day per rig. Additives discharged with desalination wastes include cleanser (up to 330 gal/month), water purifier (up to 2 gal/month), and acidifier/scale remover (up to 15 lb/month). This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of desalination unit waste quantities discharged.

2.4.3. Fire Control System Test Water

Fire control system test water is sea water that is released during the training of personnel in fire protection, and the testing and maintenance of fire protection equipment on the platform. This test water may be treated with a biocide. Recommended dosages are very situation-dependent and can vary from 1.0 to as high as 1,200 ppm. There are, however, little or no quantitative data on biocide concentrations in this discharge. There are, however, little or no quantitative data on biocide concentrations in this discharge.

Under the current permit, discharge quantities varied from 43 to 360 gpd based on discharge monitoring reports; individual discharge values are provided in Table 2-6. Therefore, it is estimated that discharges of fire control system test water will be less than 360 gpd when discharged. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of fire control system test water quantities discharged. The general permit also requires the permittee to provide an annual inventory of the type (product name) and quantity of biocides and chemicals (other than water or seawater) added to this discharge. Additionally, the general permit prohibits the discharge of free oil in this waste stream.

2.4.4. Non-Contact Cooling Water

Non-contact cooling water is sea water that is used for non-contact, once-through cooling of various pieces of machinery (e.g., power generators) on the platform. Biocides can be used to control biofouling in heat exchanger units. Recommended dosages are very situation-dependent and can vary from 1.0 to as high as 1,200 ppm. There are, however, little or no quantitative data on biocide concentrations in this discharge.

The volume of non-contact cooling water required for drilling operations can vary depending on the system used. Discharges of non-contact cooling water from an Alaskan offshore oil rig is approximately 210,000 gpd based on discharge monitoring reports. Individual discharge values are provided in Table 2-6. Therefore, it is estimated that discharges of non-contact cooling water will be less than 210,000 gpd when discharged. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of non-contact cooling water quantities discharged. The general permit also requires the permittee to provide an annual inventory of the type (product name) and quantity of biocides and chemicals (other than water or seawater) added to this discharge. Additionally, the general permit prohibits the discharge of free oil in this waste stream.

2.4.5. Ballast Water

Uncontaminated ballast water is seawater added or removed to maintain the proper ballast floater level and ship draft. It may be contaminated with oil, but usually can be discharge without treatment. Oily water can either be treated through the oil/water separation process or with a

small amount of dissolved aromatic constituents through molecular diffusion at the oil-water surface prior to discharge. The general permit prohibits the discharge of any materials that may cause a visible sheen of oil.

Under the current permit, discharge quantities varied from 40 to 2,254,000 gpd based on discharge monitoring reports; individual discharge values are provided in Table 2-6. Therefore, it is estimated that discharges of ballast water during the effective period of this permit will be highly variable, but less than 2.5 million gallons per day (mgd). This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of ballast water quantities discharged.

2.4.6. Bilge Water

Bilge water is seawater which collects in the lower internal parts of the drilling vessel hull. It becomes contaminated with oil and grease and with solids such as rust when it collects at low points in the bilges. It is usually treated with an oil/water separator to remove oil prior to discharge. The general permit prohibits the discharge of any materials that may cause a visible sheen of oil.

Two reported values of bilge water discharges from an Alaskan offshore rig are 195 and 270 gpd. Therefore, it is estimated that discharges of bilge water under this general permit will be less than 270 gpd when discharged. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of bilge water quantities discharged.

2.4.7. Boiler Blowdown

Boiler blowdown is the discharge of water and minerals drained from boiler drums to minimize solids build-up in the boiler. Although boiler blowdown discharges are not planned or likely to occur, they may occur intermittently. The general permit prohibits the discharge of free oil in this waste stream.

Under the current permit, discharge quantities varied from 174 to 140,000 gpd based on discharge monitoring reports; individual discharge values are provided in Table 2-6. Therefore, it is estimated that discharged quantities under this general permit will be highly variable, but will not be greater than 140,000 gpd when discharge. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of boiler blowdown quantities discharged.

2.4.8. Test Fluids

Test fluids are discharges that occur if hydrocarbons located during exploratory drilling are tested for formation pressure and content, usually at the completion of drilling. This would consist of fluids sent downhole during testing, along with water from the formation. The

discharge may consist of formation water, vegetable or mineral oil, natural gas, formation sands, any added acids or chemicals, or any combination thereof (USEPA, 1985). Test fluids are generally stored and treated with acid to remove oil before being discharged. The addition of strong acidic solutions downhole could cause substantial leaching of heavy metals from the formation and residual drilling mud.

The NPDES permit controls these discharges as follows:

- Oil and grease must have an average monthly concentration less than 29 mg/L and a maximum daily average concentration less than 42 mg/L.
- The pH must be between 6.5 and 8.5 standard units.
- Free oil is prohibited from being discharged.

There is currently no data available on the quantity of test fluids discharged in the Arctic; thus, it is difficult to predict quantities that will be discharged under this permit. This general permit requires the facilities to report total quantity discharged to provide a more adequate future analysis of test fluid quantities discharged.

2.4.9. Excess Cement Slurry

Excess cement slurry will result from equipment washdown after cementing operations. Excess cement slurry is discharged intermittently while drilling, depending on drilling, casing, and testing program and problems.

Under the current permit, discharge quantities varied from 43 to 9,129 gpd based on discharge monitoring reports; individual discharge values are provided in Table 2-6. Therefore, it is estimated that discharged quantities under this general permit will be highly variable, but will not be greater than 10,000 gpd when discharge. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of excess cement slurry quantities discharged.

2.4.10. Mud, Cuttings, Cement at Seafloor

Mud, Cuttings, Cement at Seafloor are materials discharge at the surface of the ocean floor in the early phases of drilling operations, before the well casing is set, and during well abandonment and plugging. This discharge is results from the marine riser disconnect and well abandonment and plugging. Aside from cement, cement extenders, accelerators, and dispersants are the main chemicals added to this discharge.

There is only one reported value of this discharge from an Alaskan offshore oil and gas facility of 94,000 gpd. Therefore, it is estimated that discharges of mud, cuttings, and cement at the seafloor under this general permit will be less than 94,000 gpd per well drilled. This general permit requires the facilities to report total quantity discharged rather than flow rates to provide a more adequate future analysis of bilge water quantities discharged.

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3.0 TRANSPORT, PERSISTENCE, AND FATE OF MATERIALS DISCHARGED

The primary materials discharged during drilling activities that are of concern to the marine environment include water-based drilling fluids (muds), specialty additives, and cuttings; the general NPDES permit prohibits the discharge of synthetic-based drilling fluids. Therefore, this analysis only discusses the transport, persistence and fate of water-based drilling fluids, specialty additives, and cuttings discharged to the marine environment.

Drilling fluids (muds) contain quantities of coarse material, fine material, dissolved solids, and free liquids. This mixture rapidly separates in the receiving water into upper and lower plumes, probably from shear forces and local turbulent flow at the discharge pipe (USEPA, 2000a). The upper plume contains about five to seven percent, by weight, of the total drilling fluid discharge (Ayers et al. as cited in USEPA, 1985). A lower plume contains the majority of the discharged materials.

Upon discharge, much of the discharged drilling muds and cuttings will initially reach the seafloor within a few hundred meters from the drilling platform. The thickness of the cuttings pile would decrease with distance from the platform. Finer materials, (e.g., barite and clays) associated with the cuttings, may extend further out from the platform. The subsequent fate of the upper and lower plumes will depend primarily on the physical processes (discussed in Section 3.1) that dilute, resuspend and transport particulates or entrain them into the sediments. Chemical or biological factors (discussed in Sections 3.2 and 3.3, respectively) significant for changes produced in the structure and/or speciation of materials that affect their bioavailability and toxicity and could also be important in stabilizing or mobilizing the material on the seafloor (e.g., through covalent binding of sediments or bioturbation).

3.1. PHYSICAL TRANSPORT PROCESSES

Physical processes include currents, mixing, settling, and diffusion. Factors influencing the physical transport and persistence of discharged drilling muds and cuttings include climate and meteorology, oceanography, characteristics of the discharge (discussed in Section 2.2), depth of discharge, discharge rate (discussed in Section 2.2), and method of disposal. Because ice covers the Arctic region during most of the year, three disposal methods are discussed in this section: open water disposal, on-ice disposal, and below-ice discharge. Shunting, the extension of the discharge outlet well below the sea surface, of drilling mud discharges is also discussed in this section.

Field studies and models of the behavior of drilling fluids and cuttings discharged to the marine environment have focused on several aspects of their fate. Among these aspects are: the transport of discharged materials in the water column, both for particulate and soluble components; deposition on the seafloor; and considerations of benthic short- and long-term fate. Field studies are discussed in Section 3.1.5 and predictive models are discussed in Section 3.1.6.

In the drilling process, rock fragments (cuttings) are brought to the surface in the drilling fluid (muds). These cuttings pose a problem both in the large volume produced and the muds that coat the cuttings as they are extracted. Oil-based fluids have the added stigma of having oil frequently coating the cuttings.

Drilling mud disposal generally becomes an issue at the end of the drilling process. However, sometimes drilling mud is disposed of during the drilling process when the mud viscosity or density needs to be changed to meet the demands of formation pressures. This can create special concerns for offshore operations where the disposal of a large volume of mud over a short period can create a mud blanket on the seafloor that can have an impact on benthic organisms. Industry is limited to using barite stock for the making of drilling mud, which passes 40 CFR 435 requirements [less than or equal to 1 microgram per kilogram ($\mu\text{g}/\text{kg}$) dry weight maximum mercury and 3 milligrams per kilogram (mg/kg) dry weight maximum cadmium].

The muds are combined, however, with dissolved and suspended contaminants including mercury, cadmium, arsenic and hydrocarbons (typically found in trace amounts). The additives listed in Section 2.2, above, may be found in waste mud, and components from the formation, such as hydrogen sulfide and natural gas, may also be dissolved in the mud. Rock cuttings from the formations overlying the target formation may contribute contaminants to the drilling mud such as arsenic or metals. Also rock cuttings create a large volume of waste and for water-based fluids the rock cuttings may be discharged to surface waters offshore. Oil-based mud will also contain diesel oil that must be disposed of properly, or more typically, conditioned for reuse. Oil-based muds and cuttings cannot be discharged to surface waters. Both oil-based and synthetic-based fluid are conditioned and reused, which reduces waste volume from drilling operations.

3.1.1. Climate and Meteorology

The Area of Coverage is located in the Arctic and subarctic climate zones. Important meteorological conditions include air temperature, precipitation (rain and snowfall), and wind speed and direction. Air temperature controls the ice formation and break-up, precipitation determines the quantity and concentration of pollutants discharged in deck drainage discharges, and wind speed and direction control coastal oceanographic conditions (ice distribution, current speed and direction, vertical and horizontal mixing, and wave action).

3.1.1.1. Air Temperature

Mean annual temperature in the Beaufort Sea is about -12°C (10°F). Air temperatures generally remain below freezing from September through May; December through March is usually the coldest period.

Along the Chukchi Sea coast north of Point Hope, the average summer temperature range is from -2 to 12°C (28 to 54°F), and the average winter temperature ranges from -33 to -6°C (-27 to 21°F).

Mean temperatures within the Norton Basin vary between -15 and -17°C in January and between 10 and 13°C in July (MMS, 1982).

3.1.1.2. Precipitation

Rainfall occurs infrequently in the summer months (July, August and September) averages less than 30 millimeters (mm) per month (Hummer in MMS, 2003). Most of the snow falls during September and October, when there is still open water on the Beaufort Sea to provide a source of moisture. The typical amount of snow received in this region is equivalent to approximately 2.1 centimeters (cm) [0.8 inches (in)] of precipitation. The average annual precipitation within the area of coverage ranges from 13 to 38 cm (5 to 15 in). Annual precipitation averages between 35.5 and 41.6 cm (14 to 17 in). Most of the rainfall is recorded in the months of July, August and September.

3.1.1.3. Winds

The Arctic region is a particularly harsh environment, especially during winter (roughly October to May) when the sun remains below the horizon for 49 consecutive days. With the ocean to the north and level tundra to the south, there are no downslope drainage areas to aid the flow of cold air to lower levels, and no natural wind barriers to reduce wind velocities.

The dominant wind direction in the open-water season is easterly to northeasterly with an average wind speed of 5 meters per second (m/s) in Stefansson Sound; wind speeds greater than 8 m/s fully mix the vertical column of water in Stefansson Sound (MMS, 2003). During winter, the area of coverage lies between a semipermanent high-pressure system to the north and a low-pressure system located to the south over the Gulf of Alaska. The northerly high-pressure system results in clear to partly cloudy skies much of the time. Strong westerlies are a common feature of this region in winter. Cold stable air moving from the north is stacked against the Brooks Range and results in a west wind parallel to the mountains. The strength and dominance of the westerly winds increase as the Brooks Range is approached. Stations to the east of Prudhoe Bay have more frequent westerly winds than stations to the west, such as Barrow. The average wind speeds are 4-6 m/s (MMS, 2003).

Surface winds along the coast between Point Lay and Barrow commonly blow from the east and northeast, while winds at Cape Lisburne are predominantly from the east and southeast. Coastal wind speeds are typically between 4 to 8 m/s [8 to 16 knots (kn)], with winds exceeding 8 m/s (16 kn) occurring less than 4 percent of the time (MMS, 1991).

Observed win directions over the area are seasonally variable and range from an average summer flow of 7 to 10 kn from the south and southwest to a winter flow, which averages 10 to 15 kn from the east and southeast.

3.1.1.4. Changes in Arctic Climate

Currently, the causes of the changes in the arctic climate are not well understood; they could be cyclical, a trend, or a modal shift. For the purposes of this evaluation, it is assumed that the changes are a trend.

Over the entire Arctic Ocean, the annual trend in surface-air temperature shows a warming of about 1.0° C per decade in the eastern Arctic, whereas the western Arctic shows no trend or even a slight cooling. During fall, the trends show a cooling of about 1.0° C per decade while spring shows a significant warming trend of 2° C per decade. Summer shows no significant trend in warming or cooling. [MMS, 2003]

Additionally, the cold halocline layer, which insulates the sea ice from the relatively warm Atlantic waters, appears to have retreated from the Eurasian Basin in recent years. This may be a result of atmospheric circulation anomalies causing a diversion of Russian river runoff and has important consequences for ice/ocean heat exchange and ice growth rates. [MMS, 2003]

3.1.2. Oceanography

Oceanographic considerations include tides, wind, freshwater overflow, ice movement, stratification, and current regime. The oceanographic and meteorologic conditions affecting dilution and dispersion for the Beaufort and Chukchi seas, and Hope and Norton Basins will be briefly summarized below and will include relevant information on conditions with the coastal waters of each of these areas.

3.1.2.1. Bathymetric Features and Water Depths

The Area of Coverage includes the continental shelf, slope, and rise of the Alaskan Beaufort Sea. Depths in the Beaufort Sea Area of Coverage range from 0 (at mean lower low water – MLLW) to 1,500 m (4,921 ft). The major bathymetric features include: the barrier islands and shoals; the continental shelf, slope, and rise; and abyssal plain.

Barrier islands serve two main functions: first, they protect the coastlines from severe storm damage; and second, they harbor several habitats that are refuges for wildlife. The salt marsh ecosystems of the islands and the coast help to purify runoffs from mainland streams and rivers. Each of these habitats has distinct animal and plant life that will be discussed in Section 4.0. Barrier islands are constantly changing; they are influenced by the following conditions:

- **Waves** - deposit and remove sediments from the ocean side of the island
- **Currents** - longshore currents that are caused by waves hitting the island at an angle can move the sand from one end of the island to another. For example, the offshore currents

along the east coast of the United States tend to remove sand from the northern ends of barrier islands and deposit it at the southern ends.

- **Tides** - move sediments into the salt marshes and eventually fill them in. Thus, the sound sides of barrier islands tend to build up as the ocean sides erode.
- **Winds** - blow sediments from the beaches to help form dunes and into the marshes, which contributes to their build-up.
- **Sea level changes** - rising sea levels tend to push barrier islands toward the mainland
- **Storms** - storms have the most dramatic effects on barrier islands by creating overwash areas and eroding beaches as well as other portions of barrier islands.

Most of the barrier islands in the Arctic are narrow (less than 250 m) and have low elevations (less than 2 m) [MMS, 2003].

The continental shelf is a gently sloping submerged plain that is an underwater extension of the coastal plain. This is where virtually all of the petroleum and fishery resources are found. The continental slopes begin at the shelf break and plunge downward to the great depths of the ocean basin proper. Deep submarine canyons are sometimes found cutting across the shelf and slope, often extending from the mouths of terrestrial rivers. Many continental slopes end in gently sloping, smooth-surfaced features called continental rises. The continental shelf, slope, and rise together are called the continental margin.

Continental shelves vary in width from almost zero up to the 1,500-km-wide [930 miles (mi)] Siberian shelf in the Arctic Ocean and average 78 km (48 mi) in width. The edge of the shelf occurs at a depth that ranges from 20 to 550 m (66 to 1,800 ft), averaging 130 m (430 ft). The shelves consist of vast deposits of sands, muds, and gravels, overlying crystalline rocks or vast thicknesses of consolidated sedimentary rocks. Although there is a great variation in shelf features, non-glaciated shelves are usually exceptionally flat, with seaward slopes averaging on the order of 205 meters per kilometer (m/km) [10 feet per mile (ft/mi)], or less than 1° of slope. The edge of the shelf, called the shelf break, is marked by an abrupt increase in slope to an average of about 4°. The continental slope in the Beaufort Sea has water depths varying from 60 (197 ft) to 1,500 m (4,921 ft). The major submarine canyon in the Beaufort Sea is the Barrow Canyon just northeast of Barrow, Alaska (MMS, 2003). The continental rises usually have an inclination of less than 1/2°. They have been found to consist of thick deposits of sediment, presumably deposited as a result of slumping and turbidity currents carrying sediment off the shelf and slope.

Abyssal plains are a broad, relatively flat expanse of sea floor lying 3 to 6 km (2 to 4 mi) below sea level. Abyssal plains are found in all the major oceans, and they extend from bordering continental rises to mid-oceanic ridges. Abyssal plains are covered in a thick layer of sediment, and their flatness is punctuated by rugged low abyssal hills and high sea mounts.

The coastal waters of the Chukchi Sea are relatively deeper and more steeply sloped than those of the Beaufort Sea and are dominated by barrier island protected bays and points and capes that extend from the coast and occasionally form protected bays. Within the Chukchi Sea Area of Coverage, the continental shelf is broad, has low relief, and is gently incline to the north (MMS 1991). The entire area of coverage is located on the continental shelf in water depths from 6 to

80 m (20 to 262 ft). Approximately 80 percent of the area lies in water depths between 30 and 60 m (98 and 197 ft).

The bathymetry of the Bering Sea can be divided into two primary regions: a shelf region (less than 150 m deep) to the northeast, and a deeper plain (3,700 to 4,000 m deep) to the southwest. Depths in Norton Sound vary from less than 10 m in the southern portion to more than 30 m in a trough-like feature which extends east-west in the nearshore region south of Nome. In Norton Sound, the marine bottom is relatively featureless and slopes gradually westward to depths of about 30 m. The bathymetry of the sound changes with major shifts in substrate in response to storm surges and ice gouging.

3.1.2.2. Circulation

The circulation in the Beaufort Sea can be divided into two main areas: nearshore (water depths less than 40 m; and offshore (water depths greater than 40 m). Offshore waters are primarily influenced by the large-scale arctic circulation known as the Beaufort Gyre, which is driven by large atmospheric pressure fields. In the Beaufort Gyre, water moves to the west in a clockwise motion at a mean rate of 5-10 cm per second.

There are two distinct periods for nearshore circulation: open water and ice covered. The open water circulation depends mostly on the direction (rather than speed) of the wind; the two dominant wind directions are northeast and southwest (Morehead et al. as cited in MMS, 2003). The nearshore surface currents respond quickly, within 1-3 hours, to changes in the wind direction (MMS, 2003).

In nearshore circulation, easterly winds cause surface currents to flow west and westerly winds cause surface currents to flow east. The mean surface current direction year-round is to the west and parallels the bathymetry. The tidal action coupled with the easterly nearshore circulation results in the gradual removal of warm, brackish water from the nearshore and replaces it with colder, more saline water. Alternatively, the tidal action coupled with westerly nearshore circulation causes the accumulation of warm, brackish water along the coast. Other controls on nearshore circulation include river discharge, ice melt, bathymetry, and the configuration of the coastline.

During ice covered periods, the landfast ice in the nearshore areas protects the water from the effects of the winds. Therefore, the circulation pattern is influenced by storms and brine drainage (MMS, 2003).

The Chukchi Sea is fed by Pacific waters and Arctic waters. Pacific waters enter the Chukchi Sea through the Bering Strait in the south. Arctic waters enter the Chukchi Sea through Long Strait and in episodic up-shelf transfers from the Arctic ocean proper (e.g., via Barrow Canyon). The circulation and modification of waters in the Chukchi Sea influences the input to the Arctic Ocean from the Pacific.

In Norton Sound, the circulation is weakly cyclonic [~ 1.0 centimeters per second (cm/s)]. During open water season, the fresh water runoff causes water-column stratification that dictates the circulation in Norton Sound. As a result, the upper layer circulation is largely uncoupled from that of the lower layer.

3.1.2.3. Currents

The direction of the current determines the predominant location of potential impacts, while current velocity influences the extent of area affected. Velocity and boundary conditions also affect mixing because turbulence increases with current speed and proximity to the seafloor. Current velocity and turbulence can vary markedly with location/site characteristics and affect the movement and concentration of suspended matter, and entrainment/resuspension/advection of sedimented matter.

The Beaufort Undercurrent is below the surface waters on the continental slope. It moves to the east with frequent reversals to the west. The Beaufort Undercurrent is part of a larger cyclonic circulation transporting Atlantic water to the Canadian Basin. Long-term mean speeds of the undercurrent are about 5-10 cm/s, but daily mean values may be 10-times greater. [MMS, 2003]

The area lying to the north and west of Point Barrow may be strongly influenced by the Alaskan coastal current. This easterly flowing countercurrent enters the Beaufort Sea along Barrow Canyon to the west of Point Barrow. The current is a continuation of flow that begins as far south as the Bering Sea, and flows through the Bering Strait northward along the coast of the Chukchi Sea, where it turns toward the east near Point Barrow. At Point Barrow, the current moves offshore and lies at depths between 50 and 200 m (160 to 660 ft). Barrow Canyon mean currents range from 14-23 cm/s, with maximum current speeds of approximately 100 cm/s (Weingartner et al. as cited in MMS, 2003).

The currents in the Chukchi Sea are strongly influenced by the bathymetry and wind. Current speeds of 20 to 30 cm/s (0.66 to 1.0 cm/s) are characteristic of the eastern Chukchi Sea. Bottom temperature gradients and currents are greatest in the vicinity of Icy Cape and Pt. Franklin (Weingartner in MMS, 1991). Current velocities of 51 to 87 cm/s have been reported south of Icy Cape (MMS, 1990). The influence of Kotzebue Sound on the Chukchi Sea current may be significant. Input of the water runoff into Kotzebue Sound may reinforce the Alaska Coastal Current (MMS, 1990).

The Alaska Coastal Current (ACC) is a narrow, fast-moving current flowing northeasterly along the Alaska coastline. North of Cape Lisburne, the ACC parallels the 20-meter isobath until it reaches the Barrow Sea Valley at Wainwright. It then follows parallel with the valley from Wainwright to Point Barrow where it turns and flows southeasterly parallel to the coastline. The ACC flow is variable and directional reversals can persist for several weeks due to changes in wind direction. During northeasterly flow, clockwise eddies can separate the nearshore circulation from the ACC between Cape Lisburne and Icy Cape (MMS, 1990).

During open-water periods, the onshore and offshore of nearshore water is driven by the wind. Northeasterly winds promote upwelling that brings cooler bottom water into the nearshore area. Southwesterly winds establish a warm coastal jet in the nearshore region and remove the cooler bottom water. Easterly winds shift the ACC offshore, centering it approximately 20 km from the coast. Westerly winds shift the ACC closer to the coast. [MMS, 1990]

The currents across the mouth of Norton Sound are on the order of 10 cm/s toward the north, with noticeable coherence between top and bottom layers. While net flow is to the north, reversals can occur, depending on atmospheric pressure difference between the Arctic and Bering Seas (MMS, 1982).

3.1.2.4. Tides

Tides in nearshore waters are semi-diurnal of low amplitude (range is 6-10 cm) and influenced by the wind (MMS, 2003). Offshore tides are nearly nonexistent. Tidal currents within Norton Sound are predominantly diurnal, except near the entrance where semi-diurnal components are also important. The magnitude of the tidal excursion ranges from negligible near the vicinity of the shorefast ice to approximately 13 km in the middle of Norton Sound. The exception is intermediate excursions in the vicinity of the Yukon Delta and Nome (Pearson et al. in MMS, 1982). Tidal height records indicate ranges of 1.6 to 6.8 ft within the Norton Sound Area (MMS, 1982).

3.1.2.5. Stratification, Salinity, and Temperature

Nearshore waters are influenced by fresh water from rivers; a two-layered system is formed with fresher water from riverine input overlying more saline oceanic water. The surface layer shows a marked decrease in salinity in the vicinity of major rivers, such as the Sagavanirktok, Kuparuk, and Colville Rivers. In the winter, the lack of freshwater input into coastal waters results in only weak stratification. Freshwater input also causes a marked division between nearshore and offshore waters occurring at the 6 m (20 ft) isobath. Alaska Coastal Water temperatures range between 5-10° C and has salinities that are generally less than 31.5 parts per thousand (Lewbel and Gallaway in MMS, 2003). Offshore waters are colder and more saline than the Alaska Coastal Water. Water temperatures are near 0°C and have salinities of 32.2-33 parts per thousand (ppt) (Lewbel and Gallaway in MMS, 2003).

3.1.2.6. Sea Ice

Sea ice is frozen seawater that floats on the ocean surface, and forms and melts with the polar seasons. In the Arctic, some sea ice persists year after year, whereas almost all Southern Ocean or Antarctic sea ice is "seasonal ice," meaning it melts away and reforms annually. Sea ice in the Arctic appears to play a crucial role in regulating climate because it regulates exchanges of heat,

moisture and salinity in the polar oceans. It insulates the relatively warm ocean water from the cold polar atmosphere except where cracks, or leads, in the ice allow exchange of heat and water vapor from ocean to atmosphere in winter.

Ice thickness, its spatial extent, and the fraction of open water within the ice pack can vary rapidly and profoundly in response to weather and climate. In the Arctic, sea ice typically covers about 14 to 16 million square kilometers (km²) in late winter; the seasonal decrease at summer's end is approximately seven to nine million square kilometers. Satellite data provide the best means of observing sea ice coverage and variability. A variety of remote sensing instruments have been used successfully to map sea ice conditions, but frequent cloud cover in the polar regions and the fact that the sun remains below the horizon for continuous periods in winter require microwave sensors to map ice cover.

There are four major zones of sea ice in the Arctic: landfast ice, stamukhi (or shear) ice, pack-ice, and oceanic ice. Each of these zones is discussed below.

3.1.2.6.1. Landfast-Ice Zone

Landfast ice, or fast ice, which is attached to the shore, is relatively immobile and extends to variable distances off shore; generally 8 to 15-m isobaths, but may extend beyond the 20-m isobath. It is usually reformed yearly, although it can contain floes of multiyear pack ice. Much of the fast ice melts within the 10-m isobath during the summer, but it is very dependent upon the wind direction which controls the ice floes. The two types of landfast ice are bottomfast and floating. Bottomfast ice is frozen to the bottom out to a depth of about 2 m. The remaining ice is floating. [MMS, 2003]

3.1.2.6.2. Stamukhi Ice Zone

Seaward of the landfast-ice zone is the stamukhi, or shear, ice zone. In this zone, large pressure ridges and rubble fields occur between the stationary landfast ice and the mobile pack ice when winds drive the pack ice into the landfast ice. The ridges can reach depths of 25 m and act as sea anchors for the landfast ice. In the Beaufort Sea, the most ridging occurs in waters that are 15-45 m deep. This zone also contains many leads that are formed between the landfast ice and the pack ice when offshore winds carry loose ice away from consolidated ice. [MMS, 2003]

3.1.2.6.3. Pack-Ice Zone

Pack ice is located seaward of the stamukhi ice zone and includes first-year ice, multiyear undeformed and deformed ice, and ice islands. First year ice forms in fractures, leads and polynyas (large areas of open water) and varies in thickness from a few centimeters to more than a meter. Leads are formed from southwesterly storms in the Beaufort Sea. Along the western Alaskan coast between Point Hope and Point Barrow, there is often a band of open water seaward of the landfast-ice zone during winter and spring. The Chukchi open-water system

appears to be the result of the general westward motion seen in the Beaufort Gyre and strongly influenced by the wind direction. [MMS, 2003]

Multiyear undeformed ice may reach thicknesses of 3-5 m and has ice floes with diameters greater than 500 m that make up 60 percent of the pack-ice zone. Some multiyear undeformed ice floes have diameters up to 10 km (MMS, 2003).

Multiyear deformed ice is identified by ridges that occur shoreward of the 20-meter isobath with typical heights of 1-2 meters, but can reach heights over 6 meters. There is increased ridging from east to west and generally in the vicinity of shoals and large necks of land (MMS, 2003).

Ice islands are icebergs that have broken off from an ice shelf with a thickness of 30-50 m and from a few thousand square meters to 500 km² in area. Ice islands often have an undulated surface, which gives them a ribbed appearance from the air (Armstrong et al., 1973).

Movement of the floating ice is controlled by atmospheric systems and oceanographic circulation. During the winter, movement is small and occurs with strong winds that last for several days. The long-term direction of ice movement is from east to west in response to the Beaufort Gyre; however, there may be short-term variations due to weather systems.

3.1.2.6.4. Oceanic Ice

Bering Sea ice is quite mobile and flows predominantly from the Bering Strait towards the southern Bering Sea. It consists of a mixture of multiyear floes with annual ice and can be completely replaced from three to ten times in any given ice season. As a collective canopy of ice, it rarely covers the northern Bering as a solid sheet of ice. Under certain conditions, Bering Sea ice can enter Norton Sound.

3.1.2.6.5. Changes in Arctic Ice

In recent years, satellite data have indicated an even more dramatic reduction in regional ice cover. In September 2002, sea ice in the Arctic reached a record minimum (Serreze et al., 2003), 4 percent lower than any previous September since 1978, and 14 percent lower than the 1978-2000 mean. In the past, a low ice year would be followed by a rebound to near-normal conditions, but 2002 has been followed by two more low-ice years, both of which almost matched the 2002 record. Taking these three years into account, the September ice extent trend for 1979-2004 is declining by 7.7 percent per decade (Stroeve et al., 2005).

Fossil fuel consumption and the resulting increase in global temperatures could explain sea ice decline, but the actual cause might be more complicated. The Arctic Oscillation (AO) is a seesaw pattern of alternating atmospheric pressure at polar and mid-latitudes. The positive phase produces a strong polar vortex, with the mid-latitude jet stream shifted northward. The negative phase produces the opposite conditions. From the 1950s to the 1980s, the AO flipped between positive and negative phases, but it entered a strong positive pattern between 1989 and 1995. This flushed older, thicker ice out of the Arctic, leaving the region with younger, thinner ice that

was more prone to summer melting. Thus, sea ice decline may result from natural variability in the AO. Growing evidence suggests, however, that greenhouse warming favors the AO's positive mode, meaning recent sea ice decline results from a combination of natural variability and global warming.

3.1.2.7. Sediment Transport

Several factors influence the rate and quantity of sediment transport in the Beaufort Sea, including ice gouging, entrainment in sea ice, wave action, currents, and disturbance of sediments by the activity of benthic organisms (bioturbation). The bulk of sediment on the Alaskan shelf is transported westward on the inner shelf (Barnes and Reimnitz, 1974). Catastrophic transport associated with severe storms is an important transport mechanism, particularly in the fall when such storms are associated with fresh ice, which enhances the erosion and often entraps sediments in the forming ice. Subsequent ice movement and melting in the spring can deposit sediment large distances from the point of entrapment.

Sediment transport and distribution in the Chukchi Sea is controlled by several factors, including storms, ice gouging, entrainment in sea ice, wave action, currents, and bioturbation. The bulk of sediment on the Alaskan continental shelf is transported northwards in the direction of the prevailing current. Sediment transport in response to severe storms is an important means of sediment transport within the area of coverage. Storm transport is particularly effective in the fall months when storms are associated with fresh ice, which enhances erosion and often entraps sediments in new ice. In the spring, the breakup and melting of this sediment-laden ice can result in sediment being transported large distances from the point of entrapment.

3.1.3. Upper Plume Transport Processes

The materials contained in the upper plume may be subjected to immediate wake-induced turbulence, and then are influenced by oceanic turbulent dispersion processes. These materials are transported at the speed and direction of prevailing currents. Sinking rates of solids in the upper plume will largely depend on four factors: discharged material properties, receiving water characteristics, currents and turbulence, and flocculation and agglomeration.

Physical properties of the discharged materials affect mixing and sedimentation. For suspended clay particulates, particle size and both physical and biological flocculation will determine settling rate. While oil exhibits little tendency to sink, it has displayed the ability to flocculate clay particles and to adsorb to particulates and sink with them to the bottom (Middleditch in USEPA, 1985).

One of the major receiving water characteristics influencing plume behavior is density structure and stratification. Density stratification can contribute to the dissipation of dynamic forces in the dynamic collapse phase of plume behavior, and represents the point at which passive diffusion and settling of the individual particles become the predominant dispersive mechanisms. Density stratification may concentrate certain components along the pycnocline. If flocculation produces

particles large enough to overcome the barrier, settling will continue. Also, if density stratification is weak or the pycnocline is above the discharge point, it may not affect plume behavior.

It has been reported (USEPA, 1985) that upper plumes followed major pycnoclines in the receiving water. This type of transport is a potential concern because sensitive life stages of planktonic, nektonic, and benthic organisms may collect along the pycnocline.

Flocculation and agglomeration affect plume behavior by increasing sedimentation rates as larger particles are formed. Flocculation is enhanced in salt or brackish waters due to increased cohesion of clay particles (Meade in USEPA, 1985). Agglomeration also results in the formation of larger particles from a number of smaller ones through the excretion of fecal pellets by filter-feeding organisms.

The extent to which discharges are dispersed can be estimated using dispersion ratios derived from measurements at several drilling operations. These ratios are calculated as:

$$\text{Dispersion ratio} = \frac{\text{suspended solids concentration of discharged fluid}}{\text{suspended solids concentration in samples}}$$

Most studies of upper plume behavior have measured particulate components and paid less attention to the liquid and dissolved materials present. Presumably, these latter components are subject to the same physical transport processes, with the exclusion of settling, as particulate matter. Studies suggest that suspended solids in the upper plume may undergo a higher dispersion rate than dissolved components.

Because drilling fluids contain both particulate and soluble components, and because particulates have an additional mode of dispersion that does not apply to soluble components (i.e., gravitational settling, which takes solids out of the water column and transfers them to the sediment), several estimates of soluble component dilution also have been made. Generally, it appears that dilution of soluble material in the upper plume may proceed at one-half to one-tenth that of dispersion particulates in the upper plume. Although these estimates are reasonably consistent, this observation must be somewhat tempered, however, because of the difficulties involved in assessing interactions between soluble tracers and drilling fluid components, such as fine particulates.

While no specific studies have been conducted in Arctic Alaska, upper plume transport was measured in Lower Cook Inlet using a soluble, fluorescent dye (fluorescein) where the currents are 41 to 103 cm per second (Houghton et al. in USEPA, 1985). They found that the plume never sank below 23 m (75 ft), while water depth at the site was 63 m (207 ft). The Cook Inlet data suggested that dilution rates may be comparable to or at a rate approximately half that of dispersion (based on generalized estimates of distances to specified levels of dispersion). These correlations may be confounded by dye-clay interactions, rendering this comparison more similar than would a true "soluble" component.

3.1.4. Lower Plume Transport Processes

The physical transport processes affecting the lower plume differ somewhat from those influencing the upper plume. The lower plume appears to have a component, comprised of coarser material, which settles rapidly to the bottom regardless of current velocity. This rapid settling is most pronounced during high-rate bulk discharges, with their high downward momentums, and in shallow water, because these conditions tend to result in the plume reaching the bottom.

The amount of fine solids settling to the bottom from the lower plume depends on collision and cohesion of clay particles, which in turn depends on suspended material concentration, salinity, and the cohesive quality of the material. Fine particles tend to flocculate more readily than larger particles. Physical-chemical flocculation can increase settling rates an order of magnitude over rates for individual fine particles. Presently, there are no water column sampling data from the lower plume. Its dynamics must be inferred from limited sediment trap data and from models of plume behavior.

Drilling fluid components in a lower plume that reaches the seafloor may be transported as a turbulent bottom plume. Solids will continue to settle out while soluble components will be diluted with distance. Such plumes have been observed for dredged material disposal, but no observations of such plumes for drilling fluids have been attempted. Data on the short-term fate of drilling discharges associated with lower plume appears largely to address the initial deposition of the material on the seafloor. However, the lack of information on the behavior of the lower plume is not critical due to the short duration of drilling activities.

Biological processes have been shown to increase settling rates for fine particles, which presumably could affect drilling discharges. Filter feeding plankton ingest particles ranging from 1 to 50 micrometers (μm) in diameter, and excrete them in fecal pellets ranging from 30 to 3,000 μm in size (USEPA, 1985). Copepods have been cited as playing an important role in biologically-induced fine particle agglomeration.

3.1.5. Seafloor Sedimentation

Studies have shown the extent of drilling fluid accumulation on the bottom to be inversely related to the energy dynamics of the receiving water. Vertical mixing also appears to be directly related to energy dynamics. Low energy environments, however, are not subject to currents removing deposited material from the bottom or mixing it into sediments. Vertical incorporation of plume components into sediments is caused by physical resuspension processes and by biological reworking of sediments. The relative contribution of these processes to mixing has not been quantified.

Houghton et al. (1981) produced an idealized pattern for sedimentation around an offshore platform located in a tidal regime (Figure 3-1); zero net current was assumed. The area of impact may have been overestimated from the true field case because no initial downward

motion was assumed, which provides for a longer settling time and greater plume dispersion. The result was an elliptical pattern, with the coarse fraction (10 to 2 mm) deposited within 125 to 175 m (410 to 574 ft) of the discharge point, the intermediate fraction (2 mm to 250 μm) deposited at 1,000 to 1,400 m (3,280 to 4,592 ft), and the medium fraction (250 to 74 μm) deposited beyond that distance. This is the greatest areal extent of bottom sedimentation for continuous discharges under the assumed conditions. Discontinuous discharges will be transported by currents at the time of release and will form a starburst pattern over time.

Currie and Isaacs (2004) examined changes to benthic infauna caused by exploratory gas drilling operations in the Minerva field located in Port Campbell, Australia. They found the abundances of two common species (*Apseudes* sp. 1 and *Prionospio coorilla*) decreased significantly at the well-head site immediately after drilling. The size of these reductions in abundance ranged between 71 and 88 percent, and persisted for less than 4 months after drilling (Currie and Isaacs, 2004). Additionally, modified communities persisted at the well-head for more than 11 months following exploratory drilling. Changes in the abundance of species aggregated by phylum varied, but significant declines in the most abundant phyla (crustaceans and polychaetes) of 45 to 73 percent were observed at all sites within a 100 m radius of the well-head following drilling (Currie and Isaacs, 2004). In most cases these changes became undetectable four months after drilling following species recruitments.

3.1.6. Studies in Arctic Alaska

The transport, persistence and fate of materials discharged into the marine environment from exploratory drilling operations have been previously evaluated for several northern Alaska offshore areas of coverage. The general conclusions reached in these studies regarding the transport, dispersion, and persistence of drilling discharges is summarized below:

The drilling mud discharge separates into an upper and lower plume. Physical descriptions of effluent dynamics and particle transport differ substantially for the two plumes.

Drill cuttings (parent material from the drill hole) are generally coarse materials that are deposited rapidly following discharge and settle within the 100-m radius mixing zone.

Discharged drilling materials typically settle in the immediate vicinity of the discharge area.

However, deposition patterns are extremely variable and are strongly influenced by several factors, including the type and quantity of mud discharged, hydrographic conditions at the time of discharge, and height above the seafloor at which discharges are made.

Although metals were enriched in the sediment, enrichment factors were generally low to moderate, seldom exceeding a factor of 10. The spatial extent of this enrichment also was

limited. These considerations suggest that exploratory activities will not result in environmentally significant levels of trace metal contamination. However, other factors, such as the intensity of exploratory activities, normal sediment loading, and proximity either to commercial shell fisheries or to subsistence populations, could alter this conclusion.

Analyses of sediment barium and trace metal concentrations have been used to examine nearfield fate of drilling fluids on the seafloor (e.g., the rate of dispersion of sedimented material). If high concentrations of barium are persistently found near a well site, this finding suggests it is in a

lower energy area, which favors deposition. If elevated levels cannot be found, even soon after drilling, then this finding suggests a higher energy environment, where resuspension and sediment transport were promoted.

Data from exploratory drilling operations have been used to examine deposition of metals resulting from drilling operations. These indicate that several metals are deposited, in a distance-dependent manner, around platforms, including cadmium, chromium, lead, mercury, nickel, vanadium, and zinc.

At present, the area-wide large-scale distribution of drilling discharges is difficult to predict. However, it can be surmised that drilling discharges associated with short-term exploration operations will have little effect on the environment due to deposition of drilling-related materials on the seafloor.

3.1.6.1. Trace Metal and Physical Benthic Alterations

A study has investigated the environmental distribution of metals from drilling fluids discharged into the Beaufort Sea, near the Mackenzie River Delta (Crippen et al., 1980). The primary objective of the program was to investigate the environmental significance of metals in drilling fluids discharged to the marine environment. The study site was an artificial island constructed from local borrow material in the Beaufort Sea near the Mackenzie River delta. The average depth of the study area was approximately seven meters. A total of 47 stations were sampled for arsenic, cadmium, chromium, lead, mercury, and zinc in the sediments and infaunal tissues.

The concentration of arsenic, cadmium, chromium, lead, and zinc in surface sediments exceeded background levels at one or more stations in the vicinity of the discharge. Subsurface concentrations of most metals, excluding chromium, were substantially higher than surface sediment sample 45 m SW of this discharge location. This sample was thought to be a pocket of drilling fluid from operations prior to the use of chrome lignosulfonate. Mercury contamination of sediments was obvious within 100 m of the point of discharge, and mercury levels were somewhat elevated above mean background levels [0.07 micrograms per gram ($\mu\text{g/g}$)] at several other stations. The highest mean value recorded was 6.4 $\mu\text{g/g}$ located less than 45 meters from the shoreline of the island, just north of the discharge.

Another study was conducted to monitor the environment fate associated with above ice disposal of drilling fluids and cuttings in the Beaufort Sea (Sohio Alaska Petroleum Company, 1980). Three wells were sampled, Sagavanirktok Delta Wells #7 and #8 (Sag 7 and Sag 8), and Challenge Island Well #1 (Challenge 1). Three sites (A, B, and C) were sampled at Challenge 1.

F-test analyses indicated that there were no significant differences ($P < 0.05$) among any pre-versus post-discharge tests at disposal sites. For post-discharge tests of disposal sites versus reference sites, a few significant differences were found. Median grain size decreased at Sag 8 and Challenge 1 (Site C) for the >0.25 mm (percentage coarser) fraction and at Sag 8 for the >0.150 mm fraction. Increased median grain size occurred for the >0.250 mm fraction at Challenge 1 (Sites A and B) and for the >0.150 mm fraction (Site B).

Trace metal analysis were conducted on samples of drilling fluids that were disposed. Comparison of pre- and post-discharge bottom sediment samples from Sag 7 indicated significant decreases in levels of barium, cadmium, and mercury that were judged unrelated to drilling fluids. Analyses of samples from Sag 8 indicated only that barium levels decreased significantly.

Analyses of Challenge 1 samples indicated significant increases in levels of cadmium, chromium, lead, and zinc at Sites A and B, and in copper, lead, and zinc at Site C. Increases of chromium and zinc were considered related to drilling fluids disposal. Cadmium data were not considered to be explained by effluent discharges because cadmium levels in the effluents and pre-discharge sediments were similar. Elevations in lead were not judged to be drilling fluid-related because of spatial patterns, other sediment characteristics, and because Site C did not melt in place.

However, elevations of cadmium and lead levels could be effluent-related. Although cadmium levels in early drilling fluid samples (0.2 mg/kg) were similar to pre-discharge sediment levels (0.19-0.35 mg/kg), an enrichment of cadmium in drilling fluid effluents occurred at all disposal sites over time, to 0.8-1.1 mg/kg. Also, for cadmium, chromium, lead, and zinc sediment levels were inversely related to distance from disposal sites (A and B) for 0-60 m, 60-85 m, and 250 m data sets.

Furthermore, for cadmium, lead, and zinc at Sag 7 and chromium, copper, lead, and zinc at Sag 8, a consistent spatial pattern of enrichment at the nearfield stations (approximately 85-200 m) occurred relative to pre-discharge levels and either within-site or far-field (315-585 m) stations. These enrichments were not statistically significant. However, trace metal levels had 95 percent confidence levels that averaged about 65 percent of the mean. This large variability substantially reduces the ability to statistically resolve differences among data sets.

Nonetheless, near-field enrichments were consistent. For both lead and zinc, enrichment was 1.3-fold at Sag 7 and 1.2-fold at Sag 8, versus 2.3- to 2.6-fold for lead and 1.4-fold for zinc at Challenge 1. Chromium levels at Sag 7 increased 2-fold versus 1.4-fold at Challenge 1.

A study has assessed the impacts of above-ice drilling effluent disposal techniques in the Beaufort Sea (Sohio Alaska Petroleum Company, 1981), between the Midway Islands and Prudhoe Bay. A simulated, above-ice disposal test was conducted.

Grain size analyses of settling pan sediment indicated that a rapid decrease in deposition rates occurred for most particle sizes. At the center of the discharge hole, deposition was 729 milligrams per square centimeters (mg/cm^2) for all grain size fractions. At 1.5 m and 3.0 m, average deposition was 313 mg/cm^2 and 168 mg/cm^2 , respectively. It was estimated that the average deposition of all particle sizes was about 200 mg/cm^2 over the test site. The average deposition rate for particles less than 45 microns, measure 3 m from the discharge point, was in the same general range of deposition rates measured at two below-ice disposal sites (166 mg/cm^2 versus 66-268 mg/cm^2 , respectively). Bottom sediment trace metal levels indicated the presence of drilling effluents three days after the discharge, but not three months post-discharge.

Trace metal analyses of drilling fluid samples and sediments were conducted both within and near the disposal sites. At one site there were no notable differences as a result of drilling activities. At the second site, however, three metals showed possible enrichment: cobalt, copper, and iron.

These sediment metal studies, when considered as a group (Table 3-1), suggest the enrichment of certain metals in surficial sediments may occur as a result of drilling activities. While confounding factors occur in most of these studies (i.e., seasonal variability and other natural and anthropogenic sources of these metals) a distance-dependent decrease in metal levels frequently is observed. However, although drilling activities are implicated as a source of metal enrichment, discharged drilling fluids and cuttings probably are not the only drilling-related source.

Barium and chromium are the only two metals that appear to be elevated around rigs or platforms and are clearly associated with drilling fluids. A study in the Canadian Arctic found that mercury would be the best trace metal tracer of discharged fluids. Examination of mercury levels in fluids and sediments for domestic operations is notably under-represented in the studies that have been reviewed. The degree of similarity between Canadian and domestic operations has not been evaluated. However, the findings of the Netsrk study and lack of information on domestic operations indicate that the relationship between drilling fluid discharges and sediment mercury levels should be further clarified.

Metals that appear to be elevated as a result of drilling activities, and not solely related to drilling fluids, include cadmium, mercury, nickel, lead, vanadium, and zinc. Cadmium, lead, and zinc may be associated with drilling fluids as contaminants that occur from the use of pipe dope or pipe thread compounds. Mercury, nickel, and zinc may originate from sacrificial anodes. Cadmium, lead, and vanadium may also originate from the release of fossil fuel in drilling operations. This release can result from burning, incidental discharges or spills from the rig or supply boat traffic, or use as a lubricant in drilling fluids. Vanadium also may derive from wearing of drill bits.

Although these metals were enriched in the sediment, enrichment factors were generally low to moderate, seldom exceeding a factor of 10. The spatial extent of this enrichment also was limited. Either of two cases occurred: enrichment was generally distributed but undetectable beyond 300-500 m or enrichment was directionally-based by bottom current flows and extended further (to about 1,800 m) but within a smaller angular component.

These considerations suggest that exploratory activities will not result in environmentally significant levels of trace metal contamination. However, other factors, such as the intensity of exploratory activities, normal sediment loading, and proximity either to commercial shell fisheries or to subsistence populations, could alter this conclusion.

3.1.6.2. Drilling Fluids Toxicity

Drilling fluids (muds) are complex mixtures and there appears to be no single explanation for toxicity. Some of the apparent (actual) toxicity may be due to physical effects, such as particle size coagulations, abrasions, etc. These are, however, a form of toxicity, producing and contributing, in part or in combination with chemical toxicity, to the end points (death) in acute toxicity tests.

Oxygen demand appears strongly correlated with toxicity in laboratory toxicity tests. Spearman Rank correlations of 96-hour LC₅₀ data and biochemical oxygen demand (BOD)/ultimate oxygen demand (UOD) data showed a remarkably strong correlation, especially with 5-day biochemical oxygen demand (BOD₅) data derived with artificial seawater and activated seed. These data showed a correlation of 0.97 with toxicity. All BOD/UOD values showed correlations of 0.87 to 0.97 BOD and 0.91 to 0.95 UOD, but total organic carbon (TOC)/chemical oxygen demand (COD) values gave correlations of 0.64 to 0.67. Given the absence of oxygen demand data, no such correlation could be developed for nongeneric muds. Another indicator of the large inherent oxygen demand of drilling muds is that dissolved oxygen levels in test environments dropped below normal, notwithstanding the continuous aeration of test media that followed pre-aeration of the test material. This was especially noted during the first day of testing, during which dissolved oxygen levels were depressed concentration dependently by the test muds.

A variety of Alaskan marine organisms have been exposed to drilling mud in laboratory or field experiments. Most of these studies have addressed short-term acute effects in a relative or "screening" sense, with little effort directed at separating chemical from physical causes. [In aquatic toxicity tests, a response measuring 50 percent lethality observed in 96 hours or less is typically considered acute (LC₅₀)]. A few studies have looked at chronic sublethal effects and bioaccumulation of heavy metals from drilling mud. Chronic refers to a stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span of an organism or more (USEPA, 1991). Chronic tests assess the effect on survivability, growth, maturation or reproduction and the results are typically reported as median effective concentrations [EC_{50s} (concentrations at which a designated effect is displayed by 50 percent of the test organisms)]. Because drilling discharges are episodic and typically only a few hours in duration, organisms that live in the water column are not likely to have long-term exposures to drilling muds; risks to these organisms are best assessed using acute toxicity data. Benthic organisms, particularly sessile species, are likely to be exposed for longer time periods; risks to these organisms are best assessed with chronic toxicity data.

Drilling mud toxicity tests have been performed using whole muds or various component fractions, such as the suspended particulate phase or mud aqueous fraction. The variability and complexity in the composition of muds is reflected in the results and interpretation of toxicity tests. Test results of sample splits of the same mud performed at two different laboratories have differed by an order of magnitude. In such cases, laboratory procedure or sample handling is a significant factor. Different batches of the same generic mud have shown significantly different toxicities. In this case, different proportions of major constituents (as allowed by mud type definition) may be a factor. EPA has attempted to improve consistency in toxicity test results by requiring standard procedures for sample handling and testing that has resulted in consistent test results. The current effluent guidelines require toxicity testing for the suspended particulate

phase. The extrapolation of single species toxicity tests to overall effects in the ecosystem still has a large, inherent uncertainty.

3.1.6.2.1. Acute Lethal and Sublethal Effects

The effects of drilling muds on biological organisms are most commonly assessed by conducting acute laboratory toxicity tests. Unfortunately, in many cases, comparison of toxicity test results obtained in different studies are difficult because different drilling muds were used, the animals were exposed to different portions of drilling mud (liquid, suspended particulates, or solids) that may have been prepared in a different manner, or experimental procedures differed between investigators. Nevertheless, results obtained in the majority of studies to date have generally indicated low toxicity.

In a summary of over 415 toxicity tests of 68 muds using 70 species, 1-2 percent exhibited LC₅₀s ranging from 100 to 999 ppm, 6 percent exhibited LC₅₀s ranging from 1,000 to 9,999 ppm, 46 percent exhibited LC₅₀s ranging from 10,000 to 99,999 ppm, and 44 percent exhibited LC₅₀s greater than 100,000 ppm (USEPA, 1985). Table 3-2 provides a summary of these toxicity tests. Two to three percent of the data were not usable. A significant difference was noted between the toxicity of generic muds, which appear to have acute, lethal toxicity characteristics similar to the distribution of the larger data set described above, and a series of 11 nongeneric muds provided to EPA by the Petroleum Equipment Supplies Association. These latter muds, as a group, appear to be substantially more toxic than would be anticipated from the toxicity distribution of either the generic muds or the larger data set. Whole muds appear to be more toxic than aqueous or particulate fractions. The suspended particulate phase appears to be more toxic than the other individual phases.

Petrazzuolo (1981) has ranked organisms according to their sensitivity to drilling fluids in tests and found the following order of decreasing sensitivity: copepods and other plankton, shrimp, lobsters, mysids and finfish, bivalves, crabs, amphipods, echinoderms, gastropods, and polychaetes and isopods. Larval organisms are more sensitive than adult stages (maximally 20-fold); animals are more susceptible during molting.

Some Alaskan organisms apparently show high tolerance to acute exposure to drilling mud (Tornberg et al. in USEPA, 1985). Sublethal effects observed following acute exposure have included alteration of respiration and filtration rates, enzyme activities, and behavior. There are several Alaskan taxa that have not been exposed to drilling mud but may be relatively sensitive. The temperate copepod, *Acartia tonsa*, has exhibited one of the lowest LC₅₀s (100 ppm) of any organism in a drilling mud. Alaskan copepods have not been tested, but there is no reason to believe their tolerances would fall outside variability in tolerances of other marine copepods.

In general, planktonic and larval forms appear to be the most sensitive of the Alaskan organisms that have been exposed to drilling mud in acute lethal bioassays; however, not all planktonic organisms are sensitive to short-term exposure to drilling muds. Carls and Rice (1981) found several drilling muds to have low toxicity to the larvae of six Alaskan species of shrimp and crab. The 96-hour LC₅₀s for the suspended particulates phase of a drilling mud seawater

mixture ranged from 500 to 9,400 ppm. Toxicity was far less when the particulates were removed: the 96-hour LC50s ranged from 5,800 to 119,000 ppm.

Houghton et al. (1981) conducted a study on several species of crustacea, including a shrimp (*Pandalus hypsinotus*), a mysid (*Neomysis integer*), an amphipod (*Eogammarus confervicolus*), and an isopod (*Gnorimosphaeroma oregonensis*), and pink salmon fry (*Onchorhynchus gorbuscha*). These species were exposed to used high-density lignosulfonate drilling fluid from lower Cook Inlet, Alaska. Pink salmon fry were the most sensitive with a 96-hour LC₅₀ of 3,000 ppm for SSP. The lowest crustacean concentration was ten times higher.

Seven arctic polymer drilling fluids were used for toxicity testing of salmon (Houghton et al. in USEPA, 1985). Five of the seven fluids displayed a 96-hour LC₅₀ of less than 40,000 ppm for the SSP fraction; the most toxic fluid had a 96-hour LC₅₀ of 15,000 ppm, and the least toxic fluid a 96-hour LC₅₀ of 190,000 ppm. Clam worms (polychaetes), soft-shelled clams, purple shore crabs, and sand fleas had approximately the same sensitivity to the fluids as did the salmon. These invertebrate 96-hour LC₅₀'s ranged from 10,000 to more than 560,000 ppm.

Unlike the water-based drilling fluids (WBFs), the synthetic-based drilling fluids (SBFs) are water insoluble and do not disperse in the water column as do WBFs, but rather sink to the bottom with little dispersion (USEPA, 2000a). Since 1984, the USEPA has used the suspended particulate phase (SPP) toxicity test, an aqueous-phase toxicity test, to evaluate the toxicity of drilling fluids, including SBFs. Using the SPP toxicity test, SBFs have routinely been found to have low toxicity; however, an interlaboratory variability study indicated that SPP toxicity results are highly variable when applied to SBFs (USEPA, 2000a). Table 3-3 summarizes toxicity test results conducted with water-column and benthic organisms for several different SBFs. In general, benthic test organisms appear to be more sensitive to the SBFs than water-column organisms. Further evaluation of these studies determined the ranking for SBF toxicity from least toxic to most toxic is: esters-internal olefins-linear alpha olefins-polyalphaolefins-paraffins (USEPA, 2000a).

The current NPDES permit has incorporated a standard acute toxicity test for drilling fluids prior to discharge. The acute toxicity test must result in an LC₅₀ value higher than 30,000 ppm for discharge of the cuttings to be permitted. The permit requires the use of the species mysid *Mysidopsis bahia* for the toxicity test. Drilling mud toxicity data compiled by USEPA, Region 10 from Alaskan exploratory and production wells indicate that the muds used in all current and recent operations are acutely toxic only to a slight degree to *Mysidopsis bahia*. LC50s for the 91 valid toxicity test data points ranged from 2,704 to 1,000,000 ppm SPP with a mean of 540,800 ppm. Only 7 of the 91 tests had LC50s less than the 30,000 ppm limit. Some of the records in this database were not included in the above statistics due to pH or other protocol breaches, incomplete reports, etc.

3.1.6.2.2. Chronic Effects

Few studies have evaluated impacts on Alaskan species following chronic exposure to drilling muds; the species that have been tested are all invertebrates. The few chronic data are consistent, however, and indicate that chronic lethal toxicity is not likely to be more than some 20-fold greater than acute lethal toxicity; chronic sublethal toxicity appears to range from three-fold to 75-fold greater than acute lethal toxicity, which is within the same range as chronic lethal effects. However, the chronic sublethal data are much more difficult to interpret, physiologically and ecologically. Sample sizes routinely are very small. Most importantly, observations that sublethal effects occur "close" to lethal effect levels miss the point; for most studies changes were also noted at the lowest level tested. Thus, estimating No-Observable-Effect-Levels (NOELs) are not possible for much of the reported data.

Laboratory studies on recruitment and development of benthic communities suggest that drilling mud and barite can affect recruitment and alter benthic communities or depress abundances. These data are corroborated by results from artificial substrate experiments conducted in the Beaufort Sea; these showed significantly different colonization rates at drilling fluid test plots and control plots, especially for amphipods and copepods.

The lowest reported concentration of drilling mud producing a significant sublethal chronic effect was 50 mg/L for 30 days of continuous exposure with bay mussels, and there was no attempt to separate chemical from physical effects (USEPA, 1985).

A laboratory study examined the chronic toxicity of cuttings from Beaufort Sea wells on the sand dollar (*Echinarachnius parma*) (Osborne & Leeder, 1989). Exposure to mixtures as low as 10 percent cuttings/90 percent sand were found to affect the survival of the benthic organisms, with 100 percent mortality occurring within 23 days in some test cases.

Other altered behavioral patterns in organisms have been noted after chronic exposures to drilling mud. USEPA (1985) discusses a study where dock shrimp and Dungeness crab larvae were exposed to 4,000 to 200,000 ppm barite and 4,000 to 100,000 ppm bentonite. The EC40 concentration inhibiting the swimming ability of half of the crab larvae ranged from 77,600 to 85,600 ppm bentonite, and was 71,400 ppm for barite. EC50's for shrimp larvae ranged from 13,800 to 34,600 ppm bentonite, and 5,400 to 50,400 ppm barite.

3.1.6.2.3. Toxicity of Mineral and Diesel Oil

In the past, the oil industry has added diesel oil to drilling fluid systems to free stuck drilling pipe and for other specialized applications. Diesel oil is highly toxic to aquatic life, and much of the toxicity (96-hour LC₅₀) of drilling muds has been attributed to its presence. Studies have found high correlations of toxicity with added diesel and mineral oil to whole mud (diesel oil r=0.88; mineral oil r=0.97). Toxicity did not correlate quite as well with the oil levels determined in a variety of mud samples (r=0.81) (USEPA, 1985). The available data indicate that this may be

partially due to various types of sequestrations within the drilling fluid matrix as well as the variable presence of toxic constituents in drilling fluids other than diesel or mineral oil.

Because of the toxicity of diesel oil, USEPA has prohibited its discharge in muds and cuttings. Instead, USEPA allows the use of mineral oils to free stuck pipes and the discharge of residual amounts of mineral oil pills, provided that the pill and a buffer of drilling fluid on either side of the pill are removed and not discharged. The residual mineral oil concentration in the discharged mud should not exceed 2 percent (v/v) and must comply with all previous permit conditions (53 FR 37857, September 28, 1988).

According to the API Hydrocarbon Usage Survey and the OOC Spotting Fluid Survey (USEPA, 1993a), diesel oil was still being used for lubricity agents and spotting fluids as of 1986. With the advent of Best Practicable Control Technology Currently Available (BPT) effluent limitation guidelines, however, current diesel oil usage for these purposes is assumed to be zero (USEPA, 1993a).

Mineral oils differ from diesel oils in that they contain a lower concentration of aromatic hydrocarbons (15-20 percent vs. 20-61 percent for diesel oil) (USEPA, 1993a). In addition, saturated aliphatics (paraffinics) generally represent a larger percentage of mineral oils compared to diesel oil. Aromatic hydrocarbons are generally more toxic and resist biodegradation to a greater degree than do paraffinics (Petrazzuolo, 1983). Research studies indicate that some mineral oils are much less acutely toxic (5 to 30 times less) to certain marine organisms than diesel oil (USEPA, 1985).

Despite the reduced toxicity of some mineral oils as compared to diesel oils, mineral oils do contribute potentially toxic organic pollutants (Table 2-3) to drilling muds to which they are added. The potential for drilling muds containing mineral oils to violate Federal water quality criteria is discussed in Section 9.0.

Neither mineral nor diesel oils possess constituents that can be biomagnified (see definition in Section 3.3.2). However, both compounds contain PAHs, which are lipid soluble and lipophilic and some of these compounds can bioaccumulate (see definition in 3.3.1) in organisms that consume prey contaminated with hydrocarbons. As stated earlier, mineral oils contain a lower concentration of aromatic hydrocarbons (15-20 percent vs. 20-61 percent for diesel). Due to the fact that the total amount of mineral oil released in the drilling cuttings is, effects in aquatic organisms due to exposure to PAH residues is not expected to be significant.

3.1.6.3. Open-Water Discharges

Only one Arctic discharge study has considered discharges during the open water period. Northern Technical Services (NORTEC, 1983) conducted a drilling effluent disposal study at Tern Island located in the Beaufort Sea. Case 1 conditions included a mud discharge rate of 13.3 cubic meters per hour (m^3/h) [84 barrels per hour (bbl/h)], a predilution of 30:1 with seawater, and an average current velocity of 12 cm/s [0.39 feet per second (ft/s)] at 3.4 m (11.2 ft) above

the seafloor. Case 2 conditions included a mud discharge rate of 5.4 m³/h (34 bbl/h), predilution of 75:1 with seawater, and an average current of 11 cm/s (0.36 ft/s). The minimum dilution (due to ambient waters only) measured for test plot 1 was 167:1 at 100 m (330 ft) and 320:1 at 160 m (530 ft) from the discharge for test plot 2. During this study, effluents remained within 0.5 m (1.6 ft) of the seafloor in the nearfield [within 10 m (33 ft) of the discharge point], and most solids were deposited within 240 m (787 ft) of the discharge point in shallow water, approximately 5.5 m (18 ft) in depth.

3.1.6.4. Below-Ice Discharges

Dilution of drilling fluids in the water column beneath ice has been examined in the Beaufort Sea. Results suggested that nearfield dilution (100- to 1,000-fold) was 1-2 orders of magnitude less than in open water situations. However, at dilution ratios of 10⁴ to 10⁶, the dilution under ice appeared to approach that in open water. Sampling problems encountered in this study may have resulted in an overestimation of far-field dispersion. Therefore, these data must be interpreted very cautiously.

Northern Technical Services (NORTEC, 1981) conducted two shallow water under-ice effluent disposal studies in 8.4 m (27.6 ft) and 5.5 m (18.0 ft) off Reindeer Island in the Beaufort Sea. The minimum dilution was 112:1 at a distance of 61 m (200 ft) from the point of discharge. This value is about an order of magnitude lower than solids dilutions typical of open-water disposal model results (Table 3-5).

NORTEC (1984) conducted a study to determine the areal extent and distribution of drilling solids discharged from Seal Island, an artificial gravel island located at a depth of 12 m (39 ft) in the Beaufort Sea. The area of cuttings deposited was limited mainly to the submerged portion of the island. Cuttings 8 to 15 cm (3 to 6 in) thick extended less than 61 m (200 ft) beyond the toe of the island.

NORTEC (1985) identified the distribution of drilling muds discharged under the ice from Mukluk Island, an artificial gravel island located approximately 45 km (24 nmi) offshore in a depth of 15 m (49 ft). Analysis of trace metal concentrations in bottom sediments near the Mukluk Island discharge site indicated that drilling muds were deposited up to 155 m (509 ft) from the toe of the island. Although metals levels were elevated from the ambient levels for the area, they were still within the range of values found elsewhere in the Beaufort Sea.

3.1.6.5. Above-Ice Discharges

Field studies (Sohio Alaska Petroleum Company, 1980, 1981) have found that the maximum mud concentration entering the marine environment from above-ice disposal sites is much less than the concentration introduced by below-ice discharge. Dilution of muds discharged above ice should be similar to or greater than that occurring during discharge to open waters, as the solids are released slowly during ice melting and breakup allowing greater dispersion.

3.1.7. Predictive Modeling of Drilling Mud Transport, Deposition, and Dilution

A model has been developed by the Offshore Operators Committee (OOC) for predicting the behavior of solid and soluble components of the lower plume; the OOC model was first made available to OOC member companies and federal and state agencies concerned with offshore drilling discharge regulation in 1983. The OOC model considers the drilling discharge plume to be divided into an upper plume, which contains fine-grained solids, and a lower plume, which contains the majority of solids. The dilution of the drilling effluent simulated by considering three phases of plume behavior: convective descent, dynamic collapse, and a later passive diffusion phase. A Gaussian formulation is used to sum the three component phases and to track the distribution of solids to the bottom. The model predicts concentrations of solids and soluble components in the water column and the initial deposition of solids on the seafloor.

The OOC model results do not include cuttings because they are expected to be of coarser grain size than muds and will, therefore, settle rapidly to the seafloor. However, the total discharge of cuttings is generally about 1.3 times greater than (as dry weight) the total discharge of drilling muds for these operations. Thus, the nearfield estimates (within 100 m of the point of discharge) of bottom accumulations of drilling mud should be considered underestimates due to the exclusion of cuttings discharge from the OOC model.

Comparison of model results with field observations indicates that the model is capable of predicting many important aspects of drilling mud discharge plume behavior. For example, a field verification study was conducted offshore of Huntington Beach, California, in waters with an average depth of approximately 18 m using a modified version of the OOC model (O'Reilly et al., 1989). The model predicted water column solids concentrations were within the range of concentrations measured at 75 percent of the sampling locations. In the lower water layer where the majority of the solids formed the lower plume, the model predicted the solids concentrations at 86 percent of the lower water layer sampling locations. However, comparison of the model predictions of bottom solids accumulation with field sediment trap data was less satisfactory, possibly due to errors associated with the field measurement technique that was used.

The OOC model makes several simplifying assumptions that may vary from actual conditions at any given site (e.g., a single discharge of limited duration and unidirectional currents). Therefore, the model predictions discussed below provide a generalized picture of expected dilution and deposition; but the model is not expected to predict exact conditions at any one well location. The model version employed for this ODCE is Version 1.0 supplied by Brandsma Engineering and is identical to that used in the previous Arctic ODCE (USEPA, 1995).

The OOC model was used to examine discharge scenarios that were 1) likely to occur in the areas of coverage, and 2) representative of the maximum allowable discharges. Therefore, discharges were only evaluated for the Beaufort and Chukchi Seas since it was determined that discharges in the Hope and Norton Basins were not likely to occur (see Section 2.2.1). Discharge scenarios were determined by examining relevant information sources describing exploratory oil and gas drilling practices. Maximum allowable discharges are those specified in the NPDES general permit for the Arctic, which are based on previous OOC model runs for earlier ODCEs in this area. Model parameters held constant for all test cases are given in Table

3-4. The NPDES permit states that the total drilling muds and drill cuttings discharge rate shall not exceed the following rates where depth is measured as meters from MLLW:

- 1,000 bbl/h in water depths exceeding 40 m;
- 750 bbl/h in water depths greater than 20 m but not exceeding 40 m;
- 500 bbl/h in water depths greater than 5 m but not exceeding 20 m; and
- no discharge in water depths less than 5 m.

In addition to the depth-related discharge requirements, the NPDES general permit also specifies the following seasonal requirements:

During open-water conditions, discharge is prohibited at depths greater than 1 meter below the surface of the receiving water between the 5 and 20-m isobaths as measured from the MLLW during open-water conditions or within 1000 m of river mouths or deltas.

During unstable or broken ice conditions, discharge is prohibited within 1000 m of river mouths or deltas or shoreward of the 20-m isobath except (1) when the discharge is prediluted to a 9:1 (ratio of seawater to drilling muds and cuttings), and (2) when environmental monitoring is conducted.

During stable ice conditions, unless authorized otherwise by the Director, the discharges shall be to above-ice locations and shall avoid to the maximum extent possible areas of sea ice cracking or major stress fracturing.

In order to simplify the following analysis of the dilution and deposition of drilling muds in offshore waters of the Beaufort and Chukchi seas, and adjacent coastal waters, the higher average total drilling mud production estimate for the Chukchi Sea Area of Coverage of 598,742 kg (1,320,000 lb), which is only 5 percent higher than the average Beaufort Sea Area of Coverage estimate, was used as the average total amount of drilling mud discharged to these waters following the completion of the average exploratory well. Because each actual exploratory well drilled will be unique, it can be assumed that the actual quantity of drilling muds produced will vary for each individual well.

Since the dilution of the discharged mud is primarily a function of the discharge rate, and not of the total mass discharged, variation in the total amount of drilling muds discharged will not affect the predicted dilutions of dissolved and solid components in the water column. However, variation in the total amount of drilling mud discharged will affect the model-predicted depth of sediments deposited on the bottom. Therefore, the model-predicted maximum sediment depths for a range of total drilling muds discharged (10 to 500 percent of the average value) will also be explored. This will assist in the evaluation of the potential smothering effect of these various discharge scenarios on benthic organisms that occur within the areas (Section 5.3).

OO model test cases that reflect the permit stipulations discussed above were run for open-water discharges, shunting, and below-ice discharges; results of the model runs are discussed below. Above-ice discharges are also discussed.

3.1.7.1. Open-Water Discharges

Open-water discharges were modeled for three depth and discharge combinations. OOC model predictions for the open-water discharge test cases are shown in Table 3-5. These test cases reflect the maximum discharge rates allowed by the NPDES general permit in different water depths - 1,000 bbl/h [159,091 liters per hour (L/h)] in water 40 m (131 ft) deep, 750 bbl/h (119,318 L/h) in water 20 m (66 ft) deep, and 500 bbl/h (79,545 L/h) in water 5 m (16 ft) deep. All model runs assume a one hour discharge of muds that have an initial solids concentration of 1.44 kilograms per liter (kg/L) (505 lb/bbl) and a unidirectional current speed of 10 cm/s (0.33 ft/s).

The quantity of mud necessary to drill one average exploratory well that was used in the following analysis is the reported estimate for the Chukchi Sea Area of Coverage. It is estimated that wells drilled in the Chukchi Sea Area of Coverage will result in the discharge of 5 percent more drilling muds than the average well in the Beaufort Sea Area of Coverage. The quantity of mud is 2.6, 3.5, 5.2, and 10.4 times greater than the quantity of mud modeled for discharge rates of 1,000 bbl/h, 750 bbl/h, 500 bbl/h, and 250 bbl/h, respectively. [The OOC model test cases assume discharge durations of one hour.]

Although the estimates of minimum solid- and dissolved-fraction dilutions will not be affected by the differences between modeled and actual discharge amounts, solids deposition will be underestimated. An estimate of the solids deposition resulting from the discharge of the quantity of mud necessary to drill an average, exploratory well was obtained by multiplying the OOC model predictions by a factor (e.g., 2.613) that represents the ratio of the total amount of mud discharged to the amount discharged in one hour. An explanation of this calculation, and calculation of the factors used in this ODCE are provided in Appendix D. This method of estimating mud accumulation assumes that a real deposition patterns will be unchanged for discharges of different quantities of mud and is reasonable provided that the rate of mud discharge does not vary from that predicted in the modeling. Mud deposition depths shown in Table 3-6 are the depths expected to occur after completion of an exploratory well.

3.1.7.1.1. 5-meter Water Depth

Modeling results for the maximum allowable discharge rate occurring at depths of 5 m (16.5 ft) show that the minimum solids dilution at 100 m (328 ft) was 7,400:1; the minimum dissolved dilution at 100 m (328 ft) was 356:1. The maximum depth of deposited mud was 452.4 cm (178.1 in) and occurred less than 10 m (33 ft) from the discharge. The mud deposition depth at the edge of the mixing zone was 0.32 cm (0.13 in). Approximately 98.8 percent of the discharged solids were deposited within the 100 m (328 ft) mixing zone (Table 3-5). There has been only one shallow water study (Northern Technical Services, 1983) of drilling effluent disposal within the Beaufort Sea Area of Coverage. The measured dilution factors and solids deposition patterns in that study support the results predicted by the OOC model.

3.1.7.1.2. 20-meter Water Depth

Model results for maximum allowable discharge rates at a depth of 20 m (66 ft) reveal that the minimum solids dilution at 100 m (328 ft) was 1,326:1 and the minimum dissolved-component dilution at 100 m (328 ft) was 747:1. Approximately 84.4 percent of the discharged solids were deposited within the mixing zone, with a maximum deposition depth of 112.0 cm (44 in). The maximum mud depth occurred 30 m (98 ft) from the discharge; the mud depth at the edge of the mixing zone was 7.15 cm (2.8 in) (Table 3-5).

3.1.7.1.3. 40-meter Water Depth

The modeled discharge of 1,000 bbl/h (159,091 L/h) of drilling muds to waters 40 m (131 ft) deep caused a minimum solids dilution of 1,173:1 at 100 m (328 ft) and a minimum dissolved-fraction dilution of 1,592:1 at 100 m (328 ft). A maximum mud deposition depth of 63.9 cm (25.1 in) occurred 10 m (33 ft) from the discharge. The mud depth at the end of the mixing zone was 7.33 cm (2.9 in) and the estimated percentage of discharged solids deposited within the mixing zone was 39.9 percent (Table 3-5).

3.1.7.1.4. Effect of varying total discharge on predicted-maximum sediment depth

The drilling mud deposited on the sediment surface may physically impact benthic communities within the area of coverage, and the potential impact depends on the character and depth of the deposited solids (Section 5.3). Because the total amount of drilling mud produced by each exploratory well may vary somewhat about the predicted average, the model-predicted mud depth at the edge of the mixing zone was calculated for a range of total discharge scenarios. These scenarios ranged from 10 to 500 percent of the average total drilling mud discharge for a typical well in the Chukchi Sea area [i.e., 59,874 to 2,993,710 kg (131,000 to 6,600,000 lb) of drilling muds]. The depth of deposited mud for each water depth and total mud discharge was calculated using the appropriate conversion factor as outlined above. All open-water cases represent a modeled unidirectional current speed of 10 cm/s (0.33 ft/s).

5-meter Water Depth. The model-predicted mud deposition depth at the edge of the mixing zone for discharge to waters 5-m deep ranged from 0.03 to 1.5 cm (0.01 to 0.59 in) (Table 3-6). Mud deposits of less than 1-cm depth are predicted to occur at the edge of the mixing zone for discharges of 1,796,226 kg (3,960,000 lb) (i.e., 300 percent of the average) or less. Mud deposits beyond the mixing zone are predicted to be less, and the maximum mud depth [452 cm (178 in) for the average total discharge] occurs within the mixing zone (Table 3-5).

20-meter Water Depth. The model-predicted mud deposition depth at the edge of the mixing zone for discharge to waters 20-m deep ranged from 0.7 to 36.0 cm (0.3 to 14.2 in) (Table 3-6). Mud deposits of less than 1-cm depth are predicted to occur at the edge of the mixing zone for discharges of 59,874 kg (132,000 lb) (i.e., 10 percent of the average). Mud deposits beyond the mixing zone are predicted to be less, and the maximum mud depth [112 cm (44 in) for the average total discharge] occurs within the mixing zone (Table 3-5).

40-meter Water Depth. The model-predicted mud deposition depth at the edge of the mixing zone for discharge to waters 40 m deep ranged from 0.8 to 36.5 cm (0.3 to 14.4 in) (Table 3-6).

Mud deposits of less than 1-cm depth are predicted to occur at the edge of the mixing zone for discharges of 59,874 kg (132,000 lb) or less (i.e., 10 percent of the average or less). Mud deposits beyond the mixing zone are predicted to be less, and the maximum mud depth [63.9 cm (25.2 in) for the average total discharge] occurs within the mixing zone (Table 3-5).

3.1.7.2. Below-Ice Discharges

Below-ice drilling mud discharges were examined with the OOC model for the same depth and discharge rate scenarios used when evaluating open-water discharges. However, current speeds for below-ice runs were reduced from the 10 cm/s (0.33 ft/s) speed used in the open-water runs to 2 cm/s (0.07 ft/s). OOC model predictions for the below-ice discharge test cases are shown in Table 3-7. Mud deposition depths shown in Table 3-8 are the depths expected to occur after completion of an exploratory well.

3.1.7.2.1. 5-meter Water Depth

The modeled maximum allowable drilling mud discharges [500 bbl/h (79,545 L/h)] into waters 5 m (16.5 ft) deep caused a minimum solids dilution of 27,521:1 at the edge of the mixing zone and a minimum dissolved dilution of 972:1 at the edge of the mixing zone. A maximum mud depth of 487.2 cm (191.8 in) occurred less than 10 m (33 ft) from the discharge. The estimated mud deposition depth at the edge of the mixing zone was 0.02 cm (0.008 in); more than 99 percent of the discharged solids were deposited within the mixing zone (Table 3-7).

3.1.7.2.2. 20-meter Water Depth

In waters 20 m (66 ft) in depth the modeled discharge of drilling muds at a rate of 750 bbl/h (119,318 L/h) caused a minimum solids dilution of 5,584:1 and a minimum dissolved dilution of 1,052:1 at the edge of the mixing zone. A maximum mud deposition depth of 257.6 cm (101.4 in) occurred less than 10 m (33 ft) from the discharge. An estimated 89.5 percent of the discharged solids were deposited in the mixing zone, with a mud deposition depth at the edge of the mixing zone of 0.14 cm (0.06 in) (Table 3-7).

3.1.7.2.3. 40-meter Water Depth

The modeling of the maximum allowable drilling mud discharges into waters 40 m (131 ft) in depth caused a solids dilution of 1,552:1 and a dissolved dilution of 1,938:1 at the edge of the mixing zone. A maximum mud deposition depth of 67.1 cm (26.4 in) occurred 50 m (164 ft) from the discharge. The drilling mud depth at the edge of the mixing zone was 1.1 cm (0.43 in); 54.6 percent of the discharged solids were deposited in the mixing zone (Table 3-7).

3.1.7.2.4. Effect of varying total discharge on predicted-maximum sediment depth

The drilling mud deposited on the sediment surface may physically impact benthic communities within the area of coverage, and the potential impact depends on the character and depth of the deposited solids (Section 5.3). Since the total amount of drilling mud produced by each exploratory well may vary somewhat about the predicted average, the model-predicted mud depth at the edge of the mixing zone was calculated for a range of total discharge scenarios. These scenarios ranged from 10 to 500 percent of the average total drilling mud discharge for a typical well in the Chukchi Sea Area of Coverage [i.e., 59,874 to 2,993,710 kg (131,000 to 6,600,000 lb) of drilling muds]. The depth of deposited mud for each water depth and total mud discharge was calculated using the appropriate conversion factor as outlined above. All below-ice cases represent a modeled unidirectional current speed of 2 cm/s (0.066 ft/s).

5-meter Water Depth. The model-predicted mud deposition depth at the edge of the mixing zone for discharge to waters 5-m deep ranged from 0.002 to 0.10 cm (0.0008 to 0.04 in) (Table 3-8). Mud deposits of less than 1-cm depth are predicted to occur at the edge of the mixing zone for all percentages of the average discharge which were evaluated. Mud deposits beyond the mixing zone are predicted to be less, and the maximum mud depth [487.2 cm (191.8 in) for the average total discharge] occurs within the mixing zone (Table 3-7).

20-meter Water Depth. The model-predicted mud deposition depth at the edge of the mixing zone for discharge to waters 20-m deep ranged from 0.014 to 0.70 cm (0.005 to 0.28 in) (Table 3-8). Mud deposits of less than 1-cm depth are predicted to occur at the edge of the mixing zone for all percentages of the average discharge which were evaluated. Mud deposits beyond the mixing zone are predicted to be less, and the maximum mud depth [257.6 cm (101.4 in) for the average total discharge] occurs within the mixing zone (Table 3-7).

40-meter Water Depth. The model-predicted mud deposition depth at the edge of the mixing zone for discharge to waters 40-m deep ranged from 0.19 to 9.5 cm (0.07 to 3.7 in) (Table 3-8). Mud deposits of less than 1-cm depth are predicted to occur at the edge of the mixing zone for discharges of 229,371 kg (660,000 lb) or less (i.e., 50 percent of the average or less). Mud deposits beyond the mixing zone are predicted to be less, and the maximum mud depth [67.1 cm (26.4 in) for the average total discharge] occurs within the mixing zone (Table 3-7).

3.1.7.3. Above-Ice Disposal

The discharge of drilling muds and cuttings above ice is usually accomplished by depositing the effluent on the ice in large frozen chunks. It may also be spread in thin layers on the ice within berms to keep the disposal site intact as long as possible. Dilution and dispersion of the effluent occur at ice breakup. No modeling results are presented due to the lack of an adequate model for above-ice drilling mud disposal. Modeling of the transport and fate of muds in above-ice disposal sites is difficult due to the complexities of ice breakup processes.

3.1.7.4. Shunting of Discharges

Both open-water and below-ice discharges can be shunted (i.e., discharged at depth rather than near the surface). Shunting of drilling mud reduces the effective depth of the discharge, and therefore, reduces both the dissolved- and solids-fraction dilution. Table 3-9 provides dilution and deposition results obtained when using the OOC model with discharges shunted below the surface. Although the shunting cases modeled are not directly comparable to the other open-water and below-ice cases, they do illustrate the reduced dissolved dilutions obtained when discharges are shunted. The frequency of shunting during exploratory oil and gas drilling is unknown, as are the discharge depths that occur during shunting. However, it is likely that any shunting that does occur is only to a depth equivalent to the draft of the drilling ship or rig used (Choof, B., 3 October 1991, personal communication). The effects of shunting are likely to be minimal in deep waters, but may potentially be a cause of concern in shallower waters.

3.1.7.5. Summary

Computer modeling of drilling discharges and results obtained in other OCS areas support the following conclusions for drilling mud discharges in the area of coverage:

Drilling muds tend to be diluted rapidly following discharge. For a given discharge rate and mud density, the dilution is dependent on the density structure of the water column, the water depth, and current speed.

Of the three disposal methods available - open water, above-ice, and below-ice disposal - below-ice disposal is the least desirable due to the lesser dilution and dispersion potential for discharges.

The deposition and dilution of drilling muds for above-ice disposal has not been modeled; however, dilution of muds is thought to be similar or greater than that occurring during discharge to open-water disposal.

Based on OOC model results, deposition of drilling mud may exceed a depth of 1 cm (0.4 in) outside the mixing zone for open-water discharge in water-depths from 20 to 40 meters and surface current speeds of 10 cm/s (0.20 kn) (Table 3-5). For below-ice discharges, muds

deposited in excess of 1-cm (0.4-in) in depth outside the mixing zone may occur during discharges to water depths of 40 m.

Based on estimates of mud deposit depths for open-water discharge of various total drilling mud discharges it was determined that drilling mud deposits less than 1-cm deep outside of the mixing zone for surface current speeds of 10 cm/s (0.20 kn) are not predicted by the model for discharges to waters 40- and 20-m deep unless the total drilling mud discharged is reduced by 90 percent.

Based on estimates of mud deposit depths for below-ice discharges of various total drilling mud discharges it was determined that a drilling mud deposits less than 1-cm deep outside of the mixing zone for surface current speeds of 2 cm/s (0.04 kn) are predicted by the model for total mud discharges as high as 5 times the average to waters 5-m or 20-m deep. For discharges to waters 40-m deep, mud deposits less than 1-cm deep beyond the mixing zone are not predicted by the model unless the total drilling mud discharged is reduced by 50 percent.

Shunting of drilling muds should be avoided in shallow waters due to the reduced dissolved-fraction dilution it causes. Data concerning the frequency of shunting and the depths at which it occurs are not available.

3.2. CHEMICAL TRANSPORT PROCESSES

Chemical processes include the dissolution of substances in seawater, particle flocculation, complexing of compounds that may remove them from the water column, redox/ionic changes, and adsorption of dissolved pollutants on solids. Chemical transport of drilling fluids is poorly described. Much must be gleaned from general principles and studies of other, related materials. Several broad findings are suggested, but the data for a quantitative assessment of their importance are lacking. Chemical transport will most likely arise from oxidation/reduction reactions that occur in sediments. Changes in redox potentials will effect the speciation and physical distribution (i.e., sorption-desorption reactions) of drilling mud constituents.

3.2.1. Inorganics

Most research on chemical transport processes affecting offshore oil and gas discharges focuses on trace metal and hydrocarbon components. The trace metals of interest in drilling fluids include barium, chromium, lead, and zinc. The source of barium in drilling fluids is barite; barite may be contaminated with several metals of interest, including arsenic, cadmium, lead, mercury, zinc, and other substances (Table 3-10). These trace metals are discussed below as they pertain to chemical transport processes.

Kramer et al. (1980) found that seawater solubilities for trace metals associated with powdered barite generally result in concentrations below background levels. Exceptions were lead and zinc sulfides, which may be released at levels sufficient to raise concentrations in excess of ambient seawater levels. MacDonald (1982) found that less than five percent of metals in the sulfide phase are released to seawater.

Barite solubility in the ocean is controlled by the sulfate solubility equilibrium, which becomes saturated at concentrations of 30 to 40 micrograms per liter ($\mu\text{g/L}$) (Houghton et al., 1981).

Background sulfate concentrations in seawater are generally high enough for discharged barium sulfate to remain a precipitate and settle to sea bottom.

Chromium discharged in drilling fluids is primarily adsorbed on clay and silt particles, although some exists as a free complex with soluble organic compounds. Chromium is added to the mud system predominantly in the trivalent state as chrome or ferrochrome lignosulfonate, or chrome-treated lignite. It may be added in the hexavalent state as a lignosulfonate extender, in the form of soluble chromates. The hexavalent form is believed to be largely converted to the less toxic trivalent form by reducing conditions downhole. The most probable environmental fate of trivalent chromium is precipitation as a hydroxide or oxide at pH > 5. Transformation to hexavalent chromium in natural waters is likely only when there is a large excess of manganese dioxide. Simple oxidation by oxygen to the hexavalent state is very slow, and not significant in comparison with other processes (Schroeder & Lee, 1975).

Dissolved metals tend to form insoluble complexes through adsorption on fine-grained suspended solids and organic matter, both of which are efficient scavengers of trace metals and other contaminants. Laboratory studies indicate that a majority of trace metals are associated with settleable solids <8 µm in size (Houghton et al., 1981).

Trace metals, adsorbed to clay particles and settling to the bottom, are subjected to different chemical conditions and processes than when suspended in the water column. These sorbed metals can be in a form available to bacteria and other organisms if located at a clay lattice edge or at an adsorption site (Houghton et al., 1981). If the sediments become anoxic, conversion of metals to insoluble sulfides is the most probable reaction, and the metals are then removed from the water column. Environments that experience episodic sediment previously in buried sediments; such current conditions also allow further exposure of organic matter complexes for further reduction and eventual release.

3.2.2. Organics

The only data generated to date on the partitioning of organics in drilling muds were generated in a laboratory study on admixtures of generic mud No. 8 with 5 percent high-sulfur diesel oil (Breteler et al., 1984). Admixture of the oil into the drilling mud resulted in recovery from the mixture of 42 percent (4-hour mixture) or 45 percent (10-minute mixture) of hydrocarbons admixed. Longer missing time (4 hours) resulted in nearly complete evaporation of the lower alkylated benzenes and other alkanes below C₁₀.

After 10 minutes of mixing and a one-hour settling time for a one percent mud/seawater mixture, 30 percent of the hydrocarbons were in the suspended particulate phase, with five percent suspended and the remaining 25 percent in the aqueous phase. The aqueous phase was relatively enriched in C₁₀ alkanes. Neither C₁-C₆ benzenes nor C₁₀ alkanes were present in the suspended phase. The suspended phase was enriched in alkylated naphthalenes and phenanthrenes, except for C₃ phenanthrene. Suspended particulate phase (aqueous suspended) was enriched in C₀-C₄ (not C₅ and C₆) benzenes, in C₀-C₃ (not C₄) naphthalene and in C₀-C₂ (not C₃) phenanthrene.

Proportionately, naphthalenes accounted for 84 percent of aromatics and 51 percent of total organics in the suspended phase as compared to 58 percent of aromatics and 17 percent of total organics (recovered) in the whole mud (10-minute mixing; 1-hour settling). Mixing for 4 hours-, rather than 10 minutes, decreased hydrocarbons in settleable muds from 70 percent to 20 percent of total hydrocarbons recovered. Aqueous phase hydrocarbon content increased from 25 to 62 percent of the total. Particulate phase hydrocarbons increased from 5 to 18 percent of the total. After 4 hours, enrichment of the aqueous phase was limited to in C₂-C₆ benzenes and C₀ naphthalene, whereas the particulate phase was enriched in C₁-C₄ naphthalenes and in C₀-C₃ phenanthrenes, while alkylated benzenes were again absent from the particulate phase.

When a 0.1 percent mud to seawater ratio was used, 10 minutes of mixing followed by one hour of settling resulted in recovery of 98 percent of alkylated hydrocarbons in the suspended particulate phase, of which only 4 percent were in the suspended phase. The suspended phase was enriched in C₂-C₄ naphthalene and in C₀-C₃ phenanthrenes. After 4 hours of mixing and on hour settling, 99.7 percent of hydrocarbons were contained in the suspended particulate phase with 35 percent in the suspended phase. The suspended phase was enriched in C₁₀ n-alkanes but not in any other hydrocarbon. The aqueous phase, however, was enriched in C₀-C₃ naphthalenes and C₀ phenanthrene. Overall recovery of aromatic hydrocarbons in this experiment, however, was very low, thus hindering the interpretation of these data.

3.3. BIOLOGICAL TRANSPORT PROCESSES

Biological processes include bioaccumulation in soft or hard tissues, biomagnification, ingestion and excretion in fecal pellets, and physical reworking to mix solids into the sediment (bioturbation). Biological transport processes occur when an organism performs an activity with one or more of the following results:

- an element or compound is removed from the water column;
- a soluble element or compound is relocated within the water column;
- an insoluble form of an element or compound is made available to the water column;
- an insoluble form of an element or compound is relocated.

The most effective way to monitor the biological effects of drilling discharges is to take quantitative samples of the benthic infauna (animals that live on the sea floor). Sample variability is typically lower than that for planktonic or pelagic communities and thus sampling precision is higher. These animals do not move much, if at all, so they are much more vulnerable to the particulate fraction of fluids that accumulates on the bottom. The most common approach is to take replicate quantitative samples and determine whether there have been changes in species richness, species composition, or abundance. With six replicate samples, it is possible to detect changes of 15-25 percent of the mean for numbers of species and 25-50 percent changes in the mean abundances of some individual species. Field studies in Arctic Alaska did not use this approach.

Biological transport of drilling fluids is poorly described and the information must be gathered from general principles and studies of other, related materials. Several broad findings are suggested, but the data for a quantitative assessment of their importance are lacking. Bioaccumulation of a number of metals from exposure to muds and mud components has been demonstrated in the laboratory and in the field. Short-term laboratory experiments and field exposures indicate that tissue enrichment factors were generally less than an order of magnitude, with the exception of barium and chromium. However, target organ analyses were scant and improper test phases were often used. Also, long-term exposures, which are particularly relevant to assessing impacts of development operations, have been studied; thus, a bioaccumulation potential for those discharges has been qualitatively demonstrated, but cannot be assessed quantitatively at this time.

Bioaccumulation of organics from drilling fluids, in particular those associated with (diesel or mineral) oils added as lubricants, has not been studied. However, such studies of these oils themselves or their component substances indicate that a variety of their toxic constituents can be bioaccumulated. Nonetheless, only a qualitative conclusion may be reached.

3.3.1. Bioaccumulation

Bioaccumulation is the ability of an organism to concentrate substances, including nutrients, naturally-occurring substances, and xenobiotics, to levels above ambient concentrations. Laboratory studies have shown that bioaccumulation of trace metals can be reversed, at least in part. When an organism is transferred from a contaminated environment to a clean one, there generally occurs a decrease in pollutant concentration in the organism. (USEPA, 1985)

The majority of research on metal accumulation from drilling fluids has focused on barite (barium) and ferrochrome lignosulfonate (chromium). Table 3-12 provides a summary of laboratory data on metal accumulation discussed in the following paragraphs. Exposure to drilling fluids or drilling fluid components has resulted in the accumulation of barium, cadmium, chromium, lead, mercury, strontium, and zinc. Mercury levels were not considered in these studies and, therefore, data is not included in this table.

Liss et al., (1980) examined barium and chromium accumulation in sea scallops (*Placopecten magellanicus*) by exposing them for 4 weeks to a suspension of synthetic mud equivalent to 0.074 g/L ferrochrome lignosulfate. They found that chromium did not concentrate in the adductor muscle, but did concentrate in the kidney from 1.7 to 4.4 mg/kg dry weight. Exposure to ferrochrome lignosulfonate alone (0.1 and 0.3 g/L) resulted in 6-fold elevations of kidney chromium concentrations. When sea scallops were exposed to synthetic mud containing 0.55 g barite/L, kidney concentrations increased from less than 1.0 mg/kg dry weight to 100 mg/kg dry weight. Once exposure ceased, kidney chromium concentrations decreased slowly; typically less than 10 percent after 24 hours.

McCulloch et al., (1980) exposed the marsh clam (*Rangia cuneata*) to a layered solid phase of used ferrochrome lignosulfonate drilling fluid, containing 485 mg chromium/kg. Nearly half of

the excess accumulation was lost in the first 24-hours of depuration, although no further loss occurred during the following two weeks.

In a third experiment, clams and sea scallops were exposed to the mud aqueous fraction of a used mid-weight lignosulfonate drilling fluid (417 mg chromium/kg and 915 mg lead/kg dry weight). Approximately half of the excess for each metal was lost after four days depuration. When oyster spat (i.e., juveniles) of the species *Crassostrea gigas* were exposed to this same used mid-weight lignosulfonate drilling fluid, they exhibited soft tissue increases in chromium concentration of two- to three-fold in two days, and four-fold after 14 days. Lead concentrations in soft tissue increased two-fold after 10 days, while no detectable increase in soft tissue zinc concentrations was noted (McCulloch et al., 1980).

Tornberg et al., (1980) exposed arctic amphipods (*Onisimus* sp. and *Boeckosimus* sp.) to mixtures of used, freshwater XC-polymer drilling fluids (5 to 20 percent by volume) and water for 20 days. Concentrations of metals in the undiluted fluid were: cadmium - 0.5 to 1.5 mg/L; chromium - 66 to 176 mg/L; copper - 10 to 16 mg/L; and zinc - 49 to 110 mg/L. The greatest uptake occurred in the ten percent mixture occurred for cadmium, chromium, and lead, and in the five percent mixture for zinc. Maximum uptake relative to control organisms was five-fold for cadmium, and two-fold for chromium, lead, and zinc.

A field study of bioaccumulation in organisms around a drilling operation on the mid-Atlantic OCS analyzed tissue data from brittle stars, polychaetes, and mollusks. Based on discharge and sediment analyses, the only metals exhibiting elevated tissue concentrations that were attributed to drilling discharges were barium and chromium (EG&G, 1982). Barium concentrations increased significantly from pre-drilling levels in polychaetes and brittle stars during the first post-drilling survey (two weeks after the completion of drilling activity); mollusks did not accumulate barium to an appreciable degree. Barium tissue levels dropped to pre-drilling levels at all stations after one year (second post-drilling survey). Average chromium and barium concentrations in mollusk, polychaete and brittle star tissues from pre- and post-drilling cruises are provided in Table 3-11. The continued increase in tissue chromium levels of all organisms over a year's time indicates possible continued bioaccumulation of chromium from the low levels in the sediments.

Carr et al., (1982) exposed five marine species representing three animal phyla (Arthropoda, Annelida, and Mollusca) to three fractions of a used lignosulfonate drilling fluid. The organisms showed an apparent ability to accumulate chromium from the three mud fractions. In all but two cases, chromium levels fell to pre-exposure levels during depuration. However, marsh clams (*Rangia cuneata*) and sandworms (*Neanthes virens*) accumulated chromium to levels two times that of the controls and retained a large fraction of the chromium for an extended period of time.

Brannon and Rao (1979) exposed grass shrimp (*Palaemonetes pugio*) to 5 mg/L and 500 mg/L mixtures of barite in a flow-through seawater system. They analyzed for barium in the carapace (hard tissue), hepatopancreas, and abdominal muscle (soft tissues). They found that the shrimp exposed to barite accumulated higher barium levels in their exoskeletal and soft tissues than control shrimp in seawater, and that the level of accumulation increased with increasing duration of exposure.

Brannon and Rao also noted shrimp ingesting particulate barite and eliminating it in fecal pellets. This could affect fecal pellet nutritional value and sinking rate, which has ecological significance because fecal pellets are important in energy flow and nutrient cycling. Shrimp exposed to barite, in the presence of adequate strontium and calcium in the test water, were found to discriminate for barium and strontium relative to calcium in the hepatopancreas and abdominal muscle. This selective incorporation of barium into soft tissues may provide a long-term opportunity for barium to enter the food chain.

In the exoskeleton, the shrimp were found to discriminate for barium and against strontium relative to calcium. This changed the relative mineral composition of cast exoskeletons of grass shrimp from calcium>strontium>barium for control organisms to calcium>barium>strontium for experimental organisms. Incorporation of trace metals into hard tissue can result in removal from the water column that is more long-term than soft tissue incorporation. Although these removal processes may not have toxic implications, they are pathways by which metals are removed from the environment.

Chow and Snyder (1980) studied barium distribution in hard tissues of marine invertebrates collected from the southern California coast, and found that barium concentrations in calcareous exoskeletons were related to the type of organism and the mineralogical structure of the skeleton. Calcite skeletons of gastropods are composed of a crystal lattice that does not allow inclusion of the larger barium ion, whereas aragonite skeletons of mussels form a larger lattice structure which does allow for barium incorporation. Skeletons that incorporate other chemical compounds in carbonate form, such as those of the barnacle and sea urchin, allow still higher barium concentrations in skeletons.

For soft tissues, Chow and Snyder (1980) indicate that the digestive tract may be the route of barium entry for some marine organisms. The standard deviation of barium content in various organs of *Mytilus* exhibited the following trend: stomach>gills>muscles>gonads>shells. This trend supports the hypothesis that the digestive tract is the route of barium entry. The trend also indicates that marine organisms have some degree of regulation over the incorporation of barium into their tissues.

Conklin et al. (1980) note that the mechanisms of barium accumulation are poorly understood. There is some evidence that barium transport is mediated by a divalent-cation-activated adenosinetriphosphate (ATP) transport carrier as well as by micropinocytotic activity of the digestive epithelium. The latter hypothesis is supported by observations that grass shrimp, juvenile lobsters, and meiobenthic nematodes ingest particulate barite and accumulate it in their exoskeletons (Brannon & Rao, 1979; Chow & Snyder, 1980; Conklin et al., 1980).

Many crustaceans have long been known to incorporate granular materials into their statocysts (organs of balance). The granular materials are cemented together by glandular secretions of the statocyst wall to form statoliths. The ectodermal inner chitinous lining and contents of the statocysts (fluid, sensory hairs, and statoliths) are cast off during molting and renewed. Chow and Snyder (1980) confirmed that grass shrimp may incorporate sand grains, barite particles, or

drilling mud particles into their statocysts as they renew the exoskeleton following a molt. The effects on the grass shrimp of this barite incorporation remains to be investigated.

Maximal observed enrichment factors (tissue levels in exposed animals compared to control animal tissue levels) generally were low (1.6 to 3.4-fold), with the exception of barium (300-fold) and chromium (36-fold). Although functional changes resulting from metal accumulation were not explicitly addressed in these studies, no gross, overt functional changes or potential alterations have been noted.

The ability of exposed animals to clear metals accumulated during exposure to drilling fluids or components also have been reported. These data are summarized in Table 3-13. Depuration studies suggest that a substantial release of barium, chromium, lead, and strontium may occur. For whole animal, soft tissue, and muscle tissue analyses, 40 to 90 percent of the excess metal (barium, lead, chromium, and strontium) that was accumulated following 4 to 28-day exposures was released during 1 to 14-day depuration periods. Possibly, length of exposure and extent of depuration are inversely related. Transient increases were observed in chromium, lead, and strontium levels during the depuration period. The only sustained increase (48 percent) during this period occurred in chromium in scallop kidney. This finding is somewhat confounded by a similar trend (>24 percent) in control animals.

These data suggest that bioaccumulation of metals as a result of drilling fluids discharges did not appear to be a significant problem. Yet, three factors argued against this conclusion. First, uptake kinetics was not adequately described, largely attributable to the rather short exposure periods. These exposures were most often for 14 days or less. Occasionally 16 to 28-day exposures occurred; in one case a 106-day exposure occurred but with only one intermediate value reported. The available data do not allow for any firm conclusions about the extent of potential uptake. Simple saturation kinetics occurs for several metals and species. However, complex saturation kinetics also occurs frequently. The long-term study with 106-day exposure did not report adequate data to characterize uptake kinetics. Since metals are highly persistent, long-term accumulation potential must be assessed.

Second, the focus of these studies was often diffuse. Bioaccumulation studies should identify which of two toxicologic problems is being addressed: (1) human health impacts (edible tissue analyses) or (2) marine organism impacts (target organ analyses). Functional studies must be undertaken to link accumulation to adverse physiological/biochemical responses.

Third, exposure levels were difficult to quantify in a meaningful way for correlation to field exposure conditions. The assessment of the bioaccumulation of drilling fluids related metals will be driven by the exposure of benthic epifauna and infauna to drilling fluid particulates. Yet, bioaccumulation studies routinely have tested whole fluids or the aqueous phase of fluids. These exposures could have either over-estimated or under-estimated potential accumulation. Furthermore, in those studies that have tested solid phase material, accumulation was only measured in response to a deposit layer. Therefore, no concentration-effect relationship can be constructed that could estimate uptake from anything but a 100 percent exposure situation. This design does not lend itself to a meaningful quantitative assessment.

In order to simulate more realistic field conditions, Neff et al. (1984) examined uptake of barium and chromium from the liquid settleable phase of drilling muds. Experiments included several species of invertebrates; clams, worms, shrimp, scallops, lobsters, and one fish (flounder). These experiments were performed for longer periods of time (56 to 119 days) than previous test and the results are consistent with previous tests. Maximum bioenrichment factors for barium and chromium were in the range of 2.6-16.8 for barium and 1.9-2.8 for chromium.

While the design of these experiments was intended to simulate more realistic field conditions, the bioaccumulation values are compromised both by the variability of the data and, more importantly, by the fact that sediment barium and chromium levels decreased dramatically during the course of each experiment (40-80 percent for barium, 25-60 percent for chromium). Thus, assessing exposure in these experiments is very difficult and extrapolation to field conditions, in which concentrations increase during drilling, is confounded by this experimental design, not simplified.

In summary, evaluation of the bioaccumulation data for drilling fluids and components has concluded:

- Several metals can be accumulated, including barium, cadmium, chromium, lead, strontium, and zinc. Mercury is absent in the laboratory uptake data.
- Any significant potential for adverse effects are opposed by the observations that enrichment factors are generally low (barium and chromium excluded), depuration release levels are high, and no gross functional alterations, resulting from metal accumulation following high exposures to drilling fluids or components, have been reported.
- There are several other observations that compromise conclusion of adverse affects. Test results indicate that uptake kinetics is not simple, with saturation plateaus beyond the scope and predictive power of studies that have been conducted. Test design problems also contribute to equivocal interpretations and to poor utility in hazard assessment analyses. These design problems include: the choice of inappropriate drilling fluid fractions as test substances; the use of only one effective exposure concentration for fluid solids exposures; and the choice of tissues for analyses that are inappropriate for the species.
- Metal accumulation should be considered an important area requiring further study because of (a) the extreme persistence of metals, (b) the elevation of sediment metal levels resulting from drilling discharges, (c) the notable toxicity of some of the metals examined (cadmium and lead), (d) the absence of laboratory data on a significantly toxic metal (mercury), and (e) the inability to estimate potential effects from environmentally realistic exposures.

3.3.2. Biomagnification

Bioaccumulation relates to contaminant accumulation in a single species. If the contaminant is passed from prey to predator on to the next trophic level, a net increase in pollutant body burden up the food chain can result, and is known as biomagnification. Biomagnification is difficult to test experimentally and is generally assessed by comparing body burdens between organisms at different trophic levels.

Little information is available to allow an assessment of biomagnification of the components of drilling fluid discharges. Studies have been examined, however, which assessed biomagnification of other inorganic and organic pollutants in various food chains.

In an experiment to evaluate food chain transfer, sand worms were fed to flounder and lobsters, including worms that had been contaminated by living on barium-rich sediments and those which had been subsequently depurated (Neff et al., 1984). The mean barium level in contaminated worms was 22 µg/g, whereas the controls contained 7.1 µg/g. Chromium levels were 1.02 µg/g in contaminated worms and 0.62 µg/g in controls. In both cases depurated worms were not significantly different from controls.

The mean enrichment in flounder and lobster muscle barium concentration was 7.2-fold. Flounder fed contaminated food while living on uncontaminated sediment did not accumulate barium in muscle tissue. There was no significant uptake of chromium in either flounder or lobster (USEPA, 1985).

Type of food had no effect on mean barium concentrations in tail muscle of lobsters exposed to uncontaminated sediments. Lobsters living on contaminated sediments accumulated barium in muscle tissue when fed either uncontaminated or contaminated food.

The above data suggests that contact with sediments may be more important in the bioaccumulation of barium than direct food transfer. Throughout these experiments, the metal content of food was highly variable. Animals may have gone through periods of uptake and depuration relative to this food and also the sediments on which they were living. Because of the timing of analyses on food (weekly) versus animals (at 56 days and 99 days), it is not possible to develop any direct relationship between food source and animal tissue concentrations.

Studies of DDT and PCB organochlorine compounds reveal that accumulation of these compounds in the tissues of fish, mammals and birds from prey to predator occurs. Moreover, lipid concentrations show an increase with trophic level which indicates that dietary uptake and subsequent biomagnification is taking place. Studies undertaken with fish provide clear evidence that organochlorine uptake occurs more rapidly than does elimination, leading to increasing pollutant burdens with time and selective tissue accumulation at higher trophic levels (Fowler as cited in USEPA, 1985). However, for species at lower trophic levels, such processes are less clear.

Fowler cites several studies analyzing specific food chains for organochlorine biomagnification with mixed results. It was suggested that these studies failed because they assumed the primary organochlorine input was through the food chain, whereas recent studies indicate the water column may be the primary source, at least for zooplankton. Fowler speculates that plankton and

small invertebrates accumulate substantial amounts of material from the surrounding water, and will reflect its composition more strongly than vertebrates, which are generally larger and have less surface area for absorption and, therefore, are more likely to accumulate most of their organochlorines from prey consumed.

Data presented from California (Schafer et al. as cited in USEPA, 1985) concern trace metal and organic compound contamination in the marine environment. They examined three different food chains and found increasing concentrations of DDT and PCB with trophic level, but no evidence of increasing metal concentrations, except for organic mercury, which had a very strong increase.

Most data on inorganic pollutant biomagnification show a decrease in trace metal and radionuclide burden with higher trophic level. However, there are exceptions found in specific food chains. Dog whelks were found to have three times more cadmium and four times more zinc than the limpets they consumed (USEPA, 1985), and subsequent depuration experiments showed the whelks retained these metals. However, other experimental results have shown that whelks did not magnify zinc or iron in contaminated barnacles upon which they were fed.

One qualification for much of the metal data, however, is that muscle tissues were the most frequently sampled and analyzed. These tissues are not known to be physiological sinks for metal contaminants. No data have been identified that address target organ sites, such as hepatopancreas or kidney tissues, which would be the functional analogs to organic contaminants in fat and muscle tissue. Thus, the apparent difference between organics and metals may be due to the choice of tissue analyzed.

Cesium-137 has been shown by Fowler to accumulate in higher trophic level fish in the food chain. Studies examining plutonium-237 also indicated biomagnification. However, more recent work has shown that the implicated organisms (starfish) rapidly absorb plutonium from the water and eliminate it slowly. This further indicates the importance of knowing the uptake pathways prior to making conclusions regarding biomagnification.

Studies assessing biomagnification of petroleum hydrocarbons are more limited than for other pollutants, but the few data available suggest that these contaminants are not subject to biomagnification. One reason for this observation is that the primary source of these compounds for organisms may be absorption from the water column rather than ingestion. Also, biological half-times of some petroleum hydrocarbons may be short, with many species purging themselves within a few days (USEPA, 1985). Since the discharge of drilling muds and cuttings from exploratory drilling operations has little or no petroleum hydrocarbons, exposure to petroleum hydrocarbons would be minimal.

3.3.3. Ingestion and Excretion

Organisms also remove material from suspension through ingestion of suspended particulate matter and excretion of this material in fecal pellets. These larger pellets exhibit different transport characteristics than the original smaller particles. It has been noted that filter feeding plankton and other organisms ingest fine suspended solids (1 μm to 50 μm) and excrete large fecal pellets (30 μm to 3,000 μm) with a settling velocity typical of coarse silt or fine sand grains. Copepods are important in forming aggregate particles.

Zooplankton has been found to play a major role in transporting metals and petroleum hydrocarbons from the upper water levels to the sea bottom (Hall et al. as cited in USEPA, 1985). The largest fraction of ingested metals moves through the animal with the unassimilated food and passes out with the fecal pellets in a more concentrated state (Fowler as cited in USEPA, 1985). Zooplankton fecal pellets have also been found to contain high concentrations of petroleum oil, especially those of barnacle larvae and copepods. Hall et al. calculate that a population of calanoid copepods grazing on an oil slick could transport three tons of oil per square kilometer per day to the bottom.

3.3.4. Bioturbation

Another pathway of biological removal of pollutants involves benthic organisms reworking sediment and mixing surface material into deeper sediment layers. This process is known as bioturbation and moves barite and clays from drilling mud to greater depths than they would otherwise achieve. Bioturbation can also expose previously buried material and could be an important factor in potential long-term impacts. No work has been found to quantify bioturbation effects, although a few studies have observed organisms living on a cuttings pile or in the vicinity of drilling discharges. However, if the environment is one which rapidly removes cuttings piles, or where physical forces dominate resuspension and reworking processes, then biological mixing activities may not prove significant.

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4.0 BIOLOGICAL RESOURCES

This section provides an overview of the biological communities found within the Beaufort Sea, Chukchi Sea, Hope Basin, Norton Basin, and adjacent state waters. The general groups of aquatic organisms that inhabit the lease sale areas include pelagic (living in the water column), epontic (living on the underside or within the sea ice), or benthic (living on or within the bottom sediments) plants and animals. The categories of offshore biological environment that will be discussed include:

Plankton
Attached macro- and microalgae
Benthic invertebrates
Fishes (demersal and pelagic)
Marine mammals
Coastal and Marine birds
Threatened and Endangered Species
Essential Fish Habitat

Each of these biological resources is assessed in terms of seasonal distribution and abundance, growth and production, environmental factors, critical areas or habitats, and effects from exploration related discharges. An analysis of the cumulative effects of the discharges to biological resources is provided in Section 4.9. Mitigation measures are provided in Section 4.10. Assumptions for the effects analysis include:

- Exploratory oil and gas well drilling activities produce a wide range of waste that is discharged into receiving waters. The types of material discharged during exploratory operation mainly include drilling muds and cuttings, but also include sanitary and domestic wastes, desalination unit wastes, boiler blowdown, test fluids, deck drainage, blowout preventer fluids, uncontaminated ballast and bilge water, excess cement slurry, compounds used for equipment and drilling maintenance activities, non-contact cooling water, and fire control system test water. Discussion of these discharges is provided in Section 2.0 of this evaluation. Based on the small quantity of discharges, other than muds and cuttings, and the permit limitations imposed on them, it is unlikely that they will impact the marine environment or any listed species.
- Exploratory discharges are not likely to exceed applicable water quality criteria outside of a 100 m radius (~1,000 m area) around each drilling discharge site.
- In most continental shelf areas, drilling muds and cuttings land on the sea bottom within 1,000 m of the discharge point.
- Exploration activities are fairly temporary and are widespread throughout the Area of Coverage.

- Exploratory oil and gas drilling generates a wide range of waste materials related to the drilling process, equipment maintenance, and personnel housing. These materials are commonly discharged directly from the rig into the receiving water. Discharges of primary concern to this evaluation are drilling fluids, also called drilling muds, and cuttings. Drilling muds are the fluids used to lubricate the drill bit and stem and to remove waste rock particles (“cuttings”) that are brought up from the hole during the drilling operation.
- Components of potential concern in drilling muds include trace metals and specialty additives used with generic drilling mud systems. Drilling muds can adversely affect marine life provided exposures are sufficiently long and concentrations sufficiently high. Effects can occur due to chemical toxicity, clogging of feeding or respiratory structures with particulates, smothering, and modifications of habitat. Because drilling discharges are episodic and typically only a few hours in duration, organisms that live in the water column are not likely to have long-term exposures to drilling muds.
- The most toxicologically important constituents of drilling muds are aromatic compounds and heavy metals. The NPDES permit incorporates a standard acute toxicity test using the mysid *Mysidopsis bahia*. Under these permits, discharge of muds with a LC₅₀ of less than 30,000 ppm SPP (suspended particulate phase) is prohibited. Drilling mud toxicity data compiled by USEPA, Region-10, from Alaskan exploratory and production wells indicate that the muds used in all current and recent operations are acutely toxic only to a slight degree to *Mysidopsis bahia*. Only 7 of the 91 tests had a LC₅₀ less than the 30,000 ppm limit.
- Water quality standards for the state of Alaska are met at the edge of a 100-meter radius mixing zone.

Some impacts may be measurable, but their effects may be minimal and/or short-term in duration; therefore, they may not require avoidance or mitigation. Adverse impacts that are reduced by mitigation below the “significance thresholds” that are incorporated into the permit, or that are demonstrated to be acceptable because the risk of the impact occurring is small, are considered “nonsignificant.” For this evaluation, “significance threshold” is defined for each resource as the level of effect that equals or exceeds the adverse changes indicated in the following impact situations:

- Biological Resources (seals, walrus, beluga whale, polar bear, marine and coastal birds, terrestrial mammals, lower trophic-level organisms, fishes, essential fish habitat, and vegetation and wetlands): An adverse impact that results in a decline in abundance and/or change in distribution requiring three or more generations for the indicated population to recover to its former status and one or more generations for polar bears.
- Threatened and Endangered Species (bowhead whale, spectacled and Steller’s eiders): An adverse impact that results in a decline in abundance and/or change in distribution requiring one or more generation for the indicated population to recover to its former status.

4.1. PLANKTON

Plankton can be divided into two major classes: phytoplankton and zooplankton. Plankton are vital components of the pelagic plankton community as they provide the food base for other groups of marine organisms found within the Arctic Area of Coverage. The distribution, abundance, and seasonal variation of these organisms are strongly influenced by the physical environment.

4.1.1. Phytoplankton

4.1.1.1. Distribution and Abundance

The predominant phytoplankton species in Arctic Alaska waters are diatoms. One species, *Nitzschia cylindrus*, predominates in both open water and eponitic habitats (MMS, 1991). *Chaetoceros* sp. has also been identified as an abundant component of the phytoplankton (MMS, 1991). In studies done in Harrison and Prudhoe Bays, flagellates were most numerous at the surface with diatoms most numerous in the water column. Microflagellates may occasionally be the most abundant group in offshore waters.

Phytoplankton spatial distribution is variable and patchy, although distribution for most species is widespread. The spacial distribution (horizontal) of diatoms in waters close to shore and river mouths suggest that light levels, rather than salinity or temperature, determine diatom distribution (ADNR, 1999).

The abundance of phytoplankton in the Beaufort Sea is generally greatest in nearshore waters, with decreasing abundance noted further offshore (MMS, 1990). Peak abundance in late July and early August follows the breakup of winter ice and the peak in solar light intensity.

4.1.1.2. Growth and Production

The growth rates of planktonic organisms are relatively rapid, and the generation lengths are relatively short. For example, the body weight doubled every 2 weeks among immature stages of the common mysid, *Mysis litoralis*, during summer 1977-1978 field studies in Simpson Lagoon, and the generation length was 1-2 years (MMS, 2003). The rapid growth rates also were evident during formation of typical summer "blooms" during 1977 and 1978.

Phytoplankton production is limited primarily by available nutrients, particularly nitrogen, and light. The most productive area of the Arctic Alaska waters is the coastal zone. Primary productivity was highest not at the surface, but in the water column where diatoms were the most abundant organism. Phytoplankton production gradually increases after ice break-up, when light becomes available. Then it declines after September when light availability limits photosynthesis. Peak primary production varies by as much as two to three times between years and depends on the relative amount of summer ice cover (Homer, 1984). The presence of a

seasonal spring phytoplankton bloom immediately following ice breakup has not been firmly established (Homer, 1984; Schell et al., 1982). However, this may be due to the limited data available on phytoplankton concentrations when ice is still present (due to logistical sampling difficulties) to detect a spring bloom.

In the southern Chukchi Sea, primary production is enhanced by the transport of upwelled nutrient-rich water from the Gulf of Anadyr in the northwestern Bering Sea through the Bering Strait and into the Chukchi Sea. An area of intense productivity, nearly twice the production of the southeastern Bering Shelf, occurs in the region near St. Lawrence Island and northward through the Bering Strait. Primary productivity tends to decrease in the northerly direction from the Bering Strait.

Primary productivity in Inner Norton Sound is low due to turbidity from the sediment load carried by the Yukon River. Primary productivity of Outer Norton Sound is high; there are intense phytoplankton blooms each year associated with the spring retreat of the ice sheet.

4.1.1.3. Environmental Factors

The major environmental factors influencing phytoplankton growth are temperature, light and nutrient availability. Phytoplankton growth is usually limited to the *photic zone*, or the depth to which sunlight penetrates the water. Light, as influenced by ice regimes, and nutrients are both important in determining levels of primary production.

The phytoplankton provides the food base for a variety of secondary producers including herbivorous zooplankton (Figure 4-1). Rapid increases of phytoplankton stock in open water deplete nutrient concentrations in the upper water column, resulting in production being nitrogen-limited during the summer (MMS, 1991). While increased phytoplankton populations provide more food to organisms at higher trophic levels, too much phytoplankton can harm the overall health of the water body. During these blooms, most of the phytoplankton die and sink to the bottom, where they decompose. This process depletes the bottom waters of dissolved oxygen, which is necessary for the survival of other organisms.

4.1.1.4. Critical Areas or Habitat

At present no important habitats or areas can be identified.

4.1.2. Zooplankton

4.1.2.1. Distribution and Abundance

More than 100 species of zooplankton have been identified in Arctic Alaska waters. Copepods are the dominant zooplankton group, both in terms of numbers and biomass (MMS, 1990). Other components of zooplankton include amphipods, mysids, euphausiids, chaetognathes, ostracods, pteropods, ctenophores, and larval stages of benthic and nektonic organisms.

Zooplankton can be found in the sunlit zone and in deep ocean waters. Zooplankton abundance and species diversity appears to increase with increasing distance from shore.

4.1.2.2. Growth and Production

The growth rates of planktonic organisms are relatively rapid, and the generation lengths are relatively short. For example, the body weight doubled every 2 weeks among immature stages of the common mysid, *Mysis litoralis*, during summer 1977-1978 field studies in Simpson Lagoon, and the generation length was 1-2 years (MMS, 2003). The rapid growth rates also were evident during formation of typical summer "blooms" during 1977 and 1978.

The currents moving north through the Bering Strait exert a strong influence on Chukchi Sea primary and secondary productivity due to the transport of nutrients, detritus, phytoplankton, zooplankton, and larval forms of invertebrates and fishes from the Bering Sea to the Chukchi Sea. Seasonal ice regimes also influence the spatial and temporal variation of primary productivity.

Zooplankton standing stock generally fluctuates in response to phytoplankton production. Productivity within the Beaufort and Chukchi Seas decreases from nearshore to offshore waters and is considerably less than the productivity observed in comparable depths in the Bering Strait.

4.1.2.3. Environmental Factors

Most copepods are primarily herbivorous, so copepods form an important link between phytoplankton and larger, carnivorous species, including species of whales that feed on pelagic zooplankton (e.g., bowhead whale) (Figure 4-1).

Zooplankton, like phytoplankton, make excellent indicators of environmental conditions because they are sensitive to changes in water quality. They respond to low dissolved oxygen, high nutrient levels, toxic contaminants, poor food quality or abundance and predation.

4.1.2.4. Critical Areas or Habitats

Zooplankton abundance is generally lower in the Chukchi Sea than in more southerly areas (Hope and Norton Basins). However, zooplankton communities have been described as being richer in the Chukchi Sea and western part of the Beaufort Sea than in the eastern Beaufort Sea (east of approximately Barter Island) (MMS, 1990). At present no important habitats or areas have been identified.

4.1.3. Effects Analysis

An extensive review found no evidence of effects on plankton from drilling muds (Neff, 1991). Based on the 1,000-meter seafloor area that might be affected temporarily by drilling discharges, plankton in the Area of Coverage probably would not be affected. During exploratory drilling, muds and cuttings are typically discharged onto sea ice. This silty material, similar to riverine overflow sediments, may block sunlight and reduce photosynthesis of plankton in the water column; however, the area of impact would be limited to the immediate vicinity of the drill site. These cuttings are carried out to sea with the drifting pack ice after spring break-up.

4.2. ATTACHED MACROALGAE AND MICROALGAE

4.2.1. Macroalgae

4.2.1.1. Distribution and Abundance

Macroalgae show a distinct and fixed pattern of vertical distribution in their habitat. Some of these plants inhabit the coast above high water mark, whereas others populate the intertidal zone or the sublittoral zone. Macroalgae populations occur naturally, but an increase in their biomass (especially if it is associated with a decrease in seagrass) may also be an indication of deteriorating water quality. Macroalgal biomass is most commonly limited by dissolved inorganic nitrogen, but can also be limited if high light attenuation prevents adequate light reaching the bottom.

The distribution of kelp is limited by three main factors: ice gouging, sunlight, and hard substrate. Ice gouging restricts the growth of kelp to protected areas, such as behind barrier islands and shoals. Sunlight restricts the growth of kelp to the depth range where a sufficient amount penetrates to the seafloor, or water less than about 11 m deep. Hard substrates, which are necessary for kelp holdfasts, also restrict kelp to areas with low sedimentation rates. Macroalgae are also unlikely to occur in shallow water and areas lacking a rocky substrate. However, benthic algae have been noted in areas where rock substrates were lacking, but these algal beds did not contain the diverse epilithic fauna that characterized areas with suitable rocky substrate (Dunton et al., 1982).

Attached macroalgae (primarily kelp) occur in state waters in nearshore and offshore barrier island areas containing suitable rocky substrate for attachment. Dunton et al. (1982) reported on the occurrence of kelp beds along the coastal areas of the eastern Beaufort Sea. Concentrated areas of kelp have been noted in state waters of the Beaufort Sea at Steffansson Sound (Boulder Patch), Stockton Islands, Belvedere and Flaxman Islands, Demarcation Bay, Elson Lagoon near Point Barrow, near Konganevik Point in western Camden Bay, and Nuvagapak Lagoon. Macroalgae concentrations along the Chukchi Seacoast not been frequently encountered in the Chukchi Sea, possibly due to the lack of adequate substrates (rock, cobble, and gravel). Kelp beds have been noted about 20 km northeast of Peard Bay near Skull Cliff and in an area 25 km (13.5 nmi) southeast of Wainwright in water depths of 11 to 13 m (MMS, 1991).

Macroalgal communities are typically dominated by the kelp, *Laminaria* sp. Studies of the Boulder Patch algal community indicated the predominance of the kelp, *Laminaria solidungula*, but red algae and a diverse assemblage of benthic invertebrates were also noted (MMS, 1990). Macroscopic red and green algae have also been noted in Peard Bay of the Chukchi Sea (Truett, 1984a).

4.2.1.2. Growth and Production

Arctic kelp grows fastest in late winter and early spring due to higher concentrations of inorganic nitrogen in the water column (ADNR, 1999). Sediments trapped in the ice above the kelp block light and restrict growth while the presence of leads and cracks has the opposite effect (ADNR, 1999).

4.2.1.3. Environmental Factors

Kelp beds provide a three-dimensional environment that provides a diverse habitat for attached microalgae, invertebrates, and fish. However, relatively few invertebrates (all polychaetous annelids and arthropods) and only six species of fish were noted in conjunction with the algae at Skull Cliff (MMS, 1991).

Kelp at Boulder Patch was estimated to contribute half of the annual primary carbon production (Dunton, 1984). Approximately 60 percent of the particulate organic carbon released to the environment originates from kelp which may be an important source of carbon to secondary producers in the community (Dunton, 1984). The only herbivore that noticeably consumes kelp in Boulder Patch is the chiton (*Amicula vestita*) (Dunton, 1984).

4.2.1.4. Critical Areas or Habitats

All likely kelp habitats have not yet been surveyed. Other kelp habitats may be discovered, as portions of the Area of Coverage are further explored. The areas of concentrated macroalgal

growth that have been identified include Skull Cliff, Steffansson Sound (Boulder Patch), Stockton Islands, Flaxman Island, Demarcation Bay, and Elson Lagoon, which may be considered important habitats or areas. Phillips and Reiss (1985) have also reported a large kelp bed approximately 25 km (13.5 nmi) southwest of Wainwright in water depths of 11 to 13 m (36 to 43 ft). This kelp bed may be a critical area for various populations within the area.

4.2.2. Microalgae

The microalgae consist primarily of pennate diatoms and microflagellates, but centric diatoms and dinoflagellates may also be present (Homer & Schrader, 1982).

While the mechanism of photosynthesis in microalgae is similar to that of higher plants, they are generally more efficient converters of solar energy because of their simple cellular structure. In addition, because the cells grow in aqueous suspension, they have more efficient access to water, CO₂, and other nutrients.

4.2.2.1. Distribution and Abundance

Attached microalgae occur in the epontic community of both state waters and the open marine waters of the Beaufort and Chukchi seas.

In general, attached microalgae are most likely to occur in areas not subjected to ice gouging and land fast ice, and where hard substrates suitable for attachment occur (MMS, 1990). However, benthic algae have been noted in areas where rock substrates were lacking, but these algal beds did not contain the diverse epilithic fauna that characterized areas with suitable rocky substrate (Dunton et al., 1982).

Benthic microalgae occur in sediments and within the macroalgal communities. Benthic microalgae may be a significant source of primary productivity in nearshore areas, but in areas of kelp production, the contribution of benthic microalgae may be relatively small. Dunton (1984) estimated that benthic microalgae contributed about 2 percent of the annual carbon produced in the Steffansson Sound Boulder Patch.

4.2.2.2. Growth and Production

Light appears to be the limiting factor which controls the distribution, development, and production of the ice-algal assemblage (MMS, 1990). The ice-algal bloom usually occurs in April and May and occasionally in early June, while the open water phytoplankton bloom does not occur until ice breakup is underway.

4.2.2.3. Environmental Factors

These algae are the primary food source for a variety of animals, including amphipods, copepods, ciliates, various worms, and juvenile and adult fishes (MMS, 1991) (Figure 4-2).

Epontic microalgae were estimated to contribute 25 percent of the annual carbon production at Boulder Patch (Dunton, 1984).

4.2.2.4. Critical Areas or Habitats

The distribution of microalgal communities has been noted as patchy on both large and small scales (MMS, 1991), and no important critical habitats or areas can be identified at present.

4.2.3. Effects Analysis

The types of material discharged during exploratory operations usually include drilling muds and cuttings, although there are restrictions on these discharges in shallow water, under ice, and near special kelp communities. Although the permit allows for a 100-m zone of potential contamination, there is no evidence of the effects on kelp and seaweed. Smothering of species within the 1,000-m seafloor area would occur and would have adverse effects to species. However, recovery of the affected benthic communities likely would occur within 1-2 years after the termination of discharges.

Drilling muds can adversely affect marine life provided exposures are sufficiently long and concentrations sufficiently high. Effects can occur due to chemical toxicity, clogging of feeding or respiratory structures with particulates, smothering, and modifications of habitat. The most toxicologically important constituents of drilling muds are aromatic compounds and heavy metals.

The benthic community in the immediate vicinity of the drilling discharge is the most likely to be impacted because of exposure to large amounts of drilling muds and cuttings. The results of the OOC model case runs indicate that benthic communities outside the prescribed 100-m mixing zone could be adversely impacted because they would receive greater than 1 cm of deposited solids.

It is not possible to accurately predict the area within the proposed area of coverage which would receive deposition amounts detrimental to benthos, because of the uncertainty of drilling rig locations and because deposition depends on site-specific oceanographic conditions. If it is assumed that a deposition depth of 1 cm (0.4 in) would be detrimental to benthic organisms, a worst-case scenario calculation indicates that less than 0.0001 percent of the total area proposed

for exploration by MMS and ADNR would potentially be adversely impacted. Solids deposition exceeding 1 cm (0.4 in) in thickness may be expected for a variety of drilling scenarios, including water depths of 5, 20, or 40 m (16.5, 66, or 131 ft., respectively) in both open-water and below-ice settings.

Uncertainty exists regarding the long-term toxicological effects of drilling muds and cuttings deposited on the seafloor. Of particular concern are the impacts arising from chronic leaching of metals, hydrocarbons, and the most persistent biocides in drilling muds and cuttings deposited on the bottom. In addition, insufficient evidence exists to demonstrate that data from short-term acute toxicity tests reveal subtle adverse effects at the ecosystem level of biological complexity (Parrish & Duke, 1990).

4.3. BENTHIC INVERTEBRATES

Benthic invertebrates are organisms that live on the bottom of a water body (or in the sediment) and have no backbone. The size of benthic invertebrates ranges from microscopic (e.g., microinvertebrates, <10 microns) to a few tens of centimeters or more in length (e.g., macroinvertebrates, >50 cm). Benthic invertebrates live either on the surface of bedforms (e.g., rock, coral or sediment - epibenthos) or within sedimentary deposits (infauna), and comprise several types of feeding groups (e.g., deposit-feeders, filter-feeders, grazers and predators). The principal benthic invertebrates found in the Area of Coverage include oligochaete worms, isopods, mysids, amphipods, bivalves, priapulids, chironomid larvae, dipterans, and hermit crabs (Broad et al., 1978).

4.3.1. Distribution and Abundance

The distribution, abundance, and seasonal variation of benthic species in the Arctic Alaska waters are strongly correlated with physical factors (e.g., substrate composition, water temperature, depth, dissolved oxygen concentrations, pH, salinity, sediment carbon/nitrogen ratios, and hydrography). Larger invertebrate communities are found in nearshore lagoons. These communities include animals living in the bottom (infauna), animals living on or near the bottom (epibenthic), and those which live in the water column (pelagic). During winter, epibenthic and pelagic species disappear, and then emerge again in spring, whereas infauna and some amphipods may be present year-round (ADNR, 1999).

In nearshore waters with depths less than 2 m (6.6 ft), relatively few species are found because the ice in this region extends all the way to the seafloor during winter. Therefore, the abundance of most species is probably dependent on annual (or more frequent) colonization. Biomass and diversity in the inshore zone generally increase with depth, except in the shear zone between approximately 15 to 25 m (49 to 82 ft). Intensive ice gouging occurs in this zone, which disturbs the sediments and presumably limits the abundance of infaunal species (Braun, 1985).

In order of decreasing numerical abundance, polychaetes (*Ampharete vega* and *Terebellides stroemi*), bivalves (*Cyrotidaria durriana*), and small crustaceans (principally amphipods) are the most abundant infaunal organisms on the continental shelf and slope of the Beaufort Sea (Carey

et al., 1974, pp. 565-680; Carey & Ruff, 1977, p. 510; Carey, 1978, p. 160). Carey et al. (1974) reported that polychaete worms comprised up to 85 percent of the infauna at stations sampled on the Beaufort Sea continental shelf.

Common epibenthic creatures (epifauna) found within the area include amphipods, mysids, the isopod *Saduria entomon*, the shrimps *Sabinea septemcarinata* and *Sclerocrangon boreas*, and the crabs *Chionoecetes opilio* (tanner crab) and *Hyas coarctatus*; pelagic species include copepods and chaetognaths. Together with euphausiids, and planktonic amphipods, they constitute a substantial portion of the invertebrate biomass, especially in inshore areas. Populations of nearshore and inshore motile epifauna do not appear to differ between the Beaufort Sea, Chukchi Sea, and the eastern Bering Sea (Broad, 1979, p. 371; Stoker, 1981). In offshore areas, echinoderms are important contributors to the total biomass.

The species composition and biomass of the Chukchi Sea is strongly controlled by the input of nutrients and organic matter from the productive waters of the Gulf of Anadyr through the Bering Strait into the Chukchi Sea (Feder et al., 1989). Two major faunal assemblages have been identified by Stoker (1981) for the Chukchi Sea: one group is dominated by the polychaete *Maldane sarsi*, the echinoderm *Ophiura sarsi*, the sipunculid *Golfingia margaritacea*, and the bivalve *Astarte borealis*; the second group is dominated by the bivalves *Macoma calcarea*, *Nucula tenuis* and *Yoldia hyperborea*, and the amphipod *Pontoporeia femorata*. These areas, in turn, served as significant foraging areas for the bottom-feeding gray whales and walrus (Feder et al., 1989).

Among epifaunal invertebrates, echinoderms seem to dominate (Frost & Lowry as cited in Truett, 1984b, p. 136). Brittle stars (usually *Ophiura sarsi*,) are particularly abundant in areas with muddy substrate. Other associated species include soft corals (*Eunephthya sp.*) and sea cucumbers (*Psolus sp.* and *Cucumaria sp.*). Epibenthic species abundance and distribution are typically quite variable within the shallow water lagoons near the Chukchi Sea Area of Coverage.

In nearshore waters with depths less than 2 m (6.6 ft), relatively few species are found. During winter, the ice in this region extends all the way to the seafloor; therefore, the abundance of most species is probably dependent on annual (or more frequent) colonization. Biomass and diversity in the inshore zone generally increase with depth, except in the shear zone between approximately 15 to 25 m (49 to 82 ft). Intensive ice gouging occurs in this zone, which disturbs the sediments and presumably limits the abundance of infaunal species (Braun, 1985, p. 67). Ice gouging continues out to about 40 m (131 ft) with decreasing intensity. Diversity and biomass of infauna increase beyond this zone with distance offshore, at least as far as the continental shelf boundary [200 m (656 ft)] (MMS, 1990). Few data are available regarding the benthic community inhabiting deeper waters within the Beaufort Sea Planning Area; therefore, it is not possible to identify the important species in this region or their distributions and abundances.

4.3.2. Growth and Production

Studies of the northeast Chukchi Sea by Feder et al. (1989) indicated that the supply of organic matter from the Bering Sea supplied the sediments with organic matter that resulted in areas of relatively higher benthic productivity.

4.3.3. Environmental Factors

The abundance, diversity, biomass, and species composition of benthic invertebrates can be used as indicators of changing environmental conditions. The biomass of benthic invertebrates declines if communities are affected by prolonged periods of poor water quality especially when anoxia and hypoxia are common. Benthic communities can change in response to:

- nutrient enrichment leading to eutrophication;
- bioaccumulation of toxins to lethal levels in molluscs (shellfish), crustaceans, polychaetes and echinoderms, and cause the loss of herbivorous and predatory species;
- lethal and sub-lethal effects of heavy metals and other toxicants derived from oil and gas activities;
- dislodged epifauna and infauna from trawling and dredging which may result in the collection and mortality of a substantial invertebrate bycatch;
- the replacement of the existing benthic community with other benthic species due to physiological stress and/or by competition or predation by species better physiologically suited to the modified conditions; and
- changes in the physical and biological characteristics and structure of habitats (i.e., their function), including supporting habitat such as seagrass meadows and sandy soft bottom areas.

Burrowing and tube-building by deposit-feeding benthic invertebrates (bioturbators) helps to mix the sediment and enhances decomposition of organic matter. Nitrification and denitrification are also enhanced because a range of oxygenated and anoxic micro-habitats are created. Loss of nitrification and denitrification (and increased ammonium efflux from sediment) in coastal systems is an important cause of hysteresis, which can cause a shift from clear water to a turbid state. The loss of benthic suspension-feeding macroinvertebrates can further enhance turbidity levels because these organisms filter suspended particles including planktonic algae, and they enhance sedimentation rates through biodeposition (i.e. voiding of their wastes and unwanted food).

Changes in the macrofauna (and flora) causes changes in nutrient storage pools and in the flux of nutrients between microfauna (and flora) and macrofauna and flora. Macrofauna are also important constituents of fish diets and thus are an important link for transferring energy and nutrients between trophic levels and driving pelagic fish and crustacean production. It is for these reasons and others, that benthic invertebrates are extremely important indicators of environmental change.

The nearshore waters provide habitat for a variety of benthic organisms which in turn serve as an important food source for birds and fishes that utilize state waters for feeding, spawning, and nursery areas. The primary prey organisms for fish, mammals [including gray whales (*Eschrichtius robustus*), beluga whales (*Delphinapterus leucas*), and walrus (*Odobenus rosmarus divergens*)], and birds are the motile pelagic organisms and motile benthic epifauna (Figure 4-2).

4.3.4. Critical Areas or Habitats

Because of the disturbance from grounded ice, most of the benthic species in the Area of Coverage are small and widely distributed, like small clams and mobile epibenthic amphipods.

The area known as Boulder Patch (located in Steffanson Sound near the Sagavanirtok River) is recognized as an important benthic habitat, primarily due to habitat provided by hard substrates and associated algal beds. This area lies within the adjacent state waters of the areas of coverage.

4.3.5. Effects Analysis

Many benthic invertebrates are relatively sedentary and sensitive to environmental disturbance and pollutants. Drilling muds can adversely affect marine life provided exposures are sufficiently long and concentrations sufficiently high. Effects can occur due to chemical toxicity, clogging of feeding or respiratory structures with particulates, smothering, and modifications of habitat. The most toxicologically important constituents of drilling muds are aromatic compounds and heavy metals.

Overall, larvae and planktonic organisms are apparently the most sensitive to drilling discharges, and effects on them will primarily be a function of dilution and dispersion of the discharge plume. It is unlikely that the chemical toxicity of drilling muds will substantially impact pelagic organisms near exploratory drilling sites because concentrations of toxic constituents are estimated to be below levels known to be acutely lethal at the edge of the 100-m (328 ft) mixing zone.

The benthic community in the immediate vicinity of the drilling discharge is the most likely to be impacted because of exposure to large amounts of drilling muds and cuttings. Little information is presently available concerning the effects of various deposition depths on benthic communities. Most studies that have investigated deposition impacts on benthos have examined deposition of dredged materials (Hale, 1972; Kranz, 1974; Mauer et al., 1978; Oliver & Slattery,

1973; Saila et al., 1972; Schafer, 1972; Schulenberger, 1970; Wilber, 1992). These studies indicate that the response to deposition and survival following such an event is species-specific. Of the species examined, burial depths from which organisms were able to migrate to the surface ranged from 1 to 32 cm (0.4 to 12.6 in). If it is assumed that most benthos are not adversely affected by deposition of drilling muds less than 1 cm, benthos in the vicinity of the discharge receiving deposition in excess of this amount may be acutely impacted by drilling activities. The results of the OOC model case runs indicate that benthic communities outside the prescribed 100-m mixing zone could be adversely impacted because they would receive greater than 1 cm of deposited solids.

It is not possible to accurately predict the area within the proposed area of coverage which would receive deposition amounts detrimental to benthos, because of the uncertainty of drilling rig locations and because deposition depends on site-specific oceanographic conditions. If it is assumed that a deposition depth of 1 cm (0.4 in) would be detrimental to benthic organisms, a worst-case scenario calculation indicates that less than 0.0001 percent of the total area proposed for exploration by MMS and ADNR would potentially be adversely impacted. Solids deposition exceeding 1 cm (0.4 in) in thickness may be expected for a variety of drilling scenarios, including water depths of 5, 20, or 40 m (16.5, 66, or 131 ft, respectively) in both open-water and below-ice settings.

Uncertainty exists regarding the long-term toxicological effects of drilling muds and cuttings deposited on the seafloor. Of particular concern are the impacts arising from chronic leaching of metals, hydrocarbons, and the most persistent biocides in drilling muds and cuttings deposited on the bottom. In addition, insufficient evidence exists to demonstrate that data from short-term acute toxicity tests reveal subtle adverse effects at the ecosystem level of biological complexity (Parrish & Duke, 1990).

The quantity of benthic organisms preyed upon by other species could be reduced in the area of the discharge if benthos migrate from the area, or experience increased mortality or decreased recruitment, through smothering, toxicity, or alteration of sediment grain size characteristics. The degree of food supply reduction caused by discharges of drilling muds and cuttings is unknown, as the size of the affected area and severity of impacts are by necessity speculative. However, a significant reduction of food supplies (benthic organisms) is judged unlikely, given that under a worst-case scenario, only a small portion of the Area of Coverage (approximately 0.0001 percent of the area) would receive deposition depths greater than 1 cm (0.4 in).

Benthic organisms near Beaufort Sea drilling sites have not been found to accumulate petroleum hydrocarbons or heavy metals (Brown, Boehm & Cook as cited in MMS, 2003). Based on the 1,000-m seafloor area that might be affected temporarily by drilling discharges, less than one percent of the benthic organisms in the Area of Coverage probably would be affected. Benthic organisms within 1,000 m of a platform would likely experience temporary sublethal effects with some lethal effects on immature stages due to trace metals in drilling muds. Within this distance, some changes would likely occur in the species composition of affected benthic areas. Recovery of the affected benthic communities likely would occur within 1-2 years after the termination of discharges.

Norton Sound supports a rich benthic community which plays a key role in an extended food chain supporting a wide range of marine mammals. Any disruption of this benthic base could seriously affect the biota of the entire region.

4.4. FISHES

The fishes occurring in the Arctic Alaska waters fall into three basic categories (MMS, 2003): 1) freshwater species that may occasionally enter marine waters, 2) anadromous species that spawn in freshwater and migrate seaward as juveniles and adults, and 3) marine species that complete their entire life cycle in the marine environment. Fish species likely to be found in the Area of Coverage are listed in Table 4-1.

4.4.1. Distribution and Abundance

Sixty-two species of fish have been collected from the coastal waters of the Alaskan Beaufort Sea (69% marine, 26% migratory, 5% freshwater). Thirty-seven species were collected in the warmer nearshore brackish waters, and 40 species were collected in the colder marine waters farther offshore (some use both habitats). Seventy-two species of fish were reported for the northeastern Chukchi Sea (MMS, 1991).

The physical environment, mainly temperature and salinity, of the Arctic waters exerts a strong influence on the temporal and spatial distribution and abundance of fish (MMS, 1990, 1991). The Chukchi Sea represents a transition zone between the fish communities of the Beaufort and Bering Seas (MMS, 1991); the fauna is primarily Arctic with continual input of southern species through the Bering Strait (Craig, 1984). Marine fish in the Chukchi Sea are generally smaller than those in areas farther south, and densities are much lower (Frost and Lowry, 1983). The lower diversity, density, and size of fish in the region have been attributed to low temperatures, low productivity, and lack of nearshore winter habitat due to ice formation (MMS, 1987b).

During the open-water season, the nearshore zone of this area is dominated by a band of relatively warm, brackish water that extends across the entire Alaskan coast. The summer distribution and abundance of coastal fishes (marine and anadromous species) is strongly affected by this band of brackish water. The band typically extends 1-6 miles offshore and contains more abundant food resources than waters farther offshore. The areas of greatest species diversity within the nearshore zone are the river deltas. As the summer progresses, the amount of freshwater entering the nearshore zone decreases, and nearshore waters become colder and more saline. From late summer to fall, migratory fishes move back into rivers and lakes to overwinter and to spawn (if sexually mature). In winter, nearshore waters less than 6 feet deep freeze to the bottom. Before they freeze, marine fishes continue to use the nearshore area under the ice but eventually move into deeper offshore waters with the advancement of landfast ice.

The freshwater environment of the Alaska Coastal Plain consists of rivers, streams, lakes, ponds, and a maze of interconnecting channels. While some of these waterbodies are completely isolated, most are permanently, seasonally, or sporadically connected. Seasonally connected lakes are flooded during breakup, while sporadically connected lakes are flooded only during

high-water years (MMS, 2003). The distribution and abundance of freshwater and migratory fishes depend on (1) adequate overwintering areas, (2) suitable feeding and spawning areas, and (3) access to these areas (typically provided by a network of interconnecting waterways) (MMS, 2003).

Since the presence of freshwater species is generally sporadic and brief within the Area of Coverage, there is little information regarding distribution and abundance, although it can be derived that these species would be found near river deltas and bays in nearshore waters; juvenile fishes prefer the warmer shallow-water habitats that become available during the open-water period (MMS, 2003). The most abundant freshwater fish is the ninespine stickleback (Hemming in MMS, 2003). The highest numbers are found in waters having emergent and submerged vegetation suitable for spawning and rearing, with overwintering sites nearby (Hemming as cited in MMS, 2003)

Anadromous fish typically leave the rivers and enter the nearshore waters during spring break-up in June. As the ice cover melts and recedes, these fish will migrate along the coast; smaller fish tend to stay near the mouths of rivers while larger fish may migrate distances of 80 mi or more in search of feeding habitat (ADNR, 1999). Migration back to rivers varies by species, but most anadromous fish return to freshwater, where they spawn and overwinter, by mid-September (ADNR, 1999).

Whitefish spend much of their life cycle feeding in salt water during the summer and generally remain in freshwater plumes extending out from river mouths and in marine waters of lower salinity (ADNR, 1999).

Cisco are among the most abundant anadromous fish in bay and delta areas. They inhabit the nearshore environment and spawn in the fall.

Salmon (anadromous species) are uncommon in the North Slope region and thought to be strays by most researchers, although pink and chum salmon have been reported throughout the Chuckchi Sea. The presence of salmon is rare in the Beaufort Sea coastal waters, particularly east of the Colville River. While the occurrence of salmon east of the Colville River is rare, small numbers of pink salmon occasionally have been taken in the Sagavanirktok River and Colville River and in some drainages west of the Colville River. However, both species do not have established populations and spawning is not known to have occurred anywhere in this area (MMS, 2003). It is possible that random small schools of pink salmon from western stocks spawn in the Sagavanirktok River on a chance basis. In recent years, chum smolts have been caught in the lower delta (MMS, 2003). Small runs also may occur in rivers closer to Barrow. Small numbers of chum are taken in the Chipp River and in Elson Lagoon, including adults in spawning condition (MMS, 2003).

Marine species appear to be widely distributed but in fairly low densities; schooling species (e.g., arctic cod) display a rather patch distribution (ADNR, 1999). Some marine species sporadically enter the nearshore areas to feed and spawn while others remain in coastal waters throughout the open-water season then move farther offshore with the advancement of the landfast ice during winter.

The most widespread and abundant marine species are the arctic cod, saffron cod, twohorn and fourhorn sculpins, the Canadian eelpout, and the arctic flounder (MMS, 1987a). Additionally, Arctic staghorn sculpin, shorthorn sculpin, and hamecon are abundant species in the Chuckchi Sea. Common marine fishes in the nearshore area include fourhorn sculpin, yellowfin sole, and capelin (MMS, 1987b, 2003). Saffron cod, arctic flounder, and snailfish also use the nearshore area; however, their occurrence is sporadic and variable, and they are found in much lower numbers. Arctic flounder, starry flounder, and fourhorn sculpin are generally found in the low-salinity waters near estuaries and river mouths. Common marine fishes in waters farther offshore include arctic cod, arctic staghorn sculpin, kelp snailfish, capelin, shorthorn sculpin, twohorn sculpin, hamecon, and Canadian eelpout (MMS, 1987a, 2003). Despite the large quantity of benthos in Norton Sound, bottomfish are less abundant there than in the other Alaskan regions in the Area of Coverage.

Arctic cod are infrequent visitors to nearshore habitats during the first portion of the open-water season when waters are warmest and salinities are low (Craig et al. as cited in MMS, 2003). Arctic cod have been found to be more concentrated along the interface between the warmer nearshore water and colder marine water.

Fourhorn sculpin are among the most widespread and numerous species along the Beaufort Sea coastline. This demersal fish is found in virtually all nearshore habitats, including deeper waters not frequented by anadromous fishes.

Saffron cod, arctic flounder, and starry flounder have similar distributions; however, their occurrence is sporadic and variable and they are present in much lower numbers (MMS, 1987a).

Canadian eelpout is a benthic fish species that is common on muddy bottoms. Twohorn sculpin is found offshore and is abundant but patchy in its distribution (ADNR, 1999).

Capelin is a widely distributed species that has been reported in areas west of the Mackenzie Delta. It is only abundant during August when it spawns in coastal habitats (MMS, 1987a).

4.4.2. Growth and Production

A lack of overwintering habitat is the primary factor limiting arctic fish populations (ADNR, 1999).

Ocean growth of pink salmon is a matter of considerable interest because, although this species has the shortest life span among Pacific salmon, it also is among the fastest growing. Entering the estuary as fry at around 3 cm in length, maturing adults return to the same area 14-16 months later ranging in length from 45 to 55 cm.

Spawning in the arctic environment can take place only where there is an ample supply of oxygenated water during winter. Because of this and the fact that few potential spawning sites

can meet this requirement, spawning often takes place in or near the same area where fishes overwinter (MMS, 2003).

The timing and location for spawning by marine fish varies. Capelin spawns in coastal areas in August. Fourhorn sculpin spawn on the bottom in nearshore habitats during midwinter. Snailfish also spawn in midwinter by attaching their eggs to rocks or kelp. Arctic cod spawn under the ice between November and February in both shallow state waters and in offshore waters (MMS, 1990).

4.4.3. Environmental Factors

Because the feeding habits of marine fishes are similar to those of anadromous fishes, some marine fishes are believed to compete with migratory fishes for the same prey resources. Competition is most likely to occur in the nearshore brackish-water zone, particularly in or near the larger river deltas.

Infaunal prey density in the nearshore substrate is very low and provides little to no food for anadromous fishes. However, prey density in the nearshore water column is high, about five times that of freshwater habitats on the Arctic Coastal Plain. The nearshore feeding area also is much larger than that of freshwater habitats on the coastal plain (MMS, 2003). For these reasons, both marine and anadromous fishes come to feed on the relatively abundant prey found in nearshore waters during summer.

In late summer when anadromous fishes are less abundant and their prey is more abundant, dietary overlap is common in nearshore waters (MMS, 2003). Marine birds also compete for the same food resources during this time. Anadromous fishes do little to no feeding during their migration back to freshwater and when spawning, but some resume feeding during winter.

In the marine environment, pink salmon fry and juveniles are food for a host of other fishes and coastal sea birds. Subadult and adult pink salmon are known to be eaten by fifteen different marine mammals, sharks, other fishes such as Pacific halibut, and humpback whales. Because pink salmon are the most abundant salmon in the North Pacific, it is likely they comprise a significant portion of the salmonids eaten by marinemammals.

Marine species feed heavily on epibenthic and planktonic crustacea such as amphipods, mysids, isopods, and copepods. Bottom fish, including flounders, also feed on bivalve mollusks and fourhorn sculpins also feed on juvenile Arctic cod (MMS, 1990). Except for Arctic cod and the leatherfin lumpsucker (*Eumicrotremus derjugini* - which feed mainly on zooplankton), all other offshore fish species rely heavily on benthic invertebrates, particularly amphipods and polychaetes (MMS, 1984).

The arctic cod has been described as a key species in the ecosystem of the Arctic Ocean due to its widespread distribution, abundance, and importance in the diets of marine mammals, birds, and other fishes. It is considered to be the most significant consumer of secondary production in

the Alaska Beaufort Sea and may influence the distribution and movements of marine mammals and seabirds.

4.4.4. Critical Areas or Habitats

The Colville River is a major overwintering area for cisco and other anadromous fish species (ADNR, 1999). During the open-water period, cisco undertake extensive migrations through the nearshore area (ADNR, 1999). Most marine species spawn in shallow coastal areas during the winter. The warmer nearshore zone with its more moderate salinity is thought to be an essential nursery area for juvenile arctic cod (Cannon, Glass, & Prewitt as cited in MMS, 2003). Fourhorn sculpin spawn on the bottom in nearshore habitats during midwinter (ADNR, 1999). Snailfish attach their eggs to rocks or kelp substrates in nearshore waters (MMS, 1987a).

Pink salmon and rainbow smelt use larger river systems and estuaries in the area, such as the Kokolik, Utukok, Kukpowruk, and Kuk, as spawning and rearing areas (Fechhelm et al., 1984, p. 236). These rivers all flow into the Chukchi Sea between Wainwright and Point Lay.

Because of the key role Arctic cod play in the food chain of the Chukchi Sea, any identified spawning habitats could be considered critical areas. Although Arctic cod are known to spawn in the winter under the ice, most of their spawning areas are unknown (Morris, 1981). Arctic cod are most often found around pressure ridges and rafted ice, where the undersurface of the ice is rough (MMS, 1991). Typical habitats include crevices, holes, caverns, and small ice cracks.

Pacific herring spawn in the subtidal regions of Norton Sound using marine vegetation such as *Focus* kelp and *Zoestra* eelgrass. High spawning densities of pacific herring are common at Bluff, from Cape Darby to Moses Point, Norton Bay, Cape Denbigh-Arctic Hills, and the area to the east of 164° W, east of the St. Michael and Stuart Islands (Barton as cited in MMS, 1982).

4.4.5. Effects Analysis

Discharges of drilling muds and cuttings may have potential toxic effects. Water quality tests indicate that lethal concentrations are generally present only within a few meters of the discharge point (USEPA, 1985). The effect on fish depends on the dilution of the discharge. In shallow depths with poor circulation, the effect is a reduction on benthic populations. Little effect was noted in depths of 66 ft or shallower with dissipating tidal or current action. Discharges in shallow, ice-covered waters are presently restricted; therefore, the likelihood that fishes would be exposed to discharges during their critical overwintering period for relatively long periods of time in areas of little circulation is reduced.

While no specific demersal fish spawning locations have been identified in any of the Arctic areas of coverage, a number of important species, including most cottids and eelpout, possess demersal eggs. Although unlikely during exploratory activities in the Area of Coverage due to the anticipated emphasis on deeper offshore drilling sites, demersal eggs could be smothered if discharge in a spawning area coincides with the period of egg production. Exploratory operations in state waters are more likely to adversely impact demersal fish spawning activities

because spawning grounds are more commonly found in nearshore waters. The potential of drilling muds and cuttings to smother demersal fish eggs is probably the most serious potential impact of exploratory drilling to fish species.

Drilling mud disposal is not expected to affect the major prey, zooplankton, or fish or their habitats. Discharges of drilling fluids and drilling cuttings may impact minor prey, benthic organisms (at sublethal levels), and benthic habitat, which in turn will impact critical habitat for fish species. Drilling discharges could displace fishes a short distance from the source however, the effects would be localized and temporary. However, the impact areas are small (less than 100-m radius) per discharger, the number of discharges is small (23 exploration wells and 14 delineation wells), and the recovery period of impacted benthos is less than two years. It is expected that fishes would re-utilize their habitat upon completion of the exploration activities.

4.5. MARINE MAMMALS

Marine mammals in the Area of Coverage include polar bears, walrus, and species of seals and whales. Common species include: spotted, ringed, and bearded seals; beluga, killer, and gray whales; polar bear; and walrus. Species of marine mammals that are protected by the Endangered Species Act (ESA) within in the Area of Coverage will be discussed in Section 4.7. At least 12 other species of marine mammals (including minke whales, Baird's beaked whales, harbor porpoise, narwhal, and hooded seal, fur seals, ribbon seals) are found occasionally or rarely in the Area of Coverage.

All marine mammals in U.S. waters are protected under the Marine Mammal Protection Act of 1972. In the act, it was the declared intent of Congress that marine mammals "be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management, and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem." The polar bear is also protected by an international treaty (i.e., International Agreement on the Conservation of Polar Bears of 1976 between Canada, Denmark, Norway, the former U.S.S.R, and the U.S.).

4.5.1. Distribution and Abundance

Year-round residents in the area of coverage include ringed and bearded seals and polar bears; seasonal summer species include the beluga whale and the spotted seal. Gray whales and walrus also reside seasonally within the Beaufort Sea, most often in areas west of Barrow. Most of the marine mammals occurring in the Chukchi Sea can be grouped into two categories: 1) baleen whales that use the area as summer feeding grounds, and 2) pinnipeds (seals and walrus) that are ice-associated during the winter and also reproduce during that time.

As described in MMS (1991), ice distribution determines the timing and route of migration for whale species, as well as the location of seals, polar bear, and walrus. Years of heavy ice will delay migration, depending on circumstances, and may redistribute seal and bear populations. Because marine mammal species are often quite mobile, it is difficult to predict the exact location of animal concentrations or to predict populations at any given time or location. A

seasonal distribution of marine mammals in the northeastern Chukchi Sea is summarized below (Morris, 1981, pp. 56-57). Some species of pinnipeds occur in great abundance in the Chukchi Sea, with densities as high as 2-3 seals/km² not uncommon in the landfast-ice zone (MMS, 1991).

Winter/Spring	Pack Ice:	polar bear
	Flaw Zone:	beluga whale, bearded seal, polar bear
	Fast Ice:	ringed seal, polar bear
Summer/Autumn	Pack Ice:	ringed seal
	Pack Edge:	walrus, polar bear, bearded seal, beluga whale
	Open Water:	(migration routes) walrus, seals, gray whale, beluga whale
	Coastal Lagoons:	beluga whale, spotted seal

Note: The flaw zone is that region between the pack ice and the fast ice where polynyas (open-water leads) are commonly found.

Some baleen whales are more abundant now than they were at the close of the commercial whaling period, but less abundant than their historical level (MMS, 1991). The eastern Chukchi Sea stock was estimated at a minimum of about 3,700 whales (Ferrero et al. as cited in MMS, 2003).

The Beaufort Sea beluga whale population was currently estimated to be in excess of 32,000 whales (Ferrero et al. as cited in MMS, 2003). Most of this population migrates from the Bering Sea into the Beaufort Sea in April or May; however, some whales may pass Point Barrow as early as late March and as late as July (MMS, 2003). An estimated 2,500-3,000 belugas summer in the northwestern Beaufort and Chukchi Seas; some use coastal areas. Fall migration back to the Bering Sea occurs in September and October along offshore pack-ice, although a small number have been observed migrating along the coast.

Since receiving protection by the International Whaling Commission in 1946, the eastern Pacific gray whale population has increased from a few thousand individuals that survived commercial harvest to more than 21,000 (MMS, 2003). The current minimum gray whale estimate is 26,635 with an estimated annual increase rate from 1967/1968-1995/1996 at 2.4% (Ferrero et al. as cited in MMS, 2003). A portion of the gray whale population summers along the west coast of North America south of the Bering Sea/Unimak Pass (56 *FR* 58870). Gray whales migrate into the northern Bering and Chukchi seas starting in late April through the summer open-water months and feed there until October-November (MMS, 2003). They migrate out of the Chukchi and Beaufort seas with freezeup and migrate out of the Bering Sea during November-December (Rugh & Braham as cited in MMS, 2003). Most whales occur within 15 km of land but have

been observed up to 200 km offshore (Bonnell & Dailey as cited in MMS, 2003). Much of the migration route north of Point Conception to and from summer feeding grounds in the northern Bering and southern Chukchi seas lies within a few kilometers of the coast or adjacent islands. Nearly all gray whale observations were west of Point Barrow, and few gray whales were seen east of Barrow (MMS, 2003).

The distribution of polar bears (*Ursus maritimus*) is strongly influenced by the state of sea ice and its effect on the distribution of prey (i.e., seals). The Beaufort Sea (from Point Barrow to Cape Bathurst) polar bear population has been estimated to be 1,300 to 2,500 individuals (U.S. Fish & Wildlife, 1993). The Southern Beaufort Sea's population (from Icy Cape to Cape Bathurst, Northwest Territories, Canada) is about 1,800 bears (Gorbics, Garlich-Miller, & Schliebe as cited in MMS, 2003). The current stock assessment is 2,272 and a minimum estimate of 1,971 bears (*Federal Register* March 28, 2002). This population has increased over the past 20-30 years at 2% or more per year and is believed to be increasing slightly or stabilizing near its carrying capacity (Amstrup; US Fish & Wildlife Service as cited in MMS, 2003). Their seasonal distribution and local abundance vary widely in the Alaskan Beaufort Sea. Amstrup, Durner, and McDonald (2000) assumed a bear density of one bear per 25 square kilometers occurs in seasonal concentration areas. Much lower densities occur beyond 100 miles offshore and higher densities near ice leads, where seals concentrate during the winter. Another study estimated their overall density from Point Barrow to Cape Bathurst as one bear every 141-269 square kilometers (54-103 square miles) (Amstrup, Stirling, & Lentfer as cited in MMS, 2003). Polar bears enter the Norton Sound region in the fall with advancing ice and usually penetrate the Bering Sea no further south than St. Lawrence Island (MMS, 1982). Occasionally polar bears summer on St. Lawrence Island. The approximate number of polar bears which occur in the Norton Basin is unknown.

The ringed seal (*Phoca huxpida*) is the smallest and most abundant seal in the Beaufort and Chukchi Seas. Ringed seals live on or near the ice year-round; therefore, the seasonal ice cycle has an important affect on their distribution and abundance (ADNR, 1999). More recently, surveys were flown perpendicular to the Alaskan coast from Shishmaref to Barrow during May-June 1999 and 2000 (Angliss & Lodge, 2002). Preliminary results from the 1999 survey indicate that the total abundance in the area surveyed was estimated at 245,048 (Angliss & Lodge, 2002). About 1.0 to 1.5 million ringed seals inhabits the Bering and Chukchi Seas (MMS, 1982). In winter, highest densities of ringed seals occur in the stable shorefast ice.

Spotted seals are found in large numbers along the Bering Sea and Chukchi Sea coasts; they are common in bays, estuaries, and river mouths and are particularly concentrated from Kasegahuk Lagoon to the mouth of the Kuk River and Peard Bay (MMS, 1991). Spotted seals haul-out along the coast of the Beaufort Sea in July in relatively low numbers (about 1,000 for the Alaskan Beaufort Sea coast). Beaufort Sea coastal haulout areas include the Colville River delta, Peard Bay, and Oarlock Island in Dease Inlet/Admiralty Bay, and spotted seals have recently frequented Smith Bay at the mouth of the Piasuk River (MMS, 1990) (see Graphic 2, MMS, 1990). They migrate out of the Beaufort Sea from September to mid-October as the landfast ice reforms and spend the winter and spring periods offshore north of the 200-m isobath along the ice front throughout the Bering Sea, where pupping, breeding, and molting occur (Lowry et al.,

2000). The Bering Chukchi population of spotted seal ranges from 280,200 to 330,000. Major population segments migrate through outer Norton Sound during spring and fall (MMS, 1982).

The majority of the bearded seal (*Erignathus barbatus*) population in Alaska is in the Bering and Chukchi seas. The sex ratio of Alaska samples consistently show slightly more females in the population (ADNR, 1999). This species usually prefers areas of less-stable or broken sea ice, where breakup occurs early in the year (Cleator & Stirling as cited in MMS, 2003). In the Beaufort Sea, the bearded seal is primarily restricted to moving pack-ice from July through October (MMS, 1996). Estimates on the abundance of bearded seals in the Beaufort Sea and in Alaskan waters currently are unavailable; however, the minimum population in Alaskan waters is expected to be at least 50,000 animals (Ferrero et al. as cited in MMS, 2003). From 300,000 to 450,000 bearded seals inhabit the Bering and Chukchi Seas (MMS, 1982); densities are highest from late November through late June.

The North Pacific walrus is most commonly found in relatively shallow water areas, close to ice or land. Spring migration from the Bering Sea usually begins in April; most of the walrus population moves north through the Bering Strait by late June. The majority of the walrus population occurs west of Barrow, although a few walrus may move east throughout the Alaskan portion of the Beaufort Sea to Canadian waters during the open water season. Walrus are very abundant in the Chukchi Sea during the summer; over 100,000 individuals, or 40 percent of the North Pacific population, can be found there (Sease & Chapman, 1988). Of this number, most are pregnant females and their dependent young. About 80 percent of the world population (160,000 to 200,000) occurs seasonally in the Bering Sea. During seasonal transition periods, walrus densities are greatest in outer Norton Sound. Calves are born during the northward migration in spring in outer Norton Sound. A substantial number of the mature males remain in the Bering Sea year-round (Fay, 1982). Solitary animals occasionally overwinter in the Chukchi Sea and eastern Beaufort Sea, but most of the population migrates south of the Bering Strait in the fall (October-December) with the southern advancement of pack-ice (Fay, 1982). In the last 20 years, the walrus population has increased rapidly and extended its range (Fay & Kelly, 1980). There are indications (i.e., decreases in physical fitness) that the carrying capacity of the environment may have been exceeded by the increased walrus abundance (Fay et al., 1984).

4.5.2. Growth and Production

Beluga whale calving is reported to occur in Norton Bay near Moses Point.

Polar bears breed during April and May. Males travel long distances during this time searching for females. When a female is found, the male will stay with her for a few days to breed and then will leave in search of other females. Cubs are born during December and January. Normally the female has two cubs and may produce only one or two litters during her life (every three to four years).

Ringed seals breed in winter and spring and give birth to a single pup in March and April. Spotted seals are annual breeders and mating occurs in late April to early May. Pupping occurs

anytime from early April to the first part of May with the peak season being the first two weeks of April.

The ability for bearded seals to conceive successfully usually occurs when females are five to six years old. Males become sexually mature at six or seven years. Bearded seals commonly become reproductively active before they attain maximum growth. The incidence of pregnancy in adult females is about 85 percent (ADNR, 1999). Females bear a single pup during late April or early May. Pupping takes place on top of the ice less than 1 m from open water (Kovacs, Lydersen, & Gjertz as cited in MMS, 2003) from late March through May mainly in the Bering and Chukchi seas, although some takes place in the Beaufort Sea. By the end of a brief nursing period (12 to 18 days), pups increase their weight almost three times, mainly due to an increase in thickness of the blubber layer (ADF&G as cited in ADNR, 1999).

The gross reproductive rate of walrus is considerably lower than that of seals. Prime reproductive females produce one calf every 2 years rather than one every year, as do other pinnipeds. Most female walrus do not begin to breed until six or seven years of age. Mating occurs from January through March, but growth of the fetus does not begin until about mid-June. Walrus calves are born mostly in mid-April to mid-June during the spring migration. Calves are dependent upon their mothers for at least 18 months and occasionally for as long as 2-½ years.

4.5.3. Environmental Factors

Gray whales migrate into the Chukchi and Beaufort Seas during spring to feed throughout the late spring, summer, and early fall. Gray whales are primarily suction-bottom feeders and primarily ingest benthic gammaridean amphipods (MMS, 1991). However, gray whales have also been observed feeding on dense swarms of pelagic euphausiids (Guerrero as cited in MMS, 1991).

Beluga whales feed on a variety of organisms, including arctic and saffron cod, capelin, herring, squid, whitefish, char, and various benthic invertebrates in nearshore waters (MMS, 2003). The majority of the eastern Pacific gray whale population feeds primarily on benthic amphipods; they suck infauna amphipods from the fine sand on the ocean bottom, producing an extensive record of feeding craters 2-20 square meters (m²) in size (MMS, 2003).

For polar bears, successful denning, birthing, and rearing activities require a relatively undisturbed environment. During early November and December, the pregnant females search out deep, south-facing snow drifts in which to dig their dens (ADF&G as cited in ADNR, 1999). Polar bear denning can occur on both land and on sea ice. Dens found on land are usually within six miles of the coastline; dens on the ice may drift up to 600 mi during the winter. Research indicates that bears do not den in the same place, but are only faithful to the general substrate and geographic area upon which they had previously denned (e.g., on-ice vs. on land). Based on radio collar surveys, the Beaufort Sea population dens locally, and is not dependent on reproduction from other known denning areas outside of the region (Amstrup & Gardner as cited in ADNR, 1999).

Polar bears are opportunistic feeders, but prey primarily on subadult ringed and bearded seals, and walrus, but they also feed on walrus, small whales, birds, seaweed, eggs, berries, lemmings, shrubs, lichens, grass, carrion, human refuse, garbage and occasionally other polar bears and humans (MMS, 1991, 1993). Hunting polar bears concentrate near open leads in winter. A polar bear has to catch approximately one seal a week to maintain itself. The mother does not eat while denning; both she and her cubs live off her fat reserves.

Seals feed primarily on pelagic fishes and invertebrates; the particular species eaten depends on availability, depth of water, and distance from shore. Ringed seals spend much of the summer and early fall in the water feeding; the important food species for ringed seals are Arctic cod, saffron cod, shrimps, and other crustaceans (ADNR, 1999). Spotted seals eat a varied diet; there are geographical and seasonal differences in their prey. Principal foods for spotted seals are schooling fishes and along the coast they feed on herring, capelin, saffron cod, some salmon (especially in lagoons and river mouths) and smelt (ADF&G as cited in ADNR, 1999). The bearded seal mainly feeds on crabs, shrimp, clams and snails (ADF&G as cited in ADNR, 1999).

Walrus feed primarily on bottom dwelling invertebrates by brushing the sea-bottom with their broad, flat muzzles. Major food items include bivalve mollusks. Other food items include snails, crabs, shrimp, worms, and occasionally seals (ADNR, 1999).

4.5.4. Critical Areas or Habitats

The adjacent state waters of the Beaufort and Chukchi seas provide important habitat areas for a variety of marine mammals. These areas include denning areas for polar bears, haulout areas for walrus and species of seals, and feeding areas for gray and beluga whales.

A major portion of the Beaufort Sea beluga whale population concentrates in the Mackenzie River estuary during July and August. Beluga whales are known to calve and may molt in Kasegaluk lagoon and Peard Bay (MMS, 2003).

Shallow coastal areas and offshore shoals in the Chukchi and western Beaufort seas provide rich benthic feeding habitat for gray whales during November-December (Rugh et al. as cited in MMS, 2003). Gray whale feeding areas offshore of northern Alaska are characterized with low species diversity, high biomass, and the highest secondary production rates reported for any extensive benthic community (Rugh et al. as cited in MMS, 2003). Most gray whale observations were west of Point Barrow, and few gray whales were seen east of Barrow (MMS, 2003).

Polar bear dens are found in a variety of regions including the Jones Island group, offshore and barrier islands, shorefast ice, along river banks, and far offshore on the pack ice (MMS, 1991). An important habitat zone is in the eastern Beaufort Sea at the seaward edge of the landfast ice corresponding roughly with the 66-ft isobath (Stirling as cited in ADNR, 1999). Most denning is concentrated on offshore barrier islands and certain portions of the mainland (MMS, 1990); areas receiving consistent use include Wrangell Island, Russia, and in Hudson Bay and James Bay,

Canada. Polar bear dens have also been located on river banks in northeast Alaska and on shorefast ice close to islands east of the mouth of the Colville River.

Landfast ice provides optimum habitat for ringed seal lair construction and supports the most productive pupping areas (Kelly, 1988). Regions of landfast ice are found in the southeastern corner of the Chukchi Sea Area of Coverage.

During the summer, two large Arctic areas are occupied by the walrus: from the Bering Strait west to Wrangell Island and along the northwest coast of Alaska from about Point Hope to north of Point Barrow. Although the Pacific walrus is associated with moving pack-ice, a coastal walrus haulout area east of Cape Lisburne in the Chukchi Sea was identified (MMS, 1990). Herds of migrant walrus appear on Big Diomedede, King, St. Lawrence, and the Penuk Islands in fall during movements into the area from the Chukchi Sea. Outer Norton Sound could be considered a calving area for the walrus.

4.5.5. Effects Analysis

Heavy metals in Beaufort Sea marine mammals and their prey are the focus of an ongoing study at the University of Alaska Fairbanks (Dehn et al., 2002). The study found differences in the total mercury in the livers of ringed and bearded seals from the Alaskan and Canadian Arctic. They suggested that those differences were related to differences in the prey, because ringed seals eat mostly pelagic organisms (i.e., euphausiids) and bearded seals eat benthic and epibenthic organisms. The variations were observed over broad regions of the arctic rather than near and far from areas in which there had been discharges.

4.6. COASTAL AND MARINE BIRDS

Migratory birds are a significant component of the marine ecosystem of the Area of Coverage. These areas comprise foraging, nesting, and rearing areas for several million birds. Species of coastal and marine birds that are protected by the ESA within in the Area of Coverage will be discussed in Section 4.7.

Of the several million birds are found in Area of Coverage, about 70 species occur regularly in the Beaufort Sea area and 85 species in the Chukchi Sea area. Most of these species are migratory and only present in the Arctic seasonally, from May through early November. Some species appear only during migration; others nest, molt, feed, and accumulate critical fat reserves needed for migration while in the area (MMS, 1987a). The main categories of species in the Area of Coverage include waterfowl (e.g., duck, goose, swan), seabirds (e.g., loon, gull, tern), shorebirds (e.g., sandpiper, plover, crane), and raptors (e.g., hawks, eagles, falcons). A complete list of all bird species within these groups for the Area of Coverage is presented in Tables 4-2 through 4-5.

4.6.1. Distribution and Abundance

Aerial surveys in the Beaufort Sea have documented that birds are widespread in substantial numbers in both nearshore and offshore waters of the Area of Coverage (MMS, 2003) and it is likely that approximately this distribution prevails along most or all of the Beaufort coastline and into the northern Chukchi Sea during the open-water season.

Birds occur out to at least 70 km offshore where open water is available, although bird densities generally are lower in offshore areas. Offshore, the highest bird density is associated with open-water leads, where more than 1 million eiders may congregate (MMS, 1991). The highest pelagic bird density is located between Barrow and Cape Halkett, which lies within the area. This is probably due to the infusion of Bering Sea water in this area, which contains high amounts of plankton that provide a food source for birds as well as other organisms.

Most avian species migrate eastward along a broad front, which may include inland, coastal, and offshore routes; arrival dates for various species range from late April to early June (MMS, 2003). The availability of open water off river deltas and in leads determines migratory routes and distribution of waterfowl and seabirds. Raptors are present in the Area of Coverage during the spring, summer, and fall.

The Beaufort shoreline use by red phalaropes is extensive, with concentrations exceeding 500 per km of gravel beach reported on the Barrow spit and in the Simpson Lagoon area (USGS as cited in MMS, 2003). Sabine's gull occurs mainly from the Deadhorse area west.

The most abundant seabird species in the northern Bering Sea are least auklet, crested auklet, common murre, thick-billed murre, parakeet auklet, and black-legged kittiwake. The majority of the least auklet (79% eastern Bering Sea population) and crested auklet (62% eastern Bering Sea population) populations are concentrated on a few breeding colonies primarily on St. Lawrence and Little Diomed Islands. The parakeet auklet is widely distributed with small colonies located along the coast of Norton Sound and larger colonies present on the offshore islands. The common and thick-billed murres are widely distributed with breeding populations on both the offshore islands and along the coast of Norton Sound. Thick-billed murres generally concentrate on offshore islands and shelf break areas, while common murres are found more in coastal areas. Black-legged kittiwakes are also widely distributed with substantial mainland, coastal and offshore island populations.

Most shorebirds and other waterfowl concentrate in snow-free coastal or inland areas until nest sites are available. Large numbers of brant and goose species often occur on lakes between Teshekpuk and the coast. Scattered colonies of brant occur through northwest Alaska, particularly from Smith Bay west to the Chukchi coast, and low numbers southward to Kasegaluk Lagoon (MMS, 2003). The Yukon-Kuskokwim River Delta has the greatest nesting concentrations of waterfowl and shorebirds in the Norton Basin with other important nesting, feeding, and staging areas occurring along the coast of the Seward Peninsula and St. Lawrence Island.

The greatest nesting concentration of geese in North America occurs on the Clarence Rhode Wildlife Range (MMS, 1982). Concentrations of Canada geese occur in the Teshekpuk Lake area and at lower density in the Prudhoe Bay region. Numbers of brants occupying the seacoast areas during the molt period vary considerably, from low thousands to tens of thousands of individuals, in part depending on greater or lesser nest success by the various species (MMS, 2003). Eiders and oldsquaw are common migrants along the coast of the Arctic National Wildlife Refuge, although oldsquaws are widespread in northern Alaska. Large numbers of oldsquaws molt in Beaufort Sea lagoons and bays beginning in mid-July (MMS, 2003). Locations of major concentrations of molting oldsquaws include south shoreline and lagoon habitats near Thetis, Spy, Long, Jones, Arey, McClure, Pingok, Leavitt, Cottle, Egg, Pole, and Flaxman islands. Most birds are located along barrier islands or in lagoons rather than seaward from lagoons or along mainland shores (Flint et al. as cited in MMS, 2003). To a considerable extent, molting and staging individuals remain in the same area of a particular lagoon during their stay in the Beaufort region (Flint et al. as cited in MMS, 2003). Males, nonbreeders, and failed breeders are joined later by females with young.

Males and nonbreeding or failed breeding female common eiders migrate to coastal molting areas in Chukchi Sea lagoons and bays beginning in late June and early July (Johnson & Herter as cited in MMS, 2003). Some females with young may molt in local coastal lagoons (MMS, 2003) before moving south to wintering areas beginning in late August and continuing into early November. Male king eiders undertake a molt migration to the Chukchi Sea and Bering Sea areas from early July through August, although some molt in the Beaufort Sea (MMS, 2003). Young leave the breeding areas in September and October.

Shorebirds are numerically dominant in most coastal plain bird communities occurring across northern Alaska (including the Arctic National Wildlife Refuge) and Canada (including Kendall Island Bird Sanctuary). Along the Beaufort coastline, nonincubating members of shorebird pairs concentrate in coastal habitats as early as mid-June. In late June to early July, several species move to habitats surrounding small coastal lagoons and nearby brackish pools. In late July and early August, adults relieved of parental duties flock in shoreline areas prior to migration. Most shorebirds have departed the area by mid-September.

4.6.2. Growth and Population

Aerial surveys over the Arctic Coastal Plain have shown that most waterfowl and other waterbird species have exhibited nonsignificant population trends since 1986 or 1992 (MMS, 2003), although there is conflicting evidence for some species. Pacific loons, glaucous gulls, northern pintails, greater scaup, whitewinged scoters, brant, snow geese, and tundra swans have exhibited overall non-significant increasing trends since 1992, while yellow-billed loons, Canada goose, and snowy owls show decreases (MMS, 2003); greater white-fronted goose and arctic tern increased significantly. Although the population of oldsquaw ducks on the Arctic coastal plain of Alaska has remained relatively stable, populations in Northwest Canada and other regions in Alaska have declined 75 percent.

Up to 7,500 snow geese nest on the Kendall Island Bird Sanctuary on the Mackenzie River delta. Snow geese nesting pairs have increased from about 100 nesting pairs in 1998 to more than 800 pairs in 2002 (MMS, 2003).

Recent Fish and Wildlife Service estimates of oldsquaws occupying the central Beaufort Sea area during surveys up to 60 kilometers offshore ranged from 20,994 in June/July to 37,792 in August, with densities ranging from 58.1-73.8 birds per square kilometer (MMS, 2003). Numbers of king eider were 19,842 (June/July) and 6,698 (August), with densities from 3.6 (June/July) to 10.0 (August) birds/km²; common eider numbers were 3,300 (June/July) and 1,477 (August), with densities from 4.6 (June/July) to 56.4 (August) birds per square kilometer. Generally, fewer than 1,000 Pacific loons, 200 red-throated loons, and 100 yellow-billed loons were present in this area at very low densities.

The highest breeding-season densities for 34 species in an area east of Prudhoe Bay ranged from 251.7 birds per square kilometer in the second week of June to 167.0 in mid-July, and 131.7 in mid-August. Most abundant were Lapland longspurs and several shorebird species (Troy Ecological Research Assocs. as cited in MMS, 2003).

Norton Sound has a relatively small seabird population with the largest concentration in the Bluff Cliffs area east of Cape Nome. Large populations of common murre are found in this area and on Sledge Island. The largest populations of black-legged kittiwakes occur on St. Lawrence and Little Diomed Islands with sizable populations on King Island, Bluff Cliffs, Sledge Island, and Cape Denbigh (MMS, 1982).

About 11.6 million waterfowl, including approximately 30 percent of North America's goose population, nest in the Bering Sea region (King & Dau as cited in MMS, 1982). The highest total densities of all waterfowl species (400 nests per square kilometer) occur along the vegetated intertidal zone (King & Dau as cited in MMS, 1982). Twenty-two species of waterfowl occur on the St. Lawrence Island; at least twelve breeding species (about 9,000 ducks, geese, and swans) nest and an additional 25,000 nonbreeding waterfowl nest, forage and molt. The open-water areas around St. Lawrence Island support an estimated 500,000 oldsquaw and 50,000 eiders during the winter (Fay as cited in MMS, 1982).

4.6.3. Environmental Factors

The spring lead system east of Point Barrow provides a long but narrow front of open water which is utilized by millions of birds in their migration to nesting grounds. Nearly all of the king eider population of Alaska and Canada, as well as thousands of oldsquaws and common eiders, use this lead system (Sousa as cited in ADNR, 1999). Major concentrations of birds occur in nearshore and coastal areas such as the Plover Islands and Barrow Spit. They also concentrate at Pitt Point and the Colville River delta.

The highest nesting densities generally occur in areas of mixed wet and dry habitats, whereas birds often move to wetter areas for broodrearing. Islands in river deltas and barrier islands provide the principal nesting habitat for several waterfowl and marine bird species in the Area of Coverage. Shorebirds prefer wet-tundra habitats or well-drained gravelly areas for nesting,

whereas loons use lakes, and geese prefer deeper ponds or wet tundra near lakes. Lagoons formed by barrier islands, bays, and river deltas provide important broodrearing and staging habitat for waterfowl, particularly molting oldsquaws. Arctic peregrine falcons, bald eagles, and Canada geese nest primarily on bluffs.

Flocks of nonbreeding and postbreeding adults of several shorebird species move from wet tundra to habitats surrounding small coastal lagoons and nearby brackish pools prior to migration. Adults relieved of parental duties flock in shoreline areas, and juvenile semi-palmated sandpipers and red phalaropes feed along inner lagoon margins prior to migration. Gravel beach and other shoreline types, especially lagoon margins, are used extensively by red phalaropes at this time.

Emergent and wetland vegetation such as various sedges are the primary food types for most waterfowl. Invertebrates in brackish and freshwater flats and ponds are the principal food sources for shorebirds. Phalaropes, terns, auklets, murrelets and kittiwakes feed on zooplankton (MMS, 1982, 1987a). Parakeet auklets also prey on a variety of pelagic invertebrates and occasional small fish. Thick-billed murrelets, common murrelets, black-legged kittiwakes, horned puffin, and pelagic cormorant prey on fish (sand lance, arctic cod, and prickleback) during the nesting season (MMS, 1982). The reproductive success of black-legged kittiwakes is greatly dependent on the availability of sand lance during the chick-rearing period (Drury as cited in MMS, 1982). Black guillemots eat all kinds of animals from the sea, including crustaceans (crabs and shrimp), mollusks (clams and snails), and worms. The black-crowned night heron is an opportunistic feeder; its diet consists mainly of fish, though it is frequently rounded out by other items such as leeches, earthworms, aquatic and terrestrial insects. It also eats crayfish, mussels, squid, amphibians, lizards, snakes, rodents, birds, eggs, carrion, plant materials, and garbage and refuse at landfills.

4.6.4. Critical Areas or Habitats

Five types of habitat particularly capable of supporting a variety of marine and coastal avifauna include the barrier islands, coastal lagoons, coastal saltmarshes, river deltas, and offshore areas. The coastal waters are primary habitat for nesting, molting, feeding, and resting activities of migratory marine birds. Coastal tundra and delta areas are also important nesting areas for waterfowl such as Pacific brants; yellow-billed, red-throated, and Pacific loons; and snow geese. King and common eiders, Arctic terns, glaucous gulls, and black guillemots nest on barrier islands (MMS, 1990, p. III-B-8).

Major concentrations of birds occur nearshore [in waters less than 20 m (66 ft) in depth] and in coastal areas such as Cape Thompson, Point Hope, Cape Lisburne, Seward Peninsula, Point Lay and Kasegaluk Lagoon, Peard Bay, Plover Islands-Barrow Spit and Elson Lagoon, Pitt Point-Cape Halkett, Fish Creek Delta, Colville River Delta, Simpson Lagoon, the barrier islands of Prudhoe Bay, Canning River delta, Yukon River delta, Hulahula River delta and Barter Island, St. Lawrence Island, Little Diomed Island, St. Matthew Island, Beaufort Lagoon, Icy Reef, and Demarcation Bay.

The Colville, Sagavanirktok, Canning, and Hulahula river deltas, Simpson Lagoon, and the Arctic National Wildlife Refuge (Capes Thompson and Lisburne, the Kasegaluk Lagoon and Peard Bay barrier islands, Icy Cape, and Point Franklin) provide important nesting habitat for loons, waterfowl, and shorebirds and include foraging habitat for seabirds nesting in these regions. Along the coast of the Seward Peninsula, most lagoons, deltas, river mouths, and coastal tundra are used by waterfowl and shorebirds for feeding, staging, molting, or nesting during some part of the year. The greatest concentrations of waterfowl and shorebirds tend to occur in the Golovin Lagoon-Fish River flats area and the Moses Point lagoon and delta area (Kwik River and the Kwiniuk River deltas).

A large number of seabirds, including gulls, terns, and eiders, nest on barrier islands and spits, especially those associated with Kasegaluk Lagoon and Peard Bay. An important seabird foraging area extends from Seward Peninsula to the east side of St. Lawrence Island. Lesser snow geese and brant nest on Howe and Duck islands in the Sagavanirktok River Delta; snow geese also nest on the Ikpikpuk River delta at Smith Bay (MMS, 2003) and on the Kendall Island Bird Sanctuary on the Mackenzie River delta. St. Lawrence Island wetland habitats provide a staging area for an international population of lesser snow geese and possibly the entire immature nonbreeding population of emperor geese during the summer. The Colville, Sagavanirktok and Kuparuk river deltas provide important breeding and brood-rearing habitats for tundra swans, black brant, snow geese, and Canada geese. Howe Island, located in the Sagavanirktok River delta, is the location of one of two known snow geese nesting colonies in the United States and is important for black brant nesting (Sousa as cited in ADNR, 1999). The Plover islands, such as Cooper and Deadman Islands, are important nesting grounds for black guillemont. The Colville River from Umiat to Ocean Point, and Franklin and Sagwon Bluffs in the Sagavanirktok River drainage are primary nesting areas for the Arctic peregrine falcon.

Common eiders, glaucous gulls, and arctic terns nest on barrier islands in the east-central Beaufort Sea in addition to on other islands and causeways (MMS, 2003). Terns also nest at high density inland across much of the Arctic Coastal Plain, and common eiders have been documented nesting on the mainland near Point Thomson (MMS, 2003). The Return Islands, Jones Islands, McClure Islands, Cross Island, and Lion Point are important for nesting common eider. Black guillemots nest mainly on barrier islands in the western Beaufort, particularly Cooper Island (Divoky, Watson, & Bartonek as cited in MMS, 2003). Yellow-billed and red-throated loons (Gotthardt as cited in MMS, 2003) nest mainly south and west of Smith Bay. Greater white-fronted geese are also found nesting and rearing in the major river deltas and other coastal plain areas (Ott as cited in ADNR, 1999).

Shorebirds use a range of habitats from dry gravelly to wet tundra and littoral. Important feeding and staging grounds for shorebirds and waterfowl include Kasegaluk Lagoon, the mouth of the Kuk River, Peard Bay, and saltmarshes along the mainland coast. These habitats are critical to waterfowl that regularly pass through or near the Beaufort and Chukchi Seas during migration.

Major concentrations of molting waterfowl occur in several areas along the Beaufort and Chukchi sea coasts including Simpson Lagoon, the Teshekpuk Lake Special Area, Peard Bay, Kasegaluk Lagoon, and Ledyard Bay from late June through August. Postmolting and broodrearing brant use various coastal habitats such as sloughs and tidal flats from early July

through August (MMS, 2003). Snow goose broodrearing occurs in Foggy Island Bay and surrounding river deltas (Johnson as cited in MMS, 2003). Oldsquaws molt in Simpson and other Beaufort lagoons and bays beginning in mid-July (MMS, 2003). Ledyard Bay serves as an important staging and molting area for eiders. It is perhaps the most important feeding habitat in the Chukchi Sea region for eiders and many other species as well (Truett, 1984b).

4.6.5. Effects Analysis

Seasonal distribution of birds in the region determines their vulnerability to potentially adverse factors associated to a large extent with oil and gas exploration. Discharges from drilling operations during exploration typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. Because bottom-feeding sea ducks and guillemots occur in dispersed flocks, relatively few are expected to occur in or rely specifically on prey potentially affected or buried at the projected drill sites under this general permit. Additionally, drill structures are likely to be quite dispersed (MMS, 2003). Thus, discharges are not likely to cause significant effects either through direct contact with birds or by affecting prey availability as a result of the authorized discharges. In addition, there is likely sufficient time between discharges at individual sites for regional bird populations to recover from the minor effects that may result at each site.

4.7. THREATENED AND ENDANGERED SPECIES

The Endangered Species Act (ESA) requires federal agencies to consult with the U. S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NOAA Fisheries) if the federal agency's actions could beneficially or adversely affect any threatened and endangered species or their critical habitat. In this case, the federal agency is the USEPA, and the discretionary action is the reissuance of the NPDES permit. The action evaluated in this evaluation could affect species under the jurisdiction of both the USFWS and NOAA Fisheries. This evaluation identifies the endangered, threatened, and proposed species and critical habitat in the project area and assesses potential effects to these species that may result from the discharge authorized in the proposed final NPDES permit.

The federal action under discussion in this document is the discharge of the waste streams listed in the general NPDES permits to the Beaufort and Chukchi Seas, and Hope and Norton Basins. The primary waste streams considered in this evaluation are drilling muds and cuttings, which are of concern due to the large volumes discharged and the potentially toxic components of drilling muds (e.g., metals). Other minor pollutant sources which are potentially of concern and were considered in this evaluation are: deck drainage, sanitary waste, domestic waste, and test fluids. A more complete discussion of these waste streams can be found in Section 2.0. Additional permitted waste streams were not considered in this evaluation because the volumes discharged are very small relative to the primary waste streams.

There are three avian species, six cetacean species, and one pinnipeds species that live or spend a significant portion of their lives in the Area of Coverage. A summary of these species status is provided in Table 4-6. Table 4-7 indicates which species have critical habitat designations. The

remaining sections of this chapter will discuss the abundance, distribution, diet, critical habitat, and effects for listed species occurring in the Area of Coverage.

4.7.1. Short-tailed Albatross

The short-tailed albatross is listed by the USFWS as Endangered under the ESA throughout its range.

4.7.1.1. Geographic Boundaries and Distribution

The short-tailed albatross once ranged throughout most of the North Pacific Ocean and Bering Sea with known nesting colonies on several islands within the territorial waters of Japan and Taiwan. However, its numbers were reduced from more than a million birds to as few as 40 or 50 in 1940. Since that time, a slow recovery has brought the number of short-tailed albatross to about 1200 birds and the numbers are increasing (USFWS, 2001). Other undocumented nesting colonies may also have existed in areas under U.S. jurisdiction on Midway Atoll and in the Aleutian Islands; however, the evidence for breeding on the Alaskan Aleutian Islands is based on scant evidence and is considered highly unlikely (USFWS 2000a).

Currently, breeding colonies are limited to the two Japanese Islands of Torishima and Minami-kojima (USFWS 2000a). The marine range within U.S. territorial waters includes Alaska's coastal shelf break areas and the marine waters of Hawaii for foraging. The extent to which the birds use open ocean areas of the Gulf of Alaska, North Pacific Ocean, and Bering Sea is unknown (USFWS 2000a). Observations by the USFWS (Terry Antrobus, Anchorage, personal communication cited in USFWS 2000a) suggest that short-tailed albatross frequent nearshore and coastal waters, with "many" birds being sighted within 10 km (6 mi) of shore, and fewer birds ("several") observed within 5 km (3 mi) of shore. The short-tailed albatross would only be present within the Area of Coverage for feeding.

4.7.1.2. Life History

The albatross is a pelagic, or open-ocean, species that live from forty to sixty years. They can stay out at sea for as long as five years before returning to the same island on which they were born. Currently, breeding colonies are limited to the two Japanese Islands of Torishima and Minami-kojima (USFWS 2000a). Birds arrive at the Torishima breeding colony in October and initiate breeding and egg-laying, which continue through late November. The chicks hatch in late December and January and are close to being full grown by late May or early June at which time the adults begin to abandon the breeding colony and return to sea. The chicks fledge after the departure of the breeding adults and depart the colony by mid-July. Non-breeders and failed breeders disperse from the breeding colony in late winter through spring (USFWS 2000a). The specific geographical and seasonal distribution patterns of the birds once they depart from the breeding colony are not well understood. The birds are reported to be long-lived and slow to

mature, with an average age at first breeding of 6 years old (USFWS 2000a). The diet of the short-tailed albatross includes flying fish eggs, crustaceans, shrimp, and squid.

4.7.1.3. Critical Habitat

No critical habitat has been designated for short-tailed albatross. The USFWS has determined that the designation of critical habitat for this species is not prudent because it would “not be beneficial to the species” (65 FR 46643, July 31, 2000). USFWS concluded that designation of critical habitat for potential and actual breeding areas within United States’ areas of jurisdiction on the Midway Atoll National Wildlife Refuge would be not provide additional benefit or protection over that conferred through the jeopardy standard of Section 7 of the ESA. With regard to the designation of critical habitat for foraging in the waters of United States, USFWS concluded there is no information available to support a conclusion that any specific marine habitat areas are uniquely important (USFWS 2000a).

4.7.1.4. Population Trends and Risks

The total population of short-tailed albatross was estimated to be 1,200 birds in 2000 (USFWS 2000a). Demographic information provided by USFWS (2000a) indicates that the breeding population on the island of Torishima is growing at a “fairly rapid rate,” with an annual population growth rate of 7.8 percent. No information is available for the other breeding colony on the island of Minami-kojima.

The short-tailed albatross population is considered to be at risk due to the following factors (USFWS 2000a):

- The primary breeding colony on Torishima Island is at risk due to the potential for habitat destruction from volcanic eruptions on the island and the destruction of nesting habitat and birds by frequent mud slides and erosion caused by monsoon rains.
- Direct harvest of birds at the breeding colonies in Japan at the beginning of the 20th century dramatically reduced the numbers of birds. Harvesting continued until the early 1930s. By 1949, there were no short-tailed albatross breeding at any of the historically known breeding sites, and the species was thought to be extinct.
- The world population is vulnerable to the effects of disease because of the small population size and extremely limited number of breeding sites.
- Oil spills are considered to pose a potential threat to the species’ conservation and recovery due to damage related to oil contamination, which could cause physiological problems from petroleum toxicity and by interfering with the bird’s ability to

thermoregulate. An oil spill in an area where a large number of birds were rafting, such as near breeding colonies, could significantly affect the population

- Consumption of plastics at sea may be a factor affecting the species' conservation and recovery. Plastics can cause injury or mortality due to internal damage following ingestion, reduction in ingestion volumes, or dehydration.
- Mortality incidental to longline fishing in the North Pacific and Bering Sea. ESA consultations have determined that Alaskan groundfish and halibut fisheries are likely to adversely affect short-tailed albatrosses, but are not likely to result in an appreciable reduction in the likelihood of survival and recovery of the species.

4.7.1.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds. Events serious enough to cause a decline in population abundance, with respect to permitted discharges, include the following:

- Discharged muds and cuttings were ingested directly;
- Consumption of prey contaminated by drilling muds in numbers sufficient to cause lethality or a decline in reproductive fitness; and
- Decline in prey populations due to toxic effects of discharged muds and cuttings.

Seasonal distribution of the spectacled eiders determines their vulnerability to potentially adverse factors associated with oil and gas exploration. The primary breeding habitat for short-tailed albatross is currently located on Torishima Island in Japan. Short-tailed albatross may spend brief amounts of time near Arctic oil and gas exploration terminals for feeding. Discharges from drilling operations during exploration typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. The discharges from oil and gas exploration areas in Beaufort Sea and Chukchi Sea may only affect a small area of this species feeding habitat. It is unlikely that exploration operations in the Area of Coverage will occur where the short-tailed albatross is found, therefore, it is unlikely that there will be any direct effects to these birds or indirect effects from contamination or loss of prey.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the short-tailed albatross** in the vicinity of the Arctic oil and gas exploration.

4.7.2. Spectacled Eider

Spectacled eiders are listed by the USFWS as threatened under ESA throughout its range in the United States and Russia.

4.7.2.1. Geographic Boundaries and Distribution

Spectacled eiders are diving ducks that spend most of the year in marine waters. Historically, spectacled eiders nested in the spring along much of the coast of Alaska, from the Nushagak Peninsula in the southwest, north to Barrow, and east nearly to the Canadian border. They also nested along much of the arctic coast of Russia. Today, two primary nesting grounds remain in Alaska; the central coast of the Yukon-Kuskokwim Delta, and the arctic coastal plain. A few pairs nest on St. Lawrence Island as well.

Between the 1970's and 1990's, the breeding population on the Yukon-Kuskokwim Delta declined by over 96 percent, and only about 4,000 pairs nest there today. An estimated 7,371 spectacled eiders (about 2 percent of the world population) seasonally occupy the arctic coastal plain (MMS, 2003) each summer. Breeding densities decrease from west to east (MMS, 2002). Population trends for spectacled eider on the arctic coastal plain are unclear, and survey data may reflect timing of surveys rather than actual densities (MMS, 2002).

Important late summer and fall molting areas in Alaska have been identified in eastern Norton Sound and Ledyard Bay. As many as 4,000 molting individuals have been observed at one time (MMS, 2002). Molting flocks gather in relatively shallow coastal water, usually less than 36 m (120 ft) deep. Males leave the breeding grounds as incubation begins, usually around mid-June, and begin a molt migration, stopping in bays and lagoons to molt and stage for fall migration. Females whose nests failed leave the nesting area to molt at sea by mid-August. Breeding females and their young remain on the nesting grounds until early September. While moving between nesting and molting areas, spectacled eiders travel along the coast up to 50 km (31 mi) offshore.

Wintering flocks of spectacled eiders, possibly the entire population, have been observed in the Bering Sea between St. Lawrence and St. Matthew islands. Winter surveys in the Bering Sea, which includes non-breeding birds, indicate a worldwide population of about 360,000 birds (USFWS, 2001). During the winter months, they move far offshore to waters up to 65 m (213 ft) deep, where they sometimes gather in dense flocks in openings of nearly continuous sea ice.

4.7.2.2. Life History

Spectacled eiders feed on bottom-dwelling molluscs and crustaceans in marine waters and aquatic insects, crustaceans, and vegetation while nesting.

4.7.2.3. Critical Habitat

The USFWS has designated critical habitat (molting areas) for spectacled eider, which includes four areas: the Yukon-Kuskokwim delta and adjacent marine waters, Norton Sound, Ledyard Bay, and Bering Sea between St. Lawrence and St. Matthew Islands. Spectacled eiders nest in wetland habitats. Ponds with emergent vegetation appear to be important brood-rearing habitat for spectacled eiders (MMS, 2002). Important molting and staging areas include Harrison Bay, Peard Bay, Kasegaluk Lagoon, Ledyard Bay, and eastern Norton Sound (MMS 2002).

4.7.2.4. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds. Events serious enough to cause a decline in population abundance, with respect to permitted discharges, include the following:

- Discharged muds and cuttings were ingested directly;
- Consumption of prey contaminated by drilling muds in numbers sufficient to cause lethality or a decline in reproductive fitness; and
- Decline in prey populations due to toxic effects of discharged muds and cuttings.

Seasonal distribution of the spectacled eiders determines their vulnerability to potentially adverse factors associated with oil and gas exploration. Discharges from drilling operations during exploration typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. Because the little available survey data from the Beaufort Sea area suggest that eiders apparently occur in low numbers and as dispersed flocks after breeding, although flocks may occur more frequently in some local area such as Harrison Bay, relatively few individuals are expected to occur in most local drill-site areas or rely specifically on prey affected or buried in such areas. Additionally, drilling structures are expected to be quite dispersed throughout the area of coverage (MMS, 2003). Thus, discharges are not likely to cause significant effects either through direct contact with birds or by affecting prey availability as a result of the discharges authorized by the general permit. The minor effects that may result from individual dischargers are not likely to substantially elevate the current nonsignificant rate of decline.

No direct impact from the discharge of exploratory oil and gas drilling muds and cuttings are expected on the spectacled eiders. The eiders may be indirectly affected from impacts of the discharge/effluent to their food supply, primarily mollusks and crustaceans. Any adverse impact on the prey species of either eider species would be negligible because most exploratory drilling sites would be in waters too shallow for allowable discharges of drilling muds and cuttings.

Feeding habitats for the endangered or threatened bird species are probably not found at permanent locations. Also, feeding by these bird species typically occurs close to shore, in water depths where discharges are typically restricted. Available information suggests that permitted discharges from oil and gas drilling and other associated activities are unlikely to destroy or adversely modify habitats critical to either eider species.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the spectacled eider and is not likely to adversely modify their critical habitat** in the vicinity of the discharge.

4.7.3. Steller's Eider

The Alaskan breeding population of Steller's eiders is listed by the USFWS as threatened under the ESA.

4.7.3.1.

4.7.3.1. Geographical Boundaries and Distribution

Steller's eiders are diving ducks that nest in the terrestrial environment, but spend most of the year in shallow, near-shore marine waters. They breed in northern Russia and Alaska. The Alaskan breeding population nests primarily on the Arctic Coastal Plain (northern population), although a very small subpopulation remains on the Yukon-Kuskokwim Delta (western population). Historically, the northern population occurred from Wainwright east to near the Alaska-Canada border and the western population occurred on the Yukon-Kuskokwim Delta and at other western Alaska sites, including the Seward Peninsula, St. Lawrence Island, and possibly the eastern Aleutian Islands and Alaska Peninsula. The historical abundance and distribution of the western population is not known, but by the 1960s or 70s, the species had become extremely rare on the Yukon-Kuskokwim Delta. No nests were found in this area from 1975-1993 and seven nests were found from 1994-2002. Evidence of nesting Steller's eiders has not been reported on the Seward Peninsula since the late 1800's or on St. Lawrence Island since 1954.

Steller's eiders in Alaska nest on tundra adjacent to small ponds or within drained lake basins, generally near the coast but ranging at least as far as 90 km (56 mi) inland. Current primary nesting range in Alaska consists of a portion of the central arctic coastal plain between Wainwright and Prudhoe Bay, primarily near Barrow. Steller's eiders have been seen mainly in the northern half of the National Petroleum Reserve-Alaska and on private land near Barrow. The majority of the sightings in the last decade have occurred east of Point Lay, west of Nuiqsut on the Colville River, and within 90 km (56 mi) of the coast. While they occur over a vast area, the density is much greater near Barrow, which is the core of the Steller's eider's breeding range. The number of pairs nesting on Alaska's arctic coastal plain is very roughly estimated at 1,000. Approximately 4,000 pairs of Steller's eiders may have nested on the Yukon-Kuskokwim Delta

prior to the 1960's. Recently, only a few pairs have been found breeding in this area (MMS, 2002).

After breeding, Steller's eiders move to marine waters where they undergo a complete molt. During the autumn molt, winter, and spring migration, the Alaska-breeding population intermixes with the larger Russian-Pacific population in the marine waters of southwest Alaska. Concentrations of molting Steller's eiders have been observed near Bering Sea islands, and in bays and estuaries from southwest Alaska to the northern shore of the Alaska Peninsula. Kessel (as cited in MMS, 2002) noted that eiders typically move through the Bering Strait between mid-May and early June. Steller's eiders gather in staging areas before beginning their spring migration. Biologists estimate that the world population of Steller's eiders is around 220,000 birds, the majority of which nest in Russia. Overall, the worldwide population of Steller's eiders may have decreased by as much as 50% over the last 30 years.

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Life History

Steller's eider nest on tundra adjacent to small ponds or drained basins in locations generally near the coast, but ranging at least as far as 90 km (56 mi) inland (USFWS 2002). Young hatch in late June and feed in wetland habitat on aquatic insects and plants until they are capable of flight in about 40 days. After breeding, Steller's eiders move to marine waters where they molt from late July to late October. After molting most birds disperse to winter in shallow, sheltered waters along the south side of the Alaska Peninsula, Kodiak island, and as far east as Cook Inlet (USFWS 2002). While in marine waters, Steller's eider forage on marine invertebrates such as mollusks and crustaceans.

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4.7.3.2. Critical Habitat

The designated critical habitat for the Steller's eider includes five units located along the Bering Sea and north side of the Alaskan Peninsula. These areas are the Delta, Kuskokwim Shoals, Seal Islands, Nelson Lagoon, and Izembek Lagoon (USFWS 2001). Within these areas, the primary habitat components that are essential include areas to fulfill the biological needs of feeding, roosting, molting, and wintering. Important habitats include the vegetated intertidal zone and marine waters up to 9 m (30 ft) and the underlying substrate and benthic community, associated invertebrate fauna, and where present, eelgrass beds and associated biota (USFWS 2001). The region surrounding Barrow has been identified as being important to the survival and recovery of the Alaska-breeding population.

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4.7.3.3. Population Trends and Risks

Determining the population trends for Steller's eider is difficult (USFWS 2000b). Counts conducted in 1992 indicated that at least 138,000 birds wintered in southwest Alaska; although the proportion belonging to the Alaska-breeding population versus those from Russian-breeding populations is uncertain (USFWS 2002). It does appear that the breeding range in Alaska has substantially contracted, with the species disappearing from much of its historical range in western Alaska (USFWS 2000b). The size of the breeding population on the Alaskan North Slope varies considerably among years, and it is not known whether the population is currently declining, stable, or improving (USFWS 2000b). The Alaska-breeding population of the Steller's eider is considered to be at risk due to the following factors; destruction or modification of habitat is not thought to have played a major role in the decline of the Steller's eider (USFWS 2002):

- Exposure to lead thought to result primarily from the ingestion of spent lead shot when foraging may pose a significant health risk to Steller's eiders.
- Although there is no information to suggest that disease contributed to the decline of Steller's eiders, recent sampling suggests that Steller's eiders and other sea ducks in Alaska may have significant exposure rates to a virus in the family Adenoviridae (USFWS 2002).
- Changes in predation pressure in breeding areas are hypothesized as the reason for the near disappearance of birds on the Y-K Delta. Recent studies within the primary breeding area on the North Slope near Barrow suggest that nest success is very poor and predation is thought to be the primary factor.
- Although hunting of Steller's eider is prohibited under the Migratory Bird Treaty Act, some intentional or unintentional shooting occurs.
- The Steller's eider Recover Plan (USFWS 2002) suggests that other unidentified factors may also have played a role in the decline of this species. The authors of this plan note that more information is needed to assess the natural or anthropogenic factors that may be affecting this species.

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4.7.3.4. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds. Events serious enough to cause a decline in population abundance, with respect to permitted discharges, include the following:

- Discharged muds and cuttings were ingested directly;
- Consumption of prey contaminated by drilling muds in numbers sufficient to cause lethality or a decline in reproductive fitness; and
- Decline in prey populations due to toxic effects of discharged muds and cuttings.

Seasonal distribution of the Steller's eiders determines their vulnerability to potentially adverse factors associated with oil and gas exploration. Discharges from drilling operations during exploration typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. Because the little available survey data from the Beaufort Sea area suggest that eiders apparently occur in low numbers and as dispersed flocks after breeding, although flocks may occur more frequently in some local area such as Harrison Bay, relatively few individuals are expected to occur in most local drill-site areas or rely specifically on prey affected or buried in such areas. Additionally, drilling structures are expected to be quite dispersed throughout the area of coverage (MMS, 2003). Thus, discharges are not likely to cause significant effects either through direct contact with birds or by affecting prey availability as a result of the discharges authorized by the general permit. The minor effects that may result from individual dischargers are not likely to substantially elevate the current nonsignificant rate of decline.

No direct impact from the discharge of exploratory oil and gas drilling muds and cuttings are expected on the Steller's eiders. The eiders may be indirectly affected from impacts of the discharge/effluent to their food supply, primarily mollusks and crustaceans. Any adverse impact on the prey species of either eider species would be negligible because most exploratory drilling sites would be in waters too shallow for allowable discharges of drilling muds and cuttings.

Feeding habitats for the endangered or-threatened bird species are probably not found at permanent locations. Also, feeding by these bird species typically occurs close to shore, in water depths where discharges are typically restricted. Available information suggests that permitted discharges from oil and gas drilling and other associated activities are unlikely to destroy or adversely modify habitats critical to either eider species.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the Steller's eider and is not likely to adversely modify their critical habitat** in the vicinity of the discharge.

4.7.4. Blue Whale (North Pacific Stock)

The North Pacific stock of blue whales is listed by the NOAA Fisheries as endangered under ESA throughout its range.

4.7.4.1. Geographic Boundaries and Distribution

Blue whales are found in all of the world's oceans from the Arctic to the Antarctic. In the North Pacific, they rarely enter the Bering Sea and are only seldom seen as far north as the Chukchi Sea (ADFG 1994a). In the eastern North Pacific, they winter off southern and Baja California; during the spring and summer they are found from central California northward through the Gulf of Alaska. Historical areas of concentration in Alaska include the eastern Gulf of Alaska and the eastern and far western Aleutians (ADFG 1994a). Blue whales are believed to migrate away

from coastlines and feed preferentially in deeper offshore waters (Gregs and Trites 2001; Mizroch et al. 1984). They are seldom seen in nearshore Alaska waters (ADFG 1994a).

Blue whales migrate to tropical-to-temperate waters during winter months to mate and give birth to calves. They can feed throughout their range, in polar, temperate, or even tropical waters. This species is rarely seen near the coast, except in polar regions when it follows the retreating ice-edge. This in turn can cause entrapment by ice as the weather changes. Blue whales are usually found either in pairs (as in mother and calf) or as a solitary animal. However, this species has been found to congregate on the feeding grounds, and do not, as a rule, dive deeply (maximum 200 m).

4.7.4.2. Life History

The blue whale is largest baleen whale. The lifespan of a blue whale is estimated to be 80 years. Blue whales are estimated to reach sexual maturity between 5 and 10 years of age, and may live as long as 70 to 80 years (Environment Canada 2004b). Upon reaching sexual maturity, females bear a single calf every two to three years (ADFG 1994a). Like many other species of baleen whales, blue whales migrate from low-latitude wintering areas to high-latitude summer feeding grounds.

Blue whales appear to practice more selective behavior in feeding than other rorquals (those baleen whales that possess external throat grooves that expand during gulp-feeding) and specialize in plankton feeding, particularly swarming euphausiids (krill) in the Antarctic. In the North Pacific, the species *Euphausia pacifica* and *Thysanoessa spinifera* are the main foods of blue whales (ADFG 1994a). Since euphausiids are also the primary food for other whales in the Area of Coverage, the blue whale is in direct competition with these species for food.

4.7.4.3. Critical Areas or Habitats

Critical habitat has not been established for this species within the Area of Coverage.

4.7.4.4. Population Trends and Risks

The pre-whaling abundance of blue whales in the North Pacific has been estimated at 4,900 to 6,000 animals and is now estimated at 1,200 to 1,700 animals (ADFG 1994a). There have been very few sightings of blue whales in Alaskan waters. The first confirmed blue whale sighting in 30 years was observed by NOAA scientists on July 15, 2004, 100 nautical miles southeast of Prince William Sound (Joling 2004).

The North Pacific blue whale is considered to be at risk due to the following factors:

- Commercial whaling harvested 9,500 blue whales from the North Pacific between 1910 and 1965 (Ohsumi and Wada 1974). Commercial whaling has been prohibited

in the United States since 1972 and there has been an International Whaling Commission prohibition on taking blue whales since 1966 (NMFS 2000b).

- Ship strikes have been implicated in the deaths of blue whales in the eastern North Pacific in 1980, 1986, 1987, and 1993. Additional mortality from ship strikes that are unreported is likely (NMFS 2000b).
- The offshore drift gillnet fishery is the only fishery likely to take blue whales in the eastern North Pacific. Approximately 2,000 whales were taken off the west coast of North America between 1910 and 1965 (NMFS 2000b).

4.7.4.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

The blue whales are seasonal feeders, obtaining their food primarily on their summer range. In the North Pacific, Blue whales seldom enter the Bering Sea and are only rarely seen as far north as the Chukchi Sea (ADFG 1194). In the eastern North Pacific, they winter off southern California and during the spring and summer are found from central California northward through the Gulf of Alaska. No specific habitats critical to the existence of the endangered whale species have been identified. Calving for the listed whales occurs outside the area under consideration in this document.

The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species.

Since Blue whales are rarely seen in the area of Arctic oil and gas exploration and due to the absence of identified critical habitats in the area proposed for exploratory oil and gas drilling, it is unlikely that discharges from the limited exploratory activities proposed would adversely impact these feeding habitats.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the blue whale** in the vicinity of the discharge.

4.7.5. Bowhead Whale (Western Arctic Stock)

The Western Arctic stock of bowhead whales is listed by the NOAA Fisheries as endangered under ESA throughout its range.

4.7.5.1. Geographical Boundaries and Distribution

The majority of the Western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea through the Chukchi Sea in the spring (March through June) and into the Canadian Beaufort Sea, where they spend much of the summer (mid-May through September) before returning again in the fall (September through November) (Braham et al.; Moore & Reeves as cited in NOAA, 2002a). The bowhead spring migration follows fractures in the sea ice around the coast of Alaska, generally in the shear zone. As the whales travel east past Point Barrow, their migration is somewhat funneled between shore and the polar pack ice (Krogman as cited in NOAA, 2002a). Most of the year, bowhead whales are closely associated with sea ice (Moore & DeMaster as cited in NOAA, 2002a); only during the summer is this population in relatively ice-free waters in the southern Beaufort Sea (Richardson et al. as cited in NOAA, 2002a). Sightings of bowhead whales do occur in the summer near Barrow (Moore; Moore & DeMaster as cited in NOAA, 2002a). Some bowheads are found in the Chukchi and Bering Seas in summer; these are thought to be part of the expanding Western Arctic stock. Fall surveys show that the bowhead whales are found close inshore east of Barter Island and from Cape Halkett to Point Barrow generally in water depths less than 50 m (MMS, 2002).

4.7.5.2. Life History

Food items of bowheads include euphausiids, mysids, copepods, and amphipods. Since euphausiids are also the primary food for other whales in the Area of Coverage, the bowhead whale is in direct competition with these species for food.

4.7.5.3. Critical Habitat

No critical habitat for bowheads has yet been defined in Alaskan waters; however, NOAA Fisheries is currently reviewing a petition to designate critical habitat. Bowheads are most sensitive during their spring migration when calves are present and their movements are restricted to open leads in the ice. Feeding concentrations occur in areas east of Barter Island (MMS, 2003) and certain areas near Barrow are important feeding grounds.

4.7.5.4. Population Trends and Risks

Bowhead whales are distributed in seasonally ice-covered waters of the arctic and near-arctic, typically between 54° N and 75°N latitude in the western Arctic Basin. The Bering Sea stock (also called the Western Arctic stock) is the largest remnant population and the only stock that is found within U. S. waters. Prior to commercial fishing in the Bering Sea (mid-19th century), it is estimated that the Western Arctic Stock population was between 10,400 and 23,000. The population dropped to less than 3,000 at the end of commercial whaling. The Western Arctic stock has increased at a rate of 3.1% from 1978 to 1993, during which time abundance increased from approximately 5,000 to 8,000 whales (Raftery et al. as cited in NOAA, 2002a). In 1993, counts at Point Barrow resulted in an estimated population of 8,000 (Zeh et al. as cited in NOAA, 2002a). Acoustic data from 1993 has resulted in an estimate of 8,200 animals and is considered the best available abundance estimate for the Western Arctic stock (IWC; Zeh et al. as cited in NOAA, 2002a).

Native hunting of bowhead whales began over 1,000 years ago, but the arrival of the Europeans in the late 1800's precipitated the near elimination of the eastern Arctic bowhead whales (USEPA 2002). Protection from hunting now extends all over the world with the exception of Alaska. Subsistence takes by Eskimos have been regulated by a quota system under the authority of the International Whaling Commission (IWC) since 1977. Alaskan tribes kill less than 50 animals per year as a limited subsistence take (USEPA 2002).

4.7.5.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

The bowhead whales are seasonal feeders, obtaining their food primarily on their summer range. Bowheads are one of the whale species with the majority of their habitat in the area of the Arctic oil and gas exploration, specifically Beaufort and Chukchi seas. Bowhead whales are most sensitive during their spring migration when calves are present and their movements are restricted to open leads in the ice. The majority of the Western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea through the Chukchi Sea in the spring (March through June) and into the Canadian Beaufort Sea, where they spend much of the summer (mid-May through September) before returning again in the fall (September through November) (Braham et al.; Moore & Reeves as cited in NOAA, 2002a). Feeding concentrations occur in areas east of Barter Island (MMS, 2003) and certain areas near Barrow are important feeding grounds. Currently, there is no designated critical habitat for the Bowhead whales.

The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species.

Studies have shown that bowhead whales are sensitive to noise from offshore drilling platforms and seismic survey operations (Richardson and Malme 1993, Richardson 1995). The majority of bowhead whales exposed to recordings of drillship noise in the Area of Coverage oriented away from the noise source. Noise levels eliciting an avoidance response were estimated to extend 4-11 km (2-6 nmi) from a drillship (Richardson et al., 1990, p. 156). Recent studies conducted for a monitoring program for the Northstar project (a drilling facility in the Beaufort Sea) found that in one of the three years of monitoring efforts, the southern edge of the bowhead whale fall migration path may have been slightly adjusted to 2-3 miles further offshore during periods when sound levels were recorded at higher levels (Richardson et al. 2004). However, the other two years showed no alteration in the fall migration pattern during these periods of disturbance. It is likely that whales will avoid the activity occurring in the drilling areas and thus avoid contact with prey residing within the more concentrated portions of the plume during discharge.

While Bowhead whales are likely to be present in the area of Arctic oil and gas exploration, studies have shown they are likely to avoid areas in the immediate vicinity of drilling rigs. Therefore these whales direct exposure to possible contaminants and contaminated prey should be minimal. The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the bowhead whale** in the vicinity of Arctic oil and gas exploration.

4.7.6. Fin Whale (Northeast Pacific Stock)

The Northeast Pacific stock of fin whales is listed by the NOAA Fisheries as endangered under ESA throughout its range.

4.7.6.1. Geographical Boundaries and Distribution

Fin whales range from subtropical (Hawaii and North American Pacific coast) to arctic waters and are usually found in areas of dense productivity. Their summer distribution extends from central Baja California into the Chukchi Sea, while their winter range is restricted to the waters off the Pacific coast of North America. The Northeast Pacific stock, one of three stocks identified for the fin whale, is the only one identified for the Area of Coverage. Reliable estimates of current and historical abundance for the Northeast Pacific fin whale stock are not currently available. The North Pacific fin whale population was estimated at 16,600 individuals in 1991 (MMS, 2002). Ranges of population estimates based on population modeling for the entire North Pacific prior to exploitation are 42,000 to 45,000 and in the early 1970s are 14,620 to 18,630 (Ohsumi & Wada as cited in NOAA, 2003a). Fin whale abundance estimates for the

Northeast Pacific stock from 1999 and 2000 surveys were nearly five times higher in the central-eastern Bering Sea (est. pop. 3,368) than in the southeastern Bering Sea (est. pop. 683) (Moore et al. as cited in NOAA, 2003a), and most sightings in the central-eastern Bering Sea occurred in a zone of particularly high productivity along the shelf break (Moore et al. as cited in NOAA, 2003a). Reliable information on trends in abundance for the Northeast Pacific stock of fin whales is not currently available. There is no indication whether recovery of this stock has or is taking place (Braham; Perry et al. as cited in NOAA, 2003a).

Some fin whales in the Northeast Pacific stock feed in the Gulf of Alaska, while others migrate farther north to feed throughout the Bering and Chukchi Seas from June through October. From September through November, most migrate southward to California; however, a few animals may remain in the Navarin Basin (MMS, 2002). Fin whales usually breed and calve in the warmer waters of their winter range. Breeding can occur year-round, but the peak occurs between November and February (MMS, 2002). Northward migration begins in spring with migrating whales entering the Gulf of Alaska from early April to June (MMS, 2002).

4.7.6.2. Life History

Fin whales tend to be more social than other rorquals, gathering in pods of 2–7 whales or more. Sexual maturity occurs at ages of 6–10 years in males and 7–12 years in females, and they may live as long as 90 years of age (OBIS 2005). Reproductive activity occurs in winter when whales have migrated to warmer waters. Females can mate every 2 to 3 years.

Fin whales are opportunistic feeders, eating a variety of fish and zooplankton species including capelin, sandlance, herring, and euphausiids (krill) (OBIS 2005). Since euphausiids are also the primary food for other whales in the Area of Coverage, the fin whale is in direct competition with these species for food.

4.7.6.3. Critical Habitat

Critical habitat has not been established for this species within the Area of Coverage.

4.7.6.4. Population Trends and Risks

The pre-whaling abundance of fin whales in the North Pacific has been estimated at 42,000 to 45,000 animals; estimates in the early 1970's range from 14,620 to 18,630 whales (Ohsumi and Wada 1974). There have been very few sightings of fin whales in Alaskan waters. A survey conducted in August 1994 covering 2,050 nautical miles of track line south of the Aleutian Islands encountered only four fin whale groups (NMFS 2003b).

The Northeast Pacific fin whale is considered to be at risk due to the following factors:

- Commercial whaling harvested 46,032 fin whales throughout the North Pacific between 1946 and 1975 (NMFS 2003b). In the North Pacific and Bering Sea, catches of fin whales ranged from 1,000 to 1,500 animals per year from the mid-1950s to mid 1960s. Commercial whaling has been prohibited in the United States since 1972 and there has been an International Whaling Commission prohibition on taking fin whales since 1976 (NMFS 2003b).

- A ship strike has been implicated in the death of a single fin whale in Uyak Bay, Alaska in 2000 (NMFS 2003b). Additional mortality from ship strikes that are unreported may occur.

- Prior to 1999, there were no observed or reported mortalities of fin whales incidental to commercial fishing operations within the range of the Northeast Pacific stock. However, in 1999, one fin whale was killed incidental to the Bering Sea/Aleutian Island groundfish trawl fishery (NMFS 2003b).

4.7.6.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

Fin whales are seasonal feeders, obtaining their food primarily on their summer range. The fin whale is one of the listed whales with feeding habitat located in the area included in the Arctic oil and gas exploration permit. Some fin whales in the Northeast Pacific stock feed in the Gulf of Alaska, while others migrate farther north to feed throughout the Bering and Chukchi Seas from June through October. The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species.

It is likely that whales will avoid the activity occurring in the drilling areas and thus avoid contact with prey residing within the more concentrated portions of the plume during discharge. The majority of bowhead whales exposed to recordings of drillship noise in the Area of Coverage oriented away from the noise source. Noise levels eliciting an avoidance response were estimated to extend 4-11 km (2-6 nmi) from a drillship (Richardson et al., 1990, p. 156).

No specific habitats critical to the existence of the endangered whale species have been identified. Calving for the listed whales occurs outside the area under consideration in this document. Due to the absence of identified critical habitats in the area proposed for exploratory oil and gas drilling, the potential for adverse impacts to habitat can not be determined definitively. However, it is unlikely that discharges from the limited exploratory activities proposed would adversely impact these feeding habitats.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the fin whale** in the vicinity of the discharge.

4.7.7. Humpback Whale (Western and Central Stocks)

The Western and Central stocks of humpback whales are listed by the NOAA Fisheries as endangered under ESA throughout their range.

4.7.7.1. Geographical Boundaries and Distribution

Humpbacks are widely distributed in all oceans, though it is less common in Arctic waters. Of the four currently recognized stocks, only two (central North Pacific stock and western North Pacific stock) are present in the Area of Coverage. The general range of the humpback whale is from tropical wintering grounds near islands and continental coasts to open-ocean temperate and sub-polar summering habitats. The range of the central North Pacific stock is from the Hawaiian Islands to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak. The range of the western North Pacific stock is from Japan to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands).

Humpback whales are seasonal migrants and are generally considered to inhabit waters over continental shelves, along their edges and around some oceanic islands. During winter (the breeding season), most humpbacks are found in temperate and tropical waters. It is thought that little feeding occurs on the wintering grounds. Although humpbacks mate and give birth in wintering areas, reproductive events may also take place during migration. There are no reported features that characterize the migration routes of all populations of humpbacks. Some whales migrate across the open ocean (from Hawaiian waters to those of Southeastern Alaska), while others migrate through coastal waters (from Mexico to Southeastern Alaska). In summer (the feeding season), most humpbacks migrate considerable distances to waters of high biological productivity, usually in higher latitudes. Summer ranges are often relatively close to shore including major coastal embayments and channels. However, humpbacks may also summer offshore, as in the Gulf of Alaska.

4.7.7.2. Life History

Humpback whales are seasonal migrants. The whales mate and give birth while in wintering areas outside of Alaskan waters. Sexual maturity occurs at age 4-6 years, with mature females giving birth every 2-3 years (ADFG 1994b). During spring, the whales migrate back to feeding areas in Alaskan waters, where they spend the summer (ADFG 1994b; Perry et al. 1999). Humpback whales use a variety of feeding behaviors to catch food including underwater exhalation of columns of bubbles that concentrate prey, feeding in formation, herding of prey, and lunge feeding (ADFG 1994b). Based on their diet, humpbacks have been classified as generalists (Perry et al. 1999).

They have been known to prey upon euphausiids (krill), copepods, juvenile salmonids (*Oncorhynchus spp.*), Arctic cod (*Boreogadus saida*), capelin (*Mallotus villosus*), Pacific herring (*Chupea harengus pallasii*), sand lance (*Ammodytes hexapterus*), walleye pollock (*Theragra chalcogramma*), pollock (*Pollachius virens*), pteropods, and some cephalopods. On Alaska feeding grounds, humpback whales feed primarily on capelin, juvenile walleye pollock, sand lance, Pacific herring, and krill (NMFS 2003c; Perry et al. 1999). Since euphausiids are also the primary food for other whales in the Area of Coverage, the humpback whale is in direct competition with these species for food.

4.7.7.3. Critical Habitat

Critical habitat has not been established for this species within the Area of Coverage. Feeding grounds are critical to the humpback's survival.

4.7.7.4. Population Trends and Risks

The pre-whaling abundance of humpback whales in the North Pacific has been estimated to be approximately 15,000 animals (ADFG 1994b). The current total estimated abundance of the Central North Pacific stock of humpback whales is 4,005 individuals (NMFS 2005b). NMFS (2005b) reports abundance within known feeding areas in Alaska as: southeast Alaska (961 whales), Kodiak Island area (651 whales), and Prince William Sound (149 whales). At least some portions of this stock have increased in abundance between the early 1800s and 2000. The rate of population increase in southeast Alaska may have recently declined, which may indicate the stock is approaching its carrying capacity (NMFS 2005b).

The Central North Pacific humpback whale is considered to be at risk due to the following factors:

- Commercial whaling harvested more than 28,000 animals from the North Pacific during the 20th century and may have reduced this population to as few as 1,000 individuals after the 1965 hunting season (NMFS 2005b).
- Direct ship strikes are a significant source of mortality in the eastern North Pacific stock of humpback whales in California, Oregon, and Washington waters, where there is an average of 0.6 whales killed per year (Perry et al. 1999). Little information

is available on mortality rates from ship strikes for humpback whale in Alaskan waters. One pregnant humpback whale was reported killed by a cruise ship in Glacier Bay in July 2001 (Richardson 2003).

- Prior to 1990, there were thought to be little mortality in U.S. waters due to commercial fishing operations. Perry et al. (1999) reported that NMFS observers had reported no mortalities from the Bering Sea, Aleutian Islands, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. Data accumulated through 1995 from Hawaii and southeastern Alaska areas were used to calculate an estimated minimum mortality incidental to commercial fishing operations of 0.8 whales per year (Perry et al. 1999).
- Humpbacks exhibit variable responses to noise, and the level and type of response exhibited by whales has been correlated to group size, composition, and apparent behaviors at the time of possible disturbance. Humpback whales have suffered severe mechanical damage to their ears from noise pulses from underwater blasting; whales exposed to playbacks of noise from drillships, semisubmersibles, drilling platforms, and production platforms do not exhibit avoidance behaviors at noise levels up to 116 db (Malme et al. 1985).

4.7.7.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

Humpback whales migrate in spring back to feeding areas in Alaskan waters, where they spend the summer (ADFG 1994b; Perry et al. 1999). NMFS (2005b) reports abundance within known feeding areas in Alaska as: southeast Alaska (961 whales), Kodiak Island area (651 whales), and Prince William Sound (149 whales). No specific habitats critical to the existence of the endangered whale species have been identified. Calving for the listed whales occurs outside the area under consideration in this document.

Since humpback whales are seasonal feeders, obtaining their food primarily on their summer range. The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species.

Another concern for Humpback whales is possible habitat alterations due to noise from oil and gas drilling. Humpback whales have suffered severe mechanical damage to their ears from noise pulses from underwater blasting; whales exposed to playbacks of noise from drillships, semisubmersibles, drilling platforms, and production platforms do not exhibit avoidance behaviors at noise levels up to 116 db (Malme et al. 1985). Due to the fact that the oil and gas exploration activities may only infringe on a small portion of the humpback whale habitat, it is likely that whales will avoid the activity occurring in the drilling areas and thus avoid contact with prey residing within the more concentrated portions of the plume during discharge.

Due to the absence of identified critical habitats in the area proposed for exploratory oil and gas drilling, it is unlikely that discharges from the limited exploratory activities proposed would adversely impact these feeding habitats. Therefore, the EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the humpback whale** in the vicinity of the Arctic oil and gas exploration.

4.7.8. Right Whale (North Pacific Stock)

The North Pacific right whale is listed by the NOAA Fisheries as endangered under ESA throughout its range.

4.7.8.1. Geographic Boundaries and Distribution

Whaling records indicate that right whales in the North Pacific ranged across the entire North Pacific north of 35°N and occasionally as far south as 20°N (Roenbaum et al. as cited in NOAA, 2003b). Sightings have been reported as far south as central Baja California in the eastern North Pacific and Hawaii in the central North Pacific, and as far north as the sub-Arctic waters of the Bering Sea and Sea of Okhotsk in the summer (NOAA, 2003b).

Before right whales in the North Pacific were heavily exploited by commercial whalers, concentrations were found in the Gulf of Alaska, eastern Aleutian Islands, southcentral Bering Sea, Sea of Okhotsk, and Sea of Japan (Braham & Rice as cited in NOAA, 2003b). The pre-exploitation size of this stock exceeded 11,000 (NOAA, 2003b). In 1973, Wada (as cited in NOAA, 2003b) estimated a total population of 100-200 in the North Pacific. During 1958-82, there were only 32-36 sightings of right whales in the central North Pacific and Bering Sea (Braham as cited in NOAA, 2003b). A reliable estimate of abundance for the North Pacific right whale stock is currently unavailable.

Right whales prefer coastlines and sometimes large bays, but may spend a lot of time on the open sea. They calve in coastal waters during the winter months. Migratory patterns of the North Pacific stock are unknown, although it is thought the whales spend the summer on high-latitude feeding grounds and migrate to more temperate waters during the winter (Braham & Rice as

cited in NOAA, 2003b). Preliminary analysis of data from recorders indicates that right whales remain in the southeastern Bering Sea at least through October (NOAA, 2003b). Right whales have not been observed outside the localized area in the southeastern Bering Sea during surveys.

4.7.8.2. Life History

As noted previously, little is known about the movements of the eastern population of North Pacific right whale; although some authors believe they may move seasonally from areas in the Bering Sea and Gulf of Alaska southward possibly as far as the waters off Baja, California (CBD 2000; NMFS 2002a). No sightings of a cow with a calf have been confirmed since 1900 (NMFS 2002b).

Among baleen whales, right whales appear to have the most specialized feeding strategy. Studies conducted in the North Atlantic suggest that right whales require high densities of copepods concentrated in surface waters for effective feeding; the feeding requirements of an adult whale are estimated to be at least 4.07×10^5 Kcal/day (CBD 2000). The feeding preferences of North Pacific right whales have not been determined; however, the NMFS has noted that these whales probably feed almost exclusively on calanoid copepods, a component of the zooplankton (NMFS 2002b). Since euphausiids are also the primary food for other whales in the Area of Coverage, the right whale is in direct competition with these species for food.

4.7.8.3. Critical Habitat

On June 3, 1994, the NMFS designated critical habitat for the species of northern right whale (NMFS 1994a), which as of April 10, 2003, became referred to as the North Atlantic right whale (NMFS 2003a). The three areas designated as critical habitat are in the North Atlantic Ocean off the eastern United States. NMFS determined at that time that insufficient information was available to consider critical habitat designation for other stocks of northern right whale, including whales residing in the North Pacific.

On October 4, 2000, the Center for Biological Diversity petitioned the NMFS to designate a portion of the southeastern Bering Sea as critical habitat for the North Pacific right whale on the basis of annual sightings of whales in the area that suggests the area is a summer feeding ground for this severely depleted population (CBD 2000). On July 11, 2001, the Marine Mammal Commission responded to this request by recommending that NMFS proceed with designating the area as critical habitat and modify the boundaries as future data on population distribution becomes available (MMC 2002). However, on February 20, 2002, NMFS published notice that the Service had determined that the petitioned action to designate critical habitat was not warranted at this time (NMFS 2002b) noting that because the essential biological requirements of the population in the North Pacific Ocean are not sufficiently understood, the extent of critical habitat cannot be determined. Currently, no critical habitat has been designated for the North Pacific right whale.

4.7.8.4. Population Trends and Risks

The pre-exploitation size of the population on North Pacific right whales has been estimated as likely exceeding 10,000 animals (67 FR 7660, February 20, 2002) to 19,000 animals (CBD 2000). The current population is thought to be very small, perhaps in the tens of animals (NMFS 2002b).

The North Pacific right whale is considered to be at risk due to the following factors:

- Whaling records indicate that during the 19th century, pelagic whalers harvested over 15,000 North Pacific right whales. As early as the 1870s, the whale was noted as being rare (CBD 2000).
- Right whales are slow-swimming and spend much of their time near the surface of the water, which makes them susceptible to ship strikes. Although vessel-related mortality rates for the North Pacific are not known, the NMFS is considering regulations to implement a strategy to reduce mortalities to North Atlantic right whales as a result of vessel collisions (NMFS 2004).
- The magnitude and nature of entanglements in fishing gear are not known. However, an estimated 57 percent of right whales in the North Atlantic bear scars and injuries indicative of fishing gear entanglement (CBD 2000). The extent of fisheries in the southeastern Bering Sea suggests that fishing gear entanglements may pose a risk to North Pacific right whale.
- Disturbance due to anthropogenic noise may affect right whales by changing normal behavior to temporarily or permanently avoid noise sources. Noise may also raise background noise levels and interfere with the detection of sounds from other whales or natural sources. Information on the hearing capacity of right whales is not available; however, some authors have suggested that their hearing abilities are especially acute below 1 kHz (CBD 2000).

4.7.8.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

Right whales are distributed in the central North Pacific, and as far north as the sub-Arctic waters of the Bering Sea and Sea of Okhotsk in the summer (NOAA, 2003b). Preliminary analysis of data from recorders indicates that right whales remain in the southeastern Bering Sea at least through October (NOAA, 2003b). Right whales have not been observed outside the localized area in the southeastern Bering Sea during surveys. No specific habitats critical to the existence

of the right whale species have been identified. Calving for the listed whales occurs outside the area under consideration in this document. Due to the absence of identified critical habitats in the area proposed for exploratory oil and gas drilling, it is unlikely that discharges from the limited exploratory activities proposed would adversely impact these feeding habitats.

The right whales are seasonal feeders, obtaining their food primarily on their summer range. The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey; the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species.

Due to the fact that right whales are normally distributed outside of the action area and the absence of identified critical habitats in the area proposed for exploratory oil and gas drilling, it is unlikely that discharges from the limited exploratory activities proposed would adversely impact these feeding habitats. Therefore, the EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the right whale** in the vicinity of the Arctic oil and gas exploration.

4.7.9. Sperm Whale (North Pacific Stock)

The North Pacific stock of humpback whales is listed by the NOAA Fisheries as endangered under ESA throughout its range.

4.7.9.1. Geographical Boundaries and Distribution

Sperm whales inhabit all ocean basins, from equatorial to polar waters. Their distribution generally varies by gender and the age composition of groups, and is influenced by prey availability and oceanic conditions (Perry et al. 1999) as the shallow continental shelf apparently bars their movement into the north-eastern Bering Sea and Arctic Ocean. In the North Pacific, sperm whales are distributed widely, with the northernmost boundary extending from Cape Navarin (62°N) to the Pribilof Islands (Angliss and Lodge 2003). Mature females, calves, and immature whales of both sexes in the North Pacific are found in social groups and remain in tropical and temperate waters year round from the equator to approximately 45°N latitude (Angliss and Lodges 2003; Perry et al. 1999). Males lead a mostly solitary life after reaching sexual maturity between 9 and 20 years of age and are thought to move north in the summer to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands. Research has revealed considerable east-west movement between Alaska and the western North Pacific (Japan and Bonin Islands), with little evidence of north-south movement in the eastern Pacific (Angliss and Lodge 2003; Perry et al. 1999).

The habitat preferred by sperm whales differs among the sexes and age composition of individual whales. The social groups comprised of females, calves, and immature whales have a broader habitat distribution than males; they are generally restricted to waters with surface temperatures greater than 15°C and are rarely found in areas with water depths less than 200 to 1,000 m (656 to 3,280 ft) (Gregs and Trites 2001; Reeves and Whitehead 1997). Males exhibit a tighter distribution over deeper waters along the continental shelf break, and are often found near steep drop-offs or other oceanographic features (e.g., offshore banks, submarine trenches and canyons, continental shelf edge), presumably because these areas have higher foraging potential (AKNHP 2005; Gregs and Trites 2001).

The distribution of sperm whale indicates that male sperm whales are the only sex that frequent Alaskan waters. Available evidence indicates that males are present offshore in the Gulf of Alaska during the summer.

4.7.9.2. Life History

Sperm whales appear to be organized in a social system that consists of groups of 10–40 adult females plus their calves which remain year-round in tropical and temperate waters. Solitary males join these groups during the breeding season, which takes place in the middle of the summer (NMML 2004a). Males reach sexual maturity at 9–20 years of age (Perry et al. 1999), but do not seem to take an actual part in breeding until their late 20s (ACS 2004). Female sperm whales reach sexual maturity at around 9 years of age and produce a calf approximately once every 5 years (NMFS 2005c).

Sperm whales feed primarily on medium-sized deep water squid, with the remaining portion of their diet comprised of octopus, demersal and mesopelagic sharks, skates, and fish; feeding occurs all year round, usually at depths below 400 feet (ACS 2004; AKNHP 2005; NMFS 2005c; NMML 2004a).

4.7.9.3. Critical Habitat

Critical habitat has not been established for this species within the Area of Coverage.

4.7.9.4. Population Trends and Risks

Pre-whaling abundance estimates of sperm whale in the North Pacific are considered unreliable and range from 472,000 to 1,260,000 animals (Angliss and Lodge 2003; Perry et al. 1999; NMFS 2005c). The abundance of whales in the North Pacific in the late 1970s was estimated to be 930,000 animals (Rice 1989). The current abundance of the North Pacific stock (Alaska) of sperm whale is unknown (NMFS 2005c).

Risk factors for sperm whale in the North Pacific are listed below:

- The population of sperm whales was likely well below pre-whaling levels before modern whaling became intensive in the 1940s (Reeves and Whitehead 1997). Commercial whaling of sperm whales in the North Pacific harvested 258,000 animals between 1947 and 1987 (Angliss and Lodge 2003). In addition to reducing overall numbers of animals, commercial whaling altered the male-to-female ratio by selective killing of the larger breeding age males (AKNHP 2005).
- Incidental mortality arising from commercial fishing operations in the Gulf of Alaska have been documented by NMFS observers and may be increasing in frequency. The average annual mortality rate based on observations from 1997 to 2001 is 0.4 whales per year. Most interactions appear to occur with the longline fishery operating in the Gulf of Alaska waters east of Kodiak Island (AKNHP 2005).
- Sperm whales may be impacted by ship strikes, although their behavior suggest that they are at a lesser risk than other baleen whales that spend a greater proportion of their time in surface waters (NMFS 2005c).
- Sperm whales may be especially sensitive to noise pollution, resulting in changes of behavior and distribution in response to unnatural low-frequency sounds (Reeves and Whitehead 1997; Perry et al. 1999).
- Chemical contaminants that bioaccumulate in higher trophic level predators such as sperm whale may be a concern. Relatively high levels of mercury have been measured in breeding females captured off Australia (Perry et al. 1999).

4.7.9.5. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

In the North Pacific, sperm whales are distributed widely, with the northernmost boundary extending from Cape Navarin (62°N) to the Pribilof Islands (Angliss and Lodge 2003). Mature females, calves, and immature whales of both sexes in the North Pacific are found in social groups and remain in tropical and temperate waters year round from the equator to approximately 45°N latitude (Angliss and Lodges 2003; Perry et al. 1999). Males lead a mostly solitary life after reaching sexual maturity between 9 and 20 years of age and are thought to move north in the summer to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands. No specific habitats critical to the existence of the endangered whale species

have been identified. Calving for the listed whales occurs outside the area under consideration in this document.

The sperm whales are seasonal feeders, obtaining their food primarily on their summer range. The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species.

Due to the fact that sperm whales are normally distributed outside of the action area and the absence of identified critical habitats in the area proposed for exploratory oil and gas drilling, it is unlikely that discharges from the limited exploratory activities proposed would adversely impact these feeding habitats. Therefore, the EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the sperm whale** in the vicinity of the Arctic oil and gas exploration.

4.7.10. Sei Whale

The sei whale was listed as endangered under the ESA on June 2, 1970.

4.7.10.1 Geographical Boundaries and Distribution

Sei whales have historically occurred in all oceans of the world, migrating from low-latitude wintering areas to high-latitude summer feeding grounds (Fisheries and Oceans Canada 2005). In the eastern North Pacific, sei whales are common in the southwest Bering Sea to the Gulf of Alaska, and offshore in a broad arc between about 40°N and 55°N (Environment Canada 2004a; WWF 2005).

The sei whale prefers deeper offshore waters, with preferred habitat tending to occur in offshore areas that encompass the continental shelf break (Gregs and Trites 2001). Commercial whaling catch records off British Columbia indicate that less than 0.5 percent of sei whales were caught in waters over the continental shelf (Environment Canada 2004a). These preferences make it unlikely that sei whales would frequent Cook Inlet waters within the geographic area covered by the general NPDES permit.

4.7.10.2 Critical Habitat

No critical habitat has been designated for the sei whale.

4.7.10.3 Life History

Sei whales reach sexual maturity between 5 and 15 years of age, and may live as long as 60 years. Like many other species of baleen whales, sei whales migrate from low-latitude wintering areas to high-latitude summer feeding grounds. Catch records suggest that whale migrations are

segregated according to length (age), sex, and reproductive status. Pregnant females appear to lead the migration to feeding grounds, while the youngest animals arrive last and depart first (Environment Canada 2004a). Sei whales feed primarily on copepods, followed by small squid, euphausiids, and small pelagic fish (Trites and Heise 2005).

4.7.10.4 Population Trends and Risks

The pre-whaling abundance of sei whales in the North Pacific has been estimated to range from 42,000–62,000 animals (Ohsumi and Wada 1974; Tillman 1977). There are no current data on trends in sei whale abundance in the eastern North Pacific waters. A fact sheet prepared by NMFS (2000a) on the eastern North Pacific stock of sei whale suggest that the population is expected to have grown since being given protected status under the MMPA in 1976; however, continued unauthorized take, incidental ship strikes, and fill net mortality makes this uncertain. The eastern North Pacific sei whale is considered to be at risk due to the following factors:

- Commercial whaling harvested 61,500 sei whales from the North Pacific between 1947 and 1987. Commercial whaling has been prohibited in the United States since 1972 and there has been an International Whaling Commission prohibition on taking sei whales since 1976 (NMFS 2000a).
- Ship strikes may occasionally kill sei whales; no strikes have been reported for this species in the eastern North Pacific (NMFS 2000a).
- Environment Canada (2004a) notes there are no species-specific factors limiting the recovery of sei whales. However, indirect threats to which they are exposed include habitat loss and degradation through competition with commercial fisheries, vessel noise and traffic, seismic exploration, chemical contamination, and competition with some species of fish.

4.7.10.5 Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

Sei whales are common in the southwest Bering Sea to the Gulf of Alaska, and offshore in a broad arc between about 40°N and 55°N (Environment Canada 2004a; WWF 2005). It is possible that oil and gas operations could impact the habitat and food supply of the Sei whale, however the action area includes Beaufort Sea and Chukchi sea which are located north of Sei whale habitat and could possibly impact only a small portion of their overall habitat and prey. Since there are currently no oil and gas exploration leases in Norton Basin or Hope Basin, no activities

are expected in these areas. Therefore, it is expected that the Arctic General Permit for Oil and Gas Exploration will have insignificant effects on the Sei whale.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the Sei whale** in the vicinity of the Arctic oil and gas exploration.

4.7.11. Steller Sea Lion (Western Alaska Stock)

The Western stock of Steller sea lion is listed by the NOAA Fisheries as endangered under ESA throughout its range.

4.7.11.1. Geographical Boundaries and Distribution

The Steller sea lion is distributed around the North Pacific Ocean rim from northern Hokka, Japan along the western North Pacific northward through the Kuril Islands and Okhotsk Sea, then eastward through the Aleutian Islands and central Bering Sea, and southward along the eastern North Pacific to the Channel Islands, California (NMML 2004b). Two distinct populations (western and eastern) are thought to occur within this range, with the dividing line being designated as 144°W longitude (NMFS 1997).

4.7.11.2. Life History

The breeding season for Steller sea lions is from May to July, where the animals congregate at rookeries and the males defend territories, mating occurs, and the pups are born. Nonreproductive animals congregate to rest at more than 200 haulout sites where little or no breeding occurs. Bulls become sexually mature between 3 and 8 years of age, but typically are not able to gain sufficient size and successfully defend territory within a rookery until 9–10 years of age. Females reach sexual maturity and mate at 4–6 years of age and typically bear a single pup each year. Sea lions continue to gather at both rookeries and haulout sites throughout the year, outside of the breeding season (NMML 2004b). Habitat types that typically serve as rookeries or haulouts include rock shelves, ledges, slopes, and boulder, cobble, gravel, and sand beaches. Seasonal movements occur generally from exposed areas in summer to protected areas in winter (ADFG 1994c). When foraging in marine habitats, Steller sea lions typically occupy surface and mid-water ranges in coastal regions. They are opportunistic predators and feed on a variety of fish (walleye Pollock, Atka mackerel (*Pleurogrammus monopterygius*), Pacific herring, capelin, sand lance, Pacific cod (*Gadus macrocephalus*), and salmon), and invertebrates (squid, octopus) (ADFG 1994c; NMML 2004b).

4.7.11.3.

4.7.11.4. Critical Habitat

In 1993, NMFS issued a final rule designating critical habitat for the Steller sea lion, including all U.S. rookeries, major haulouts in Alaska, horizontal and vertical buffer zones (5.5 km) around these rookeries and haulouts, and three aquatic foraging areas in north Pacific waters: Sequam Pass, southeastern Bering Sea shelf, and Shelikof Strait (NMFS 1993b). This final rule was amended on June 15, 1994 to change the name of one designated haulout site from Ledge Point to Gran Point and to correct the longitude and latitude of 12 haulout sites, including Gran Point (NMFS 1994b).

Critical habitat includes a terrestrial zone that extends 3,000 ft (0.9 km) landward from the baseline or base point of each major rookery and major haulout in Alaska. Critical habitat includes an air zone that extends 3,000 ft (0.9 km) above the terrestrial zone of each major rookery and haulout area measured vertically from sea level. Critical habitat within the aquatic zone in the area east of 144°W longitude (ESA threatened population) extends 3,000 ft (0.9 km) seaward in state and federally managed waters from the base point of each rookery or major haulout area. Critical habitat within the aquatic zone in the area west of 144°W longitude (ESA endangered population) extends 20 nautical miles (37 km) seaward in state and federally managed waters from the baseline or base point of each rookery or major haulout area (NMFS 1993b).

4.7.11.5. Population Trends and Risks

In 1956-60, the population of sea lions in the Gulf of Alaska and Aleutian Islands was estimated at 140,000 (NOAA, 2002b). In 1980, the world population of Steller sea lion was estimated to be between 245,000 and 290,000 (Loughlin et al. 1992). The number of Steller sea lions in the western stock declined by 75% between 1976 and 1990. The western population of Steller sea lion has declined at about 5.0 percent per year over the period of 1991-2000, while the eastern population has increased at about 1.7 percent per year (Loughlin and York 2000). In 1998, surveys estimated a minimum abundance of 38,788 Steller sea lions in the western U.S. stock (NOAA, 2002b). Counts at trend sites during 2000 indicate that the number of sea lions in the Bering Sea/Aleutian Islands region has declined 10.2% between 1998 and 2000. Based on recent survey data collected in 2003-2004, Fritz and Stinchcomb (2005) suggest that the decline of the western population within Alaskan territory may have abated in recent years, with an annual rate of increase estimated at 2.4 to 4.2 percent.

A substantial amount of research has been devoted to trying to determine the cause(s) of the Steller sea lion decline, whose number has dropped by more than 80 percent in the last three decades in Alaskan waters (National Academies 2002). Currently, there is no consensus on a single causal factor, and it is likely that many factors could have contributed to the decline of this species (NMML 2004b). The hypotheses can be divided into two categories (National Academies 2002); those that propose factors that would affect the overall health and fitness of sea lions and those that propose factors that would directly kill sea lions regardless of their general health. The first four items listed below fall into the former category; the last five items fall within the latter category:

- Reduced prey availability or prey quality due to large-scale fishing operations
- Climate changes in the 1970s that may have affected the availability of quality of prey
- Non-fatal diseases that inhibit sea lions' ability to forage for food
- Impairment (reduced fecundity) caused by the consumption of contaminated prey
- Predation by killer whales
- Incidental mortality caused by fishing operations
- Illegal harvest
- Subsistence harvesting
- Fatal diseases caused by contagious pathogens or increased exposure to pollutants

While there may not be consensus on a single causative factor for the decline of sea lion abundance in Alaskan waters, nutritional stress is probably the leading hypothesis (NMFS 1995B; Porter 1997). Sea lion declines in abundance have coincided with the declines of other Alaskan pinniped stocks (harbor seal and northern fur seal) and some sea bird breeding colonies. Over the same period of these declines, there has been a rapid growth in groundfish fisheries in Alaska, which suggests that competition by fisheries and reduced prey availability may be limiting the growth and reducing the fitness of sea lions (Porter 1997). Pollock make up over 50 percent of the prey consumed by sea lions; the removal of large quantities of Pollock, and other groundfish that could provide alternative prey, by commercial fisheries may have caused increased nutritional stress and reduced the fitness of sea lions resulting in increased mortality rates.

4.7.11.6. Effects Analysis

Endangered or threatened species may be adversely impacted by exploratory oil and gas operations either directly, by the discharged muds and cuttings and other permitted discharges, or indirectly, via impacts to their habitat and food supply (e.g., bioaccumulation of metals from discharge of muds and cuttings). The potential adverse effects of drilling muds and cuttings discharges are of primary concern due to the large volume discharged and the presence of potentially toxic components (e.g., metals) in the discharged muds.

The habitat of the Steller sea lion is located from the central Bering Sea south through the Aleutian Islands and further South through the Pacific coast. It is possible that oil and gas operations could impact the habitat and food supply of the Steller sea lion, however the action area includes Beaufort Sea and Chukchi sea which are located north of Steller sea lion habitat and could possibly impact only a small portion of their overall habitat and prey. Since there are currently no oil and gas exploration leases in Norton Basin or Hope Basin, no activities are expected in these areas. Therefore, it is expected that the Arctic General Permit for Oil and Gas Exploration will have insignificant effects on the Steller sea lion or their critical habitat.

The EPA has determined that the issuance of this permit **may affect but is not likely to adversely affect the Steller sea lion** in the vicinity of the Arctic oil and gas exploration.

4.7.12. Uncertainty Evaluation

4.7.12.1. Environmental Baseline

The measurement of chemicals associated with the discharge from oil and gas exploration facilities has been sporadic at best. Most of the studies conducted were only for drilling muds and cuttings and located in the Gulf of Mexico. Studies for Arctic Alaska were conducted in the late 1970's and early 1980's. There is no discussion of the hydrological or hydraulic conditions which will affect dispersion of the constituents associated with the discharges. Sediment samples have not been collected as part of the investigation of chemicals associated with oil and gas exploration facilities in the Arctic. Thus, the data reported for sediment concentrations represent estimates of the contaminant load; however, there is a great deal of uncertainty regarding how representative these samples are of the distribution of contaminants in the Arctic environment. A quality assurance review of the data was not completed therefore the accuracy of the data are unknown.

No specific studies of biota were done in the area. Therefore, no definitive statements can be made regarding the chemical contaminants in aquatic fish and any fish data cannot be directly correlated with any sediment data collected in and near the vicinity of the oil and gas exploration facilities.

Other sources of constituents associated with oil and gas exploration facilities include sanitary and domestic wastes, desalination unit wastes, boiler blowdown, test fluids, deck drainage, blowout preventer fluids, uncontaminated ballast and bilge water, excess cement slurry, non-contact cooling water, fire control system test water, and excess cement slurry at the sea floor. None of these sources is described in detail nor are they specific data associated with their effluent discharges or operations. Without specific data for these other sources it is difficult to attribute any baseline data.

Cumulative exposures to multiple stressors from other sources were not evaluated in this permit. Other exposures to stressful conditions may render species more or less sensitive to the constituents in the oil and gas exploration discharges. They also may alter the behavior of the species such that they are or more or less likely to be exposed to releases from the discharges. The lack of knowledge regarding the likelihood of cumulative exposures increases the uncertainty in the effects determination.

Uncertainty in toxic chemical levels is primarily associated with variability in fish tissue and sediment concentrations over space and time as well as errors in chemical analytical methods.

When compiling concentration data the detection limit for each chemical in each sample introduces uncertainty in the resulting concentrations. The detection limits in the sediment data was sufficiently high for the treatment of non-detects to hide trends between dioxin and furan concentration and distance.

4.7.12.2. Ecological Effects Determinations

4.7.12.2.1. Parameters of concern

Chemical descriptions are based on general information regarding the physical, chemical, and biological behavior of the mill effluent constituents in fresh water. Information on certain compounds is extremely limited due to the lack of site specific data on these particular constituents.

The parameters of concern in this evaluation are those which were considered under the effluent guidelines or as having "reasonable potential" in the development of effluent limits for the final permit. Other pollutants may be present in the effluent discharge, but at concentrations that are well below the applicable water quality standards.

4.7.12.2.2.

4.7.12.2.3. Conclusion determinations

Confidence in the conclusions of the evaluation that uses the toxicity in relevant studies depends upon the quality of the available toxicity data. Ideally, to predict with the greatest accuracy whether an effect may be adverse, one would use toxicity data from an experiment that measures the type of toxicological response that is of interest, using the species of interest and the experimental design most easily extrapolated to the conditions of interest. However, there are no specific toxicity studies which are appropriate for this particular evaluation.

A thorough review of the scientific literature was conducted to identify as many sources of toxicity data for these parameters as possible. In some cases, toxicity data were obtained from a previously compiled collection of toxicity information. In other cases, individual papers published in the scientific literature were reviewed. In still other cases, the toxicity data used by EPA to derive water quality criteria or effluent guidelines were reviewed.

The quantity and quality of toxicity data available for permitted discharges varies widely. Most studies obtained toxicity data from experiments using a single chemical in a controlled exposure setting (such as an aquarium).

In some cases, the study reporting the lowest concentration for a parameter did not report the endpoint [e.g., no observable effect concentration (NOEC), lowest observable effect concentration (LOEC)]. For these chemicals, the lowest endpoint reported was used and then other endpoints were extrapolated using safety factors (e.g., if only a LC₅₀ was reported, then a safety factor would be applied to obtain an estimated LOEC and another safety factor would be applied to obtain an estimated NOEC).

Extrapolation across species

Although using surrogate toxicity data from a similar species, lifestage, or parameter increases the uncertainty associated with the evaluation, this approach is preferable to omitting the evaluation of a species or parameter with no toxicity data.

Actual direct testing of potential toxicity has not been conducted for all chemicals and listed species. While some toxicity data have been collected for nearly all the parameters of concern, toxicity data are generally not available for every life stage of a listed species. In cases where little or no toxicity data are available for a parameter of concern to each lifestage of a listed species, toxicity data from a similar parameter, species, or lifestage was used as a surrogate.

The surrogate species were selected as the closest related organism for which information was available. In judging whether other (tested) species can be used as a surrogate for listed species, it is important to know whether the tested species is more sensitive than, less sensitive than, or about equally sensitive as the listed species. In this case, "sensitivity" refers to the relative severity of the observed toxicity in one species as compared to the other. A highly sensitive species exposed to a certain concentration of a parameter would experience more severe toxicity than a less sensitive species exposed to the same concentration.

When a tested species is more sensitive or about equally sensitive to a non-tested species, the tested species can be considered a suitable surrogate for the non-tested species. The comparative sensitivity of listed species and surrogate species can be ascertained by comparing the toxicity observed in surrogate species to the toxicity observed in other species exposed to certain well-studied chemicals. Dwyer et al. (1995) used this type of comparative sensitivity approach to estimate the potential toxicity of several chemicals to endangered and threatened fish species for which no toxicity data were available. Generally, the rainbow trout (*Oncorhynchus mykiss*) has been considered a suitable surrogate for coldwater fishes, and the Fathead minnow (*Pimephales promelas*) has been considered a suitable surrogate for warm water fishes (Dwyer et al., 1995).

Extrapolation across chemicals

For some parameters with effluent limits in the proposed permit, little or no toxicity data using aquatic species are available. Therefore, parameter-specific toxicity data cannot be used to assess potential effects to listed species. For some species there is no data on specific chemicals nor are there data for extrapolation across chemicals or species. For avian species there are no data in the literature for the effects of most chemicals. A determination of likely to cause adverse effects was made although there are no data to support this position. The goal of this evaluation is to set limits which are protective of the endangered species. It was therefore assumed that in lieu of any data to the contrary a determination that there is a likelihood of adverse effects will be made when there are no toxicity data to make a site specific determination.

4.7.12.2.4. Indirect effects to prey species

The effects determination relied on the salmonids as a measure of the effect on fish prey species and the benthic community. The determination was simply based on the possibility of benthic organisms inhabiting the area adjacent to and within the 1,000 meter area of the discharge.

Little information is presently available concerning the effects of various deposition depths on benthic communities. Most studies that have investigated deposition impacts on benthos have examined deposition of dredged materials (Hale, 1972; Kranz, 1974; Mauer et al., 1978; Oliver & Slattery, 1973; Saila et al., 1972; Schafer, 1972; Schulenberger, 1970; Wilber, 1992). These studies indicate that the response to deposition and survival following such an event is species-specific. Of the species examined, burial depths from which organisms were able to migrate to the surface ranged from 1 to 32 cm (0.4 to 12.6 in). If it is assumed that most benthos are not adversely affected by deposition of drilling muds less than 1 cm, benthos in the vicinity of the discharge receiving deposition in excess of this amount may be acutely impacted by drilling activities.

4.7.12.2.5. Exposure

Aquatic fish and mammal exposure to harmful substances in this evaluation includes direct uptake or contact through absorption across the gills (for fish only) and ingestion of water, food, or sediments. Direct contact for avian species is through incidental ingestion of water and ingestion of food (prey species representative by salmonids).

Frequency and duration

In addition to the toxicity studies, the determination of an effect involves some evaluation of exposure. The modeling used to estimate effluent drilling muds and cuttings may under or over estimate the concentrations depending on spatial and temporal variability as well as model error.

Exposure duration is defined as the time period over which an organism is exposed to one or more contaminants. The exposure duration used in this evaluation is a daily average. The model was based on a daily average. It is expected that all actions in this permit were below acute levels at or near the discharge release. The determination of likelihood of adverse affects is based on an assumption that an average daily exposure is adequate to address the habitat preferences of the endangered species.

Bioaccumulation

Ideally, to understand the relationship between the water column concentration and fish tissue, site-specific bioaccumulation factors (BAFs) are needed for each non-ionic organic compound of interest. BAFs account not only for uptake via water exposure, but also uptake through the food chain and the influence of sediment concentrations on both the food and water routes. Thus, site-specific BAFs reflect the disequilibrium of the compound in the major components of the local system (water, sediment, organisms) and should not be transferred from one system to another without considering carefully the underlying assumptions in so doing. In general, one would prefer to develop and run a model for a specific location that reflects back the state of the system (i.e., describing how each compound is partitioning into organic matter in the water column and sediments, and into lipids in the organisms of different trophic states, and how higher level organisms are obtaining their tissue concentrations through food, water, and sediment exposures).

Such a model and supporting data do not currently exist for the ecosystem in the vicinity of the discharges of oil and gas exploration facilities. The lack of estimating bioaccumulation for other organic chemicals results in an uncertainty in the effects for these chemicals. The resultant benchmarks may not be fully protective of the endangered species.

Species Life history

While the life history of the species is discussed in general terms there may be site specific behavior or habitat factors which limit or alter the species preferences. A review of the scientific

literature found that younger life stages of fish are generally more sensitive to chemical toxicants than older fish.

Effluent concentrations

Models and existing data were used to estimate how the proposed effluent limitations for drilling muds and cuttings could potentially cause exposure (magnitude, frequency, and duration). A discussion of the exposure volume model inputs and assumptions is provided in section 3.1.7.

4.7.12.3. Field Studies

Field studies were performed by the Sohio Alaska Petroleum Company (1981 & 1982) and Crippen et al. (1980) to monitor the environment fate associated with above ice disposal of drilling fluids and cuttings in the Beaufort Sea. However, these studies, which are discussed in Section 3.1.6.1, were only conducted in the Beaufort Sea area and were only for discharges of drilling muds and cuttings. No studies have been conducted in the Arctic environment for below ice or open water discharges.

4.7.13. Issues of Take

The purpose of this section is to assess whether or not take of a listed species is likely to result from the proposed activity. "Take" is defined as in Section 3(18) of the ESA means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct". The USFWS further defines "harm" as "significantly impairing behavioral patterns such as breeding, feeding, or sheltering", and "harass" as "actions that create the likelihood of injury of listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering". Further, the "incidental take" in Section 10(a)(1)(B) of the ESA means "any taking otherwise prohibited by Section 9(a)(1)(B) if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity". Finally, a "take" may occur only to individuals of a species, not to a species' habitat or to designated critical habitat. The take prohibition does not extend to proposed or candidate species.

Applying these definitions to the previous analysis, it is likely that an incidental take of bowhead whale, spectacled eider or Steller's eider, in the form of harm and harassment, could occur. Harm would occur when a whale entered a mixing zone for feeding or breeding but was unable to perform these activities due to physiological alteration from exposure to TSS, metal, organic compounds, or toxicity. This, of course, is dependent on how long the whale remains within the impact area of these parameters. Harassment due to loss of prey species is a more likely scenario, which could occur to both whale and eider species within the Action Area. Exposure to toxic levels of chemical compounds or mixtures at toxic levels or that bioaccumulate to toxic levels would impair development or result in death to aquatic prey species. Another possible problem is the movement of the bowhead whale that could result in multiple exposures to some individuals.

4.8. ESSENTIAL FISH HABITAT

Essential fish habitat (EFH) is the waters and substrate (sediments, etc.) necessary for fish to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires EPA to consult with the NOAA Fisheries when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH.

In the Area of Coverage, EFH has been established for red and blue king crabs, snow crabs, yellowfin sole, sculpins, and Pacific salmon (chinook, coho, pink, sockeye, and chum). Table 4-8 presents the location and life stages of EFH species within the Area of Coverage.

4.8.1. Red King Crab

Red king crab (*Paralithodes camtschaticus*) is widely distributed throughout the Bering Sea. Red king crabs are typically at depths less than 100 fathoms (fm). Norton Sound has a discrete population of red king crab that is actively fished. The minimum size limit for harvest of male only crab from the Norton Sound population is 12 cm. The commercial fishery for red king crab in Norton Sound occurs in the summer, opening July 1 and a winter through the ice fishery opens November 15 and closes May 15.

Egg hatch of larvae is synchronized with the spring phytoplankton bloom in Southeast Alaska suggesting temporal sensitivity in the transition from benthic to planktonic habitat. Early juvenile stage red king crabs are solitary and need high relief habitat or coarse substrate such as boulders, cobble, shell hash, and living substrates such as bryozoans and staked ascidians. Young-of-the-year occur at depths of 50 m or less. Late juvenile stage red king crabs of the ages of two to four years exhibit decreasing reliance on habitat and a tendency for the crab to form pods consisting of thousands of crabs. Podding generally continues until four years of age (about 6.5 cm when the crab move to deeper water and join adults in the spring migration to shallow water for molting and mating. The approximate upper size limit of juvenile female and male red king crabs in Norton Sound at 50 percent maturity is 7 and 9 cm carapace length, respectively. While red king crab juveniles primarily feed on diatoms and hydroids; juvenile crabs are cannibalistic during molting.

King crab molt multiple times per year through age 3 after which molting is annual. At larger sizes, king crab may skip molt as growth slows. Females grow slower and do not get as large as males. Female red king crabs in the Norton Sound area reach 50% maturity at 6.8 cm and do not attain maximum sizes found in other areas. Mature red king crabs exhibit seasonal migration to shallow waters for reproduction. The remainder of the year, red king crabs are found in deep waters. Males grasp females just prior to female molting, after which the eggs (43,000 to 500,000) are fertilized and extruded on the female's abdomen. The female red king crab carries the eggs for 11 months before they hatch, generally in April. Natural mortality of adult red king crab is estimated at about 25 percent per year due to old age, disease, and predation. Pacific cod is the main predator on red king crabs. Walleye Pollock, yellowfin sole, and Pacific halibut are minor consumers of pelagic larvae, settling larvae, and larger crabs, respectively. Adult king

crab feed on mollusks, echinoderms, polychaetes, decapods, crustaceans, algae, urchins, hydroids and sea stars.

4.8.2. Blue King Crab

Blue king crab (*Paralithodes platypus*) has a discontinuous distribution throughout their range (Hokkaido, Japan to Southeast Alaska). There are no distinct stocks of blue king crab that are fished within the Area of Coverage.

Early juvenile blue king crabs require refuge substrate characterized by gravel and cobble overlaid with shell hash, and sponge, hydroid and barnacle assemblages, while late juveniles require nearshore rocky habitat with shell hash. Blue king crab molt multiple times as juveniles; skip molting occurs with increasing probability for those males larger than 10 cm carapace length. The approximate upper size limit of juvenile female and male blue king crabs at 50 percent maturity is 9 and 12 cm carapace length, respectively. Unlike red king crab, juvenile blue king crabs do not form pods, instead relying on cryptic coloration for protection from predators.

Mature blue king crabs occur most often between 45-75 m depth on mud-sand substrate adjacent to gravel rocky bottom. Adult male blue king crabs occur at an average depth of 50 m and an average temperature of 0.6 degrees C while females are found in a habitat with a high percentage of shell hash. Larger female blue king crabs have a biennial ovarian cycle and a 14 month embryonic period. Fecundity of females range from 50,000-200,000 eggs per female. It is suggested that spawning may depend on availability of nearshore rocky-cobble substrate for protection of females. Larger older crabs disperse farther offshore and are thought to migrate inshore for molting and mating. Pacific cod is a predator on blue king crabs.

4.8.3. Snow Crab

Snow crabs (*Chionoecetes opilio*) are distributed on the continental shelf of the Bering Sea and Chukchi Sea. Snow crabs are thought to be of one stock in the Bering Sea. In the Bering Sea, snow crabs are common at depths less than 200 m. The eastern Bering Sea population within U.S. waters is managed as a single stock; however, the distribution of the population extends into Russian waters to an unknown degree. Only male crab greater than 7.8 cm carapace width may be harvested; however, a market minimum size of about 10.2 cm carapace width is generally observed. Most male snow crabs are thought to enter the fishery at around age 6. The season opening date is January 15.

Snow crab larvae mainly feed on diatoms, algae and zooplankton. Larvae of the snow crab are found in early summer and exhibit diel migration. The last of 3 larval stages settles onto bottom in nursery areas. Shallow water areas of the Eastern Bering Sea are considered nursery areas for snow crabs and are confined to the mid-shelf area due to the thermal limits of early and late juvenile life stages. A geographic cline in size of snow crabs indicates a large number of morphometrically immature crabs occur in shallow waters less than 80 m. The approximate upper size limit of juvenile female and male snow crabs at 50 percent maturity is 5 and 6.5 cm

carapace width, respectively. While snow crab juveniles primarily feed on crustaceans, polychaetes, mollusks, diatoms, algae and hydroids; juvenile crabs are cannibalistic during molting.

The median size of maturity for male snow crabs is 6.5 cm carapace width (approximately 4 years old). Males larger than 6 cm grow at about 2 cm per molt, up to an estimated maximum size of 14.5 cm carapace width, but individual growth rates vary widely. While 50 percent of the females are mature at 5 cm carapace width, the mean size of mature females varies from 6.3-7.2 cm carapace width. Females cease growing with a terminal molt upon reaching maturity, and rarely exceed 8 cm carapace width. Female snow crabs are acknowledged to attain terminal molt status at maturity. Primiparous female snow crabs mate January through June and may exhibit longer egg development period and lower fecundity than multiparous female crabs. Multiparous female snow crabs are able to store spermatophores in seminal vesicles and fertilize subsequent egg clutches without mating. At least two clutches can be fertilized from stored spermatophores, but the frequency of this occurring in nature is not known. Females carry clutches of approximately 36,000 eggs and nurture the embryos for approximately one year after fertilization. However, fecundity may decrease up to 50 percent between the time of egg extrusion and hatching, presumably due to predation, parasitism, abrasion or decay of unfertilized eggs. Brooding probably occurs in depths greater than 50 m. Changes in proportion of morphometrically mature crabs by carapace width have been related to an interaction between cohort size and depth. Natural mortality of adult snow crab is estimated at about 25 percent per year. Pacific cod, sculpins, and pollock are the main predator on snow crabs in terms of biomass. Other predators include yellowfin sole, flathead sole, Alaska plaice, walleye Pollock, Pacific halibut, rock sole, skates, bearded seals and walrus. Adult snow crab feed on polychaetes, brittle stars, mollusks, crustaceans, hydroids, algae and diatoms.

4.8.4. Yellowfin Sole

Yellowfin sole (*Limanda aspera*) is distributed in North American waters from off British Columbia, Canada (approximately latitude 49° N), to the Chukchi Sea (about latitude 70° N) and along the Asian coast to about latitude 35° N off the South Korean coast in the Sea of Japan. Fishery recruitment begins at about age six and they are fully selected at age 13. Historically, the fishery has occurred throughout the mid and inner Bering Sea shelf during ice-free conditions, although much effort has been directed at the spawning concentration in nearshore northern Bristol Bay.

Juvenile yellowfin sole are separate from the adult population, remaining in shallow areas until they reach approximately 15 cm. The estimated age of 50 percent maturity is 10.5 years (approximately 29 cm) for females based on samples collected in 1992 and 1993. The approximate size limit of juvenile fish is 27 cm. Juvenile yellowfin sole feed on polychaetes, bivalves, amphipods and echiurids.

Adult yellowfin sole exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions on the eastern Bering Sea shelf. From over-winter grounds near the shelf margins, adults begin a migration onto the inner shelf in April or early May each

year for spawning and feeding. Adults feed mainly on bivalves, polychaetes, amphipods and echinurids. During wintertime migration to deeper waters of the shelf margin to avoid extreme cold water temperatures, their feeding diminishes. Natural mortality rate is believed to range from 0.12-0.16. Groundfish predators include Pacific cod, skates and Pacific halibut, mostly on fish ranging from 7-25 cm length.

4.8.5. Sculpins

Sculpins (*cottidae*) are a large circumboreal family of demersal fishes in the Bering Sea, including Yellow Irish lords (*Hemilepidotus jrodani*), Red Irish lords (*Hemilepoditus hemilepidotus*), Butterfly sculpin (*Hemilepidotus papilio*), Bigmouth sculpin (*Hemitripterus bolini*), Great sculpin (*Myoxocephalus polyacanthocephalus*), and Plain sculpin (*Myoxocephalus jaok*). Yellow Irish lords are distributed from subtidal areas near shore to the edge of the continental shelf (down to 200 m) throughout the Bering Sea. Red Irish lords, however, are distributed from rocky, intertidal areas to about 100 meter depth on the middle continental shelf (most are shallower than 50 m) throughout the Bering Sea. Butterfly sculpins are distributed in the Bering Sea and Chukchi Sea in depths of 20-250 m. Bigmouth sculpin are distributed in deeper waters offshore, between about 100-300 m in the Bering Sea. Great sculpin are distributed from the intertidal areas to 200 m, but may be most common on sand and muddy/sand bottoms in moderate depths (50-100 m) throughout the Bering Sea. Plain sculpin are distributed throughout the Bering Sea from intertidal areas to depths of about 100 meters, but most common in shallow waters (<50 m). Sculpins are not a target of groundfish fisheries in the Bering Sea, but are a bycatch from bottom trawl fisheries for flatfish, Pacific cod and Pollock; almost all is discarded. Annual sculpin bycatch has ranged between 1 and 4 percent of the annual survey biomass estimates, however little is known of the species distribution of the bycatch.

Sculpins live in a broad range of habitats from rocky intertidal pools to muddy bottoms of the continental shelf, and rocky, upper slope areas. Most species live in shallow water or in tidepools, but some inhabit the deeper waters (to 1,000 m) of the continental shelf and slope. Most species do not attain a large size (generally 10-15 cm), but those that live on the continental shelf and are caught by fisheries can be 30-50 cm. Sculpins generally eat small invertebrates (e.g., crabs, barnacles, mussels), but fish are included in the diet of larger species.

4.8.6. Pacific Salmon

Salmon essential fish habitat in freshwaters of Alaska is designated as virtually all the coastal streams to about 70° N. latitude. Salmon essential fish habitat in marine waters of Alaska formally is designated as the area within the 320 km exclusive economic zone boundary of the United States down to a depth of 500 m (North Pacific Fisheries Management Council, 1998). Salmon essential fish habitat is defined to the outer boundary of the exclusive economic zone and to a depth of 500 m, while the written descriptions of salmon indicate that in the juvenile marine stage, they (all five species) head to the Bering Sea and south to the Gulf of Alaska for this stage (North Pacific Fisheries Management Council, 1998).

Habitat areas of particular concern (HAPC) include nearshore areas of intertidal and submerged vegetations, rock, and other substrates. Shallow nearshore estuarine and marine habitats including submerged aquatic vegetations and emergent vegetation are habitat areas of particular concern used by Pacific Salmon. Substrates of high-micro habitat diversity serving as cover from groundfish and other organisms such as areas rich in epifauna communities or substrate with large particulate size such as the Boulder Patch. Streams and lakes and other freshwater areas used by Pacific salmon and other anadromous fish (such as smelt), especially located near urban areas or areas with intensive human-induced developmental activities also are habitat areas of particular concern (North Pacific Fisheries Management Council, 1998).

Essential Fish Habitat for the salmon fisheries off the coast of Alaska consists of the aquatic habitat, freshwater and marine, necessary to allow for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to healthy ecosystems. Since this federal action only occurs in marine waters, this discussion only addresses EFH in marine waters.

4.8.6.1. Pink Salmon

Pink salmon (*Oncorhynchus gorbuscha*) are widely distributed throughout the Bering Sea; however, north, east and west of the Bering Strait, spawning populations become more irregular and occasional. Pink salmon are not a major fishery in the Area of Coverage.

The timing and pattern of seaward dispersal is influenced by many factors, including general size and location of the spawning stream, characteristics of adjacent shoreline and marine basin topography, extent of tidal fluctuations and associated current patterns, physiological and behavioral changes with growth, and different genetic characteristics of individual stocks. When newly emerged pink salmon fry migrate from freshwater to marine waters, they tend to remain along the shoreline for several weeks in shallow water of only a few centimeters deep to feed. Juvenile pink salmon in the Bering Sea off the northeastern Kamchatka coast are found in one of three hydrological zones during their first three to four months of marine life: (1) the littoral zone, up to 150 m from shore; (2) open parts of inlets and bays from 150 meters to 3.2 km from shore; and (3) the open parts of the large Karaginskiy Gulf, 3.2 to 96.5 km from shore. Distribution within these regions is seasonally related to the size of pinks, with an offshore movement of larger fish in August and September. The approximate size limit of juvenile fish is 25 cm.

Pink salmon juveniles routinely obtain large quantities of food sufficient to sustain rapid growth from a broad range of habitats providing pelagic and epibenthic foods. Collectively, diet studies show that pink salmon are both opportunistic and generalized feeders and on occasion they specialize in specific prey items. Diel sampling of stomachs showed fewer and more digested food items at night than during the day indicating that juvenile pinks are primarily diurnal feeders. In the marine environment, pink salmon fry and juveniles are food for a host of other fishes and coastal seabirds.

The population biology of pink salmon revolves around a two-year life cycle. Entering the estuary as a fry at around 3 cm in length, maturing adults return to the same area 14-16 months later ranging in length from 45 to 55 cm. Pink salmon adults feed on fish, squid, euphausiids, amphipods and copepods. In the marine environment, subadult and pink salmon are known to be eaten by fifteen different marine mammals, sharks, other fishes (e.g., Pacific halibut), and humpback whales. Because pink salmon are the most abundant salmon, it is likely they comprise a significant portion of the salmonids eaten by marine mammals.

4.8.6.2. Chum Salmon

Chum salmon (*Oncorhynchus keta*) are widely distributed throughout the Bering Sea, Arctic Ocean, Chukchi Sea, and Beaufort Sea to the Mackenzie River delta. Major fisheries occur for chum salmon southward of the Noatak River in the Hope Basin. Chum salmon are often captured incidentally in fisheries targeting pink or sockeye salmon. Chum salmon have also been captured incidentally in the trawl fisheries for Pollock in the Bering Sea.

Chum salmon fry migrate (mostly at night) out of the streams directly to the sea shortly after emergence. This outmigration occurs between February and June, but most fry leave the streams during April and May. Chum salmon do tend to linger for several months to forage in the intertidal areas (intertidal grass flats and along the shore) at the head of bays before actively migrating into channels on the way to the outside waters. Therefore, estuaries are very important for chum salmon rearing during spring and summer as most juveniles are present in coastal waters during this time period. Offshore movement of larger juveniles occurs mostly in July-September. Juvenile chum salmon are thought to leave the coastal waters and move south into the North Pacific Ocean between Kodiak and False Pass during late fall. After chum salmon form an annulus on their scales (January-March) they are considered immature. They may remain immature for several years until they start maturing and begin their migration to their spawning streams. In Alaska, chum salmon return from the ocean to spawn between June and November. Juvenile chum salmon utilize a wide variety of food items, including mostly invertebrates (including insects), and gelatinous species.

Chum salmon reside in the ocean for about one to six years. Adults mature at ages 2 through 7 years; 4-, 5- and 6-year old chum salmon dominate the northern stocks. Recently, immature and maturing chum salmon from Washington, British Columbia, and southeast Alaska have been identified in the Bering Sea in August. Chum salmon eat a variety of foods during their ocean life (e.g., amphipods, euphausiids, pteropods, copepods, fish and other species of salmon. Chum salmon have two habitat requirements that are essential in their life history that make them very vulnerable: (1) reliance on upwelling ground water for spawning and incubation, and (2) reliance on estuaries/tidal wetlands for juvenile rearing after migrating out of freshwater streams.

The 1976-77 Regime Shift in the North Pacific Ocean created very favorable ocean conditions for all species of salmon from northern British Columbia to northern Alaska that resulted in increased stock abundance in the mid-1990s. However, as the abundance increased age at maturity increased and the size at age decreased drastically. Chum salmon of the same age in the

early 1990s weighed up to 46 percent less than they weighed in the early 1970s. These changes in size and age at maturity as population numbers increased suggests that there may be carrying capacity limits for chum salmon under certain conditions.

4.8.6.3. Sockeye Salmon

Sockeye Salmon (*Oncorhynchus nerka*) are widely distributed throughout the Bering Sea; however, populations become more irregular and occasional north of the Bering Strait. In marine environments, sockeye salmon occupy ocean waters south of their spawning systems.

The approximate size limit of juvenile fish is 25 cm. Typically, juvenile anadromous sockeye utilize lake rearing areas for one to three years after emergence, however, some populations utilize stream areas for rearing and migrate to sea soon after emergence. Emergent fry feed in the stream or low-salinity estuaries for several months before migrating to offshore ocean areas. These sea-type sockeye smolts are typically the same size as yearling smolts [average range of 60-125 mm and 2-30 grams (g)] when they migrate to offshore ocean areas. After smoltification and exodus from natal river systems in spring or early summer, juvenile sockeye enter the marine environment. Depending on the stock, they may reside in the estuarine or nearshore environment before moving into oceanic waters. They are typically distributed in offshore waters by autumn following outmigration. During the initial marine period, yearling sockeye forage actively on a variety of organisms, apparently preferring copepods and insects, but also eating amphipods, euphausiids, and fish larvae when available. In the marine environment, sockeye salmon juveniles are food for many other fishes and coastal sea birds.

Sockeye may spend from one to four years in the ocean before returning to fresh water to spawn and die in late summer and fall. Sockeye salmon from different regions differ in growth rate as well as age and size at maturity. Growth in length is greatest during the first year at sea and increase in weight is greatest during the second year. Adult sockeye salmon consume copepods, insects, amphipods, small fish and squid. Measured marine survivals of sockeye salmon, from entry of smolts into stream mouth estuaries to returning adults, have ranged from about 5-50 percent. In general, it is believed that much of the natural mortality of sockeye salmon juveniles in the marine environment occurs within the first few months, and is probably influenced by three factors of unknown relative importance: (1) size and age at seaward migration; (2) timing of entry into the marine environment; and (3) length of stay in the ocean. Variations in oceanographic conditions and in marine predator populations (fish, mammals and birds) undoubtedly have affected the marine survival of sockeye populations in different ways around the North Pacific rim, but these effects are poorly understood. They are known to be eaten by marine mammals and sharks.

4.8.6.4. Chinook Salmon

Chinook salmon (*Oncorhynchus tshawytscha*) range widely throughout the Bering Sea, but has been identified as far as the Mackenzie River that discharges into the Beaufort Sea. The largest

river systems (e.g., Yukon River) tend to support the largest aggregate runs of chinook salmon and have the largest individual spawning populations.

Chinook salmon are highly prized by commercial, sport, and subsistence fishers because of their large size and excellent palatability. In Alaska, approximately 1 million chinook salmon are harvested annually. Because of their distribution in the water column, the majority of the chinook salmon harvested in commercial troll fisheries are caught at depths of 30 m or greater, and chinook salmon is the most common salmon species taken as bycatch in mid-water and bottom trawl fisheries. In most of Alaska, there is no direct harvest of chinook salmon in the EEZ; the FMP for salmon in the Alaska EEZ prohibits commercial harvest in this area, with few exceptions. Most of the fishing effort takes place in the coastal or riverine waters of the State. The regulatory minimum size used in the Alaska hook-and-line fisheries is 71 cm total length.

Chinook salmon demonstrate variable ocean migration patterns and timing of spawning migrations. This variation in life history strategy has been explained by separating chinook salmon into two races: stream- and ocean-type fish. Stream-type fish have long freshwater residence as juveniles (1-2 years), migrate rapidly to oceanic habitats, enter freshwater as immature or "bright" fish, and spawn far upriver in late summer or early fall. Ocean-type fish have short, highly variable freshwater residency (from a few days to 1 year), extensive estuarine residency, enter fresh water at a more advanced state of maturity, and spawn within a few weeks of freshwater entry in lower portions of the watershed. Within these two types, there is also substantial variability due to a combination of phenotypic plasticity and genetic selection to local conditions. For example, adult run-timing is strongly influenced by in-river flow volumes and temperature levels.

Chinook salmon are typically 33-36 mm in length when they emerge from the incubation gravel. Residency in freshwater and size and timing of seawater migration are highly variable. Since chinook salmon can mature at ages of 2-8 years, the term 'juvenile' is better defined by physiological progress of maturation rather than threshold size. Ocean-type fish can migrate seaward immediately after yolk absorption. The majority of ocean-type fish migrate at 30-90 days after emergence, but some fish move seaward as fingerlings in the late summer of their first year, while others overwinter and migrate as yearling fish. Stream-type fish, in contrast, generally spend at least one year in freshwater, migrating as one- or two-year old fish. In Alaska, the stream-type life history predominates although ocean-type life histories have been documented in a few Alaska watersheds. Water and habitat quality and quantity determine the productivity of a watershed for chinook salmon. Both stream- and ocean-type fish utilize a wide variety of habitats. The seaward migration of smolts is timed so that the smolts arrive in the estuary when food is plentiful. Migration and rearing habitats overlap. Stream flows during the migratory period tend to be high, which facilitates seaward movement and provides some sheltering from predation. After entering saltwater, chinook juveniles disperse to oceanic feeding areas. Ocean-type fish have more extended estuarine residency, tend to be more coastal oriented, and do not generally migrate as far as stream-type fish. Food in estuarine areas includes epibenthic organisms, insects, and zooplankton.

Chinook salmon typically remain at sea for 1 to 6 years. They have been found in oceanic waters at temperatures ranging from 1-15° C. Chinook salmon occur over a broad geographic

range, encompassing different ecotypes and very diverse habitats. Ocean distribution patterns have been shown to be influenced by both genetics and environmental factors. Migratory patterns in the ocean may have evolved as a balance between the benefits of accessing specific feeding grounds and the energy expenditure and dispersion risks necessary to reach them. Across the geographic range which the species has colonized, populations of chinook salmon have developed localized adaptations to site specific characteristics. These local adaptations result in different and diverse characteristics of biological importance, including timing of spawning, adult and juvenile migration timing, age and size at maturity, duration of freshwater residency, and ocean distribution. Currently there is little data for the estuarine and marine habitats beyond presence/absence or density information.

Chinook salmon are distributed deeper in the water column. They are most abundant at depths of 30-70 m and are often associated with bottom topography. Because of their relatively low abundance in coastal and oceanic waters, chinook salmon in the marine environment are typically only an incidental food item in the diet of other fishes, marine mammals, and coastal sea birds. Chinook salmon are the most piscivorous of the Pacific salmon; fish make up the largest component of their diet at sea, although squid, pelagic amphipods, copepods, and euphausiids are also important at times.

4.8.6.5. Coho Salmon

Coho salmon (*Oncorhynchus kisutch*) are widely distributed in cool areas of the Bering Sea and most adjoining fresh and estuarine waters. In Alaska, most coho are wild fish with a distribution north to Point Hope on the eastern Chukchi Sea. Coho is an important commercial, sport, and subsistence fishery in the Area of coverage; catch is at historically high levels and trends in abundance of most stocks are rated as stable. Fisheries in the Alaska Region primarily target adult coho and take place in coastal marine migration corridors, near the mouths of rivers and streams, and in freshwater migration areas. Those fisheries coincide with migrations toward spawning areas from July through October.

In fall, juveniles may migrate from summer rearing areas to areas with winter habitat. Such juvenile migrations may be extensive within the natal stream basin or between basins through salt water or connecting estuaries. Seaward migration of coho smolts occurs usually after 1-2 years in fresh water. The migration is timed primarily by photoperiod and occurs in spring, usually coincident with the spring freshet. At sea, juvenile Adult coho are highly migratory and depend on suitable habitat in their migration routes. Alaska coho generally migrate north and offshore into the Bering Sea. Unobstructed passage and suitable water depth, water velocity, water quality, and cover are important elements in all migration habitats. Juvenile coho primarily use estuarine habitat during their first summer and also as they are leaving fresh water during their seaward migration. Intertidal section of freshwater streams (i.e., stream-estuary ecotones) can be important rearing habitat for coho from May to October. These areas may account for one-quarter of the juvenile production in small streams. Growth in these areas is particularly rapid because of abundant invertebrate food. Habitats used include glides and pools during low tide, and coho occupy the freshwater lens during high tide. In fall, juvenile coho

move upstream to overwinter in freshwater. After leaving freshwater, coho spend up to four months in coastal waters before migrating offshore and dispersing throughout the Bering Sea. Offshore, juvenile salmon are concentrated over the continental shelf within 37 km of shore where the shelf is narrow, but may extend to at least 74 km from shore in some areas. Stock-specific aggregations have not been noted at this stage. Marine invertebrates are the primary food when coho first enter salt water, and fish prey increase in importance as the coho grow. Juveniles are eaten by a variety of birds (e.g., gulls, terns, kingfishers, cormorants, mergansers, herons) and fish (e.g., Dolly Varden, steelhead, cutthroat trout, and arctic char). Juvenile coho are also significant predators of pink salmon fry during their seaward migration.

Most coho remain at sea for about 15 months before returning to coastal areas and entering fresh water to spawn, although some males will return to spawn after about six months at sea. They occupy epipelagic areas in the Bering Sea during the 12 to 14 month after leaving coastal areas. Some coho also use coastal and inshore waters at this life stage, but those are likely to be smaller at maturity. The spacial distribution of suitable habitat conditions is affected by annual and seasonal changes in oceanographic conditions; however, coho generally use offshore areas of the Bering Sea. The distribution of ocean harvest is generally more northerly than that for stocks from other regions. Growth is controlled mainly by food quantity, food quality, and temperature. Food for salmon is most abundant above the halocline which may range from 100 to 200 m in depth. Coho growth is best in epipelagic offshore habitat where forage is abundant and sea surface temperature is between 12 and 15° C; coho rarely use areas where sea surface temperature exceeds 15° C. Adult coho provide important food for bald eagles, marine mammals (e.g., Steller sea lion, harbor seal, beluga, and orca), and salmon sharks.

4.8.7. Effects Analysis

The EPA has determined that the issuance of this permit is **not likely to adversely modify the critical habitat for red and blue king crabs, snow crabs, yellowfin sole, sculpins, pink salmon, and chum salmon, chinook salmon, coho salmon, and sockeye salmon** in the vicinity of the discharge for the following reasons:

- The proposed permit has been developed in accordance with the Alaska water quality standards to protect aquatic life species in marine waters. NPDES permits are established to protect water quality in accordance with State water quality standards. The standards are developed to protect the designated uses of the waterbody, including growth and propagation of aquatic life and wildlife. Self-monitoring conducted by the industry indicates that the facilities covered under this general permit will be able to comply with all limits of the proposed permit.
- The derivation of permit limits and monitoring requirements (refer to Section II and Appendix A and B of the fact sheet for specifics pertaining to the proposed permit) for an NPDES discharger are in accordance with state water quality standards using procedures prescribed in EPA guidance (USEPA, 1991).

- The majority of activity under this permit will occur in the Beaufort Sea; it is unlikely that activity will occur in the Chukchi Sea, Hope Basin or Norton Basin (MMS, 2002). Generally, there is little evidence of viable self-sustaining salmon populations in the Beaufort Sea.
- Drilling mud disposal will not affect the major prey, zooplankton, or fish or their habitats.
- Discharges of drilling fluids and drilling cuttings may impact minor prey, benthic organisms (at sublethal levels), and benthic habitat, which in turn will impact critical habitat for EFH species. However, the impact areas are small (less than 100 m radius) per discharger, the expected total number of discharges is small (37 total wells; 23 exploration wells and 14 delineation wells), and the recovery period of impacted benthos is estimated to be less than two years.
- While no specific demersal fish spawning locations have been identified in any of the Arctic areas of coverage, a number of essential fish species possess demersal eggs. Although unlikely during exploratory activities in the Area of Coverage due to the anticipated emphasis on deeper offshore drilling sites, demersal eggs could be smothered if discharge in a spawning area coincides with the period of egg production. Exploratory operations in state waters are more likely to adversely impact demersal fish spawning activities because spawning grounds are more commonly found in nearshore waters. The potential of drilling muds and cuttings to smother demersal fish eggs is probably the most serious potential impact of exploratory drilling to fish species.

4.9. CUMULATIVE EFFECTS ANALYSIS

This analysis only considers past, present, and reasonably foreseeable future exploration discharges to biological resources. MMS (1982, 1991, 2002, 2003) and ADNR (1999) have conducted cumulative effect analysis of exploration activities in the broader sense of the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions of all activities (federal and non-federal).

Impacts of any kind from a single drilling site are likely to be localized. Although benthic organisms may be smothered or develop body burdens of heavy metals above background in localized areas, the benthic and epontic (ice-associated) communities in the Arctic areas of coverage would not be expected to decline significantly. However, no data exist to evaluate the potential impact to benthic and epontic communities for several drilling sites that would be located close enough to each other that dispersion of the discharged muds from all of the sites would cumulatively cover a large contiguous portion of the area.

Impacts from bioaccumulation, toxicity and changes in community structure could be cumulative spatially and over the short term, but it is unlikely that these impacts would be persistent. In addition, lessening impacts can reasonably be expected over time. Although more complete knowledge would be of value in assessing the magnitude and significance of cumulative

environmental impact, available data indicate that unreasonable degradation is not likely to occur in areas of adequate dispersion and dilution.

Another factor to be considered in assessing the environmental impacts from drilling discharges is the susceptibility of the area to periodic storm surges. These events could, by redistributing localized platform discharges, consequently redistribute the zone of impact.

4.10. CONSERVATION MEASURES

The general permit has several conservation measures that would reduce the impact to biological resources. These conservation measures are discussed in the following sections.

4.10.1. Area Restrictions

The permittee is prohibited from discharging:

- In water depths less than 5 m (as measured from MLLW);
- Between the shore (mainland and the barrier islands) and the 5-m isobath;
- Within 1000 m of the Steffansson Sound Boulder Patch (near the mouth of the Sagavanirktok River) or between individual units of the Boulder Patch where the separation between units is greater than 2000 m but less than 5000 m;
- Within 1000 m of Thetis Island and Colville River Delta;
- Within Omalik Lagoon;
- Within Kasegaluk Lagoon; or
- Within 3 mi of the following passes of Kasegaluk Lagoon: Kukpowruk Pass, Akunik Pass, Utukok Pass, Icy Cape Pass, Alokiakatat Pass, Naokok Pass, and Pingaorarak Pass.

4.10.2. Seasonal Restrictions

- The permittee is prohibited from discharging in open waters at depths greater than 1 meter below the surface of the receiving water between the 5 and 20 m isobaths as measured from the MLLW during open-water conditions or within 1000 m of river mouths or deltas.
- The permittee is prohibited from discharging during unstable or broken ice conditions within 1000 m of river mouths or deltas or shoreward of the 20 meter isobath as measured from the MLLW during unstable or broken ice conditions except when the discharge is prediluted to a 9:1 ratio of seawater to drilling fluids and cuttings, and the permittee conducts the environmental monitoring required under paragraph B.5 of the general permit.
- The permittee is prohibited from discharging below the ice during stable ice conditions and shall avoid, to the maximum extent possible, areas of sea ice cracking or major stress fracturing unless authorized otherwise from the EPA.

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4.10.3. Environmental Monitoring Requirements

The permittee is required to conduct the environmental monitoring requirements of this section when the authorization to discharge is within 4000 m of the prohibited areas discussed in sections 4.10.1 and 4.10.2, above. The permittee must submit a plan of study for the environmental monitoring program to the EPA and the Alaska Department of Environmental Conservation (ADEC) for review with the notice of intent (NOI) (i.e., the application for coverage under the general permit). The permittee must incorporate any changes required by the EPA or ADEC in the monitoring program's design. A copy of the final study plan must be sent to the North Slope Borough. The permittee must include in the environmental monitoring study plan relevant hydrographic, sediment hydrocarbon, and heavy metal data from surveys conducted before and during drilling fluid disposal operations and up to at least one year after drilling operations cease. The permittee must submit an annual report to the EPA by March 1st of the following year. Copies of the report must be sent to ADEC and the North Slope Borough. Further requirements for environmental monitoring are found in Appendix C (NPDES general permit, section II.B.5, page 15).

4.10.4. Limitation on Number of Wells Drilled

The permittee is limited to drilling discharges from no more than five wells at a single drilling site, although additional wells may be drilled upon approval by the EPA. Specific requirements are found in Appendix C (NPDES general permit, section II.B.6, page 17).

4.10.5. Restrictions on Discharges of Mineral Oil Pills

The permittee is authorized to discharge residual amounts of mineral oil pills (mineral oil plus additives) under the conditions set forth in Appendix C (NPDES general permit, section II.B.8, page 17).

4.10.6. Toxicity Testing Requirements

In order to determine potential toxic effects of the discharge, the permit requires regular SPP toxicity testing of effluent from discharge 001. The test species required for this permit include *Mysidopsis bahia*. Toxicity tests focus on the sensitive life stage of the test species on the assumption that protection of this stage will protect the species as a whole. These species are currently the best available surrogates for assessing impacts on the listed fish species and, therefore, toxicity testing using these species will give an indication of toxicity from the whole effluent. See Attachment 4 of the permit located in Appendix C for more details regarding the drilling fluids toxicity requirements.

4.10.7. Quality Assurance Plan

The permit requires the development and implementation of a Quality Assurance Plan (QAP) to assist in planning for the collection and analysis of effluent and receiving water samples in support of the permit and to explain data anomalies if they occur. All monitoring is required to use the EPA Methods published in 40 CFR §136. The QAP must specify analytical methods to achieve these method detection limits. See section IV.A of the permit located in Appendix C for more details regarding the QAP requirements.

4.10.8. Best Management Practices Plan

Best management practices (BMPs) are measures that are intended to prevent or minimize the generation and the potential for release of pollutants from industrial facilities to waters of the U.S. The permit requires the permittee to prepare and implement a BMP plan to minimize the quantity of pollutants discharged, reduce the toxicity of the discharges to the extent practicable, prevent the entry of pollutants into waters, and minimize storm water contamination. See section IV.B of the permit located in Appendix C for more details regarding the BMP plan requirements.

4.10.9. Drilling Fluid Plan

The drilling fluid (mud) plan is one component of the Best Management Practices Plan. The drilling fluid plan requirement is also based upon the Pollution Prevention Act (PPA) and its policy of prevention, reduction, recycling, and treatment of wastes (PPA Section 102(b)) through measures that include process modification, materials substitution, and improvement of management (PPA Section 107(b)(3)). The goal of requiring development of a drilling fluid plan is to ensure that personnel on-site are knowledgeable about the information needed and the methods required to formulate the mud/additive systems in order to meet the effluent toxicity limit. The intent of the mud plan is a written guide to planning for and using a mud/additive system in compliance with the permit. To date, Alaskan operators have demonstrated that thorough planning and evaluation of mud/additive systems with respect to possible cumulative toxicity does consistently result in discharge of muds that are less toxic than the required limitation.

The mud plan is intended to demonstrate that the discharged mud/additive system for the well in question will meet the effluent limitation based on the following decision criteria:

- Estimates of worst case cumulative discharge toxicity (either calculated or actual toxicity test results);
- Estimates of toxicity of discharged mud when a mineral oil pill has been used; and
- Use of less toxic alternatives, where possible.

The mud plan is also required to include a clearly stated procedure for dealing with situations in which additives not originally planned for are needed at the last minute. This procedure should

enable drilling and mud personnel to determine whether an additive or mud component may be added to the circulating mud system without significant effect upon the discharge toxicity. Criteria for reaching this type of last minute additive decision are required to be clearly specified in the drilling fluid plan. See section IV.C of the permit located in Appendix C for more details regarding the drilling fluid plan requirements.

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5.0 HUMAN HEALTH

This section provides a discussion of the impact to human health exposure of discharges associated with oil and gas exploration activities within the Beaufort Sea, Chukchi Sea, Hope Basin, Norton Basin, and adjacent state waters. Since it is most likely that exploration activities will occur in the Beaufort Sea area, this evaluation mainly takes into account exposures in that area, although the other areas are also discussed.

Ecological resources for human consumption within the nearshore marine environment were the basis for this analysis because available information suggests that effects of discharges are more likely to occur there. This area generally includes nursery areas since larval and juvenile forms are considered the life stages most sensitive to discharges of wastes. The nearshore environment of concern is shoreward of the 10-m isobath in the Beaufort and Chukchi Seas and shoreward of the 20-m isobath in the Hope and Norton Basins.

5.1. DIRECT EXPOSURE

There is no known direct exposure pathway to humans from the discharges associated with oil and gas exploration.

5.2. CONSUMPTION OF EXPOSED AQUATIC SPECIES

Ingestion of organisms that have accumulated significant concentrations of heavy metals from drilling fluids and cuttings is the potential principal source of adverse human health effects caused by discharge of drilling fluids and cuttings into the marine environment. Certain metals, like lead and cadmium, can be quite toxic to mammals if eaten in sufficiently large amounts, but neither the Food and Drug Administration (FDA) nor the USEPA has set maximum levels of these chemicals in fish and shellfish slated for human consumption, with the exception of methylmercury. This evaluation only considers the potential effects to humans from consumption of aquatic life likely to be exposed to discharges from oil and gas exploration facilities authorized by this permit.

The Area of Coverage is characterized by a food web in which the zooplankton and epifauna (mysid shrimp, copepods, amphipods, euphysiids, etc.) comprise the major food resource of birds, marine mammals, and fishes in the area. Fishes are a food source for birds, and some fishes and marine mammals. Humans consume shellfish, fishes, some birds, and marine mammals.

5.2.1. Subsistence Consumption

Subsistence harvests occur year-round, with different species being emphasized during different seasons. Due to the migratory and seasonal nature of subsistence resources for consumption, the period of their peak availability is often very brief and localized. Therefore, the annual harvest

and consumption of species closely reflects the timing and specific mix of locally available resources that varies by region (Beaufort Sea, Chukchi Sea, Hope Basin, or Norton Basin) and local communities within the Area of Coverage. Since the pattern of resource availability is so unstable and the harvest success for individual families and villages is so variable, communities in Arctic Alaska have adapted to form a highly complex, diverse, and flexible pattern of subsistence activity that continually adapts to harvest opportunities. Extensive sharing and trade of subsistence harvests among families and between villages further complicates the subsistence consumption patterns.

A description of subsistence-harvest patterns and potential areas impacted by exploratory drilling in the Beaufort Sea is provided in MMS (2003) and ADNR (1999). The subsistence areas and activities of Wainwright, Barrow, Atkasuk, Nuiqsut, and Kaktovik are expected to be affected, at least indirectly, by drilling discharges in the Beaufort Sea.

A description of subsistence-harvest patterns for each community and potential areas impacted by exploratory drilling in the Chukchi Sea is provided in MMS (1991). The subsistence areas and activities of Wainwright, Barrow, Atkasuk, Nuiqsut, Point Lay and Point Hope are expected to be affected, at least indirectly, by drilling discharges in the Chukchi Sea. Point Lay and Point Hope communities rely extensively on resources harvested within or adjacent to the Chukchi Sea.

A description of subsistence-harvest patterns for each community and potential areas impacted by exploratory drilling in the Norton Basin is provided in MMS (1982). The Yukon-Kuskokwim River Delta in the Norton Basin is critical to the Alaska Native Tribes' subsistence harvest; 50-75% of Norton Sound Village diet is by acquisition of marine resources (MMS, 1982). The subsistence areas of Kingikmiut, Kauwarak, Unaligmiut, and Ikogmiut are expected to be affected, at least indirectly, by drilling discharges in the Norton Basin. These include the contemporary communities of Shishmaref, Brevig Mission, Teller, Mary's Igloo, Whales, Inalik (Little Diomedea), King Island, Gambell, Savoonga (St. Lawrence Island), Solomon, Golovin, White Mountain, Council, Elim, Koyuk, Shaktoolik, Unalakleet, St. Michel, Stebbins, Kotlik, Bill Moore's Slough, Hamilton, Emmonak, Alakanuk, and Sheldon Point.

A description of subsistence-harvest patterns for each community and potential areas impacted in the Hope Basin is provided in USEPA (1984). The subsistence areas and activities of Kivalina, Naotak are expected to be affected, at least indirectly, by drilling discharges in the Hope Basin. The communities of Kotzebue, Ambler, Buckland, Deering, Kiana, Kobuk, Noorvik, Seawik, and Shungnak may also be affected, to a lesser extent, by drilling discharges.

5.2.1.1. Fishes

Marine fishes are seasonally important to subsistence communities. The relative importance of fisheries to the annual subsistence harvest varies between communities depending on the

availability of other food resources. Harvested species depend upon the region (Beaufort Sea, Chukchi Sea, Hope Basin, or Norton Basin) and local communities in the Area of Coverage.

Harvested species in the Beaufort Sea include chum and pink salmon, char cod, smelt, burbot, Arctic char, arctic cisco, least cisco, grayling, capelin, sculpin and whitefish. Fishes comprise 34% of the Nuiqsut subsistence harvest, 13% of the Kaktovik subsistence harvest, and 14% of the Barrow subsistence harvest (ADNR, 1999).

Harvested species in the Chukchi Sea include pink, coho, and chum salmon, arctic char, whitefish, grayling, tomcod, flounder, least cisco, burbot, sculpin, smelt, and cod. Fishes comprise 10.3% of the Wainwright meat consumption, 14.9% of the Barrow meat consumption, 20.7% of the Nuiqsut meat consumption, and 32.4 % of the Point Hope meat consumption (MMS, 1991). No data were available for Point Lay and Atkasuk (MMS, 1991).

Harvested species in the Norton Basin include five North American salmon (pink, chum, chinook, coho, and king), herring, smelt, saffron cod, whitefish, grayling, arctic char, tomcod, flounder, pike, sheefish, blackfish, halibut, and sculpin. The consumption of all fish species for individual communities is not known; salmon comprise 30-40% of Norton Sound Village diet.

Harvested species in the Hope Basin are Arctic char, chum salmon, sheefish, whitefish, tomcod, and smelt. Fishes comprise 38.3% of the Kivalina subsistence resources harvested and 45.6% of the Naotak subsistence resources harvested (USEPA, 1984). Species specific consumption data for other communities located in the Hope Basin is not available.

5.2.1.2. Marine Mammals

Marine mammals supply a substantial proportion of the edible resources harvested by subsistence communities. The native populations are opportunistic hunters. This tendency, along with natural variability in mammal abundances, leads to variability in the number of individuals taken each year.

The majority of the marine mammals harvested in the Beaufort and Chukchi Seas occur in the Chukchi Sea, except for bowhead whales, which are also harvested east of Barrow during the fall, and polar bears. Species of major importance to subsistence harvests are the bowhead and beluga whales; bearded, ringed, hair and spotted seals; walrus; and polar bear. Bowheads are unavailable to the people of Point Lay (MMS, 1991) because they migrate too far from shore; thus, in Point Lay, the beluga whale is harvested. Seals are a preferred food to all communities. Seal oil, from hair and bearded seals, is an important staple and a necessary complement to other subsistence foods. In spite of the walrus' increasing population, the importance of walrus for human consumption has been decreasing (MMS, 1991). The harvest of polar bears has remained relatively constant since 1980. Approximately 85 animals have been taken annually by residents of the Chukchi and Bering Seas (USFWS, 1993).

The bowhead whale comprises 20.7% of the Wainwright meat consumption, 10.4% of the Barrow meat consumption, and 17.6% of the Point Hope meat consumption; walrus comprises 4.5% of the Barrow meat consumption and 2.9% of the Point Hope meat consumption; bearded seals comprised 6.9% of the Wainwright meat consumption, 1.5% of the Barrow meat consumption, 3.4% of the Nuiqsut meat consumption and 11.8% of the Point Hope meat consumption; and other seals comprised 5.9% of the Point Hope meat consumption (MMS, 1991). No data were available for Point Lay and Atkasuk (MMS, 1991).

Harvested species in the Norton Basin includes bearded, spotted, and ringed seals; bowhead, gray, beluga, and minke whales; walrus; and sea lions. Marine mammals comprise 15-20% of the Norton Sound Village diet (MMS, 1982).

Harvested species in the Hope Basin bearded, spotted, and ringed seals; and beluga and bowhead whales. Marine mammals comprise 42.3% of the Kivalina subsistence harvest and 5.8% of the Noatak subsistence harvest (USEPA, 1984). No consumption data is available for other communities located in the Hope Basin.

5.2.1.3. Coastal and Marine Birds

Migratory birds and eggs are harvested in the spring and early summer and are important sources of food at a time when fresh meat is not readily available. Birds are particularly important to the whaling camps even though they are harvested incidentally to other subsistence activities. Migratory waterfowl and their eggs are an important source of food for all Yukon Delta fishing villages.

Harvested species in the Beaufort and Chukchi Sea include ducks, geese, brant, ptarmigan, oldsquaw, sandhill crane, tundra swan, and eiders. Migratory waterfowl species are harvested in the Hope and Norton Basins. Birds comprise 2.9% of the Point Hope meat consumption and 1.5% of the Barrow meat consumption. No consumption data were available for other Arctic communities.

5.2.1.4. Shellfish

Crab, clams, and mussels are harvested by the communities of Shaktoolik, Unalakleet, Nome, Golovin, Elim, and White Mountain. Shellfish consumption data is not available for these communities.

5.2.2. Effects Analysis

Some impacts may be measurable, but their effects may be minimal and/or short-term in duration; therefore, they may not require avoidance or mitigation. Adverse impacts that are

reduced by mitigation below the "significance thresholds" that are incorporated into the permit, or that are demonstrated to be acceptable because the risk of the impact occurring is small, are considered "nonsignificant." For this evaluation, "significance threshold" is defined as the level of effect that equals or exceeds the adverse changes in subsistence harvest patterns such that one or more important subsistence resources would become unavailable, undesirable for use, or available only in greatly reduced numbers for a period of 1-2 years.

Several fishes and marine mammals harvested for subsistence are benthic feeders. Exploratory drilling is more likely to have a negative impact on animals associated with the ocean bottom. Therefore, special attention should be given to these animals when evaluating the effects of drilling discharges. Exploratory operations within nearshore waters have a higher likelihood of adverse impacts to fisheries, although overall the impact is expected to be minimal. Mammal subsistence harvesting may be affected to the extent that discharge sites may alter the distribution of the animals; however, effects should be insignificant if discharge locations are not in close proximity to each other. The likelihood of significant metal uptake or transference to humans is small due to the limited number of expected discharges, their limited areal extent, and the mobility of potentially exposed species. Residues of pollutants accumulated in the marine biota are not expected to pose a significant hazard to people.

Overall, significant impacts to human health are not expected to result from the limited discharges of drilling mud that characterize the exploratory phase in the Arctic lease sales. The hazard associated with consuming fish and shellfish contaminated with metals or petroleum hydrocarbons is expected to be low. The reasons for this assessment are: bioconcentration factors for heavy metals other than methylmercury and for mobile aromatic hydrocarbons such as benzene are too low to warrant concern about biomagnification; mercury, which is potentially the most hazardous metal, is a relatively minor constituent of drilling muds; and the areas affected by exploratory drilling discharges are too small to contribute substantially to the diet of fish or shellfish harvested by fisheries.

The Norton Sound environment is currently in a pristine state with no major industry and a local population of only 12,000 (OCSEAP as cited in MMS, 1982). Disruption of the natural environment may have sociological as well as environmental impacts; the natives of this area depend on the migrating mammals, native fisheries, and seasonal bird populations for a subsistence harvest. Some of the potential impacts from offshore oil and gas discharges include adverse effects to the benthic biota from platform discharges, possible disruption of migratory patterns of marine mammals, and interference with the subsistence harvest of the natives.

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6.0 TRIBAL RESOURCES

Tribal resources are utilized for much more than just nutrition. Tribal resources include those resources used for direct personal or family use (e.g., food, shelter, fuel, clothing, tools, or transportation) and the making and selling of handicraft articles. Subsistence in Alaska is more than harvesting, gathering, processing, sharing, and trading; it also includes cultural, social, and economic values associated with the taking, use, and exchange of these resources. Subsistence embodies the essence of Inupiat culture. The values these resources hold and the importance Native Alaskans place on sharing with family and village, and in continuing as a harmonious part of the ecosystem of which they are a part, is paramount.

Language, culture, spiritual beliefs, customs, and respect for others and for oneself, are all tied into an integrated, holistic view of the world centered on the traditional hunting, fishing, and gathering way of life associated with local resources. The collection, processing, and distribution of subsistence resources nearly always involve some group activity; the cultural value placed on kinship and family relationships is apparent in the sharing, cooperation, and subsistence activities that occur in their society. The continued opportunity to engage in subsistence uses is a fundamental component of all Alaska Native cultures and serves as the keystone to social, ethnic and psychological identity. Therefore, the loss of any subsistence resource could greatly impact the social structure of these communities.

The Inupiat in the Arctic depend on subsistence taking of shellfish, fish, marine mammals, birds, and whales for subsistence. Many marine species are the basis of an elaborate food distribution system and has enormous cultural significance for all communities. Bowhead whaling also remains at the center of Inupiat spiritual and emotional life; it embodies the values of sharing, association, leadership, kinship, arctic survival, and hunting prowess. Because they migrate too far from shore, bowheads are unavailable to the people of Point Lay (MMS, 1991). In Point Lay, a communal hunt of the beluga whale serves many of the same economic and social purposes that bowhead whaling does for other North Slope communities. Open skinboat (umiak) hunting of the Pacific walrus is economically and culturally the most important subsistence activity for the communities of Little Diomedede, King Island, Gambell, Savoonga and Whales. Salmon is the most important cash resource for communities in the Norton Basin; 70-85 percent of income is from salmon fishing (Ellanna as cited in MMS, 1982). Besides providing meat for food and skins for clothing, waterfowl have always been deeply involved in Native folklore and mythology (Davidson as cited in MMS, 1982). Herring are a primary source of cash for the communities of St. Michael and Stebbins.

Many non-edible parts of the animals harvested are used to make both functional items as well as arts and crafts. Marine mammal bones and hides are used to construct temporary shelters and traditional boats. Seal skins and gut are used for clothing and other mohme uses, as well as crafts. Seal skin, particularly that of the bearded seal, is also used to cover the whaling boats and carrying water. Whale baleen is decorated and etched into story-telling art works and baskets. Whale bones are carved into miniature animals, umiaks, and hunting scenes, or made into

functional items such as knife or ulu handles and needle cases. Walrus cowhides are the only suitable hide for covering the skinboat (umiak) and bull walrus are highly prized for their ivory. Walrus meat is traditionally used, particularly in Point Lay, for dog food. Bearded seal whiskers are used in making earrings. Polar bear and seal fur are used to make parkas, slippers, mukluks, hats, dolls, and Eskimo yo-yos. Bird beaks, bones, and feathers adorn ceremonial dresses and masks. Animal and bird skins are used to make drums and many other craft items, such as spirit masks.

Any activity that has the potential to harm marine resources has the potential to affect tribal resources. Oil and gas exploration discharges have the potential to cause avoidance behavior or loss of supporting habitat for tribal resources in the marine environment. This would result in the potential reduction in local fish and marine mammal populations, increased travel distance and hunting time required to harvest resources, potential reductions in harvest success rates, and increased competition for nearby subsistence resources. The following examples illustrate the sensitivity of Arctic communities to Western influence: The community of Teller has already shown decreased subsistence dependence and perhaps loss of subsistence knowledge due to a long history of contact with other commercial activities (e.g., mining, reindeer herding); and The increased use of aluminum boats, rather than umiaks, for walrus hunting has introduced some social changes associated with the hunt and its distribution. Consequently, the impacts from oil and gas exploration activities, themselves, are likely to have far more adverse impacts to tribal resources than the discharges associated with those activities.

7.0 RECREATIONAL AND COMMERCIAL FISHERIES

This section describes the recreational and commercial fisheries in the Area of Coverage and the potential impacts exploratory drilling discharges may have on these activities. Two major determinations of whether a fishery is viable are the abundance and biomass of the target species. Fish biomass and diversity in both the Beaufort and Chukchi Seas are relatively low. The abundance and biomass for epibenthic invertebrates appears to be low as well, based on limited-scale bottom trawl survey efforts in the Beaufort and Chukchi Seas (Morris, 1981).

7.1. COMMERCIAL HARVESTS

The potential for commercial fisheries in Arctic waters is probably limited to nearshore, localized, small-scale efforts. Additional information on commercial harvests is provided in Section 4.8.

No commercial fishery is currently operating within the boundaries of the Beaufort Sea. The only continuous commercial fishery operations on the Alaska North Slope occur during the summer and fall months in the Colville River Delta, adjacent to the Beaufort Sea Area of Coverage (MMS, 2002). The Colville River delta fisheries include two commercial enterprises. Arctic cisco is the most important resources harvested. This species, along with broad and humpback whitefish, are marketed for human consumption. Least cisco is sold for dog food (MMS, 1990). The harvest of Arctic and least cisco varies considerably from year-to-year due to variability in juvenile recruitment, and unpredictable physical factors such as the distribution of saline water in the delta (Moulton et al., 1992).

Aside from a relatively small chum salmon fishery in Kotzebue Sound, there are no commercial fisheries in the Chukchi Sea Area of Coverage (MMS, 2002). Among the most abundant species in the Chukchi Sea, the majority is not commercially valuable (e.g., sculpins and eelpouts). Trawl survey results for the Chukchi Sea do not indicate any potential for commercial harvest (Morris, 1981).

Important commercial fisheries in Norton Sound include five North American salmon (pink, chum, chinook, coho, and king), Pacific herring, and king crab (MMS, 1982). The fishery is relatively small and localized. Although commercial harvests in the Norton Sound area are low in volume and value compared to other areas of Alaska, the economic returns from fish harvesting have benefited virtually every family in the smaller communities which circle Norton Sound (MMS, 1982).

7.2. RECREATIONAL HARVESTS

For the purpose of this evaluation, recreational harvests are those conducted by non-residents of the region. The recreational opportunities in the Area of Coverage are somewhat limited compared to other areas of the state due to the restricted and costly access, the lack of support

facilities, and the harsh weather conditions. Non-resident participation is often limited to professionally-guided fishing trips for Arctic char, grayling, and salmon.

7.3. EFFECTS OF DRILLING DISCHARGES ON HARVEST QUANTITY

Disposal of drilling muds via any discharge technique is not expected to directly interfere with commercial fish harvests.

7.4. EFFECTS OF DRILLING DISCHARGES ON HARVEST QUALITY

The exploratory drilling discharges are not expected to significantly impact the quality of the commercial fish harvest.

7.5. SUMMARY

Nearshore locations used for commercial fisheries are predominantly outside areas that could conceivably be impacted by activities conducted during Beaufort Sea and Chukchi Sea exploratory drilling discharges. Exploratory discharges within state waters have a higher likelihood of adverse impacts to fisheries, although overall the impact is expected to be minimal.

8.0 COASTAL ZONE MANAGEMENT

8.1. REQUIREMENTS OF COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act requires that states make consistency determinations for any federally licensed or permitted activity affecting the coastal zone of a state with an approved Coastal Zone Management Program (CZMP) (16 USC Sec. 1456(c)(A) Subpart D). Under the Act, applicants for federal licenses and permits must submit a certification that the proposed activity complies with the state's approved CZMP. The state then has the responsibility to either concur with or object to the consistency determination. For general NPDES permits, USEPA is considered an applicant submitting the general permit to the state for a consistency determination.

Consistency certifications are required to include the following information (15 CFR 930.58):

- A detailed description of the proposed activity and its associated facilities;
- A brief assessment relating the probable coastal zone effects of the proposal and its associated facilities to relevant elements of the CZMP;
- A brief set of findings indicating that the proposed activity, its associated facilities, and their effects are consistent with relevant provisions of the CZMP; and
- Any other information required by the state.

Consistency determinations are required if a federally licensed or permitted activity "affects" the coastal zone. Discharges of drilling muds and cuttings during exploration oil and gas activities in the Area of Coverage are expected to occur in the adjacent state waters, therefore, a consistency assessment is required. The enclosed certification statement is based upon the requirements listed in 15 CFR Part 930.39 and the Alaska Division of Governmental Coordination's "Guide to Preparing an ACMP Consistency Determination for Federal Activities."

8.2. AGENCY INFORMATION

Agency: USEPA
District or Region: Region 10
Agency Contact: Kristine Koch
Phone: (206) 553-6705
Fax Number: (206) 553-0165
Address: 1200 6th Avenue, M/S OWW-130, Seattle, WA 98101
Electronic Mail: koch.kristine@epa.gov

8.3. PROJECT INFORMATION

The proposed reassurance of the Arctic General Permit (GP) would authorize the following discharges from exploratory offshore oil and gas operations in the coverage area corresponding with MMS OCS regions of the Beaufort and Chukchi Seas, Hope and Norton Basins, and state of Alaska waters contiguous to the landward boundary of these MMS OCS regions. Discharges from exploratory offshore oil and gas operations include: drilling mud and drilling cuttings; deck drainage; sanitary wastes; domestic wastes; desalination unit wastes; blowout preventer fluid; boiler blowdown; fire control system test water; non-contact cooling water; uncontaminated ballast water; uncontaminated bilge water; excess cement slurry; mud, cuttings, and cement at the seafloor; and test fluids. A map of the coverage area is provided in Figure 1-1.

8.4. PROJECT DESCRIPTION

8.4.1. Detailed Description

The proposed reassurance of this GP is to continue permit coverage that had been authorized under the previous permit. The discharges are described in further detail in Section 2.0. Changes made to the GP include more stringent applicability and notification requirements, new requirements for all discharges, inclusion of new federal effluent guidelines for the discharge of drilling fluids and drilling cuttings (discharge 001), new requirements for submittal of information to discharge from more than five wells (discharge 001), more stringent requirements for the discharge of sanitary wastes (discharge 003), requirements for a quality assurance plan, updated requirements for a best management practices plan, and update of standard conditions to reflect the federal regulations.

8.4.2. Timeline

The proposed GP would be effective for a five year term that would commence after the public review process, the development of a response to comments, and the final permit issuance. In addition, the provisions of the GP may be administratively extended beyond the five year term for covered facilities that timely reapply until EPA reissues the GP.

8.4.3. Site Plan

An applicant is required to submit a map of the coverage area with the Notice of Intent to be authorized under this GP if they are requesting a mobile discharge authorization.

8.4.4. Supporting Documentation

Please refer to the proposed GP in Appendix C, Fact Sheet for the GP in Appendix E, and other sections of this ODCE.

8.4.5. Proposed Best Management Practices

Permittees are required to develop and implement a BMP Plan. This requirement can be found in Permit Part IV.B of the GP (Appendix C).

8.5. PROJECT LOCATION

Figure 1-1 depicts the geographic area covered by the proposed GP. This geographic area covers the area of federal waters of the U.S. located in the Beaufort Sea, Chukchi Sea, Hope Basin, and Northern Norton Basin seaward of the State water boundary from Point Hope to the Alaska, USA and Yukon, Canada border and to all State waters contiguous to the Beaufort Sea, Chukchi Sea, Hope Basin, and Norton Basin Minerals Management Service planning areas. The proposed GP would authorize qualifying discharges into waters of the U.S. located in the coverage area.

8.6. CONSISTENCY WITH THE ENFORCEABLE POLICIES OF THE ALASKA COASTAL MANAGEMENT PROGRAM

8.6.1. District Policies

A final consistency determination on the current GP was made on November 29, 1994 (State I.D. No. AK9409-03PA). Additional comments on the proposed GP's consistency with the District CMPs will be solicited from the affected coastal districts by Department of Natural Resources, Office of Project Management and Permitting, Alaska Coastal Zone Management during the review period following this Federal agency notification (15 CFR Part 930.41).

8.6.2. Alaska Coastal Management Program Standards

The following analysis addresses the consistency of the proposed action with the relevant ACMP standards.

6 AAC 80.040: Coastal Development

The proposed GP would authorize qualifying discharges into marine waters (saltwater). The activity is water-dependent.

6 AAC 80.060: Recreational Use,
6 AAC 80.080: Transportation and Utilities, and
6 AAC 80.120: Subsistence

The proposed GP authorizes wastewater discharges from several types of facilities. Nothing in this permit grants the right to build a facility contrary to the local, state and federal laws applicable to the coverage area.

6 AAC 80.130: Habitats

POTENTIAL IMPACTS

The problems that are anticipated to arise should be remedied by instituting a BMP Plan attempting to foresee and plan to alleviate any potential impacts. The fact sheet and proposed GP contain general situations which must be addressed in the BMP Plan. More site-specific issues will be addressed as appropriate.

GENERAL PERMIT PROVISIONS

Effluent Limitations. Permit Parts II.A, through II.N contain effluent limitations restricting the discharge of pollutants. Please see the proposed GP (Appendix C) and fact sheet (Appendix E) for a full description of the effluent limitations for each type of discharge. It is anticipated that ADEC will certify mixing zone provisions into the GP to allow for a site specific evaluation before authorizing a mixing zone for domestic wastewaters. These provisions are contained in the proposed permit.

Best Management Practices. Part IV.B of the permit includes the requirement for a BMP plan in order to minimize adverse environmental effects from activities authorized by the GP.

OFFSHORE AREAS

The proposed GP would authorize the discharge of domestic wastewater, construction dewatering, discharges of hydrostatic test waters, storm water and discharges from mobile response units to the marine environment. The GP contains proposed effluent limitations for each category of discharger and requires that a BMP Plan be developed, as described above.

WETLANDS

Discharges of wastewaters to tundra wetlands are not authorized under this proposed GP.

RIVERS, STREAMS, AND LAKES

Discharges of wastewaters to rivers, streams and lakes are not authorized by this proposed GP.

6 AAC 80.140. Air, Land, and Water Quality

AIR QUALITY STANDARDS

The proposed GP would regulate discharges into waters of the United States. Under the NPDES program, EPA does not have jurisdiction over activities affecting air quality.

WATER QUALITY STANDARDS

Section 301 of the CWA prohibits the discharge of pollutants to waters of the United States unless that discharge complies with technology-based effluent limitations or any more stringent limitation necessary to achieve state water quality standards. Section 402 of the Act authorizes EPA to issue NPDES permits with conditions necessary to ensure that a discharge complies with the requirements of the CWA.

The proposed GP would include effluent limitations, best management practices, and monitoring and reporting requirements to ensure that authorized discharges comply with the Alaska Water Quality Standards (AWQS).

Effluent Limitations. The proposed effluent limitations incorporate specific AWQS for parameters applicable to each category of discharge. It is anticipated that the ADEC will certify mixing zone provisions into the GP. If this does not occur, no mixing zone provisions for the proposed discharge will appear in the final GP.

Best Management Practices. Part IV.B of the GP includes a requirement to develop and implement a BMP Plan in order to ensure compliance with the AWQS for discharges authorized under this permit.

Monitoring and Reporting Requirements. The GP requires monitoring for compliance with the effluent limitations listed in the permit.

LAND QUALITY STANDARDS

The proposed GP would regulate discharges into waters of the United States. Under the NPDES program, EPA does not have jurisdiction over upland activities which do not involve a discharge to the waters of the United States.

6 AAC 80.150: Historical, Prehistoric, and Archeological Resources

It is unlikely that discharges authorized under this GP would affect historical, prehistoric, and archaeological resources. However, the discharge of dredged or fill material associated with the construction of the facilities may affect these resources. The state would have an opportunity to identify these resources during the ACMP review for the required Section 404 permit.

8.7. CONSISTENCY DETERMINATION

15 CFR Part 930.37. Consistency Determinations for Proposed Activities

Based on the above analysis of the state and district CMPs, EPA believes that the proposed general NPDES permit for Facilities related to Oil and Gas Production located off-shore of Alaska in the Beaufort and Chuckchi Seas is consistent to the maximum extent practicable with approved State management programs.

The EPA determines that the proposed activity complies with, and will be conducted in a manner consistent to the maximum extent practicable with, the ACMP, including affected coastal district programs.

9.0 MARINE WATER QUALITY CRITERIA

The 403(c) regulations of the CWA allow a 100-m (328-ft) radius mixing zone for initial dilution of discharges. At the edge of the mixing zone, marine water quality criteria must be met. Compliance with water quality criteria at the edge of any authorized mixing zone for drilling muds and cuttings under this permit is assessed in this section.

Marine water quality criteria for the protection of aquatic life (45 FR 79318, 50 FR 30784, 51 FR 43665, and 52 FR 6213) are stated as acute (a 1-hour (h) or 24-h average concentration not to be exceeded more than once every three years on average) and chronic (a 96-h average concentration not to be exceeded more than once every three years on average) criteria, and risk-based marine water concentration criteria are stated for protection of humans due to consumption of marine fish (CMF) (assuming a 10^{-6} risk level and an average lifetime consumption of 6.5 grams per day (g/day) of contaminated fish and/or shellfish for a 70 kg male) (USEPA, 1986). The chronic and CMF criteria are applicable to relatively continuous discharges that expose organisms in their vicinity to a relatively constant flux of pollutants. Acute criteria values are applicable to instantaneous releases or short-term discharges of pollutants.

9.1. TRACE METALS

The four methods of sample preparation for metals analysis that have been recognized by EPA include 1) total metals, 2) total recoverable metals, 3) acid soluble metals, and 4) dissolved metals. The first three of these methods measure metals that are dissolved in water, along with metals that become dissolved when samples are refluxed in acid. The severity of the extraction procedures decreases in the order: total metals > total recoverable metals > acid soluble metals method. Dissolved metals are operationally defined as those that pass through a 0.45 μm pore-size filter at the time of collection.

Historically, federally recommended water quality criteria for metals in marine waters were stated in terms of acid soluble concentrations of trace metals, which until recently was believed by EPA to be the "scientifically correct" basis upon which to establish water quality criteria for trace metals (USEPA, 1986). Recently, however, EPA has re-evaluated the use of metals criteria in water quality standards extended to protect aquatic life (USEPA, 2002). This guidance supersedes past criteria document statements expressing criteria in terms of the dissolved metal. The new EPA guidance (USEPA, 2002) recommends using dissolved metals because they more accurately reflect the bioavailable fraction, and hence the potential toxicity of a metal. The state of Alaska has adopted these criteria for protection of state waters in Title 18, Chapter 70 of the Alaska Administrative Code (18 AAC 70). EPA also uses these criteria to ensure protection of federal waters.

9.1.1. Drilling Fluids

Evaluation of water quality compliance for the discharge of drilling muds during exploratory oil and gas drilling in previous ODCEs has relied on measurements of metals concentrations performed on generic drilling muds. Metal concentrations were reported as "whole mud concentrations," which were assumed to be equivalent to values obtained using the total metals method. Previous ODCEs have also assessed compliance with water quality criteria using estimates of dissolved metal concentrations. This approach has been justified because exploratory drilling discharges are intermittent, diluted rapidly, and quickly deposited on the ocean floor in the vicinity of the discharge. Toxicity from dissolved metals are thought to be of primary concern, as organisms are exposed to dissolved metals via uptake of water through gills, skin, or cell walls.

Determination of compliance with Alaska's current marine criteria for metals requires that the dissolved metal fraction of the whole mud be used to determine compliance with water quality criteria. Since there are little data pertaining to the partitioning of metals between dissolved and particulate phases of drilling fluids, previous ODCEs have assumed that partitioning of metals between dissolved and solid phases in drilling muds are similar to that measured for dredged material. Previous ODCEs have also used a ratio of 0.001 as a conservative estimate of the partitioning between dissolved and solid phases for all metals when evaluating compliance with water quality criteria. However, Avanti Corporation (1993) provided measured trace metal leach percentages from barite and drilling fluids, which provides for a more accurate analysis of this discharge. Table 9-1 provides the mean and maximum trace metal leach factors (leach percentages divided by 100) reported in Avanti Corporation (1993).

Since there are currently no dissolved fraction data for whole muds in the Alaskan marine environment, the values in Table 9-1 were used to evaluate the metals concentrations in the water column and at the edge of a 100-m mixing zone. First, the total metals concentration in the drilling fluid (Table 2-2) was used to determine which metals in drilling fluids have the potential to be problematic (Case Study I). Then the maximum and mean leach factors in Table 9-1 were used to convert the total metals concentrations in the drilling fluid to water column concentrations (Case Studies II and III, respectively). Tables 9-3 through 9-5 show the maximum predicted dissolved metal (arsenic, barium cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc) concentrations for each case study at the edge of the mixing zone due to the discharge of Alaskan drilling muds in water depths of 40, 20, and 5 m in both open water and below ice. The predicted dissolved metal concentration is based on the maximum reported drilling mud total metal concentration, the assumed partition coefficient, and the dilution factors predicted by the OOC model for each discharge scenario (e.g., open-water discharge in 20-m water depth) available in Tables 3-5 and 3-7. The predicted dissolved metal concentration were compared directly to the marine water quality criteria, also presented in Tables 9-3 through 9-5.

The results of Case Study I (Table 9-3) show that chromium, copper, lead, and zinc are potentially problematic (i.e., may exceed water quality criteria at the edge of the mixing zone).

(It should be noted that for chromium, the total chromium concentration in the mud was assumed to be chromium VI since this is the Alaska water quality criteria but there is no data for the chromium VI concentration in drilling. This would provide an overestimate of the chromium VI concentration in the water column due to the drilling fluid.) However, Case Studies II and III show that all dissolved metal concentrations are less than their respective water quality criteria at the edge of the mixing zone boundary. Thus, EPA concludes that there are unlikely to be any exceedances of water quality criteria for any metals based on the predicted dilutions obtained from the OOC model runs. However, more information should be obtained to show partitioning of metals from the discharge of whole muds used in Alaska for future analysis.

9.1.2. Drilling Cuttings

Determination of compliance with Alaska's current marine criteria for metals requires that the dissolved metal fraction of the drilling cuttings be used to determine compliance with water quality criteria. Since there are little data pertaining to the partitioning of metals between dissolved and particulate phases of drilling muds and cuttings, this ODCE assumes that partitioning of metals between dissolved and solid phases in drilling cuttings are similar to that measured for dredged material. This is believed to be a reasonable assumption because of the physical similarity of the two materials. Dredged materials are naturally occurring sediments frequently containing elevated concentrations of contaminants, with variable proportions of sand, silt, and clay particles, and containing up to 80 percent water. Table 9-2 provides soluble and solids metals concentrations for dredged materials dumped at sea and partitioning of metals in Arctic Rivers and the Coastal Beaufort Sea.

Since there are currently no dissolved fraction data for drilling cuttings in the Alaskan marine environment, dissolved metal concentrations were evaluated under three case analyses: (1) that all the metals in the drilled cuttings will dissolve in the water column; (2) that the dissolved metals fraction is two orders of magnitude lower than that of the drilled cuttings; and (3) that the metals in the drilled cuttings will partition similar to that of dredge material dumped at sea. The first case will grossly over-estimate the potential effects since metals in solids will not fully dissolve in the marine environment; however, this does provide a worst-case estimate. The second case was based on EPA's knowledge of how metals partition in marine waters (i.e., drilled cuttings are one to two orders of magnitude higher than those in the suspended particulate phase, which in turn are one to two orders of magnitude higher than those in the liquid phase) (USEPA, 1985, 1993a, 2000a). The third case is based on the physical similarity of drilled cuttings and dredged materials.

Tables 9-6 through 9-8 show the maximum predicted dissolved metal (arsenic, cadmium, chromium, copper, lead, mercury, and zinc) concentrations for each case study at the edge of a 100-m mixing zone due to the discharge of Alaskan drilling cuttings in water depths of 40, 20, and 5 m in both open water and below ice. The predicted dissolved metal concentration is based on the maximum reported drilling cuttings total metal concentration (Table 2-4), the assumed partition coefficient (Table 9-2), and the dilution factors predicted by the OOC model for each

discharge scenario (e.g., open-water discharge in 20-m water depth) available in Tables 3-5 and 3-7. In general, the calculation was performed as follows:

$$[\text{Dissolved Metal}]_{\text{MZ}} = [(\text{Total Metal})_{\text{BOP}} (\text{Partition Coefficient})] / [\text{Dilution Factor}] \quad (1)$$

where:

- [Dissolved Metal]_{MZ} = the dissolved metal concentration at the edge of the mixing zone in mg/L.
- [Total Metal]_{BOP} = the drilling mud total metal concentration at the end of the pipe in mg/kg dry weight.
- [Partition Coefficient] = the most conservative dissolved metal to total metal ratio (in kg/L) – Equals 1.0 in Table 9-6; equals 0.01 in Table 9-7; and equals values in Table 9-2 for Table 9-8.
- [Dilution Factor] = the OOC model-predicted dilution factor at the edge of the mixing zone for each of the modeling cases available in Tables 3-5 and 3-7 (unitless).

The predicted dissolved metal concentrations were compared directly to the marine water quality criteria, also presented in these tables. Table 9-6 shows that cadmium, copper, lead, mercury, nickel and zinc are potentially problematic (i.e., may exceed water quality criteria at the edge of the mixing zone). The extent to which these metals partition is evaluated in Tables 9-7 and 9-8. These tables show that all dissolved metal concentrations are less than their respective water quality criteria at the edge of the mixing zone boundary, except for lead and zinc in Case II (Table 9-7) for open water discharges at a depth of 5 m. Historical discharge data from discharge monitoring reports show that open water discharges have not occurred in the past. Thus, EPA concludes that there are unlikely to be any exceedances of water quality criteria for any metals based on the predicted dilutions obtained from the OOC model runs. However, more information should be obtained to show partitioning of metals from the discharge of drilling cuttings in Alaska for future analysis.

9.2. ORGANIC COMPOUNDS

Organic compounds are found in drilling muds and also have the potential to cause marine water quality criteria exceedances. Table 2-3 summarizes results from several studies that examined organic chemical concentrations in drilling muds and mineral oils, respectively. None of the individual compounds that were detected have established marine water quality criteria. More organic chemical data are needed to fully assess the potential for organic compounds in discharged drilling muds to violate water quality criteria.

9.3. TOTAL RESIDUAL CHLORINE

Total residual chlorine from the disinfection process of the sanitary discharge has the potential to cause marine water quality criteria exceedances under certain circumstances. The NPDES permit limits are 1.0 mg/L as a maximum daily limit within Alaska State waters with an approved mixing zone and in Federal waters. EPA evaluated this limit at the edge of a 100-m mixing zone due to the discharge of Alaskan drilling cuttings in water depths of 40, 20, and 5 m in both open water and below ice. The dilution factors in Tables 3-5 and 3-7 were used to predict the concentrations at the edge of the mixing zone. Table 9-9 provides a summary of this analysis. Based on this evaluation, only the 5-m open-water discharge has the potential to violate Alaska water quality standards. However, more information (e.g., model verification, environmental sampling, effluent sampling) should be obtained to determine whether the assumed dilution factors are appropriate for future analysis.

9.4. SUMMARY

Trace metals in drilling mud discharges from exploratory oil and gas wells are not expected to exceed marine water quality criteria; however, more information regarding how muds and cuttings discharged in Alaska partition in the environment is needed to provide a more complete analysis. An assessment of the potential for organic compounds to exceed water quality criteria was not possible due to a lack of data concerning the concentrations of such materials in drilling muds and the lack of applicable water quality criteria for some of the chemicals detected in the muds. Total residual chlorine in sanitary discharges is not expected to exceed marine water quality criteria; however, the dilution factors and modeling should be verified to ensure that water quality standards are met in future analysis.

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10.0 DETERMINATION OF UNREASONABLE DEGRADATION

Chapter 1.0 of this ODCE provides the regulatory definition of unreasonable degradation of the marine environment (40 CFR 125.121[e]) and indicates the ten criteria which are to be considered when making this determination (40 CFR 125.122). The actual determination of whether the discharge will cause unreasonable degradation is made by the USEPA Region 10 Administrator. The intent of this chapter is to briefly summarize information pertinent to the determination of unreasonable degradation.

While the information contained in this ODCE is intended to provide the basis for the determination of unreasonable degradation, it should be cautioned that significant gaps exist in our understanding of the risk of discharging drilling muds into the marine environment, both generally and in the area of coverage. Of particular concern are the long-term chronic and sublethal impacts of drilling muds and cuttings on marine biota. In addition, uncertainty exists regarding determinations of compliance with federal water quality criteria. To assist in filling these data gaps it is recommended that research be conducted to accomplish the following:

- Develop more laboratory data on sublethal and chronic effects at environmentally realistic concentrations.
- Generate data on the bioaccumulation of specific organisms and the interpretation of the significance of bioaccumulation.
- Conduct field studies to quantify the environmental concentrations of drilling fluids (e.g., Parrish and Duke 1990).
- Determine total recoverable metal concentrations of drilling muds and partition coefficients for calculating dissolved metal concentrations under ambient conditions to allow an acceptable evaluation of toxicological risk to marine biota that can be used to evaluate compliance with water quality standards.
- Conduct laboratory/field studies to determine the critical amount and rate of sedimentation that will adversely impact benthic communities in Alaskan waters.
- Identify critical spawning regions for demersal and pelagic fish within the area of coverage.
- Identify locations that include critical substrate used by commercially important epibenthic invertebrates.

10.1. CRITERION 1

The quantities, composition, and potential for bioaccumulation or persistence of the pollutants to be discharged.

It is estimated that 21 exploration wells and 12 delineation wells will be drilled in the Beaufort Sea, 2 exploration wells and 2 delineation wells will be drilling in the Chukchi Sea, and no wells will be drilled in the Hope Basin or Norton Sound. Drilling fluids and cuttings will be the primary discharge from exploration facilities; however, several other discharges from support activities may occur as well.

Components of concern in drilling fluids include trace metals and specialty additives used with generic and synthetic-based drilling mud systems. Mass loadings of the additives depend on the concentrations, frequency of usage, and conditions encountered during drilling. It is estimated that 10,345 bbl drilling muds and 58,040 bbl drill cuttings (8,085 bbl drilling muds and 50,160 bbl drill cuttings in the Beaufort Sea; 2,260 bbl drilling muds and 7,880 bbl drill cuttings in the Chukchi Sea) will be discharged in the area of coverage. Drill cuttings tend to settle quickly upon discharge and tend to accumulate near the discharge point. Drilling muds tend to be diluted rapidly following discharge and are of intermittent and short duration. Modeling and studies have shown that the discharge is generally limited to the immediate discharge area (within 100 m of the facility). Studies have shown that drilling muds and cuttings from a single well would not be detectable in the environment after 1-2 years.

It is difficult to predict the quantities of discharges from support activities (i.e., sanitary and domestic wastes, deck drainage, blowout preventer fluid, desalination unit waste, fire control system test water, non-contact cooling water, ballast water, bilge water, boiler blowdown, test fluids, excess cement slurry, and mud, cuttings, cement at seafloor) since quantities in the past were reported as flow rates and the duration was not reported. The new permit requires permittees to report the volumes of these discharges so future analysis can consider the total effects. Since these discharges are intermittent and small in volume, they are not a significant source of pollutants to the environment. These discharges can include ethylene glycol, lubricants, fuels, biocides, surfactants, detergents, corrosion inhibitors, cleaners, solvents, paint cleaners, bleach (chlorine), dispersants, coagulants, oil and grease, suspended solids, bacteria, cement, cement extenders, and accelerators. These discharges are generally limited to the immediate discharge area (within 100 m of the facility).

Existing data are inadequate for the quantification of potential bioaccumulation from exposure to discharges from exploratory oil drilling operations. Available data suggest that the hazard is toxicologically insignificant.

10.2. CRITERION 2

The potential transport of such pollutants by biological, physical, or chemical processes.

Physical transport includes currents, mixing, settling, and diffusion. Exploratory drilling solids deposition and accumulation is generally limited to the immediate discharge area (within 100 m of the facility). At present, the area-wide large-scale distribution of drilling discharges is difficult to predict; however, it can be surmised that drilling discharges associated with short-term exploration operations will have little effect on the environment due to deposition of drilling-related materials on the seafloor. Drill cuttings will rapidly settle to the seafloor upon discharge, where the other discharges will remain in the water column for a longer period of time. These discharges tend to be diluted rapidly following discharge; however, dilution is dependent on the density, depth, and current speed of the waterbody. Of the three disposal

methods available (open-water, above-ice, and below-ice), below-ice disposal is the least desirable due to the lesser dilution and dispersion potential for discharges.

Chemical transport includes the dissolution of substances in seawater, particle flocculation, complexing of compounds that may remove them from the water column, redox/ionic changes, and adsorption of dissolved pollutants on solids. Chemical transport of drilling fluids and other discharges is poorly described. Much must be gleaned from general principles and studies of other, related materials. Several broad findings are suggested, but the data for a quantitative assessment of their importance are lacking. Chemical transport will most likely arise from oxidation/reduction reactions that occur in sediments. Changes in redox potentials will effect the speciation and physical distribution (i.e., sorption-desorption reactions) of discharged constituents.

Biological transport includes bioaccumulation in soft or hard tissues, biomagnification, ingestion and excretion in fecal pellets, and physical reworking to mix solids into the sediment (bioturbation). The most effective way to monitor the biological effects of drilling discharges is to take quantitative samples of the benthic infauna (animals that live on the sea floor). Biological transport of drilling discharges is poorly described and the information must be gathered from general principles and studies of other, related materials. Several broad findings are suggested, but the data for a quantitative assessment of their importance are lacking. Bioaccumulation of a number of metals from exposure to muds and mud components has been demonstrated in the laboratory and in the field. Short-term laboratory experiments and field exposures indicate that tissue enrichment factors were generally less than an order of magnitude, with the exception of barium and chromium. However, target organ analyses were scant and improper test phases were often used. Also, long-term exposures, which are particularly relevant to assessing impacts of development operations, have been studied; thus, a bioaccumulation potential for those discharges has been qualitatively demonstrated, but cannot be assessed quantitatively at this time. Bioaccumulation of organics from drilling fluids, in particular those associated with (diesel or mineral) oils added as lubricants, has not been studied. However, such studies of these oils themselves or their component substances indicate that a variety of their toxic constituents can be bioaccumulated. Nonetheless, only a qualitative conclusion may be reached

10.3. CRITERION 3

The composition and vulnerability of the biological communities which may be exposed to such pollutants, including the presence of unique species or communities of species, the presence of species identified as endangered or threatened pursuant to the Endangered Species Act, or the presence of those species critical to the structure or function of the ecosystem, such as those important for the food chain.

During exploratory drilling, muds and cuttings are typically discharged onto sea ice. This may block sunlight and reduce photosynthesis of plankton in the water column in the immediate vicinity of the drill site.

When solids are discharged, benthic communities (algae, kelp, invertebrates) may be adversely impacted by smothering due to sediment accumulations. This would only occur within 100-meters of a discharge location. A worst case analysis for the High Resource Scenario (25 exploratory wells and 11 delineation wells) indicates that less than 0.0001 percent of the area of coverage would receive deposition of drilling mud in amounts thought to have an adverse impact on benthic communities [i.e., 1 cm (0.4 in)]. However, recovery of the affected benthic communities likely would occur within 1-2 years after the termination of discharges.

Benthic organisms within 100 m of a discharge will likely experience temporary sublethal effects with some lethal effects on immature stages due to trace metals. Research on the chemical toxicity of drilling muds has indicated that larval stages and planktonic organisms are the most sensitive of the Alaskan species that have been evaluated. It is unlikely that organisms would be exposed for periods of time typically used to determine acute toxicity since drilling mud discharges are episodic with durations of only a few hours. Additionally, recovery of the affected benthic organisms likely would occur within 4 months (Currie and Isaacs, 2004) to 2 years after the termination of discharges.

Discharges may have potential toxic effects to fishes. Water quality tests indicate that lethal concentrations are generally present only within a few meters of the discharge point. The effect on fish depends on the dilution of the discharge. In shallow depths with poor circulation, the effect is a reduction in prey species. Demersal eggs could be smothered if discharge of solids occurs in a spawning area during egg production. While no specific demersal fish spawning locations have been identified in any of the Arctic areas of coverage, a number of important species, including most cottids and eelpout, possess demersal eggs. Although unlikely during exploratory activities in the Area of Coverage due to the anticipated emphasis on deeper offshore drilling sites, demersal eggs could be smothered if discharge in a spawning area coincides with the period of egg production. Exploratory operations in state waters are more likely to adversely impact demersal fish spawning activities because spawning grounds are more commonly found in nearshore waters. The potential of drilling muds and cuttings to smother demersal fish eggs is probably the most serious potential impact of exploratory drilling to fish species. Little effect to fish species was noted in depths of 66 ft or shallower with dissipating tidal or current action. The most common effect to fishes would be displacement due to avoidance; however, this would only be a short distance (less than 100 m) and the effects would be temporary (less than 2 years). Discharges in shallow, ice-covered waters are presently restricted; therefore, the likelihood that fishes would be exposed to discharges during their critical overwintering period for relatively long periods of time in areas of little circulation is reduced. It is expected that fishes would re-utilize their habitat upon completion of the exploration activities.

Seasonal distribution of birds in the region determines their vulnerability to potentially adverse factors associated to a large extent with oil and gas exploration. Discharges from drilling operations during exploration typically disperse rapidly in the surrounding water, although some may be deposited on the bottom near drill sites. Because bottom-feeding sea ducks and guillemots occur in dispersed flocks, relatively few are expected to occur in or rely specifically on prey potentially affected or buried at the projected drill sites under this general permit. Additionally, drill structures are likely to be quite dispersed; thus, discharges are not likely to

cause significant effects either through direct contact with birds or by affecting prey availability as a result of the authorized discharges. In addition, there is likely sufficient time between discharges at individual sites for regional bird populations to recover from the minor effects that may result at each site.

Whales are seasonal feeders, obtaining their food primarily on their summer range. The consumption of contaminated prey items could result in the bioaccumulation of metals (i.e., cadmium or organic forms of mercury) by whales, potentially resulting in toxicity. The degree to which food supplies of these whales would be impacted would depend on the area affected and the concentrations of these metals in the discharge. Based on the limited areal extent of impacts in relation to the total area containing potential prey, the episodic nature of the discharges, the low concentrations of metals in the discharge, and the mobility of whales and their prey, the discharge is not likely to adversely affect the listed whale species. It is likely that whales will avoid the activity occurring in the drilling areas and thus avoid contact with prey residing within the more concentrated portions of the plume during discharge. The majority of bowhead whales exposed to recordings of drillship noise in the Area of Coverage oriented away from the noise source. Noise levels eliciting an avoidance response were estimated to extend 4-11 km (2-6 nmi) from a drillship, which is much greater (100 times) than the affected area due to the discharge (100 m).

There are ten (10) threatened and endangered species within the Area of Coverage: three avian species (short-tailed albatross, spectacled eider, and Steller's eider), six cetacean species (bowhead, blue, fin, humpback, right, and sperm whales), and one pinniped (Steller sea lion). These species live or spend a significant portion of their lives in the Area of Coverage. Impacts to these species may potentially occur from behavioral changes resulting from drillship noise, drilling support activities, and impacts to potential prey or exposure from bioaccumulation of contaminants. Based on the limited areal extent of impacts in relation to the total lease area containing prey, and the mobility of these species, impacts are judged to be minimal. (See general discussions in previous paragraphs.)

10.4. CRITERION 4

The importance of the receiving water area to the surrounding biological community, including the presence of spawning sites, nursery/forage areas, migratory pathways, or areas necessary for other functions or critical stages in the life cycle of an organism.

Kelp beds are important habitats for various populations within the area. The areas of concentrated macroalgal growth that have been identified include Skull Cliff, Steffansson Sound (Boulder Patch), Stockton Islands, Flaxman Island, Demarcation Bay, Elson Lagoon, and an area approximately 25 km (13.5 nmi) southwest of Wainwright in water depths of 11 to 13 m (36 to 43 ft).

Larger river systems and estuaries provide important spawning and rearing areas for anadromous fishes. Most marine species spawn in shallow coastal areas during the winter. The Colville,

Kokolik, Utukok, Kukpowruk, Kuk and Yukon rivers are known critical areas. High spawning densities of pacific herring are common at Bluff, from Cape Darby to Moses Point, Norton Bay, Cape Denbigh-Arctic Hills, and the area to the east of 164° W, east of the St. Michael and Stuart Islands.

The ice patterns are a major determinant of the distribution of marine mammals within the Area of Coverage. The importance of pack ice (which extends poleward), fast ice (which is attached to shore), and the flaw zone (between the pack and fast ice) changes seasonally. Polar bear dens are found near shorefast ice (near the Colville River) and pack ice. Shorefast ice provides optimum habitat for ringed seal lair construction and supports the most productive pupping areas.

Shallow coastal areas and offshore shoals provide rich benthic feeding habitat for gray whales. Kasegaluk Lagoon and Peard Bay is used by beluga whales as a calving and molting ground; their population concentrates in the Mackenzie River estuary. Kasegaluk Lagoon is also a calving area for spotted seals. Outer Norton Sound could be considered a calving area for the walrus.

The coastal waters are primary habitat for nesting, molting, feeding, and resting activities of migratory marine birds. Coastal tundra and delta areas are also important nesting areas for waterfowl. Eiders, terns, gulls, and guillemots nest on barrier islands.

Designated critical habitat (molting areas) for the spectacled eider includes the Yukon-Kuskokwim delta and adjacent marine waters, Norton Sound, Ledyard Bay, and Bering Sea between St. Lawrence and St. Matthew Islands. Important molting and staging areas include Harrison Bay, Peard Bay, Kasegaluk Lagoon, Ledyard Bay, and eastern Norton Sound.

Designated critical habitat for Steller's eiders includes nesting areas on the Yukon-Kuskokwim delta and areas on the north side of the Alaska Peninsula (Izembek Lagoon, Nelson Lagoon, and Seal Islands) where Steller's eiders molt, winter, and stage during spring migration. The region surrounding Barrow has been identified as being important to the survival and recovery of the Alaska-breeding population.

The blue whale has rarely been found in the Bering Sea. This species is rarely seen near the coast, except in Polar Regions when it follows the retreating ice-edge. Fin whales feed throughout the Bering and Chukchi Seas during the summer months, although little is known about their migratory pathways. Humpback, male sperm, and right whales' summer range in the Bering Sea is often relatively close to shore, including major coastal embayments and channels, but right whales may spend a lot of time on the open sea.

The bowhead spring migration follows fractures in the sea ice around the coast of Alaska, generally in the shear zone. As the whales travel east past Point Barrow, their migration is somewhat funneled between shore and the polar pack ice. Most of the year, bowhead whales are closely associated with sea ice; only during the summer is this population in relatively ice-free waters in the southern Beaufort Sea.

There is no designated critical habitat for the Steller sea lion within the area of coverage.

In order to protect the surrounding biological community, the permit prohibits from discharges of muds and cuttings in the following areas:

- In water depths less than 5 m (as measured from mean lower low water);
- Between the shore (mainland and the barrier islands) and the 5-m isobath;
- Within 1000 meters of the Steffansson Sound Boulder Patch (near the mouth of the Sagavanirktok River) or between individual units of the Boulder Patch where the separation between units is greater than 2000 m but less than 5000 m;
- Within 1000 m of Thetis Island and Colville River Delta;
- Within Omalik Lagoon;
- Within Kasegaluk Lagoon; or
- Within 3 mi of the following passes of Kasegaluk Lagoon: Kukpowruk Pass, Akunik Pass, Utukok Pass, Icy Cape Pass, Alokikatat Pass, Naokok Pass, and Pingaorarak Pass.

10.5. CRITERION 5

The existence of special aquatic sites including, but not limited to, marine sanctuaries and refuges, parks, national and historic monuments, national seashores, wilderness areas, and coral reefs.

No marine sanctuaries or other special aquatic sites, as defined by 40 CFR 125.122, are known to be located in or adjacent to the area of coverage. Areas of the Alaska Maritime National Wildlife Refuge located adjacent to the area of coverage are not likely to be adversely impacted by exploratory drilling operations. The "Boulder Patch" area located near the Sagavanirktok River is recognized as an important benthic habitat, primarily due to habitat provided by hard substrates and associated algal beds. In order to protect the Boulder Patch, the permit prohibits from discharges of muds and cuttings within 1000 m of the Steffansson Sound Boulder Patch (near the mouth of the Sagavanirktok River) or between individual units of the Boulder Patch where the separation between units is greater than 2000 m but less than 5000 m.

10.6. CRITERION 6

The potential impacts on human health through direct and indirect pathways.

There is no known direct exposure pathway to humans from the discharges associated with oil and gas exploration in Alaska; indirect exposure is primarily from direct consumption of species exposed to discharges.

Overall, significant impacts to human health are not expected to result from the limited discharges of drilling mud that characterize the exploratory phase in the Arctic lease sales. The hazard associated with consuming fish and shellfish contaminated with metals or petroleum hydrocarbons is expected to be low. The reasons for this assessment are: bioconcentration

factors for heavy metals other than methylmercury and for mobile aromatic hydrocarbons such as benzene are too low to warrant concern about biomagnification; mercury, which is potentially the most hazardous metal, is a relatively minor constituent of drilling muds; and the areas affected by exploratory drilling discharges are too small to contribute substantially to the diet of fish or shellfish harvested by fisheries.

10.7. CRITERION 7

Existing or potential recreational and commercial fishing, including finfishing and shellfishing.

The Colville River delta fisheries include two commercial enterprises. There is a small chum salmon fishery in Kotzebue Sound. Norton Sound includes important, but small, commercial fisheries of salmon. Disposal of drilling muds in state waters is not expected to adversely affect the quantity or quality of fish harvested in these fisheries.

10.8. CRITERION 8

Any applicable requirements of an approved Coastal Zone Management Plan.

Waste discharges associated with oil and gas exploration in areas of coverage are consistent with the Alaska Coastal Management Program.

10.9. CRITERION 9

Such other factors relating to the effects of the discharge as may be appropriate.

No other factors have been identified relating to the effects of the discharge.

10.10. CRITERION 10

Marine water quality criteria developed pursuant to Section 304(a)(I)

The discharge of drilling muds into water depths greater than 5 m is expected to comply with water quality criteria at the edge of a 100-m mixing zone.

11.0 REFERENCES

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APPENDIX A

FIGURES

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Arctic NPDES General Permit Area

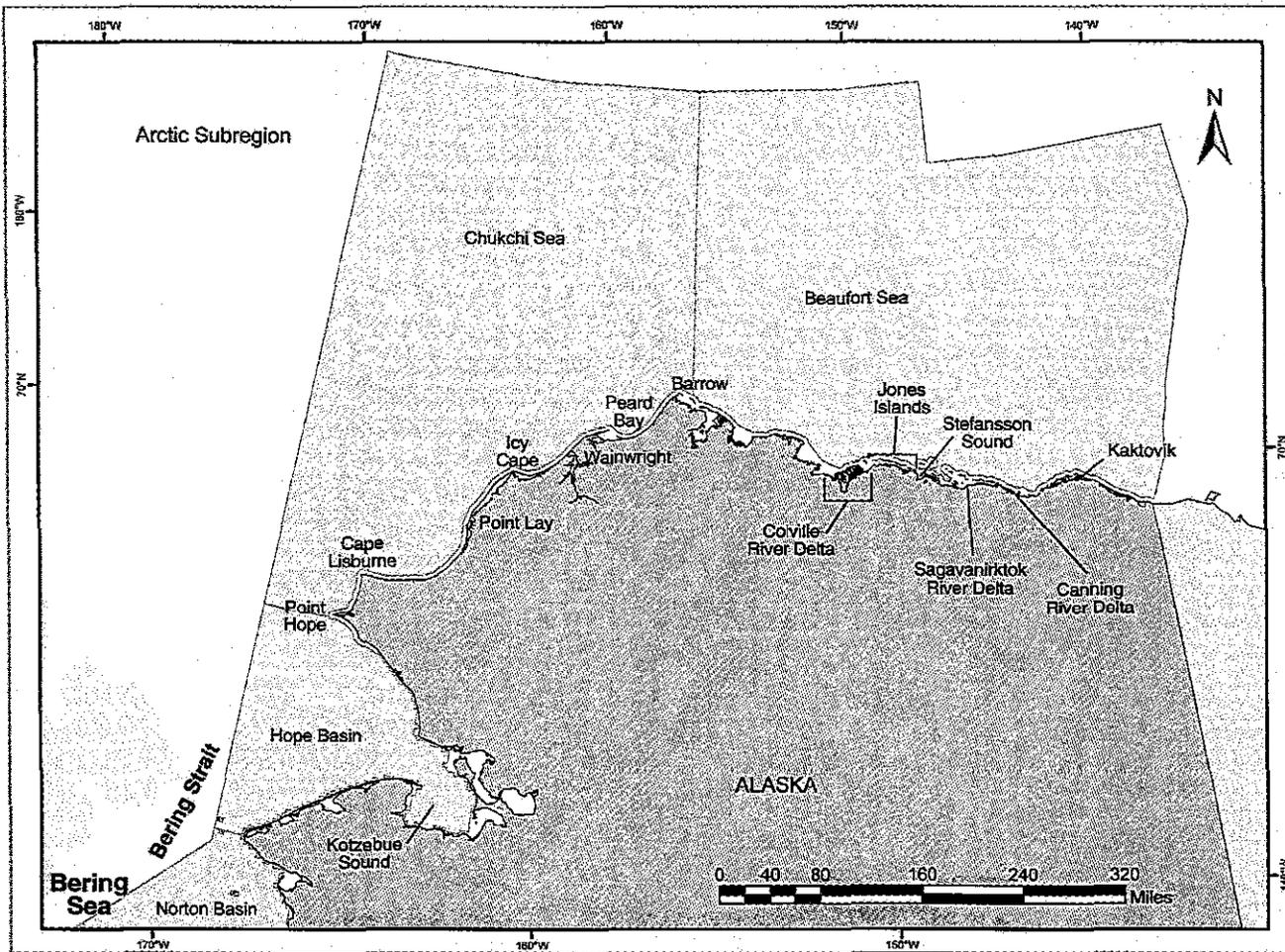


Figure 1-1. Arctic NPDES General Permit Area of Coverage

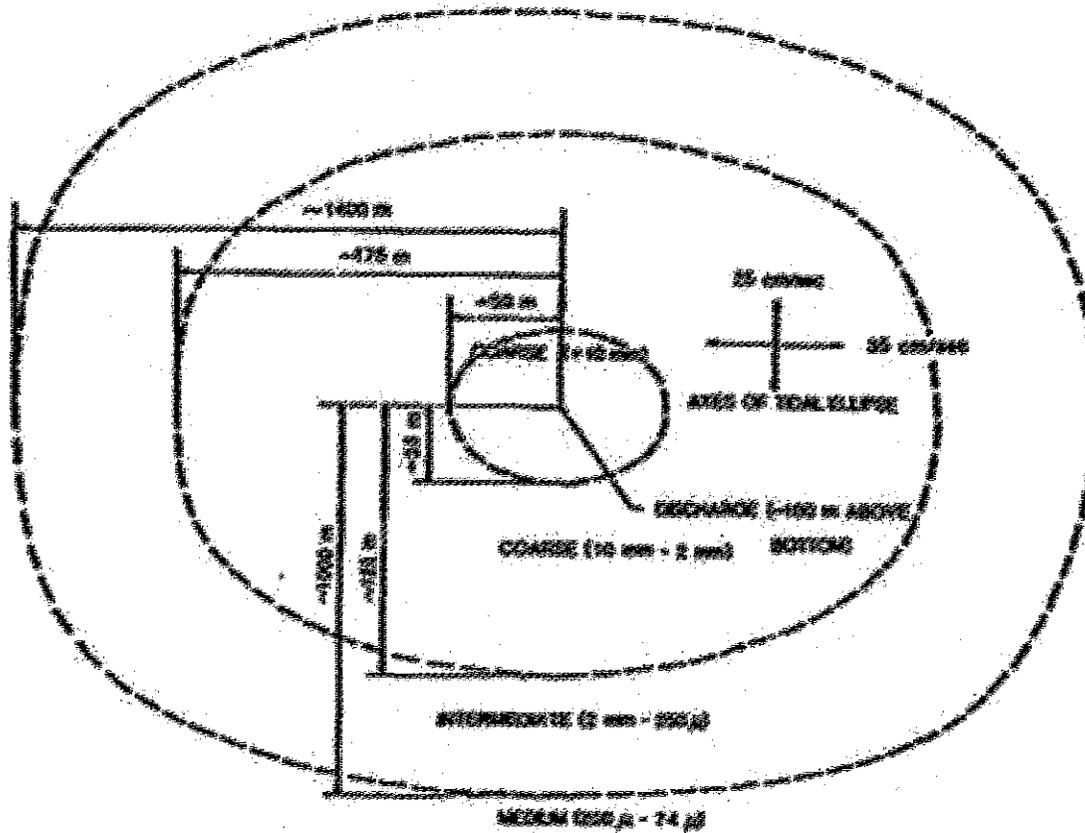


Figure 3-1. Approximate Pattern of Initial Particle Deposition. (Houghton et al., 1981)

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APPENDIX B

TABLES

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Table 2-1. Eight Generic Drilling Mud Compositions (USEPA, 1985)

Seawater/Potassium/Polymer Mud		Seawater/Freshwater Gel Mud	
Components	#/BBL	Components	lb/bbl
KCl	5 – 50	Attapulgit or Bentonite Clay	10 – 50
Starch	2 – 12	Caustic	0.5 – 3
Cellulose Polymer	0.25 – 5	Cellulose Polymer	0 – 2
XC Polymer	0.25 – 2	Drilled Solids	20 – 100
Drilled Solids	20 – 100	Barite	0 – 50
Caustic	0.5 – 3	Soda Ash/Sodium Bicarbonate	0 – 2
Barite	0 – 450	Lime	0 – 2
Seawater	As Needed	Seawater/Freshwater	As Needed
Seawater Lignosulfonate Mud		Lime Mud	
Components	#/BBL	Components	lb/bbl
Attapulgit or Bentonite	10 – 50	Lime	2 – 20
Lignosulfonate	2 – 15	Bentonite	10 – 50
Lignite	1 – 10	Lignosulfonate	2 – 15
Caustic	1 – 5	Lignite	0 – 10
Barite	25 – 450	Barite	25 – 180
Drilled Solids	20 – 100	Caustic	1 – 5
Soda Ash/Sodium Bicarbonate	0 – 2	Drilled Solids	20 – 100
Cellulose Polymer	0.25 – 5	Soda Ash/Sodium Bicarbonate	0 – 2
Seawater	As Needed	Freshwater	As Needed
Nondispersed Mud		Spud Mud (slugged intermittently with seawater)	
Components	#/BBL	Components	lb/bbl
Bentonite	5 – 15	Attapulgit or Bentonite	10 – 50
Acrylic Polymer	0.5 – 2	Lime	0.5 – 1
Barite	25 – 180	Soda Ash/Sodium Bicarbonate	0 – 2
Drilled Solids	20 – 70	Caustic	0 – 2
Freshwater	As Needed	Barite	0 – 50
		Seawater	As Needed
Lightly Treated Lignosulfonate Freshwater/Seawater Mud		Lignosulfonate Freshwater Mud	
Components	#/BBL	Components	lb/bbl
Bentonite	10 – 50	Bentonite	10 – 50
Barite	0 – 180	Barite	0 – 450
Caustic	1 – 3	Caustic	2 – 5
Lignosulfonate	2 – 6	Lignosulfonate	4 – 15
Lignite	0 – 4	Lignite	2 – 10
Cellulose Polymer	0 – 2	Drilled Solids	20 – 100
Drilled Solids	20 – 100	Cellulose Polymer	0 – 2
Soda Ash/Sodium Bicarbonate	0 – 2	Soda Ash/Sodium Bicarbonate	0 – 2
Lime	0 – 2	Lime	0 – 2
Seawater to Freshwater Ratio	1:1 approx.	Freshwater	As Needed

lb/bbl = pounds per barrel

Table 2-2. Metals Concentrations in Barite Used in Drilling Fluids

Metal	"Clean" Barite Concentrations (mg/kg)
Cadmium	1.1
Mercury	0.1
Aluminum	9,069.9
Antimony	5.7
Arsenic	7.1
Barium	359,747.0
Beryllium	0.7
Chromium	240.0
Copper	18.7
Iron	15,344.3
Lead	35.1
Nickel	13.5
Selenium	1.1
Silver	0.7
Thallium	1.2
Tin	14.6
Titanium	87.5
Zinc	200.5

Source: EPA 821-R-93-003 (Offshore ELG Development Document); Table XI-6

Table 2-3. Concentration of Organic Pollutants in Three Mineral Oils (Battelle, 1984)

Chemical	Concentration in Oils (mg/kg)		
	Oil A	Oil B	Oil C
Benzene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Naphthalene	50	ND	ND
Fluorene	ND	150	10
Phenanthrene	ND	200	40
Phenol	ND	ND	ND
Alkylated benzenes	30,000	ND	ND
Alkylated naphthalenes	280	690	ND
Alkylated fluorenes	ND	1,740	ND
Alkylated phenanthrenes	ND	140	ND
Alkylated phenols	ND	ND	ND
Alkylated biphenyls	230	5,570	20
Alkylated dibenzothiaphenes	ND	370,000	ND

ND = not detected.

Table 2-4. Water Quality Data for Drilling Cuttings (CENTEC, 1984)

Pollutant	Range of Concentration	
	Before Washing	After Washing
Conventional Parameters		
pH (s.u.)	5.70 – 8.42	7.00 – 9.20
Specific gravity (kg/L)	1.26 – 2.07	0.98 – 1.59
BOD-5 (mg/kg)	325 – 4,130	3,890 – 8,950
UOD-20 (mg/kg)	2,640 – 10,500	12,800 – 26,600
TOC (mg/kg)	58,300 – 64,100	23,000 – 27,200
COD (mg/kg)	190,000 – 291,000	90,600 – 272,000
Oil & Grease (mg/kg)	54,200 – 130,000	8,290 – 108,000
Metals (mg/kg)		
Zinc	107 – 2,710	114 – 3,200
Beryllium	<1.0	<1.0
Aluminum	6,020 – 10,900	5,160 – 10,500
Barium	34 – 84.8	27.2 - 235
Iron	16,600 – 30,800	17,400 – 20,600
Cadmium	0.402 – 16.4	0.408 – 15.8
Chromium	9.48 – 11.7	10.7 - 12
Copper	20.6 – 55.3	20.4 – 42.6
Nickel	<6 – 12.1	6.2 – 15.9
Lead	21.4 - 298	47.6 - 264
Mercury	0.09333 – 0.4893	0.0920 – 0.944
Silver	0.447 – 0.574	0.222 – 0.568
Arsenic	7.07 – 10.3	7.0 – 10.6
Selenium	<3.0	<3.0
Antimony	<0.06 - <0.35	<0.06 - <0.35
Thallium	0.235 – 0.57	0.134 – 0.866
Organics (µg/kg)		
Acenaphthene	677 – 38,800	--
Naphthalene	3582 – 149,000	63,500
4-Nitrophenol	30,400	--
N-Nitrosodiphenylamine	2,870 – 56,500	3,150 – 24,300
Bis (2-ethylhexyl) Phthalate	--	17,300
Phenanthrene	59,900 – 145,000	25,800 – 65,700
Pyrene	18,900	7,860
Dibenzothiophene	37,300	15,000
Dibenzofuran	2,150 – 33,700	21,700
N-Dodecane	23,000 – 403,000	6,300 – 185,000
Diphenylamine	56,500	5,900 – 23,400
Alphaterpineol	--	6,310
Biphenyl	4,230 – 69,400	1,170 – 33,000

Table 2-5. Pollutant Concentrations in Untreated Deck Drainage (USEPA, 1993a)

Pollutant	Range of Concentration	Pollutant	Range of Concentration
Temperature (°C)	20-32		
Conventionals (mg/L)			
pH	6.6-6.8		
BOD	<18-550		
TSS	37.2-220.4		
Oil and Grease	12-1,310		
Nonconventionals (µg/L)			
TOC (mg/L)	21-137		
Aluminum	176-23,100		
Barium	2,420-20,500		
Boron	3,110-19,300		
Calcium	98,200-341,000		
Cobalt	<20		
Iron	830-81,300		
Magnesium	50,400-219,000		
Manganese	133-919		
Molybdenum	<10-20		
Sodium	151x10 ⁴ -		
Tin	568x10 ⁴		
Titanium	<30		
Vanadium	4-2,030		
Yttrium	<15-92		
	<2-17		
Priority Metals (µg/L)		Priority Organics (µg/L)	
Antimony	<4-40	Acetone	ND-852
Arsenic	<2-20	Benzene	ND-205
Beryllium	<1-1	m-Xylene	ND-47
Cadmium	<4-25	Methylene chloride	ND-874
Chromium	<10-83	N-octadecane	ND-106
Copper	14-219	Naphthalene	392-3,144
Lead	<50-352	o,p-Xylene	105-195
Mercury	<4	Toluene	ND-260
Nickel	<30-75	1,1-Dichloroethene	ND-26
Selenium	<3-47.5		
Silver	<7		
Thallium	<20		
Zinc	2,970-6,980		

*Ranges for four samples, two each, at tow of the three facilities in the three-facility study.

Table 2-6. Quantities of Discharges in Arctic Alaska (1997-2003)

Discharge	Quantity Discharged^a
Drilling Fluids & Cuttings	11,399 bbl 7,212 bbl 1,197 bbl 6,607 bbl & 1,650 bbl, respectively 1,086 bbls (drilling fluids only)
Sanitary & Domestic Waste	4,029 gpd 517 gpd & 518 gpd, respectively 565 gpd & 5,793 gpd, respectively 1,633 gpd 2,419 gpd 2,500 gpd 75,150 gpd 75,000 gpd 975 gpd 868 gpd
Excess Cement Slurry	260 bbls 200 gpd 43 gpd 9,129 gpd 6,300 gpd
Desalination Unit Waste	12,600 gpd 7,275 gpd 31,518 gpd 36,730 gpd 8,032 gpd 6,315 gpd 5,600 gpd 140,000 gpd 174 gpd
Boiler Blowdown	6.2 gpd 7 gpd 47 gpd 586 gpd 40 gpd 27 gpd 38 gpd
Non-contact Cooling Water	202,380 gpd 209,435 gpd
Uncontaminated Bilge Water	270 gpd 195 gpd
Uncontaminated Ballast Water	40 gpd 1,857 gpd 113,000 gpd 2,254,000 gpd
Deck Drainage	213 gpd 75,061 gpd 78,193 gpd 75,000 gpd 12 gpd
Fire System Test Water	360 gpd 43 gpd 370 gpd
Mud, cuttings, cement at seafloor	94,000 gpd

Source: USEPA Region 10 discharge monitoring data for AKG284200 from 1995-2005.

^a Reported numbers represent monthly discharge from a facility.

Table 3-1. Summary of Sediment Trace Metal Alterations from Drilling Activities (USEPA, 1985)

Trace Metal	Location	
	Mackenzie River Delta	Beaufort Sea
Arsenic (As)	+ (1.2-2.5)	ND
Cadmium (Cd)	+ (2-6x)	+ (2-6x)
Chromium (Cr)	+ (4-7x)	+ (1.4-2x)
Copper (Cu)	ND	±
Mercury (Hg)	+ (1.2-15x)	-
Nickel (Ni)	ND	ND
Lead (Pb)	+ (1.5-202x)	+ (1.2-2.6x)
Vanadium (V)	ND	ND
Zinc (Zn)	+ (1.7x)	+ (1.2-1.4x)

Abbreviations: ND not determined
 + increased levels (magnitude change in parentheses) related to drilling
 - decreased levels related to drilling
 ± isolated increases, not a clearly distance-related pattern

Table 3-2. Summary Table of the Acute Lethal Toxicity of Drilling Fluid (USEPA, 1985)

	Number of Species Tested	Number of Fluids Tested	Number of Tests	Number of 96-hour LC ₅₀ Values (ppm) ^a					
				Not Determinable	< 100	100 - 999	1,000 - 9,999	10,000 - 99,999	> 100,000
Phytoplankton	1	9	12	5	0	0	7	0	0
Invertebrates									
Copepods	1	9	11	1	0	3	5	2	0
Isopods	2	4	6	0	0	0	0	1	5
Amphipods	4	11	22	0	0	0	0	7	15
Gastropods	5	5	10	0	0	0	0	2	8
Decapods									
Shrimp	9	23	66	0	0	6(1) ^b	5	36	19
Crab	8	18	32	1	0	0	3	17	11
Lobster	1	2	7	0	0	0	1	3	3
Bivalves	11	22	59	19 ^d	0	0	1	19	20
Echinoderms	2	2	4	0	0	0	0	1	3
Mysids	4	17	64	2(1) ^d	0	0	1	29	32
Annelids	7	14	34	3 ^d	0	0	0	12	19
Finfish	15	24	80	0	0	0	2	50	36
TOTALS	48	40^e	303	31 (23)^d	0	4-9	25	179	171
Percentages as a fraction of the total number of tests	70	68	415 392 ^a	2%	0%	2.4% (1%) ^b	6%	46%	44%
Average percentage in a category for each group of animals				5.3%	0%	2.8% (2.1%) ^b	9.4%	33%	50%

Adapted from Petrazzuolo (1983)

a Placement in classes according to LC₅₀ value.

Lowest boundary of range if LC₅₀ expressed as a range.

Cited values if given as ">" "<". There were 199 such LC₅₀ values; 95 were 100,000 ppm; 20 were <3,200 ppm.

b These include tests conducted on drilling fluids obtained from Mobile Bay, Alabama, and which may not be representative of drilling fluids used and discharged on the OCS. The value in parenthesis is the result of not including those drilling fluids.

c The fluids used in Gerber et al., 1980, Neff et al., 1980, and Carr et al. 1980 were all supplied by API. Their characteristics were very similar and they may have been subsamples of the same fluids. If so, the total number of fluids tests would be 35.

d Data not available.

e Number of tests with actual data.

Table 3-3. Reported Toxicities of Synthetic-Based Drilling Fluids (LC_{50s}) (USEPA, 2000a)

Drilling Fluid	Algae	Mollusc	Copepod	Amphipod				Shrimp	Fish
	<i>Skeletonema costatum</i>	<i>Abra alba</i>	<i>Acartia tonsa</i>	<i>Ampelisca abdita</i>	<i>Leptcheirus plumulosus</i>	<i>Rhepoxynius abronius</i>	<i>Corophium volutator</i>	<i>Mysidopsis bahia</i>	<i>Fundulus grandis</i>
Base Fluid with Natural Sediment (LC₅₀)									
Diesel	ND	ND	ND	0.7 ml/kg 1.0 ml/kg 879 mg/kg	850 mg/kg	24mg/kg	840 mg/kg	ND	ND
EMO	ND	ND	ND	575 mg/kg	251 mg/kg	239 mg/kg	7146 mg/kg	ND	ND
IO	2,050 mg/L	300 mg/L	>10,000 mg/L	3.0 ml/kg 4.0 ml/kg 3121 mg/kg	3.7 ml/kg 2944 mg/kg	299 mg/kg	7,100 mg/L >30,000 mg/kg	ND	ND
PAO	3,900 mg/L	7,900 mg/L	>50,000 mg/L	12.5 ml/kg 13.4 ml/kg 10,690 mg/kg	9,636 mg/kg	975 mg/kg	3.0 ml/kg 12.0 ml/kg >30,000 mg/kg	ND	ND
Ester	60,000 mg/L	>100,000 mg/L	50,000 mg/L	ND	ND	ND	ND	ND	ND
Acetal	>100,000 mg/L	549 mg/L	>100,000 mg/L	ND	ND	ND	ND	ND	ND
LAO	>10,000 mg/L	1,021 mg/L	>10,000 mg/L	ND	ND	ND	ND	ND	ND
Whole Fluid with Natural Sediment (LC₅₀)									
Diesel	ND	ND	ND	1.5 ml/kg	9.4 ml/kg	ND	ND	ND	ND
IO	ND	303 mg/kg	ND	1.5 ml/kg	2.3 ml/kg	ND	7,131 mg/kg	ND	ND
PAO	82,400 mg/L	572 mg/kg 7000 mg/L	>50,000 mg/L	3.7 ml/kg	36.5 ml/kg	ND	>10,000 mg/kg	ND	>8.4 % TPH
Ester	ND	ND	34,000-145,000 mg/L	ND	ND	ND	ND	ND	ND
LAO	ND	277 mg/kg	ND	ND	ND	ND	1,268 mg/kg	ND	ND
Whole Fluid - No Sediment (LC₅₀)									
IO	ND	ND	ND	ND	ND	ND	ND	56,500 - >10 ⁶ ppm (SPP)	ND

ND No data
 EMO Enhanced mineral oil
 IO Internal olefin
 PAO Polyalphaolefin
 LAO Linear alpha olefin
 SPP Suspended particulate phase

Table 3-4. OOC Model Input Parameters Held Constant

Discharge Conditions				
Duration (hours)			1.0 ^a	
Angle of Pipe (degrees downward from horizontal)			90.0	
Depth of Pipe Mouth (m)			0.3	
Pipe Radius			0.1	
Rig Type			Jackup	
Rig Length (m)			70.1	
Rig Width (m)			61.0	
Rig Wake Effect			Included	
Drilling Mud Characteristics				
Bulk Density (g/cm ³)			2.085	
Initial Solids Concentration in Whole Mud (mg/L)			1,441,000	
Mud Particle Distribution				
Class Number	Density (g/cm ³)	Volume Fraction in Whole Mud (cm ³ /cm ³)	Settling Velocity	
			(cm/sec)	(ft/sec)
1	3.959	0.0364	0.658	0.021600
2	3.959	0.0364	0.208	0.006820
3	3.959	0.0437	0.085	0.002780
4	3.959	0.0728	0.044	0.001430
5	3.959	0.1383	0.023	0.000758
6	3.959	0.0364	0.013	0.000427
Receiving Water Characteristics				
Significant Wave Height (m) ^a			0.6	
Significant Wave Period (sec) ^a			12.0	
Surface Water Density (σ_t)			22.0	
Density Gradient ($\Delta\sigma_t/m$)			+0.1	

^a All under-ice model runs omitted the effect of waves in the model.

Table 3-5. Summary of OOC Model Results for Open-Water Discharge Test Cases Representative of the Arctic NPDES General Permit Area of Coverage

Modeling Test Case	OWC 1	OWC 2	OWC 3
Water Depth	40 m	20 m	5 m
Discharge Rate (bbl/h) (L/h)	1,000 (159,091)	750 (119,318)	500 (79,545)
Total Solids Discharged (kg)	598,742	598,742	598,742
Unidirectional Current Speed (cm/sec)	10	10	10
Minimum Solids Dilution at 100 m	1,173:1	1,326:1	7,400:1
Minimum Dissolved Dilution at 100 m	1,592:1	747:1	356:1
Maximum Depth of Deposited Mud (cm) ^a	63.9	112.0	452.4
Distance from Discharge for Maximum Mud Depth (m)	10	30	<10
Estimated Mud Deposition Depth (cm) at Edge of Mixing Zone ^a	7.33	7.15	0.32
Estimated Percentage of Discharged Solids Deposited Within the Mixing Zone	39.9	84.4	98.8

^a Derivation of this value assumes a discharge of 598,742 kg (1,320,000 lbs) of dry drilling mud for the average exploratory well depth of 3,170 m (10,400 ft).

Table 3-6. Estimated Depth of Drilling Muds at the Edge of the Mixing Zone for Open-Water Discharge

Water Depth and Discharge Rate	Percent of Average Total Discharge							
	10	25	50	100	200	300	400	500
	Total Drilling Mud Discharged in Kilograms (Pounds)							
	59,874 (132,000)	149,686 (330,000)	229,371 (660,000)	598,742 (1,320,000)	1,197,484 (2,640,000)	1,796,226 (3,960,000)	2,394,968 (5,280,000)	2,993,710 (6,600,000)
40 m 1,000 bbl/h (159,091 L/h)	0.8	1.9	3.7	7.3	14.6	21.9	29.2	36.5
20 m 750 bbl/h (119,091 L/h)	0.7	1.8	3.6	7.2	14.4	21.6	28.8	36.0
5 m 500 bbl/h (79,545 L/h)	0.03	0.08	0.15	0.3	0.6	0.9	1.2	1.5

Note: Shaded areas indicate model scenarios that predict a drilling mud depth of less than 1 cm in areas beyond the 100-m mixing zone boundary.

Table 3-7. Summary of OOC Model Results for Below-Ice Discharge Test Cases Representative of the Arctic NPDES General Permit Area of Coverage

Modeling Test Case	UIC 5	UIC 6	UIC 7
Water Depth	40 m	20 m	5 m
Discharge Rate (bbl/h) (L/h)	1,000 (159,091)	750 (119,318)	500 (79,545)
Total Solids Discharged (kg)	598,742	598,742	598,742
Unidirectional Current Speed (cm/sec)	2	2	2
Minimum Solids Dilution at 100 m	1,552:1	1,584:1	27,521:1
Minimum Dissolved Dilution at 100 m	1,938:1	1,052:1	972:1
Maximum Depth of Deposited Mud (cm) ^a	67.1	257.6	487.2
Distance from Discharge for Maximum Mud Depth (m)	50	<10	<10
Estimated Mud Deposition Depth (cm) at Edge of Mixing Zone ^a	1.1	0.14	0.02
Estimated Percentage of Discharged Solids Deposited Within the Mixing Zone	54.6	89.5	99.3

^a Derivation of this value assumes a discharge of 598,742 kg (1,320,000 lbs) of dry drilling mud for the average exploratory well depth of 3,170 m (10,400 ft).

Table 3-8. Estimated Depth of Drilling Muds at the Edge of the Mixing Zone for Below-Ice Discharge

Water Depth and Discharge Rate	Percent of Average Total Discharge							
	10	25	50	100	200	300	400	500
	Total Drilling Mud Discharged in Kilograms (Pounds)							
	59,874 (132,000)	149,686 (330,000)	229,371 (660,000)	598,742 (1,320,000)	1,197,484 (2,640,000)	1,796,226 (3,960,000)	2,394,968 (5,280,000)	2,993,710 (6,600,000)
40 m 1,000 bbl/h (159,091 L/h)	0.11	0.28	0.55	1.1	2.2	3.3	4.4	5.5
20 m 750 bbl/h (119,091 L/h)	0.014	0.035	0.07	0.14	0.28	0.42	0.56	0.70
5 m 500 bbl/h (79,545 L/h)	0.002	0.005	0.01	0.02	0.04	0.06	0.08	0.10

Note: Shaded areas indicate model scenarios that predict a drilling mud depth of less than 1 cm in areas beyond the 100-m mixing zone boundary.

Table 3-9. Summary of OOC Model Results for Shunting Test Cases

Modeling Test Case	SHC 9	SHC 10
Water Depth (m)	40	40
Shunting Depth (m)	20.3	35.3
Discharge Rate (bbl/h) (L/h)	750 (119,318)	500 (79,545)
Total Solids Discharged (kg)	598,742	598,742
Unidirectional Current Speed (cm/sec)	10	10
Minimum Solids Dilution at 100 m	1,284:1	1,821:1
Minimum Dissolved Dilution at 100 m	150:1	293:1
Maximum Depth of Deposited Mud (cm) ^a	152.4	463.3
Distance from Discharge for Maximum Mud Depth (m)	20	<10
Estimated Mud Deposition Depth (cm) at Edge of Mixing Zone ^a	9.62	2.76
Estimated Percentage of Discharged Solids Deposited Within the Mixing Zone	84.0	98.2

^a Derivation of this value assumes a discharge of 598,742 kg (1,320,000 lbs) of dry drilling mud for the average exploratory well depth of 3,170 m (10,400 ft).

Table 3-10. Concentration of Trace Metals in Barite (Kramer et al., 1980)

Metal	Samples used in solubility studies		Values from literature review	
	High trace metal sample	Low trace metal sample	Vien deposits	Bedded deposits
Arsenic	67	1.8	7 ^a	500 ^b
Cadmium	12	0.65	0.2-19	50 ^b
Cobalt	5.4	2.2	ND	<5-60
Copper	91	7.6	2-97	3-20
Lead	1,370	0.95	4-1,220	<10
Mercury	8.1	0.13	0.06-14	0.06-0.19
Nickel	33	5.7	19 ^c	<5-5
Zinc	2,750	9.8	10-4,100	200 ^b

ND = not detected.

^a One analysis

^b Semiquantitative emission spectrographic analysis.

^c Mean of 83 analyses.

**Table 3-11. Concentrations ($\mu\text{g/g}$) in Molluscs, Polychaete and Brittle Star Tissues
(EG&G, 1982)**

Species	Pre-drilling Cruise		Post-drilling Cruise I ^a		Post-drilling Cruise II ^b	
	Chromium	Barium	Chromium	Barium	Chromium	Barium
mollusc tissue	6.71	NA	18.5	NA	31.7	NA
polychaete tissue	2.28	23.5	11.2	87.8 - 206	41.0	23.5
brittle star tissue	1.49	15.2	1.12	217.8 - 372	2.87	15.2

^a Two weeks after pre-drilling cruise.

^b One year after pre-drilling cruise.

Table 3-12. Summary of Metal Bioaccumulation Study Results (Petrazzuolo, 1983)

Test Organism	Test Substance (ppm)	Exposure Period (days)	Duration Period (days)	Metals, Enrichment Factor ^a							Ref. ^b	
				Ba	Ca	Cd	Cr	Cu	Pb	Sr		Zn
Onisimus sp., Boekosimus sp.	XC-polymer- Unical fluid	20 static	0									1
	(50,000)					3.2	1.2		2.0		1.6	
	(100,000)					6.4	1.8		2.2		1.3	
Whole Animal not gutted	(200,000)					6.0	1.4		1.5		1.5	
Palaemonetes pugio	Barite	7, 48-hour replacement										2
	5		--	150						1.3		
	50		--	350						1.9		
	5		14	2.2					1.8			
Whole Animal not gutted	50		14	29					2.2			
Carapace Hepatopancreas Abdominal muscle	Barite	8 days post-ecdysis (48-hour replacement)	0									
	500			7.7					1.2-2.5			
	500			13					1.9-2.8			
	500			12					1.5-2.8			
Carapace Hepatopancreas Abdominal muscle	Barite	106	0									
	500			60-100	0.07							
	500			70-300	1							
	500			50-120	1							
Mytilus edulis Soft tissue	12.7 lb/gal lignosulfonate fluid, MAF (Cr=1.4 ppm)	1	--				6.6					3
	Ferrochrome lignosulfonate (Cr=0.7 ppm)						13					
	(Cr=6.0 ppm)						64					
	CrCl ₃ (Cr=0.6 ppm)						50					

Ranea cuneata Soft tissue	12.7 lb/gal lignosulfonate fluid, MAF (50,000)	4, static	-			1.4		1.7			4
			4			1.1		1.2			
	13.4 lb/gal lignosulfonate fluid MAF (100,000)	16, static	--	1		2.5					
		--	--	14		1.7					
	(layered solid phase)	4, daily replacement	--			4.3					
			1			2.0					
Crassostreagigas Soft tissue	9.2 lb/gal spud fluid (40,000 MAF)	10, static	0					2.1		1.1	
	(10,000 SPP)		0			2.5					
	(20,000 SPP)		0			3.0					
	(40,000 SPP)	4, 24-hour replacement	0			3.0					
	(60,000 SPP)		0			5.5					
	(80,000 SPP)		0			7.4					
	12.7 lb/gal lignosulfonate fluid (40,000 MAF)		10, static	0					2.3		1.4
	(20,000 MAF)	14	0			2.9					
	(40,000 MAF)	14	0			3.9					
	(10,000 MAF)		0			2.2					
	(20,000 SPP)	4, 24-hour replacement	0			4.4					
(40,000 SPP)	0				8.6						
(60,000 SPP)	0				24						
(80,000 SPP)	0				36						
Crassostreagigas Soft tissue (cont.)	17.4 lb/gal lignosulfonate fluid (40,000 MAF)	10, static	0					0.56		1.0	
	(20,000 MAF)	14	0			2.1					
	(40,000 MAF)	14	0			2.2					

Table 3-13. Depuration of Metals Bioaccumulated during Exposure to Drilling Fluids or Components^a (Petrazzuolo, 1983)

Test Species	Test Substance	Exposure Period (days)	Metal	Tissue	Depuration Level ^b	Depuration Period (days)
Palaemonetes pugio	BaSO ₄	7	Ba	Whole animal, not gutted	-90%	7
			Sr		-90%	7
Rangia cuneata	SLF (LSP)	1-4	Cr	Soft tissue	-(40-65%)	7
	MDLF (MAF)	4	Cr		-75%	4
	SLF (MAF)	16	Pb		-70%	4
			Cr		-53%	1
Placopectan magellanicus	LDF (WM)	27	Cr	Kidney	+48% ^c	14
			Cr	Adductor muscle	-63%	14
	FCLS	14	Cr	kidney	-(17-54%)	14

^a Adapted from Brannon and Rao (1979); McCulloch et al., (1980); Liss et al., (1980).

^b Percentage of excess metal released.

^c Control animals exhibited a 24% increase during the depuration period.

Abbreviations: SLF – seawater lignosulfonate fluid
MDLF – medium density lignosulfonate fluid
LDLF – low density lignosulfonate fluid
MAF – mud aqueous fraction
WM – whole fluid

Table 4-1. Fishes Located in the Area of Coverage

Freshwater		Anadromous or Resident		Marine	
Common Name	Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name
Arctic grayling	<i>Thymallus arcticus</i>	Arctic char	<i>Salvelinus alpinus</i>	Arctic flounder	<i>Liopsetta glacialis</i>
Round whitefish	<i>Prosopium cylindraceum</i>	Dolly Varden	<i>Salvelinus malma</i>	Starry flounder	<i>Platichthys stellatus</i>
Burbot	<i>Lota lota</i>	Arctic cisco	<i>Coregonus autumnalis</i>	Arctic cod	<i>Boreogadus saida</i>
Slimy sculpin	<i>Cottus cognatus</i>	Least cisco	<i>Coregonus sardinella</i>	Saffron cod	<i>Eleginus gracilis</i>
Lake trout	<i>Salvelinus namaycush</i>	Bering cisco	<i>Coregonus laurette</i>	Capelin	<i>Mallotus villosus</i>
Arctic blackfish	<i>Dallia pectoralis</i>	Broad whitefish	<i>Coregonus nasus</i>	Snailfish	<i>Liparus sp.</i>
Northern pike	<i>Esox lucius</i>	Humpback whitefish	<i>Coregonus pidschian</i>	Pacific sandlance	<i>Ammodytes hexapterus</i>
Longnose sucker	<i>Catostomus catostomus</i>	Cum salmon	<i>Onchorynchus keta</i>	Pacific Herring	<i>Clupea harengus</i>
Arctic lamprey	<i>Lampetra japonica</i>	Rainbow smelt	<i>Osmerus mordax dentex</i>	Slender eelblenny	<i>Lumpenus fabricii</i>
		Boreal smelt	<i>Osmerus eperlanus</i>	Stout eelblenny	<i>Lumpenus medius</i>
		Ninespine stickleback	<i>Pungitius pungitius</i>	Eelpout	<i>Lycodes spp.</i>
		Threespine stickleback	<i>Gastrosteus aculeatus</i>	Arctic sculpin	<i>Myoxocephalus scorpiodes</i>
		Pink salmon	<i>Onchorynchus gorbuscha</i>	Spotted Snailfish	<i>Liparus callyodon</i>
		Coho salmon		Sculpin	<i>Myoxocephalus sp.</i>
		Chinook salmon		Saffron cod	<i>Eleginus gracilis</i>
		Sockeye salmon		Fourhorn sculpin	<i>Myoxocephalus quadricornis</i>
				Arctic staghorn sculpin	<i>Gymnocanthus tricuspis</i>
				Shorthorn sculpin	<i>Myoxocephalus scorpius</i>
				Hamecon	<i>Arctediellus scaber</i>
				Yellowfin sole	<i>Limanda aspera</i>

Table 4-2. Shorebirds Located in the Area of Coverage

Common Name	Scientific Name	Location in Area of Coverage			
		Beaufort Sea	Chukchi Sea	Hope Basin	Norton Basin
Sandhill Crane	<i>Grus canadensis</i>	+	*	+	+
Eurasian Coot	<i>Fulica atra</i>	-	-	+	+
Black-bellied Plover	<i>Pluvialis squatarola</i>	+	+	+	+
American Golden-Plover	<i>Pluvialis dominica</i>	+	*	+	+
Semipalmated Plover	<i>Charadrius semipalmatus</i>	+	*	*	*
Mongolian Plover	<i>Charadrius mongolus</i>	-	-	+	+
Common Ringed Plover	<i>Charadrius hiaticula</i>	-	-	*	*
Whimbrel	<i>Numenius phaeopus</i>	+	*	+	+
Hudsonian Godwit	<i>Limosa haemastica</i>	+	+	-	-
Bar-tailed Godwit	<i>Limosa lapponica</i>	+	*	+	+
Black-tailed Godwit	<i>Limosa limosa</i>	-	-	+	+
Ruddy Turnstone	<i>Arenaria interpres</i>	+	*	*	*
Black Turnstone	<i>Arenaria melanocephala</i>	-	+	+	+
Red Knot	<i>Calidris canutus</i>	+	-	+	+
Great Knot	<i>Calidris tenuirostris</i>	-	*	+	+
Sanderling	<i>Calidris alba</i>	+	+	+	+
Semipalmated Sandpiper	<i>Calidris pusilla</i>	+	*	+	+
Western Sandpiper	<i>Calidris mauri</i>	+	*	+	+
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	+	*	+	+
Baird's Sandpiper	<i>Calidris bairdii</i>	+	*	+	+
Pectoral Sandpiper	<i>Calidris melanotos</i>	+	*	+	+
Stilt Sandpiper	<i>Calidris himantopus</i>	+	-	+	+
Buff-breasted Sandpiper	<i>Tryngites subruficollis</i>	+	+	+	+
Wood Sandpiper	<i>Tringa glareola</i>	-	-	+	+
Solitary Sandpiper	<i>Tringa solitaria</i>	-	-	+	+
Terek Sandpiper	<i>Xenus cinereus</i>	-	-	+	+
Common Sandpiper	<i>Actitis hypoleucos</i>	-	-	+	+
Least Sandpiper	<i>Calidris minutilla</i>	-	-	*	*
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	-	-	+	+
Rock Sandpiper	<i>Calidris pilocnemis</i>	-	-	*	*
Curlew Sandpiper	<i>Calidris ferruginea</i>	-	-	+	+
Dunlin	<i>Calidris alpina</i>	+	*	+	+
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	+	*	+	+
Short-billed Dowitcher	<i>Limnodromus griseus</i>	-	-	+	+
Common Snipe	<i>Gallinago gallinago</i>	+	*	*	*
Jack Snipe	<i>Lymnocyptes minimus</i>	-	-	+	+
Red-necked Phalarope	<i>Phalaropus lobatus</i>	+	*	*	*
Red Phalarope	<i>Phalaropus fulicaria</i>	*	*	*	*
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	-	-	+	+
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	-	*	*	*
Red-faced Cormorant	<i>Phalacrocorax urile</i>	-	-	*	*
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	-	-	+	+
Killdeer	<i>Charadrius vociferus</i>	-	-	+	+
Eurasian Dotterel	<i>Eudromias morinellus</i>	-	-	+	+

Common Name	Scientific Name	Location in Area of Coverage			
		Beaufort Sea	Chukchi Sea	Hope Basin	Norton Basin
Black Oystercatcher	<i>Haematopus bachmani</i>	-	-	+	+
Common Greenshank	<i>Tringa nebularia</i>	-	-	+	+
Greater Yellowlegs	<i>Tringa melanoleuca</i>	-	-	+	+
Lesser Yellowlegs	<i>Tringa flavipes</i>	-	+	+	+
Spotted Redshank	<i>Tringa erythropus</i>	-	-	+	+
Wandering Tattler	<i>Heteroscelus incanus</i>	-	*	+	+
Gray-tailed Tattler	<i>Heterosceles brevipes</i>	-	-	+	+
Bristle-thighed Curlew	<i>Numenius tahitiensis</i>	-	-	+	+
Far Eastern Curlew	<i>Numenius madagascariensis</i>	-	-	+	+
Rufus-necked Stint		-	+	+	+
Little Stint	<i>Calidris minuta</i>	-	-	+	+
Temminck's Stint	<i>Calidris temminckii</i>	-	-	+	+
Long-toed Stint	<i>Calidris subminuta</i>	-	-	+	+
Ruff	<i>Philomachus pugnax</i>	-	-	+	+

* = breeds in Area

+ = occurs in Area (nonbreeder)

- = not in Area

Table 4-3. Raptors Located in the Area of Coverage

Common Name	Scientific Name	Location in Area of Coverage			
		Beaufort Sea	Chukchi Sea	Hope Basin	Norton Basin
Northern Harrier	<i>Circus cyaneus</i>	+	*	+	+
Osprey	<i>Pandion hallaetus</i>	-	-	+	+
Rough-legged Hawk	<i>Buteo lagopus</i>	+	*	+	+
Bald Eagle	<i>Haliaeetus leucocephalus</i>	-	+	+	+
White-tailed Eagle	<i>Haliaeetus albicilla</i>	-	-	+	+
Golden Eagle	<i>Aquila chrysaetos</i>	+	*	-	-
Peregrine Falcon	<i>Falco peregrinus</i>	*	*	+	+
Gyr Falcon	<i>Falco rusticolus</i>	+	*	+	+
Snowy Owl	<i>Nyctea scandiaca</i>	+	*	*	*
Short-eared Owl	<i>Asio flammeus</i>	+	*	+	+
Boreal Owl	<i>Aegolius funereus</i>	-	-	+	+
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	-	-	+	+
Merlin	<i>Falco columbarius</i>	-	+	-	-

* = breeds in Area

+ = occurs in Area (nonbreeder)

- = not in Area

Table 4-4. Seabirds Located in the Area of Coverage

Common Name	Scientific Name	Location in Area of Coverage			
		Beaufort Sea	Chukchi Sea	Hope Basin	Norton Basin
Red-throated Loon	<i>Gavia stellata</i>	*	*	*	*
Pacific Loon	<i>Gavia pacifica</i>	+	*	+	+
Common Loon	<i>Gavia immer</i>	+	-	+	+
Yellow-billed Loon	<i>Gavia adamsii</i>	*	*	-	-
Arctic Loon	<i>Gavia arctica</i>	*	-	-	-
Red-necked Grebe	<i>Podiceps grisegena</i>	+	*	+	+
Northern Fulmar	<i>Fulmarus glacialis</i>	-	+	*	*
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	+	*	+	+
Parasitic Jaeger	<i>Stercorarius parasiticus</i>	+	*	+	+
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	+	*	*	*
Mew Gull	<i>Larus canus</i>	+	*	+	+
Herring Gull	<i>Larus argentatus</i>	+	+	*	*
Glaucous Gull	<i>Larus hyperboreus</i>	*	*	*	*
Sabine's Gull	<i>Xema sabini</i>	+	*	+	+
Bonaparte's Gull	<i>Larus philadelphia</i>	-	-	+	+
Franklin's Gull	<i>Larus pipixcan</i>	-	-	+	+
Common Black-headed Gull	<i>Larus ridibundus</i>	-	-	+	+
Slaty-backed Gull	<i>Larus schistisagus</i>	-	-	+	+
Glaucous-winged Gull	<i>Larus glaucescens</i>	-	+	*	*
Ivory Gull	<i>Pagophila eburnea</i>	-	+	+	+
Ross' Gull	<i>Rhodostethia rosea</i>	-	+	+	+
Black-legged Kittiwake	<i>Rissa tridactyla</i>	+	*	*	*
Red-legged Kittiwake	<i>Rissa brevirostris</i>	-	-	*	*
Arctic Tern	<i>Sterna paradisaea</i>	*	*	+	+
Common Tern	<i>Sterna hirundo</i>	-	-	+	+
Aleutian Tern	<i>Sterna aleutica</i>	-	-	+	+
Dovekie	<i>Alle alle</i>	-	-	+	+
Common Murre	<i>Uria aalge</i>	-	*	*	*
Thick-billed Murre	<i>Uria lomvia</i>	-	*	*	*
Black Guillemot	<i>Cephus grille</i>	*	*	-	-
Pigeon Guillemot	<i>Cephus columba</i>	-	*	*	*
Horned Puffin	<i>Fratercula corniculata</i>	-	*	*	*
Tufted Puffin	<i>Fratercula cirrhata</i>	-	*	*	*
Black-footed Albatross	<i>Phoebastria nigripes</i>	-	-	+	+
Laysan Albatross	<i>Diomedea immutabilis</i>	-	-	+	+
Mottled Petrel	<i>Pterodroma inexpectata</i>	-	-	+	+
Fork-tailed Storm-Petrel	<i>Oceanodroma furcata</i>	-	+	+	+
Leach's Petrel	<i>Oceanodroma leucorhoa</i>	-	-	+	+
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	-	-	+	+
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	-	-	+	+
Kitlitz's Murrelet	<i>Brachyramphus brevirostris</i>	-	*	*	*
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	-	-	+	+
Parakeet Auklet	<i>Aethia psittacula</i>	-	-	*	*
Crested Auklet	<i>Aethia cristatella</i>	-	+	*	*
Least Auklet	<i>Aethia pusilla</i>	-	+	*	*

Table 4-5. Waterfowl Located in the Area of Coverage

Common Name	Scientific Name	Location in Area of Coverage			
		Beaufort Sea	Chukchi Sea	Hope Basin	Norton Basin
Mallard	<i>Anas platyrhynchos</i>	+	*	+	+
Tundra Swan	<i>Cygnus columbianus</i>	*	*	+	+
Whooper Swan	<i>Cygnus cygnus</i>	-	-	+	+
Greater White-fronted Goose	<i>Anser albifrons</i>	*	*	+	+
Snow Goose	<i>Chen caerulescens</i>	*	+	+	+
Canada Goose	<i>Branta canadensis</i>	*	*	+	+
Bean Goose	<i>Anser fabalis</i>	-	-	+	+
Emperor Goose	<i>Chen canagica</i>	-	*	+	+
Green-winged Teal	<i>Anas crecca</i>	+	*	+	+
Brant	<i>Branta bernicla nigricans</i>	*	*	+	+
Northern Pintail	<i>Anas acuta</i>	+	*	*	*
Northern Shoveler	<i>Anas clypeata</i>	+	*	+	+
American Wigeon	<i>Anas americana</i>	+	+	-	-
Greater Scaup	<i>Aythya marila</i>	+	*	+	+
Lesser Scaup	<i>Aythya affinis</i>	-	-	+	+
Common Eider	<i>Somateria mollissima</i>	*	*	*	*
King Eider	<i>Samateria spectabilis</i>	*	*	+	+
Oldsquaw	<i>Clangula hyemalis</i>	*	*	*	*
Black Scoter	<i>Melanitta nigra</i>	+	+	+	+
Surf Scoter	<i>Melanitta perspicillata</i>	+	+	+	+
White-winged Scoter	<i>Melanitta fusca</i>	+	+	*	*
Red-breasted Merganser	<i>Mergus serrator</i>	+	*	+	+
Common Merganser	<i>Mergus merganser</i>	-	-	+	+
Hooded Merganser	<i>Lophodytes cucullatus</i>	-	-	+	+
Garganey	<i>Anas querquedula</i>	-	-	+	+
Common Pochard	<i>Aythya ferina</i>	-	-	+	+
Canvasback	<i>Aythya valisineria</i>	-	-	+	+
Redhead	<i>Aythya Americana</i>	-	-	+	+
Tufted duck	<i>Aythya fuligula</i>	-	-	+	+
Ring-necked Duck	<i>Aythya collaris</i>	-	-	+	+
Harlequin Duck	<i>Histrionicus histrionicus</i>	-	*	+	+
Common Goldeneye	<i>Bucephala clangula</i>	-	-	+	+
Barrow's Godeneye	<i>Bucephala islandica</i>	-	+	+	+
Bufflehead	<i>Bucephala albeola</i>	-	-	+	+
Smew	<i>Mergellus albellus</i>	-	-	+	+

* = breeds in Area

+ = occurs in Area (nonbreeder)

- = not in Area

Table 4-6. Summary of ESA Listed Species Occurring Within the Area of Coverage

Species	Range in Area of Coverage	Present Status	Federal Register Notice	
Birds				
Short-tailed Albatross (<i>Phoebastria albatross</i>)	Bering Sea Coast	Endangered	65 FR 46643	07/31/00
Spectacled Eider (<i>Somateria fischeri</i>)	Western and Northern Alaska (coastal)	Threatened	58 FR 27474	05/10/93
Steller's Eider (<i>Polysticta stelleri</i>)	Western and Northern Alaska	Threatened	62 FR 31748	06/11/97
Marine Mammals				
Stellar Sea Lion (<i>Eumetopias jubatus</i>)	Bering Sea	Endangered	62 FR 24345	05/0597
Blue Whale (<i>Balaenoptera musculus</i>)	Bering Sea	Endangered	35 FR 8491	06/02/70
Bowhead Whale (<i>Balaena mysticetus</i>)	Chukchi Sea and Beaufort Sea	Endangered	35 FR 8491	06/02/70
Fin Whale (<i>Balaenoptera psysalus</i>)	Chukchi Sea and Beaufort Sea	Endangered	35 FR 8491	06/02/70
Humpback Whale (<i>Magaptera novaeangliae</i>)	Bering Sea	Endangered	35 FR 8491	06/02/70
North Pacific Right Whale (<i>Eubalaena japonica</i>)	Bering Sea	Endangered	35 FR 8491	06/02/70
Sperm Whale (<i>Physeter macrocephalus</i>)	Bering Sea	Endangered	35 FR 8491	06/0270

Table 4-7. Summary of Critical Habitat Designations for ESA Listed Species Occurring Within the Area of Coverage

Species	Population/DPS	Present Status	Federal Register Listing Notice	
Birds				
Spectacled Eider (<i>Somateria fischeri</i>)	ND	Threatened	66 FR 9146	02/06/01
Steller's Eider (<i>Polysticta stelleri</i>)	ND	Threatened	66 FR 8849	02/02/01

DPS Distinct Population Segment
 ND Not Determined

Table 4-8. Essential Fish Habitat for Species in the Area of Coverage

Species	Life Stage	Waterbody Regions			
		Hope Basin	Norton Basin	Chukchi Sea	Beaufort Sea
Red King Crab	eggs		X		
	juveniles		X		
	spawning		X		
	adults		X		
Blue King Crab	eggs	X	X		
	juveniles	X	X		
	adults	X	X		
Snow Crab	eggs	X	X		
	larvae	X	X		
	juveniles		X		
	adults	X	X		
Yellowfin Sole	juveniles	X	X		
	adults	X	X		
	adults	X	X		
Sculpins	juveniles	X	X		
	adults	X	X		
	adults	X	X		
Chinook Salmon	juveniles	X	X	X	
	adults	X	X	X	
	adults	X	X	X	
Coho Salmon	juveniles	X	X	X	
	adults	X	X	X	
	adults	X	X	X	
Pink Salmon	juveniles	X	X	X	X (rare)
	adults	X	X	X	X (rare)
	adults	X	X	X	X (rare)
Sockeye Salmon	juveniles	X	X	X	
	adults	X	X	X	
	adults	X	X	X	
Chum Salmon	juveniles	X	X	X	X (rare)
	adults	X	X	X	X (rare)
	adults	X	X	X	X (rare)

Table 9-1. Trace Metal Leach Factors from Barite and Drilling Fluids

Trace Metal	Mean Seawater Leach Factor	Maximum Seawater Leach Factor
Arsenic	0.005	0.0081
Barium	0.0021	0.0059
Cadmium	0.11	0.24
Chromium	0.034	0.064
Copper	0.0063	0.015
Iron	0.13	0.48
Lead	0.02	0.034
Mercury	0.18	0.064
Nickel	0.043	0.088
Zinc	0.0041	0.0056

Source: Offshore Environmental Assessment (Avanti Corporation, 1993)

Table 9-2. Soluble and Solids Metals Concentrations

Metal	Dredged Materials Dumped at Sea ^a		
	Mean Solid Phase (mg/kg)	Mean Liquid Phase (mg/L)	Partition Coefficient ^b
Arsenic	4.0	0.0049	0.0012
Cadmium	1.2	0.0016	0.0013
Chromium	33.0	0.0048	0.0001
Copper	30.4	0.0027	0.0001
Lead	29.6	0.0068	0.0002
Mercury	0.3	0.0003	0.0010
Zinc	68.8	0.0325	0.0005
	Arctic River and Coastal Beaufort Sea ^c		
Copper	33.3	0.00034	0.0000102
Lead	15.7	0.000053	0.00000034
Zinc	124	0.00038	0.00000031

^a Reference: Bigham et al., 1982

^b Liquid phase: solid phase (kg/L)

^c Reference: MMS, 2004c

Table 9-3. Comparison of Drilling Mud Predicted Dissolved Metal Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

Case 1: Whole mud metal concentration as dissolved metal concentration.

Metal	Maximum Whole Mud Conc. ^a (µg/kg)	Estimated Dissolved Metal Conc. ^b (µg/L)	Acute Marine AWQC ^c (µg/L)	Chronic Marine AWQC ^c (µg/L)	Predicted Concentration at Mixing Zone Boundary ^e (µg/L)					
					Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
					Water Depth (m)					
					40	20	5	40	20	5
Arsenic	7,100	7,100	69	36	4	10	20	4	7	7
Barium	359,747,000	359,747,000	NA	NA	225,972	481,589	1,010,525	185,628	341,965	370,110
Cadmium	1,100	1,100	40	8.8	0.7	1.5	3.1	0.6	1.0	1.1
Chromium	240,000	240,000	1,100	50	151	321	674	124	228	247
Copper	18,700	18,700	4.8	3.1	11.7	25.0	52.5	9.6	17.8	19.2
Iron	15,344,300	15,344,300	NA	NA	9,638	20,541	43,102	7,918	14,586	15,786
Lead	35,100	35,100	210	8.1	22.0	47.0	98.6	18.1	33.4	36.1
Mercury	100	100	1.8	0.94	0.06	0.13	0.28	0.05	0.10	0.10
Nickel	13,500	13,500	74	8.2	8.5	18.1	37.9	7.0	12.8	13.9
Zinc	200,500	200,500	90	81	126	268	563	103	191	206

^a Maximum measured whole mud metal concentrations in drilling muds discharged in Alaskan waters (Table 2-2)

^b The assumption for this comparative analysis is that all the metals in the whole mud are available to dissolve in the water column.

^c Alaska Marine Water Quality Criteria – these values are all dissolved.

^d The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively.

Table 9-4. Comparison of Drilling Mud Predicted Dissolved Metal Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

Case 2: Dissolved fraction estimated from maximum trace metal leach factors in Table 9-1.

Metal	Maximum Whole Mud Conc. ^a (µg/kg)	Estimated Dissolved Metal Conc. (µg/L)	Acute Marine AWQC ^b (µg/L)	Chronic Marine AWQC ^b (µg/L)	Predicted Concentration at Mixing Zone Boundary ^c (µg/L)					
					Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
					Water Depth (m)					
					40	20	5	40	20	5
Arsenic	7,100	58	69	36	0.04	0.08	0.16	0.03	0.05	0.06
Barium	359,747,000	2,122,507	NA	NA	1,333	2,841	5,962	1,095	2,018	2,184
Cadmium	1,100	264	40	8.8	0.2	0.4	0.7	0.1	0.3	0.3
Chromium	240,000	15,360	1,100	50	10	21	43	8	15	16
Copper	18,700	281	4.8	3.1	0.2	0.4	0.8	0.1	0.3	0.3
Iron	15,344,300	7,365,264	NA	NA	4,626	9,860	20,689	3,800	7,001	7,577
Lead	35,100	1,193	210	8.1	0.7	1.6	3.4	0.6	1.1	1.2
Mercury	100	6.4	1.8	0.94	0.004	0.01	0.02	0.003	0.01	0.01
Nickel	13,500	1,188	74	8.2	0.7	1.6	3.3	0.6	1.1	1.2
Zinc	200,500	1,123	90	81	0.7	1.5	3.2	0.6	1.1	1.2

^a Maximum measured whole mud metal concentrations in drilling muds discharged in Alaskan waters (Table 2-2)

^b Alaska Water Quality Criteria – these values are all dissolved.

^c The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively.

Table 9-5. Comparison of Drilling Mud Predicted Dissolved Metal Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

Case 3: Dissolved fraction estimated from mean trace metal leach factors in Table 9-1.

Metal	Maximum Whole Mud Conc. ^a (µg/kg)	Estimated Dissolved Metal Conc. (µg/L)	Acute Marine AWQC ^b (µg/L)	Chronic Marine AWQC ^b (µg/L)	Predicted Concentration at Mixing Zone Boundary ^c (µg/L)					
					Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
					Water Depth (m)					
					40	20	5	40	20	5
Arsenic	7,100	36	69	36	0.02	0.05	0.10	0.02	0.03	0.04
Barium	359,747,000	755,469	NA	NA	475	1,011	2,122	390	718	777
Cadmium	1,100	121	40	8.8	0.08	0.16	0.34	0.06	0.12	0.12
Chromium	240,000	8,160	1,100	50	5	11	23	4	8	8
Copper	18,700	118	4.8	3.1	0.07	0.16	0.33	0.06	0.11	0.12
Iron	15,344,300	1,944,759	NA	NA	1,253	2,670	5,603	1,029	1,896	2,052
Lead	35,100	702	210	8.1	0.4	0.9	2.0	0.4	0.7	0.7
Mercury	100	1.8	1.8	0.94	0.001	0.002	0.01	0.001	0.002	0.002
Nickel	13,500	581	74	8.2	0.4	0.8	1.6	0.3	0.6	0.6
Zinc	200,500	822	90	81	0.5	1.1	2.3	0.4	0.8	0.8

^a Maximum measured whole mud metal concentrations in drilling muds discharged in Alaskan waters (Table 2-2)

^b Alaska Water Quality Criteria – these values are all dissolved.

^c The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively.

Table 9-6. Comparison of Drilling Cutting Predicted Dissolved Metal Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

Case 1: Total drilling cutting metal concentration as dissolved metal concentration.

Metal	Maximum Drilling Cutting Conc. ^a (µg/kg)	Estimated Dissolved Metal Conc. ^b (µg/L)	Acute Marine AWQC ^c (µg/L)	Chronic Marine AWQC ^c (µg/L)	Predicted Concentration at Mixing Zone Boundary ^d (µg/L)					
					Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
					Water Depth (m)					
					40	20	5	40	20	5
Arsenic	10,600	10,600	69	36	7	14	30	5	10	11
Cadmium	16,400	16,400	40	8.8	10.3	22.0	46.1	8.5	15.6	16.9
Chromium	12,000	12,000	1,100	50	8	16	34	6	11	12
Copper	55,300	55,300	4.8	3.1	34.7	74.0	155.3	28.5	52.6	56.9
Lead	298,000	298,000	210	8.1	187.2	398.9	837.0	153.8	283.3	306.6
Mercury	944	944	1.8	0.94	0.59	1.26	2.65	0.49	0.90	0.97
Nickel	15,900	15,900	74	8.2	10.0	21.3	44.7	8.2	15.1	16.4
Silver	574	574	1.9	--	0.4	0.8	1.6	0.3	0.5	0.6
Selenium	3,000	3,000	290	71	2	4	8	2	3	3
Zinc	3,200,000	3,200,000	90	81	2,010	4,283	8,989	1,651	3,042	3,292

^a Maximum measured drilling cutting metal concentrations (Table 2-4)

^b The assumption for this comparative analysis is that all the metals in the drilling cuttings are available to dissolve in the water column.

^c Alaska Marine Water Quality Criteria – these values are all dissolved.

^d The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively.

Table 9-7. Comparison of Drilling Cutting Predicted Dissolved Metal Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

Case 2: Dissolved metal concentration is two orders of magnitude lower than drilling cutting concentrations.

Metal	Maximum Drilling Cutting Conc. ^a (µg/kg)	Estimated Dissolved Metal Conc. ^b (µg/L)	Acute Marine AWQC ^c (µg/L)	Chronic Marine AWQC ^c (µg/L)	Predicted Concentration at Mixing Zone Boundary ^d (µg/L)					
					Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
					Water Depth (m)					
					40	20	5	40	20	5
Arsenic	10,600	106	69	36	0.1	0.1	0.3	0.1	0.1	0.1
Cadmium	16,400	164	40	8.8	0.1	0.2	0.5	0.1	0.2	0.2
Chromium	12,000	120	1,100	50	0.1	0.2	0.3	0.1	0.1	0.1
Copper	55,300	553	4.8	3.1	0.3	0.7	1.6	0.3	0.5	0.6
Lead	298,000	2,980	210	8.1	1.9	4.0	8.4	1.5	2.8	3.1
Mercury	944	9.44	1.8	0.94	0.01	0.01	0.03	0.005	0.01	0.01
Nickel	15,900	159	74	8.2	0.1	0.2	0.4	0.1	0.2	0.2
Silver	574	574	1.9	--	0.004	0.01	0.02	0.003	0.01	0.01
Selenium	3,000	30	290	71	0.02	0.04	0.08	0.02	0.03	0.03
Zinc	3,200,000	32,000	90	81	20	43	90	17	30	33

^a Maximum measured drilling cuttings metal concentrations (Table 2-4)

^b The assumption for this comparative analysis is that the metals in the dissolved fraction are two orders of magnitude lower than the drilling cuttings (divide by 100).

^c Alaska Water Quality Criteria – these values are all dissolved.

^d The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively.

Table 9-8. Comparison of Drilling Cutting Predicted Dissolved Metal Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

Case 3: Dredged material partition coefficients are used to estimate dissolved metal concentrations in drilling cuttings.

Metal	Maximum Whole Mud Conc. ^a (µg/kg)	Estimated Dissolved Metal Conc. ^b (µg/L)	Acute Marine AWQC ^c (µg/L)	Chronic Marine AWQC ^c (µg/L)	Predicted Concentration at Mixing Zone Boundary ^d (µg/L)					
					Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
					Water Depth (m)					
					40	20	5	40	20	5
Arsenic	10,600	13	69	36	0.01	0.02	0.04	0.01	0.01	0.01
Cadmium	16,400	21.3	40	8.8	0.01	0.03	0.06	0.01	0.02	0.02
Chromium	12,000	1.2	1,100	50	0.001	0.002	0.003	0.001	0.001	0.001
Copper	55,300	5.5	4.8	3.1	0.003	0.01	0.02	0.003	0.01	0.01
Lead	298,000	59.6	210	8.1	0.04	0.08	0.17	0.03	0.06	0.06
Mercury	944	0.944	1.8	0.94	0.001	0.001	0.003	0.0005	0.001	0.001
Nickel	15,900	15.9	74	8.2	0.01	0.02	0.04	0.01	0.02	0.02
Silver	574	0.6	1.9	--	0.0004	0.001	0.002	0.0003	0.001	0.001
Selenium	3,000	3	290	71	0.002	0.004	0.01	0.002	0.003	0.003
Zinc	3,200,000	1,600	90	81	1	2	4	1	2	2

^a Maximum measured drilling cuttings metal concentrations (Table 2-4)

^b The assumption for this comparative analysis is that the metals in the drilling cuttings partition similar to that of dredged materials dumped at sea. Total drilling cutting concentrations are multiplied by the partition coefficients in Table 9-1.

^c Alaska Water Quality Criteria – these values are all dissolved.

^d The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively.

Table 9-9. Comparison of Sanitary Waste Predicted Total Residual Chlorine Concentrations (at Mixing Zone Boundary) to Marine Water Quality Criteria

TBEL Conc. (mg/L)	Chronic Marine AWQC (mg/L)	Predicted Concentration at Mixing Zone Boundary ^a (µg/L)					
		Open-Water Discharge, Current Speed of 10 cm/sec			Below-Ice Discharge, Current Speed of 2 cm/sec		
		Water Depth (m)					
		40	20	5	40	20	5
1.0	0.002	0.0006	0.001	0.003	0.0005	0.001	0.001

^a The predicted dissolved-metal concentrations calculated by dividing the estimated dissolved-metal concentration by the appropriate modified OOC model-predicted dilution factors for open-water and below-ice discharges in Tables 3-5 and 3-7, respectively

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APPENDIX C

**NPDES GENERAL PERMIT FOR OIL AND GAS EXPLORATION
IN THE ARCTIC**

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APPENDIX D

CALCULATION OF SOLIDS DEPOSITION MULTIPLIERS

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The OOC model scenarios used in the ODCE predict the deposition of solids after one hour of discharge. This time period was chosen to be consistent with the input parameters of earlier modeling efforts on exploratory oil and gas ODCEs. An interval of one hour is not sufficient time to discharge all of the drilling muds generated by an average exploratory well at discharge rates ranging from 250 to 1,000 bbl/h. In order to predict the maximum solids thickness at the completion of an exploratory well, an estimate for the average amount of drilling muds produced by each exploratory well is required. Estimates of drilling mud production for Beaufort Sea and Chukchi Sea lease sale areas are given below (MMS 1990, 1991):

Region	Average Drilling Mud Production Per Exploratory Well (kg)	Average True Vertical Well Depth (m)
Beaufort Sea	571,526	3,048
Chukchi Sea	598,742	3,170

In order to predict the maximum thickness of drilling mud upon completion of an exploratory well, a multiplier must be calculated which accounts for the production of drilling muds beyond the one-hour time period specified in the model. The multiplier is calculated by dividing the average production (given above) by the production period predicted after one hour, which is calculated by the following formula:

$$\text{Drilling mud production (kg)} = [\text{discharge rate (L/h)}] * [\text{solids concentration in whole mud (kg/L)}] * [\text{time (h)}]$$

An example calculation for the Chukchi Sea is given below:

$$\text{Drilling mud production} = [(1,000 \text{ bbl/hr}) * (159 \text{ L/bbl})] * (1.441 \text{ kg/L}) (1 \text{ hr}) = 229,119 \text{ kg}$$

$$\text{Ratio} = 598,742 \text{ kg} / 229,119 \text{ kg} = 2.613$$

Thus, all solids thickness values given in Section 3 for the case runs which included a discharge rate of 1,000 bbl/h were multiplied by 2.613 to represent the maximum completion-of-well values for an average exploratory well drilling in the Chukchi Sea. This method of estimating mud accumulation assumes that area deposition patterns will be unchanged for discharges of different quantities of mud and is reasonable provided that the rate of mud discharged does not vary from that predicted in the modeling.

It should be noted that dilution values, either for solids or the dissolved fraction, are unaffected by the differences between the modeled and actual discharge amounts and would not be subject to the multiplier calculated above.

The following table shows the multipliers for four discharge rates in the Beaufort and Chukchi seas. [In this ODCE, multipliers for the Chukchi Sea were applied to the entire Area of Coverage.]

	Discharge Rates (bbl/h)			
	1,000	750	500	250
Beaufort Sea	2.494	3.326	4.989	9.978
Chukchi Sea	2.613	3.484	5.226	10.453

APPENDIX E

FACT SHEET
FOR
NPDES GENERAL PERMIT FOR OIL AND GAS EXPLORATION
IN THE ARCTIC

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**Alaska Wilderness League • Audubon Alaska • Center for Biological
Diversity • Defenders of Wildlife • Earthjustice • Natural Resources Defense
Council • Northern Alaska Environmental Center • Oceana • Ocean Conservancy •
Pacific Environment • Sierra Club • The Wilderness Society • World Wildlife Fund**

April 9, 2010

Submitted via e-mail to: arcticeis.comments@noaa.gov

Mr. P. Michael Payne
Chief – Permits, Conservation, & Education Division
Office of Protected Resources
National Marine Fisheries Service
Room 13705
1315 East-West Highway
Silver Spring, MD 20910-6233

**Re: Scoping Comments for NMFS’s Proposed Programmatic
Environmental Impact Statement Concerning the Effects of Oil and
Gas Activities in the Arctic Ocean**

Dear Mr. Payne,

Thank you for this opportunity to submit scoping comments on the National Marine Fisheries Service’s (NMFS) proposed environmental impact statement (EIS) to analyze impacts associated with issuing incidental take authorizations (ITAs) for activities related to oil and gas exploration in federal and state waters of the Beaufort and Chukchi seas. Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, 75 Fed. Reg. 6175–77 (Feb. 8, 2010). These comments are submitted on behalf of: Alaska Wilderness League, Audubon Alaska, Center for Biological Diversity, Defenders of Wildlife, Earthjustice, Natural Resources Defense Council, Northern Alaska Environmental Center, Oceana, Ocean Conservancy, Pacific Environment, Sierra Club, The Wilderness Society, and World Wildlife Fund.

In 2007, NMFS and the Minerals Management Service (MMS) released a Draft Programmatic Environmental Impact Statement for Seismic Surveys in the Beaufort and Chukchi Seas (2007 DPEIS). 72 Fed. Reg. 17,117 (April 6, 2007). The agencies did not release a final EIS, and, in October 2009, they recognized that the 2007 DPEIS was outdated and inadequate. 74 Fed. Reg. 55,539 (Oct. 28, 2009). NMFS and MMS withdrew the 2007 DPEIS and announced the initiation of a new National Environmental Policy Act (NEPA) process. *Id.*

We applaud the decision to initiate a new EIS process that will analyze a broader range of potential effects of oil and gas activities in the Beaufort and Chukchi seas,

including both seismic surveys and exploratory drilling. We are encouraged that NMFS intends to address the cumulative effects of such activities over time, consider a reasonable range of alternatives, and analyze the range of mitigation and monitoring measures available to protect marine mammals and ensure the availability of marine mammals for subsistence uses. 75 Fed. Reg. at 6175.

Oil and gas activities are expanding rapidly in the Beaufort and Chukchi seas. Production from the Northstar facility in the Beaufort Sea is ongoing. This summer, Shell intends to conduct exploratory drilling in both the Beaufort and Chukchi seas, and has proposed both a shallow hazard survey and an ice gouge survey in the Beaufort Sea. See, e.g., National Oceanic and Atmospheric Administration (NOAA) and URS, Map: Federal and State Offshore Oil & Gas Leases, Chukchi and Beaufort Seas (2010) (NOAA Map).¹ In addition, Statoil intends to conduct 3D seismic exploration on its leases in the Chukchi Sea this summer, while TGS and ION Geophysical have applied to conduct 2D seismic surveys that would cover vast areas of the Beaufort and Chukchi seas. *Id.* The U.S. Geological Survey plans to conduct seismic work during a research cruise in the Beaufort Sea, as well. *Id.* Industry will likely push for increased activity in the future. ConocoPhillips has already announced plans to engage in exploration drilling in the Chukchi Sea in 2012, and state waters in the Beaufort Sea may be subject to leasing and exploration in future years. In addition to oil and gas activities, tourism, commercial shipping, and vessel traffic are increasing in Arctic waters as summer sea ice retreats. This growth in industrial activities comes at a time when a rapidly warming climate is causing profound changes to the region, and when ocean acidification will contribute additional stress to marine ecosystems.

The potential impacts of these industrial activities and environmental changes—both individually and cumulatively—demand a comprehensive analysis. This analysis, and the alternatives it contains, should:

- incorporate local and traditional knowledge, and be sensitive to the concerns of Arctic communities;
- account for shifting baseline conditions in the Arctic, such as those caused by climate change and ocean acidification;
- review fully the potential cumulative impacts of industrial activities;
- acknowledge data gaps and obtain missing information;
- consider a precautionary approach like that which was used in the North Pacific Management Council's Arctic Fishery Management Plan; and
- allow for coordination with future National Ocean Council processes such as the proposed Arctic strategic action plan and marine spatial planning in the Arctic region.

¹ A bibliography of referenced documents and additional supporting documents is attached to this letter. To the extent possible, we have collected digital copies of these documents on compact discs (CDs). We will send copies of those CDs to NMFS via U.S. mail. We request that NMFS consider all the documents and materials on the CDs as it prepares the proposed EIS, and further request that NMFS add all the documents and materials on the CDs to the administrative record for the proposed EIS.

In addition, NMFS should issue no new incidental harassment authorizations until the proposed EIS is completed.

Section I of these scoping comments contains background information on Arctic communities and resources, and changes affecting the region. Section II provides a brief review of statutory requirements imposed by NEPA, the Marine Mammal Protection Act (MMPA), and the Endangered Species Act (ESA). Section III provides overarching policy recommendations. Section IV discusses the potential impacts of noise associated with oil and gas activities. Section V discusses other potential impacts associated with oil and gas activities, including oil spills, pollution, and increased vessel traffic. Finally, Section VI discusses alternatives including recommendations regarding monitoring and mitigation, and implementation of five-year regulations pursuant to section 101(a)(5)(A) of the MMPA.

I. The ecological baseline of the proposed EIS must acknowledge that the Arctic contains some of the world's few remaining largely intact marine ecosystems, but the region is threatened by impacts from climate change, ocean acidification, and increasing industrial activities.

A. The Arctic is home to vibrant communities and treasured wildlife.

The Arctic is among the most beautiful and forbidding places on Earth. Despite harsh conditions, the Arctic is home to vibrant human communities and functioning ecosystems. Many Arctic peoples make extensive use of the marine environment to support their subsistence way of life, and subsistence hunting is a mainstay of the economy and culture in the region. The Arctic also provides vital habitat for iconic wildlife, including polar bears, whales, walruses, fish, birds, and several species of ice-dependent seals. In addition, the region plays a vital role in the regulation of the planet's climate.

The Arctic has sustained human communities for thousands of years, and for many Arctic peoples, the sea remains a focal point of life and culture. Coastal peoples in the Arctic use marine plants and animals for food, clothing, and other necessities. Along the coasts of the Chukchi and Beaufort seas, most villages hunt bowhead whales, and view the whale hunt as a centerpiece of their culture. They prepare for the hunt year-round, celebrate successful hunts, and share food throughout the community. Arctic peoples also use other ocean resources, such as fish, walrus, seals, and seabirds, to support their subsistence way of life. For many residents of the Arctic, there is a direct connection between the continued health of the marine environment and the health of their food supply and culture.

Arctic waters are also important to people around the world. The cold, ice-covered waters at the top of globe play a special role in regulating our planet's climate. The gradient from cold air near the pole to warm tropical air near the equator is a primary driver of atmospheric circulation and ocean currents. These currents move heat away from the equator toward the North Pole, where it eventually escapes to

space, helping to regulate the earth's climate. In this sense, the Arctic acts as an air conditioner for the planet. In a broader sense, the Arctic occupies an important place in our history, our mythology, and our imaginations, and it is part of our shared natural heritage.

In addition to supporting human communities and cooling the globe, the Arctic is home to an array of marine life, including some of the world's most iconic wildlife species. Marine mammals such as Pacific walruses and polar bears; bowhead and beluga whales; and spotted, bearded, ribbon, and ringed seals inhabit the waters of the Chukchi and Beaufort seas. Migratory species from around the globe—including gray, humpback, minke, and killer whales, and millions of seabirds, shorebirds, and waterfowl—take advantage of the burst of summer productivity in the Arctic for breeding, feeding, and rearing of their young. The Arctic supports an array of fish, invertebrate, and algal species, as well. Forage species such as krill, Arctic cod, and capelin are a vital part of the marine food web.

The proposed EIS should recognize expressly that the Arctic is home to vibrant coastal communities that enjoy a special relationship with the ocean and its resources. It should also acknowledge the globally important role that the Arctic plays in regulating climate and in providing habitat for wildlife.

B. Climate change, ocean acidification, and increasing industrial activities threaten Beaufort and Chukchi sea ecosystems.

Arctic ecosystems, and those who depend on them, are confronted by fundamental changes. These changes include a rapidly warming climate, the increasing acidification of the surface waters of the ocean, and the swift growth of industrial activities in Arctic waters. NMFS must account for these shifting baseline conditions in its analysis. The proposed EIS must assess the likely range of environmental impacts that could reasonably be expected to result from its alternatives based on these changing conditions.

(1) Climate change

Climate change is warming the Arctic roughly twice as fast as the rest of the world. That warming is forcing pronounced alterations of the environment that affect Arctic ecosystems and have worldwide implications.

The most dramatic change in the Arctic has been the rapid loss of sea ice. See *generally* O'Rourke, Ronald, coordinator, "Changes in the Arctic: Background and Issues for Congress," Congressional Research Service 7-10 (Mar. 30, 2010). In 2007, the seasonal minimum sea ice extent in the Arctic was 23% lower than it had ever been since satellite measurements began in 1979 and was 39% lower than the 1979 to 2000 average. National Snow and Ice Data Center, "Arctic Sea Ice Shatters All Previous Record Lows" (Oct. 1, 2007). In 2008, the minimum sea ice extent was lower than any year but 2007, and the ice pack was thinner and more diffuse, suggesting that 2008

established a record low for ice volume. National Snow and Ice Data Center, “Arctic Sea Ice Down to Second-Lowest Extent; Likely Record-Low Volume” (Oct. 2, 2008). Although the minimum sea ice extent was greater in 2009 than it was in 2007 and 2008, the minimum sea ice extent in 2009 was the third-lowest on record. National Snow and Ice Data Center, “Arctic sea ice extent remains low; 2009 sees third-lowest mark” (Oct. 6, 2009). The rate at which sea ice cover is declining exceeds even the most dramatic predictions from just a few years ago. NOAA now predicts that the Arctic could be seasonally ice-free in as few as thirty years. NOAA, *Ice-Free Arctic Summers Likely Sooner Than Expected* (Apr. 2, 2009).

Climate-related changes, such as loss of sea ice cover, have profound effects on Arctic peoples, opportunities for the subsistence way of life, and Arctic marine ecosystems. Reduced ice cover makes fishing, hunting, and travel more difficult and unpredictable for Arctic peoples. Loss of sea ice also has dramatic effects on many Arctic species. See *generally, e.g.*, Moore, S.E. *et al.*, “Marine mammals and sea ice loss in the Pacific Arctic,” 26 Book of Abstracts, Alaska Marine Science Symposium Anchorage, Alaska (Jan. 2010). The reduction of sea ice also eliminates habitat for ice-dependent species. For example, projected impacts to polar bears from loss of sea ice habitat led the United States Department of Interior to list the species as threatened under the ESA. The polar bear listing relied, in part, on the U.S. Geological Survey’s conservative prediction—made before the recent record-breaking minimum sea ice extents and ice volumes—that polar bear populations in this part of the Arctic could be extinct within forty-five years. Loss of sea ice also has adverse impacts on walrus and other species that rest on the platform provided by sea ice between foraging sessions. More broadly, loss of sea ice almost certainly will result in a fundamental restructuring of the Arctic marine food web, and may shift the flow of productivity from primarily benthic and ice-associated food webs to pelagic food webs.

Loss of sea ice cover, the potential for seasonally ice-free conditions across the Arctic, and other climate-related changes are, and will continue to be, major stressors for many species in the Arctic. These changes may lead to local loss or extinction of species that cannot adapt to the rapidly changing conditions. NMFS’s proposed EIS must discuss and incorporate into its analysis climate change and its impacts on Arctic people and the Arctic environment.

NEPA requires NMFS to take account of climate change in its analysis of potential impacts of the activities it permits. It must analyze the effects of those activities in the environment as it exists, namely an Arctic Ocean undergoing dramatic and rapid shifts due to climate change. Recent draft guidance from the Council on Environmental Quality (CEQ) confirms this obligation, directing agencies to incorporate climate change into the environmental baseline against which effects are measured. See CEQ, *Draft Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* 7 (Feb. 18, 2010). Because climate change in the Arctic is so rapid, the EIS should acknowledge that the environmental baseline of the region is changing, and that the effects of later-occurring activities may have to be measured against a different baseline than the effects of earlier-occurring activities. The EIS must

analyze and evaluate how the effects of climate change will combine or act synergistically with other impacts, including impacts from industrial activities and current or potential impacts from ocean acidification.

(2) Ocean acidification

The Arctic is projected to be one of the first regions to be affected significantly by increased ocean acidification. Roughly one-third of the carbon dioxide that is added to the atmosphere from the combustion of fossil fuels will dissolve into seawater. There, it reacts to form carbonic acid, which increases the acidity of the water. The solubility of carbon dioxide gas in seawater increases as water temperature decreases. In addition, low-salinity waters have less capacity to buffer acidification than do high-salinity waters. The Arctic Ocean has relatively low water temperatures and—because it receives large volumes of freshwater from ice melt and inflow from the Mackenzie and other rivers—it has relatively low salinity. As a result, the Arctic Ocean is particularly susceptible to acidification. The Arctic's ice cover may have acted as a barrier to carbon dioxide absorption, slowing acidification of the polar sea. But as sea ice disappears, the surface waters of the Arctic Ocean will likely absorb carbon dioxide from the atmosphere at higher rates.

Acidification will introduce a fundamental shift in the biogeochemical cycling of the Arctic Ocean. Among the most immediate impacts will be carbonate ion depletion and its related effects, which will have substantial impacts on shellfish and other marine organisms that form their shells and other hard parts from calcium carbonate. Animals most at risk include mollusks, crustaceans, echinoderms, encrusting algae, and certain types of marine phytoplankton. Among other effects, increasing acidity will also change the growth rates of photosynthetic phytoplankton, the toxicity of marine toxins, the availability of ammonia for uptake by marine plants, and the efficiency of respiration in fish and other marine organisms. Increased acidity may also make the ocean louder, which could exacerbate the impacts of noise from industrial activities. See, e.g., Hester *et al.*, "Unanticipated consequences of ocean acidification: A noisier ocean at lower pH," 35 *Geophysical Res. Letters* (Oct. 2008).

The diversity of the anticipated effects and inherent complexity of ecosystem interactions make it difficult to predict with certainty how Arctic ecosystems will respond to increased ocean acidification. However, changes brought about by ocean acidification are likely to outstrip the adaptive capacity of many Arctic marine species. As discussed above with respect to climate change, NMFS's proposed EIS must discuss ocean acidification and its potential impacts on Arctic ecosystems. It must also analyze and evaluate the extent to which the effects of ocean acidification will combine with other impacts, including impacts from climate change and industrial activities.

(3) Increased industrial activities in Arctic waters

The reduction in Arctic sea ice cover, combined with economic drivers, is opening the region to increased industrial activity. Most immediately, there is a push to

expand oil and gas exploration and development in the Chukchi and Beaufort seas, the subject of NMFS's proposed EIS. Growth in oil and gas operations in the Arctic will result in increased seismic exploration, drilling, and vessel traffic in Arctic waters. As discussed below, all these activities have the potential to generate environmental impacts.

In addition to the expansion of oil and gas activities, there is growth in ship traffic in the Beaufort and Chukchi seas. As more ice melts, more vessels will seek to travel in the Arctic Ocean. The growth of commercial shipping in the Arctic will result in increased noise, air, and water pollution. Greater emissions of nitrogen oxides and carbon monoxide could triple ozone levels in the Arctic, and increased black carbon emissions would result in reduced ice reflectivity that could exacerbate the decline of sea ice. Increased shipping also increases the chance of introducing exotic species that may become invasive.

Although commercial fishing is currently prohibited in the Chukchi and Beaufort seas, fishing is growing at the margins of the Arctic. The introduction of commercial fishing to the Arctic could alter food webs, impact seafloor habitat, cause noise disturbance, and impair opportunities for the subsistence way of life. Directly or indirectly, large-scale commercial fishing could compete with subsistence hunters for the limited productivity of Arctic waters.

NMFS's proposed EIS should discuss potential impacts from all of the foregoing industrial activities. In doing so, the EIS should analyze and evaluate the way in which industrial impacts will combine with impacts from climate change and ocean acidification.

II. The proposed EIS must comply with the requirements contained in environmental and conservation statutes such as NEPA, the MMPA, and the ESA.

NEPA requires NMFS to take a hard look at the environmental impact of oil and gas activities in the Arctic Ocean. In doing so, NMFS must also consider other environmental statutes, such as the MMPA and ESA.

A. NEPA

NEPA is the "basic national charter for protection of the environment." 40 C.F.R. § 1500.1(a). The statute is meant to ensure that agency decision-makers "will have available, and will carefully consider, detailed information concerning significant environmental impacts." *Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 768 (2004). It is also designed to ensure that "relevant information will be made available" to the public. *Id.*

When an agency undertakes a major federal action, it must prepare an EIS to analyze the environmental impacts of that action. Among other things, an EIS must

provide an adequate description of the baseline conditions of the area affected. *Half Moon Bay Fisherman's Mktg. Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988); 40 C.F.R. § 1502.15. Agencies must disclose if relevant information is incomplete or unavailable. 40 C.F.R. § 1502.22. An EIS must also describe in detail the environmental consequences of the proposed action and reasonable alternatives. 42 U.S.C. § 4332(2)(C)(i), (iii); 40 C.F.R. §§ 1502.14, 1502.16. Information should contribute to a meaningful decisionmaking process, and should not be used merely to “rationalize or justify decisions already made.” 40 C.F.R. § 1502.5.

B. MMPA

Congress enacted the MMPA to manage marine mammals “for their benefit and not for the benefit of commercial exploitation.” H. Rep. No. 92-707, *reprinted in* 1972 U.S.C.C.A.N., 1972, pp. 4144–45. The primary mechanism by which the MMPA protects marine mammals is through the implementation of a “moratorium on the taking” of marine mammals. 16 U.S.C. § 1371(a). Under the MMPA, the term “take” is broadly defined to mean “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” *Id.* §1362(13). “Harass” includes acts of “torment” or “annoyance” that have the “potential” to injure a marine mammal or marine mammal stock in the wild or have the potential to “disturb” them “by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.” *Id.* § 1362(18); *see also* 50 C.F.R. § 216.3 (defining “Level A” and “Level B” harassment).

NMFS may, upon request, authorize take in the form of harassment by an incidental harassment authorization (IHA) for a period of not more than one year, provided certain conditions are met. To receive such take authorization, an activity (i) must be “specified” and limited to a “specific geographical region,” (ii) must result in the incidental take of only “small numbers of marine mammals of a species or population stock,” (iii) can have no more than a “negligible impact” on species and stocks, and (iv) cannot have “an unmitigatable adverse impact on the availability of such species or stock for taking for subsistence uses” by Alaska Natives. 16 U.S.C. § 1371(a)(5)(D). In issuing an authorization, NMFS must provide for the monitoring and reporting of such takings and must prescribe methods and means of effecting the “least practicable impact” on the species or stock and its habitat. *Id.* § 1371(a)(5)(D)(ii)(I). The authorized activity cannot have the “potential to result in serious injury or mortality[.]” 50 C.F.R. § 216.107.

C. ESA

Congress enacted the ESA as “a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.” 16 U.S.C. § 1531(b). The ESA “afford[s] endangered species the highest of priorities.” *TVA v. Hill*, 437 U.S. 153, 194 (1978). Under the ESA, federal agencies must consult with the U.S. Fish and Wildlife Service and/or NMFS—depending on the species—whenever those agencies take “any action” that “may affect” a listed species. 16 U.S.C. § 1536(a)(2); 50

C.F.R. § 402.14(a); *Nat'l Wildlife Fed'n v. Nat'n Marine Fisheries Serv.*, 422 F.3d 782, 790 (9th Cir. 2005). Such consultation is meant to ensure that agency actions do not “jeopardize the continued existence” of listed species. 16 U.S.C. § 1531(b).

III. Overarching Policy Recommendations

A. Insufficient information on Arctic ecosystems requires a precautionary approach to the selection of alternatives and analysis of impacts.

(1) Lack of Western science

One of the principal challenges confronting Arctic managers and decision-makers is the lack of sufficient scientific information on the composition, structure, and functioning of dynamic Arctic marine ecosystems. Baseline scientific information for Arctic waters is inadequate and often outdated. Moreover, there is insufficient information on potential impacts—including the impact of noise on marine mammals—and inadequate monitoring of ongoing effects.

Under NEPA regulations, the proposed EIS must identify missing information, determine which missing information is relevant to potential impacts and essential to a reasoned choice among alternatives, and obtain that information, unless doing so is exorbitantly costly or the means unknown. 40 C.F.R. § 1502.22. The MMPA requires NMFS to take a precautionary approach, giving the benefit of the doubt to the protected species. This is even more important in light of the many unknowns about the Chukchi and Beaufort seas and the ways in which industrial activities will affect species there.

There is a lack of baseline information on many Arctic species, and the physical, chemical, and biological processes that help drive the composition of the food web, energy flow, and spatial variability are not well understood. For example, there are no reliable estimates of the stocks of ringed seals, spotted seals, ribbon seals, Pacific walrus, and minke whales. There is inadequate information on the feeding, resting, and migration habitats of these species, as well. Scientists know relatively little about the fall migration of bowhead whales in the Chukchi Sea, or about the whales' feeding activities during that time. Basic data are still needed for other species, including gray whales, beluga whales, and harbor porpoises. There is insufficient information about the biology and distribution of important prey, such as squid or benthic invertebrates for walrus and gray whales. The existence of significant kelp beds other than in the Boulder Patch is likely, but their locations are unknown. And scientists know relatively little about the abundance, distribution, migration, and role of fish and other marine species in Chukchi and Beaufort ecosystems. Especially critical is the lack of information on forage fishes, such as Arctic cod. Other significant information gaps exist, as well. See, e.g., Compendium of Lease Sale 193 FEIS Unknowns (describing data gaps in the Final Environmental Impact Statement associated with MMS lease sale 193 in the Chukchi Sea).

Even when scientific information is available on Arctic species, it is often outdated or limited only to ice-free seasons. This is important in light of the rapid pace of climate change in the Arctic. Sea ice cover and water temperature play critical roles in Arctic marine ecology, but those factors have changed dramatically in the last fifteen years and are continuing to change at a startling pace. In this context, older information is of limited value when attempting to describe current conditions. As noted above, the environmental baseline in the Arctic is shifting as climate change and ocean acidification affect the region.

In addition to the lack of up-to-date baseline information, much is unknown about impacts of proposed activities on species. For example, scientists do not have a solid understanding of the potential effects of sound on marine mammals, especially long-term sublethal effects, or the effects of exposure to increasing levels of noise year after year. The need for more information regarding the effects of sound—and appropriate mitigation measures—was emphasized in a report issued by an interagency task force led by a representative from NMFS’s parent agency, NOAA:

There is considerable scientific uncertainty regarding the nature and magnitude of the actual impacts of anthropogenic sound on the marine environment, as well as the most appropriate and effective mitigation measures where effects have been demonstrated or are likely.

Joint Subcommittee on Ocean Science & Technology, “Addressing the Effects of Human-Generated Sound on Marine Life: An Integrated Research Plan for U.S. Federal Agencies,” at 1 (Jan. 2009) (“JSOST”).

NMFS itself has observed that the “continued lack of basic audiometric data for key marine mammal species” that occur throughout the Chukchi Sea inhibits the “ability to determine the nature and biological significance of exposure to various levels of both continuous and impulsive oil and gas activity sounds.” NMFS Comments on MMS Draft EIS for Chukchi Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea, at 2 (Jan. 30, 2007). NMFS explained that the lack of information on the impacts of noise would make it “very difficult to permit and conduct seismic surveys in a manner that has no more than a negligible impact to the stock and minimizes disturbance and harassment to the extent practicable.” *Id.*

(2) Incorporate local and traditional knowledge

As discussed above, Western scientists have much to learn about the fish, wildlife, and ecosystems of the Beaufort and Chukchi seas. At the same time, Arctic peoples have a wealth of local and traditional knowledge about their environment. The proposed EIS should make every effort to include and incorporate that local and traditional knowledge in its analyses.

As noted above, many people who live on Alaska’s Arctic coast rely on the ocean for food and other resources. Their experience and their traditional way of life—passed

down through uncounted generations—has given them great knowledge of their environment and the species with which they share it. Beginning as early as possible in the process, NMFS should work with local communities to formulate a plan to gather, document, and use this information in the proposed EIS. At the scoping meeting for the proposed EIS held in Anchorage on March 23, we were encouraged to hear NMFS pledge to do work closely with local communities, and we look forward to seeing the agency carry out its pledge as it develops the EIS.

(3) Use a precautionary approach

To be meaningful, NMFS must obtain and incorporate local and traditional knowledge before it commits to management decisions that may adversely affect subsistence resources. As discussed above, Arctic peoples' ocean-based subsistence activities are central to their culture and sense of identity. In this context—where a management misstep could have cascading effects that jeopardize subsistence and cultural traditions—extra caution is warranted. NMFS's proposed EIS should adopt a precautionary approach to ensure that adverse impacts to subsistence resources are minimized and mitigated.

The MMPA also requires a precautionary approach. NMFS has an affirmative obligation to find that impacts are no more than “negligible” and are limited to the harassment of only “small numbers” of marine mammals. In making these determinations, NMFS must give the benefit of the doubt to the species. The MMPA was “deliberately designed to permit takings of marine mammals only when it was known that that taking would not be to the disadvantage of the species.”

In the teeth of . . . lack of knowledge of specific causes, and of the certain knowledge that these [marine mammals] are almost all threatened in some way, it seems elementary common sense to the Committee that legislation should be adopted to require that we act conservatively—that no steps should be taken regarding these animals that might prove to be adverse or even irreversible in their effects until more is known. As far as could be done, we have endeavored to build such a conservative bias into the legislation here presented.

Comm. for Humane Legislation, Inc. v. Richardson, 540 F.2d 1141, 1150 (D.C. Cir. 1976) (quoting legislative history of the MMPA, H.R. Rep. No. 92-707).

B. The proposed EIS must provide a rigorous analysis of cumulative effects.

The expansion of industrial activity in the Arctic will serve only to multiply the pressures on Arctic ecosystems that result from climate change and ocean acidification. Individually, industrial activities may add substantial stress to Arctic ecosystems, but many of these activities are likely to be concurrent, and may have synergistic effects on the health of the ecosystem and opportunities for the subsistence way of life. For this reason, it is critical that the proposed EIS contain a rigorous cumulative effects analysis.

Federal agencies must consider cumulative impacts in their NEPA analyses. 40 C.F.R. § 1508.25(c)(3). A “[c]umulative impact’ is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” *Id.* § 1508.7.

In the Arctic, the oil and gas industry often pursues multiple activities at the same time in the same sea. For example, this summer, various companies intend to conduct exploration drilling, a shallow hazard survey, an ice gouge survey, a 2D seismic survey, and production activities in the Beaufort Sea. *See, e.g.*, NOAA Map. The proposed EIS must explore the cumulative impacts of multiple activities that happen in the same general area at the same general time. The oil and gas industry also pursues concurrent activities in different regions of the ocean. For example, in addition to the Beaufort Sea activities mentioned above, industry also plans to conduct exploration drilling, a 3D seismic survey, and a 2D seismic survey in the Chukchi Sea this coming summer. *Id.* Seismic activity in the Canadian Beaufort Sea is also possible.

Airgun pulses from seismic surveys can be detected hundreds of kilometers from the sound source. *See, e.g.*, LGL, Monitoring of Industrial Sounds, Seals, and Bowhead Whales Near BP’s Northstar Oil Development, Alaskan Beaufort Sea, 2009: Annual Summary Report (Mar. 15, 2010) at 3-30 (noting detection of airgun pulses when nearest seismic activity at the time was “far to the north” or “far to the east,” “hundreds of km” away from the acoustic monitors). And airgun pulses are frequent, adding noise to the ocean around the clock: during a study period between August 27, 2008 and September 24, 2008, acoustic monitors in the Beaufort Sea detected airgun pulses in 72% of all ten-minute periods. *Id.* Airgun noise was so pervasive and disruptive during the 2008 season that researchers at the Northstar oil production island noted that airgun noise “constitute[d] a strong confounding factor in achieving [their] objective of assessing the effects of Northstar sounds on bowhead whale behavior.” LGL, Monitoring of Industrial Sounds, Seals, and Bowhead Whales Near BP’s Northstar Oil Development, Alaskan Beaufort Sea, 2008: Annual Summary Report (Mar. 2009) at 3-35. As pointed out at the 2010 Open Water Meeting in Anchorage, bowhead whales may encounter effects from seismic operations in multiple areas during one migration season.

Seismic work represents just one type of oil and gas activity that occurs in the Arctic Ocean. The proposed EIS must explore the cumulative impacts of multiple types of activities—including multiple, concurrent seismic surveys, exploration drilling, shallow hazard surveys, icebreaking, and other activities—that happen in adjoining regions of the ocean at the same general time. The proposed EIS must also consider the cumulative impact of multiple oil and gas activities occurring in the Arctic over a period of years.

The Arctic is also subject to numerous current and projected uses other than oil and gas activities, including shipping, fisheries, navigation, military activities, deepwater ports, and a variety of energy projects. The proposed EIS must consider the cumulative impact of these activities in conjunction with oil and gas activities. Moreover, because some species do not stay in Arctic waters year-round, the EIS must analyze impacts of oil and gas activities in Arctic waters when combined with impacts to species that result from activities outside the Chukchi and Beaufort seas. For example, when analyzing cumulative impacts to walruses, the EIS should consider not only the impacts from oil and gas activities in the Chukchi Sea, but the potential impacts of bottom trawling in the Bering Sea, as well.

As discussed above, the cumulative effects analysis in the proposed EIS must consider the impacts of oil and gas activities and other industrial activities in the context of rapid climate change and increasing ocean acidification. The EIS cannot ignore, exclude, or downplay these fundamental changes; they must be incorporated into the analysis to describe accurately the impacts that Arctic species face.

Preparing an adequate discussion of cumulative effects will require significant analysis. It is not enough for the proposed EIS to merely list the various current and projected uses of the Arctic Ocean. Instead, the proposed EIS must describe and analyze how impacts from oil and gas activities will interact with other foreseeable activities over space and time, against a baseline of rapid and ongoing climate change and increasing ocean acidification.

C. NMFS should be sensitive to local communities and the proposed EIS must address issues of environmental justice.

Federal agencies must “make achieving environmental justice part of ... [their] mission[s].” Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.” Agencies must work to ensure effective public participation and access to information, and must “ensure that public documents, notices, and hearings relating to human health or the environment are concise, understandable, and readily accessible to the public.”

In the memorandum to heads of departments and agencies that accompanied Executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns: “[e]ach Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by [NEPA].” The memorandum emphasizes the importance of NEPA’s public participation process, directing that “each Federal agency shall provide opportunities for community input in the NEPA process.” Agencies are further directed to “identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial documents, and notices.”

Environmental justice concerns have been a serious issue during prior NEPA processes in the Arctic, including in the process associated with the withdrawn 2007 DPEIS. For example, public review and comment periods have sometimes occurred during critical whaling and other subsistence activity seasons when many of the key individuals in the communities were likely unavailable. Additionally, proposed actions have occurred simultaneously or in such rapid succession that Native communities were limited in their capacity to participate, much less produce thoughtful and meaningful reviews, which the agencies ask for and expect. The pressure to review, comment on, and ultimately live with the rapid pace of industrial activities creates stress and other adverse impacts to individuals living in Arctic communities. See, e.g., National Research Council, *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope* 139 (2003) (noting Alaska Natives in North Slope communities “are faced with the need to attend industry-related meetings and hearing, and review documents, because they believe that decisions will be made that can significantly affect their daily lives and those of generations to come.”). As NMFS prepares the new EIS, it should be cognizant that multiple, overlapping, fast-tracked planning processes have serious impacts on the communities of the Arctic.

To avoid the mistakes of the past and mitigate stress on community members, NMFS must work with communities, ensure appropriate opportunities for input, and be aware of processes that its sister agencies may be undertaking at the same time. NMFS must communicate with tribal governments and local officials to determine the optimal time to hold meetings or public hearings in order to gain maximum participation and meaningful review. Often the tribal and local government offices in these small communities are overburdened and overwhelmed by the amount of information requested from them by the various agencies involved in oil and gas projects as well as various mining and transportation projects. Dialogue with tribal and local governments about the importance of the proposed EIS and expectations regarding participation by the affected communities is imperative. For this to be meaningful, it must be more than just another letter sent to the local government offices.

In addition to concerns about the NEPA process, members of Arctic communities are worried about the potential human health impacts from proposed oil and gas exploration, development, and production activities. These concerns include air quality issues and subsequent increases in respiratory problems, as well as contamination of subsistence resources through water and air pollution. NMFS is obligated by Executive Order 12898—and subsequent guidance from CEQ and NOAA—to study possible human health impacts, including impacts on wildlife that would affect subsistence users.

D. NMFS should ensure that its EIS is integrated with ongoing executive branch planning efforts in the Arctic

Last year, President Obama created the Interagency Ocean Policy Task Force (Task Force) charged with developing a national ocean policy and a framework for effective coastal and marine spatial planning. NOAA has been an important member of the Task Force; it recognizes the importance of the administration's National Policy for

the Oceans, Our Coasts, and the Great Lakes, and has committed itself to the comprehensive management of our oceans and adequate coastal and marine spatial planning.

The Task Force's interim report on National Ocean Policy recognized changing conditions in the Arctic as a priority objective, and recommended creating a strategic action plan for the Arctic within six to twelve months of the creation of a National Ocean Council (NOC). CEQ, Interim Report of the Interagency Ocean Policy Task Force (Sept. 10, 2009). The Task Force's interim framework on coastal and marine spatial planning recommends the creation of an Alaska regional planning body to develop and implement coastal and marine spatial planning in the state, including in the Arctic. CEQ, Interim Framework for Effective Coastal and Marine Spatial Planning (Dec. 9, 2009). The development of a strategic action plan for the Arctic may begin within weeks or months, and the beginning of coastal and marine spatial planning in the Arctic may not be much further behind.

As NMFS develops alternatives for its proposed EIS, it should coordinate its efforts with the future NOC. The Task Force highlighted the importance of creating a broad management plan for the Arctic, and the alternatives contained in the proposed EIS should align with that goal. As the NOC develops a strategic action plan for the Arctic, NMFS should incorporate relevant elements of that plan into its proposed EIS. This may require NMFS to focus on broader research and planning efforts that will provide an expanded environmental baseline for future activities in the region. NMFS should also ensure that the alternatives in the proposed EIS are compatible with efforts to develop and implement coastal and marine spatial planning in the Arctic.

E. The proposed EIS cannot substitute for site-specific NEPA analysis

NMFS has described the proposed EIS as a broad analysis of the impacts of oil and gas activities including seismic surveys and exploration drilling. NMFS should make clear that such a programmatic EIS is not a substitute for site-specific NEPA analyses that must be performed in conjunction with the approval of individual projects and activities. A programmatic EIS, such as the EIS proposed by NMFS, cannot provide the detailed information required to ensure that specific projects will avoid serious environmental harms. For example, it may be necessary to identify with specificity the locations of sensitive habitats that may be affected by individual projects in order to develop and implement appropriate site- and project-specific mitigation measures. This will require the preparation of site-specific NEPA analysis—possibly EISs—for future exploration and/or seismic activities.

F. NMFS should not issue IHA permits for new activities until it has completed the proposed EIS

In announcing its intent to prepare a new EIS to analyze the impacts of oil and gas activities in the Arctic, including both seismic surveys and exploration drilling, NMFS reaffirmed its previous determination that a programmatic EIS process is necessary to

address the overall, cumulative impacts of increased oil and gas activity in the Arctic Ocean. 75 Fed. Reg. at 6175. It also announced its intent to incorporate into that analysis new scientific information and new information about projected seismic and exploratory drilling activity in both the Beaufort and Chukchi seas. *Id.*

At the same time, oil and gas operators have applied or will soon apply for IHAs for seismic and exploration drilling activities this coming summer, before NMFS can complete its proposed EIS. For example, Shell has applied for IHAs associated with exploration drilling in the Beaufort and Chukchi seas, and Statoil, ION, and TGS have applied for authorization to conduct 3D and 2D seismic surveys in Arctic waters. See, e.g., NOAA Map.

As discussed below, see *infra* Sections IV and V, any one of these activities, standing alone, may cause significant impacts to bowhead whales and other marine mammals in Arctic waters. But NMFS cannot consider Shell's proposed operations in isolation. As NMFS has acknowledged, there is potential for significant cumulative effects to marine mammals from multiple seismic and exploratory drilling operations in the Arctic Ocean. As a result, NMFS must complete a full cumulative impacts assessment before authorizing the drilling or seismic projects proposed for this summer and beyond.

This approach is consistent with the mandate of NEPA. NEPA “emphasizes the importance of coherent and comprehensive up-front environmental analysis to ensure informed decision making” so that “the agency will not act on incomplete information, only to regret its decision after it is too late to correct.” *Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1216 (9th Cir. 1998) (quoting *Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 371 (1989)). Conducting an upfront, “coherent and comprehensive” analysis of the environmental impacts of expanded seismic and drilling activities in the Alaskan Arctic Ocean will enable NMFS and MMS to make informed decisions and provide adequate protection for the affected resources.

Moreover, NEPA regulations make clear that NMFS should not proceed with authorizations for individual projects—like exploration drilling or seismic proposals—until its programmatic EIS is complete. Agencies are explicitly prohibited from undertaking any major action covered by a programmatic EIS that is underway:

While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment

40 C.F.R. § 1506.1(c) (The omitted part of the regulation provides an exception to this prohibition that does not apply to future seismic and exploration drilling proposals because EISs have not been prepared for them).

NMFS and MMS have made it clear that the proposed EIS is necessary for an adequate evaluation of the environmental impacts of approving currently proposed and reasonably foreseeable oil and gas exploration activity in the Beaufort and Chukchi seas. Work on such an EIS has been in progress since 2006, when NMFS and MMS first proposed the 2007 DPEIS. The withdrawal of the 2007 DPEIS and initiation of a new EIS process merely reflects a decision to expand the scope of the EIS process to reflect the “renewed interest in exploratory drilling” along with other relevant new information. 74 Fed. Reg. at 55,539.

In light of this ongoing EIS process, it would be unlawful for NMFS to authorize new exploration drilling or seismic activity in the Beaufort or Chukchi seas before it completes the proposed EIS. Only by evaluating as a whole the cumulative, long-term impacts associated with expanding levels of seismic exploration and exploratory drilling can the full and potentially synergistic effects of the various individual projects be understood and adequately protective mitigation measures be put in place. If the agencies issue individual authorizations before the required comprehensive analysis is complete, future options for protecting vulnerable resources may be compromised. NMFS should postpone consideration of IHA applications for proposed exploration drilling or seismic work in the Beaufort and Chukchi OCS pending completion of the proposed EIS.

IV. The proposed EIS should discuss the impacts of noise generated by seismic surveys, exploration drilling, production, icebreaking, vessel traffic, and other activities associated with oil and gas operations.

Activities associated with oil and gas exploration and development—including seismic exploration, exploration drilling, production activities, use of icebreakers, and other vessel traffic—can generate loud noises that may cause a variety of potentially significant impacts on marine resources in the Beaufort and Chukchi seas. Under water, sound travels quickly and with less attenuation than in air. Certain species of marine animals can detect high intensity, low-frequency sounds up to tens or hundreds of kilometers from the sound source. As a result, even a few sound sources may affect a large fraction of a population.

High levels of noise can cause temporary or permanent hearing damage to marine mammals. Even at lower levels, noise can cause long-term impacts to marine mammals. NMFS and MMS have acknowledged that exposure to noise over extended durations may cause behavioral changes that adversely affect the health and reproductive fitness of certain Arctic marine mammal populations, even when the noise causes no immediate physiological injury:

There are indications that repeated short-term avoidance tactics can lead to long-term impacts at the population level, either through displacement from important habitats, which can reduce the fitness of targeted populations, or via physiological constraints at the individual level, which may lead to decreased reproductive output. For a food-limited population,

energetics may provide the causal link between demonstrable short-term behavioral responses and difficult-to-detect population level impacts.

2007 DPEIS at III-152 (internal citations omitted). This risk is of particular concern for species like the bowhead whale, which may be excluded from large areas as it “deflects” away from sound sources due to its acute sensitivity to noise.

The MMPA defines harassment to include “any act of pursuit, torment or annoyance” that “has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.” 16 U.S.C. § 1362(18)(A)(ii). As a result, an activity that generates noise that has the potential to cause a marine mammal to deflect from its usual course constitutes harassment for purposes of the MMPA.

A. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that affects endangered bowhead whales.

Bowhead whales use both the Beaufort and Chukchi seas during their annual migrations. Important in their own right, bowhead whales are also an important subsistence and cultural resource in several North Slope communities.

NMFS has acknowledged that “[o]il and gas exploration could result in considerable increase in noise and disturbance in the spring, summer, and autumn range of the Western Arctic bowhead whales This noise may result from various activities, including seismic, vessel traffic and icebreaker operation, drilling, and construction, and support activities.” NMFS, Biological Opinion for Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska at 86 (Jul. 2008) (BiOp for Leasing and Exploration).

Substantial evidence suggests that migrating bowhead whales deflect at significant distances from a sound source to avoid active seismic vessels. For example, monitoring of the 1996 through 1998 seismic surveys associated with BP’s Northstar unit indicates that bowhead whales may begin to deflect around a seismic source at a distance of approximately 35 km, and may stay offshore for “50 km or more” to the west of a seismic source. See Richardson, *et al.*, “Marine Mammal and Acoustical Monitoring of Western Geophysical’s Open-Water Seismic Program in the Alaskan Beaufort Sea,” September 1998, Section 5.3.5 at 5-60.

In addition, Alaska Eskimo Whaling Commission whaling captains report that bowhead whales begin to show disturbed or “skittish” behavior well before they begin to deflect. This behavior indicates that noise from active seismic operations may cause behavioral disruptions well before bowhead whales begin to deflect. Depending on the nature of the seismic activity and the level of ambient noise at a given time, the distance at which bowhead whales could experience harassment could be far—many

kilometers— from the seismic sound source. Evidence presented at the 2010 Open Water Meeting in Anchorage also suggests that noise from seismic operations may cause bowhead whales to reduce their calls or stop calling altogether. NMFS must consider the potential effects of this behavioral modification, as well.

NMFS must also consider bowhead whales' sensitivity to sound when analyzing impacts from oil and gas operations other than seismic surveys. Vessels, particularly icebreaking vessels, can emit loud noises that may affect whales. Similarly, exploration drilling and production rigs generate noise that may impact bowhead whales. The proposed EIS should consider potential effects on bowhead whales from all these sources of sound, both individually and cumulatively. The cumulative impact analysis should consider impacts from concurrent operations in the same region, from noise generated by operations taking place over the course of a season, from noise generated by operations taking place across different regions of the sea (including the Canadian Beaufort), and from long-term exposure to industrial noise.

B. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that affects gray whales.

Gray whales rely on the northern Bering Strait and Chukchi Sea as primary feeding grounds. MMS, Oil and Gas Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea, at IV- 149 (May 2007) (LS 193 FEIS) at III-79. In the Chukchi, they typically favor coastal areas and offshore shoals and have increasingly been found around Hanna Shoal, as MMS recognized in its response to comments submitted on the draft EIS for lease sale 193. Gray whale numbers have declined since NMFS delisted the Eastern North Pacific stock in 1994, and there is speculation that the population is responding to environmental limitations. *Id.*

Like bowhead whales, gray whales have been shown to abandon habitat in response to anthropogenic noise. National Research Council, Marine Populations and Ocean Noise, at 14 (2005) (NRC Ocean Noise). For example, scientists have documented dramatically reduced numbers of Western gray whales feeding in their primary (nearshore) feeding area adjacent to Piltun Bay, Sakhalin Island, Russia following increased oil and gas activity in the area. See International Union for Conservation of Nature, Report of the Western Gray Whale Advisory Panel at its Sixth Meeting, 21-24 April, 2009. In response, Sakhalin Energy (operated largely by Royal Dutch/Shell) agreed to cancel planned seismic activities in the area last year. When evaluating the impacts of noise from potential oil and gas operations, NMFS should consider the proximity of those operations to potential Eastern North Pacific gray whale feeding areas, such as Hanna Shoal.

C. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that affects beluga whales.

Beluga whales inhabit Arctic waters, including the Chukchi Sea. In June and July, belugas use nearshore areas of the Chukchi Sea to feed, calve, and molt. They

also are associated with offshore pack ice in the Chukchi Sea in the summer. Belugas are targeted by subsistence hunters in certain Arctic communities, including Point Lay and Wainwright, and are an important subsistence resource in those communities.

Belugas are known to be sensitive to noise from human activities. See Statement of Dr. David Bain at 4-5, 10-11 & 13 (“Bain statement”); LS 193 FEIS at IV-149 (noting sensitivity of toothed whales to high-frequency sounds). See *also* Natural Resources Defense Council, *Sounding the Depths II: The Rising Toll of Sonar, Shipping, and Industrial Ocean Noise on Marine Life*, at 38 (Nov. 2005) (“Sounding the Depths”) (noting that belugas in the Arctic have responded “dramatically” to ships and icebreakers); *Small Takes of Marine Mammals Incidental to Specified Activities; Open-water Marine Survey Program in the Chukchi Sea, Alaska, During 2009–2010*, 74 Fed. Reg. 26,217, 26,226 (June 1, 2009) (noting data suggesting that “some belugas might be avoiding the seismic operations at distances of 10–20 km.”).

The Alaska Beluga Whale Committee reports that hunters in Kotzebue Sound have observed belugas avoid areas of high boat traffic, areas impacted by noise from shore, and areas affected by aircraft overflights. Alaska Beluga Whale Committee, *Comments on 2007 DPEIS* (May 5, 2007). Aerial surveys conducted during seismic surveys have reported “much lower sighting rates for belugas near seismic vessels.” *Id.* Belugas may react to noise from icebreaking vessels at distances up to forty miles. *Id.* Such disturbance may be particularly disruptive in June and July, when belugas are feeding, calving, and molting in nearshore areas in the Chukchi Sea. *Id.*

The proposed EIS should discuss the importance of beluga whales, including their importance as a subsistence resource in certain Chukchi Sea communities. The EIS should also explore rigorously the potential impact on beluga whales from noise caused by oil and gas activities, including seismic operations. As noted above with respect to bowhead whales, the proposed EIS should analyze thoroughly the potential cumulative impacts to beluga whales including impacts from noise caused by concurrent operations, impacts from noise generated by operations taking place over the course of a season, and impacts from long-term exposure to industrial noise.

D. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that affects endangered North Pacific right whales.

With a population perhaps as low as 100 individuals, the endangered North Pacific right whale is among the most imperiled species of whale in the world. The Chukchi Sea provides potential habitat for these whales. According to NMFS, “the North Pacific right whale (*E. japonica*), historically rang[ed] in the North Pacific Ocean from latitudes 70° N to 20° N.” *Endangered Status for North Pacific and North Atlantic Right Whales*, 73 Fed. Reg. 12,024, 12,026 (Mar. 6, 2008); see *also* Hideo Omura *et al.*, *Black Right Whales in the North Pacific*, 13 SCI. REP. WHALES RES. INST. 1, 44 (1969). Moreover, Arctic Natives have reported seeing right whales in the Chukchi Sea. See 2007 DPEIS, Point Hope Transcript. Changes to the global climate may make

Chukchi Sea habitat even more important to right whales in coming years. As a result, the proposed EIS should analyze potential impacts of oil and gas activities—including impacts from noise generated by seismic surveys, exploration drilling, and increased vessel traffic—on North Pacific right whales.

E. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that affects other marine mammals, including harbor porpoises, ice-seals, walruses, and polar bears.

Noise from oil and gas operations may affect other marine mammal species, including harbor porpoises, ice seals, walruses, and polar bears. The proposed EIS must analyze impacts to these species. The analysis should consider that many of these species are already stressed, and in the future will be increasingly stressed, by climate changes including loss of summer sea ice.

Harbor porpoises are perhaps the most abundant cetacean in the Chukchi Sea, and are particularly responsive to sound. LS 193 FEIS at IV- 149 (noting sensitivity of toothed whales to high-frequency sounds); *see also* NRDC, *Sounding the Depths*, at 5-6 & 30 (noting that harbor porpoise are “notoriously sensitive” to sound and will flee tens of miles to escape, endangering themselves in the process). For example, exhaustion due to rapid flight from noise many have triggered mortality among harbor porpoises following sonar exercises in Juan de Fuca and Haro Straits in 2003. *See* Bain statement at 3. Behavioral changes, including exclusion from an area, can occur at received levels from 90-110 dB or lower, and in some cases, porpoises avoid sound sources of roughly 130 dB at distances up to 1000 meters.² *Id.* at 5, 10-11. Observers have witnessed harbor porpoises moving away from a large seismic array “at a distance of over 60 km.” *Id.* at 11. Such observations indicate that noise from oil and gas activities could displace porpoises tens of kilometers and disrupt their feeding behavior. *Id.* at 13.

This sensitivity of harbor porpoises to noise may be compounded by the over-inclusive division of the harbor porpoise population. Pursuant to general conventions, the Chukchi Sea harbor porpoises belong to the so-called “Bering Sea stock,” with an estimated population of more than 60,000 animals. However, biological data supporting the concept of a “Bering Sea stock” is insufficient, and the concept of the stock is based on “arbitrarily set geographic boundaries.” LS 193 FEIS at III-78 to III-79. Recent harbor porpoise stock assessments completed elsewhere have identified multiple small stocks of harbor porpoise—numbering in the 1000s—within what formerly was considered a single large stock. *See* Bain statement at 10–11. NMFS must use the “best available scientific evidence” in its determination of negligible impacts. 50 C.F.R. § 216.104(c); *id.* § 216.102(a). Accordingly, the proposed EIS should not use an over-inclusive, arbitrary definition of the harbor porpoise stock when assessing whether potential harassment affects small numbers and leads to no more than a negligible impact to the stock. NMFS is not required to develop a definitive stock assessment, but

² Unless otherwise stated, sound measurements are given as RMS (root mean square) sound pressure levels, *i.e.*, dB re μ Pa (rms).

it cannot rely on admittedly inaccurate information in order to comply with its MMPA obligations. *Cf. Center for Biological Diversity v. Lohn*, 296 F. Supp. 2d 1223, 1238 (W.D. Wash. 2003), *vacated as moot*, 511 F.3d 960 (9th Cir. 2007) (remanding NMFS's decision not to list Southern Resident orca whales under the ESA when NMFS relied on an outdated definition of the orca taxon despite its own scientists' agreement that the classification is inaccurate).

Ice seals, too, are vulnerable to noise from oil and gas operations. Data from observers indicate that “seals were detected less frequently near active seismic sound sources, and that during those same periods, were observed more frequently a short distance away, suggesting a localized avoidance of the seismic sound sources.” Savarese *et al.*, “Localized Avoidance of Seismic Sounds by Arctic Seals,” 27 Book of Abstracts, Alaska Marine Science Symposium, Anchorage, Alaska (Jan. 2010). MMS has acknowledged that seals may be affected by seismic surveys, noting that ice seals are likely “more susceptible to masking of biologically significant signals by low frequency sounds, such as from seismic surveys,” and that such masking—even for brief intervals—might have “long-term consequences for individuals or populations of marine mammals” exposed to multiple simultaneous surveys. MMS, Beaufort Sea and Chukchi Sea Planning Areas, Oil and Gas Lease Sales 209, 212, 217, and 221, Draft Environmental Impact Statement (Nov. 2008) (Multisale DEIS), at 4-185-86. NMFS' analysis should consider that mitigation measures that rely on visual monitoring of safety zones may not be effective for seals, because seals are more difficult to detect than some other marine mammals. NMFS must also consider impacts to seals in the context of climate change and shrinking summer sea ice.

The proposed EIS must also evaluate carefully the potential impacts of noise on walrus. The dynamic movements of pack ice may transport walrus within range of drilling operations, and “walrus in the vicinity of drilling operations could be subjected to prolonged or repeated disturbances.” U.S. Fish and Wildlife Service (FWS), Environmental Assessment, Final Rule to Authorize the Incidental Take of Small Numbers of Pacific Walrus (*Odobenus rosmarus divergens*) and Polar Bears (*Ursus maritimus*) During Oil and Gas Industry Exploration Activities in the Chukchi Sea at 25 (March 2008). The most likely response to these disturbances would be for walrus “to abandon the area,” which could disrupt feeding or other biological processes. *Id.* MMS has noted that “walrus commonly react to sounds from moving vessels,” and that walrus near moving ice breakers exhibited avoidance behavior. MMS, Environmental Assessment, Shell 2010 Exploration Plan for Prospects in the Chukchi Sea Outer Continental Shelf (Dec. 2009) (EA for Chukchi EP), at 72. “During ice-breaking activities, walrus moved 12.4 to 15.5 mi (20 to 25 km) from the operations where sound energy levels were 11%-19% above ambient sound level.” *Id.* MMS has also recognized that walrus are already facing significant stress from the impacts of climate change and changing sea ice distribution, and that disturbance caused by industrial activities in walrus habitat, even at a considerable distance, would further stress walrus, especially vulnerable females with calves. *See id.*; *see also* LS 193 FEIS at IV-147-148, IV-153.

The proposed EIS must also analyze impacts to polar bears from noise associated with oil and gas activities. Evidence indicates that “female polar bears entering dens, or females in dens with cubs, are more sensitive than other age and sex groups to noises.” FWS, Programmatic Biological Opinion for Polar Bears (*Ursus maritimus*) on Beaufort Sea Incidental Take Regulations 34 (June 23, 2008) (Programmatic BiOp for Polar Bears). Mothers and their cubs may abandon their dens if exposed to industrial noise and human disturbance. *Id.* at 35. “Polar bears are known to run from sources of noise and the sight of vessels or icebreakers and aircraft, especially helicopters . . . [and] on a warm spring or summer day, a short run may be enough to overheat a well insulated polar bear.” *Id.* at 36. MMS has observed that air and vessel traffic associated with oil and gas activities may elicit a flight response. EA for Chukchi EP at 45. When polar bears encounter vessels, they may exhibit such avoidance behavior—or they may move toward the sound source. *Id.* In either case, noise from the vessels may cause disturbance. As with ice seals and walruses, NMFS must consider these potential impacts in light of a warming climate and disappearing seasonal sea ice.

F. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that will affect fish in the Arctic Ocean.

Fish may be affected by loud noises, such as noise from seismic airguns. Fish use sound in many of the ways that marine mammals do: to communicate, defend territory, avoid predators, and, in some cases, locate prey. See, e.g., A.N. Popper, Effects of Anthropogenic Sounds on Fishes, 28(10) Fisheries 26-27 (2003); M.C. Hastings & A.N. Popper, Effects of Sound on Fish 19 (2005) (Report to the California Department of Transportation, Contract No. 43A0139); D.A. Croll, Marine Vertebrates and Low Frequency Sound—Technical Report for LFA EIS 1-90 (1999)).

One series of recent studies showed that fish sustained extensive damage to the hair cells located at the sensory epithelia of the inner ear after they were exposed to impulsive air gun noise. McCauley *et al.*, High Intensity Anthropogenic Sound Damages Fish Ears, J. Acoust. Soc. Am. 113 (Jan. 2003). The damage, described as “blebbing” and “blistering” on the surface of the epithelia, “suggest[s] that hair cells had been ‘ripped’ from the epithelia (immediate mechanical damage) or, alternatively, had ‘exploded’ after exposure (physiological damage).” *Id.* at 640. This is significant because the inner ear of the species examined—pink snapper—“is typical” of a number of important fish species found in the Beaufort and Chukchi seas, including salmon, cod, and haddock. *Id.* at 641.

Unlike mammals, fish are thought to regenerate hair cells. However, the pink snapper in the aforementioned studies did not appear to recover within approximately two months after exposure, leading researchers to conclude that the damage was permanent. *Id.* Research has also shown that noise can induce temporary hearing loss in fish. Even at fairly moderate levels, for example, noise from outboard motor engines is capable of temporarily deafening some species of fish, and other sounds have been

shown to affect the short-term hearing of a number of other species, including sunfish and tilapia. A.R. Scholik and H.Y. Yan, Effects of Boat Engine Noise on the Auditory Sensitivity of the Fathead Minnow, *Pimephales promelas*, 63 *Environmental Biology of Fishes* 203-09 (2002); A.R. Scholik and H.Y. Yan, The Effects of Noise on the Auditory Sensitivity of the Bluegill Sunfish, *Lepomis macrochirus*, 133 *Comparative Biochemistry and Physiology Part A* at 43-52 (2002); M.E. Smith *et al.*, Noise-Induced Stress Response and Hearing Loss in Goldfish (*Carassius auratus*), 207 *Journal of Experimental Biology* 427-35 (2003); Popper, *Effects of Anthropogenic Sounds* at 28.

Researchers have consistently acknowledged that even a short-term loss in hearing can diminish substantially a fish's chance of survival: "[f]ishes with impaired hearing would have reduced fitness, potentially leaving them vulnerable to predators, possibly unable to locate prey, sense their acoustic environment, or, in the case of vocal fishes, unable to communicate acoustically." McCauley *et al.*, *High Intensity Anthropogenic Sound Damages*, at 641; see *also* Popper, *Effects of Anthropogenic Sounds* at 29.

Hearing loss is not the only effect that ocean noise can have on fish. Multiple studies have noted that fish exhibit "alarm" behavior in response to airguns and other forms of anthropogenic noise. For years, fishermen in various parts of the world have complained about declines in their catch after intense acoustic activities moved into the area, suggesting that noise alters the behavior of some commercial species. A group of Norwegian scientists working in a Barents Sea fishery found that catch rates of haddock and cod (the latter known for its particular sensitivity to low-frequency sound) plummeted in the vicinity of an airgun survey covering 1600 square miles. In another experiment, catch rates of rockfish were similarly shown to decline. Drops in catch rates in these experiments range from 40 to 80 percent.

The potential for seismic operations to cause significant behavioral changes in fish and fish stocks is particularly acute when there are multiple sound sources. In such cases, "concurrent [seismic] surveys may facilitate the stranding of some schooling or aggregated arctic fishes onto coastal or insular beaches." 2007 DPEIS at III-50. Equally troubling are the high mortalities from noise exposure seen in developmental stages of fish. A number of studies, including one on non-impulsive noise, show that intense sound can kill eggs, larvae, and fry—or retard their growth in ways that may hinder their survival later. Increased mortality for fish eggs has been shown to occur at distances of 5 meters from an airgun source; mortality rates approaching 50 percent affected yolk sac larvae at distances of 2 to 3 meters. Larvae in at least some species are known to use sound in selecting and orienting toward settlement sites. Acoustic disruption at that stage of development could have significant consequences on affected species.

The proposed EIS should evaluate carefully the potential impacts of noise from seismic operations on fish in the Arctic Ocean.

G. The proposed EIS should analyze thoroughly the potential for oil and gas operations to generate noise that will affect invertebrates in the Arctic Ocean.

Animals other than mammals and fish may be affected by noise associated with oil and gas activities. Many species of invertebrates possess mechanosensors that bear resemblance to vertebrate ears, making it “important to examine the effect of anthropogenic sounds on a wider range of marine fauna.” Popper, *Effects of Anthropogenic Sounds*, at 30.

Scientists have recorded two strandings of multiple giant squid on the Spanish coast, in both cases coinciding with nearby seismic airgun operations. During the first event, five giant squid washed up dead on Spanish beaches shortly after two seismic survey vessels conducted operations in the area. Two years later, four additional strandings were recorded under similar circumstances. All the dead squid had lesions on their skin and damaged internal organs. See Angel Guerra, Institute for Marine Investigations, Vigo, Spain, Presentation to the Annual Science Conference of the International Council for the Exploration of the Sea (2004); Debora MacKenzie, “Seismic Surveys May Kill Giant Squid,” *New Scientist* (Sept. 2004). Other species of squid have been shown to exhibit a strong startle response to air guns signals; based on that response, it is thought that seismic surveys may significantly alter squid behavior up to 2 to 5 kilometers away. Robert D. McCauley, *et al.* *Marine Mammal Seismic Surveys: Analysis and Propagation of Air-Gun Signals; and Effects of Air-Gun Exposure on Humpback Whales, Sea Turtles, Fishes and Squid*, Curtin University, Centre for Marine Science and Technology (August 2000).

Captive brown shrimp raised in a noisy environment showed reduced growth and reproduction rates as well as an increased rate of aggression (cannibalism). J.P. Lagardère, “Effect of Noise on Growth and Reproduction of *Cragon cragon* in Rearing Tanks,” *Marine Biology* 71 177-185 (1982). And preliminary research from Canada suggests that snow crabs exposed to seismic surveys may show increased incidence of liver and ovary damage. Department of Fisheries and Oceans, Canadian Science Advisory Secretariat, *Potential Impacts of Seismic Energy on Snow Crab*, (September 2004).

The proposed EIS should analyze rigorously potential impacts to invertebrates from noise generated by oil and gas operations in the Beaufort and Chukchi seas to ensure that such operations will not adversely impact important prey species.

V. The proposed EIS should explore fully other potential impacts and effects associated with oil and gas activities, and should evaluate carefully potential impacts to subsistence resources.

Aside from introducing noise into the ocean environment, oil and gas operations may cause a variety of other impacts to the marine environment, marine wildlife, and subsistence resources. For example, activities associated with oil and gas exploration

and development increase the threat of oil spills, emit pollutants into the air, discharge pollutants into the water, and generate increased vessel and air traffic. The proposed EIS should describe in detail these potential impacts and their effects on marine resources, including subsistence resources.

A. The proposed EIS should analyze in detail the threat of oil spills and the potential impacts of such spills on the Arctic marine ecosystem.

Oil and gas activities raise the risk of oil spills. Major crude oil spills can occur in association with exploration, production, or transportation activities. Indeed, well blowouts have occurred with significantly greater frequency during exploration drilling than during production. See Bercha Group, *Alternative Oil Spill Occurrence Estimators and their Variability for the Beaufort Sea – Fault Tree Method*, MMS Contract Number 1435-01-04-PO-336507 (2006) at 4.30.

A large oil spill in the Arctic, though relatively unlikely to result from exploration activities, is possible—and the consequence of such a spill would be catastrophic. A large oil spill in Arctic waters would be extremely difficult to clean up, especially in slush or broken ice conditions. Even in open water, high winds, sea state, freezing spray, and other factors could impede or preclude spill response efforts. A spill late in the season could force responders to deal with escalating ice cover, or to halt cleanup during the winter months. If oil becomes trapped under the ice, it could become extremely difficult to locate, let alone recover.

Spilled oil can have dramatic effects on marine mammals, particularly polar bears and bowhead and other whales, as well as on subsistence uses and fish. See, e.g., LS 193 FEIS at II-34-39. The effects of an oil spill can last for many years, potentially causing long-term impacts at the population level. See, e.g., *id.* at IV-157. The proposed EIS should contain a detailed discussion of the potential impacts of oil spills on marine mammals and other Arctic wildlife, including migratory birds, many of which are subsistence resources. It should include in that discussion an analysis of the potential impacts to subsistence resources—and by extension people who use those subsistence resources—that could result from a large oil spill.

For example, the EIS should analyze the impacts of an oil spill on Pacific walrus because they "are particularly vulnerable to population-level perturbations and would require more time to recover from population-level impacts [than] would species with different life history strategies" given their tendency to aggregate in large groups, their longevity, and their low rates of reproduction. *Id.* at IV-156. Furthermore, the potential impacts to female walrus and dependent calves are a "major concern and merit special consideration." *Id.* The EIS should evaluate the impacts of a spill and spill response efforts affecting walrus' preferred shallow-water feeding grounds and on walrus prey inhabiting those benthic areas. It should also evaluate the implications if a spill or the spill response efforts force animals away from important sea ice and terrestrial haulouts. This analysis should not be limited the traditional walrus haulouts along the coast of the Russian Chukchi Sea, but should include the haulouts on the

Alaskan side of the Chukchi between Barrow and Point Hope where walrus have congregated in recent years in record numbers.

In addition, the proposed EIS should contain a detailed discussion of the potential impacts of oil spills on migratory birds, large numbers of which occur in the Beaufort and Chukchi seas during migrating, molting, breeding, and post-breeding seasons. See *generally*, Smith, Melanie E., Arctic Marine Synthesis: Atlas of the Chukchi and Beaufort Seas, Audubon Alaska (2010). Additional birds, such as short-tailed shearwaters, breed in the Southern Hemisphere and “summer” as nonbreeders in the Chukchi Sea. *Id.* Very little work has been done on avian distribution and ecology in winter, but polynas are known to be important for such species as the threatened spectacled eider, and any areas of open water in winter may prove to be highly important. To the extent that there is any use of patches or leads of open water in the Chukchi and Beaufort seas, the birds using these areas will be highly vulnerable to any spilled oil. Even tiny amounts of oil on avian plumage will result in death in cold conditions. Finally, the proposed EIS should review the results of the *Exxon Valdez* oil spill with regard to lingering effects on benthic-feeding species, such as Harlequin Ducks. See, e.g., Esler, D. *et al.*, Cytochrome P4501A biomarker indication of oil exposure in harlequin ducks up to 20 years after the Exxon Valdez oil spill, Environmental Toxicology and Chemistry (2010, in press); Esler, D. *et al.*, Harlequin duck population recovery following the Exxon Valdez oil spill: progress, process, and constraints, Marine Ecology Progress Series 241:271-286 (2002). The work of Esler and others is highly relevant to possible impacts on threatened spectacled and Steller’s eiders, which also are benthic feeders. Both species use both the Chukchi and Beaufort seas, and the spectacled eider gathers in large numbers in such places as Ledyard Bay for their annual molt, during which time they are flightless and highly vulnerable to spilled oil.

The proposed EIS should discuss the extent to which a lack of response capacity and lack of information on current, wind, ice, and weather patterns could adversely affect the ability to predict spill trajectories or the ability to mount an effective recovery effort. It should explain the extent to which lack of baseline scientific information would hinder post-spill recovery and rehabilitation efforts, including efforts to detect adverse environmental impacts and assess damages. The proposed EIS should review the adequacy and environmental impacts of anticipated spill response measures, such as dispersants or in-situ burning, in the Arctic environment. For example, the Environmental Protection Agency (EPA) has noted that “in-situ burning is rarely used on marine spills because of widespread concern over atmospheric emissions and uncertainty about its impacts on human and environmental health.” EPA, Understanding Oil Spills and Oil Spill Response 15 (Dec. 1999). The proposed EIS should consider the potential impacts associated with leaving oil in the water and ice over the winter season. It should also identify any potential risk reduction, spill prevention, and mitigation measures that could reduce impacts from an oil spill in the Arctic.

B. The proposed EIS should analyze the impacts of air pollution associated with oil and gas operations in the Arctic.

Activities associated with oil and gas exploration and development, including vessel traffic and exploration drilling, can emit massive quantities of pollutants into the atmosphere. One major concern is the emission of fine particulate matter (PM 2.5), including black carbon. The emission of fine particulate matter is a human health threat. In addition, the emission of black carbon almost certainly exacerbates the decline in sea ice by reducing the albedo—or reflectivity—of snow and ice, thereby accelerating a positive-feedback loop that amplifies melting and warming in the Arctic. Oil and gas operations may also emit significant quantities of nitrogen oxides, coarse particulate matter, and carbon dioxide. The proposed EIS should analyze fully impacts from air pollution associated with oil and gas activities in the Arctic.

C. The proposed EIS should analyze the impacts of water pollution associated with oil and gas operations in the Arctic.

Water quality is a central concern to Arctic communities and other stakeholders. Activities associated with oil and gas exploration and development discharge pollutants into the water, thereby degrading water quality.

Vessels used to conduct seismic surveys or exploration drilling can discharge pollutants during refueling spills, or in other accidents. Exploration drilling may result in a variety of discharges, including drilling muds (fluids) and drilling cuttings, sanitary and domestic wastes, desalination unit wastes, test fluids, deck drainage, blowout preventer fluids, uncontaminated ballast and bilge water, excess cement slurry, cooling water, fire control system test water, and excess cement slurry at the sea floor. Drilling mud or fluid may contain weighting materials, corrosion inhibitors, dispersants, flocculants, surfactants, and biocides.

The toxins present in these discharges can bioaccumulate, affecting apex predators such as toothed whales and polar bear. See FWS, Programmatic BiOp for Polar Bears at 32; NMFS, BiOp for Leasing and Exploration at 39. The discharges, which contain heavy metals, can create a blanket of mud that may adversely affect the benthic community. In the Chukchi Sea, walruses and gray whales feed on the benthos, and could be harmed by the presence of toxins and/or the decline of the benthic community.

Thermal discharge from cooling water may also impair water quality. “Thermal effluents in inshore habitat can cause severe problems by directly altering the benthic community or killing marine organisms, especially larval fish.” Fisheries Management Plan for Fish Resources of the Arctic Management Area (August 2009) (Arctic FMP) at 92. Changes in temperature can affect behavior and physiology of marine organisms. *Id.* Cooling water may also contain toxins that can cause adverse impacts.

Discharge of pollutants into certain Arctic waters may be especially harmful during the summer months, if water is stratified. The stratification may inhibit dispersal of the discharge, potentially confining it to the shallow upper section of the ocean, where marine mammals such as bowhead whales are more likely to encounter it.

The proposed EIS should include a full discussion of the potential impacts of water pollution caused by discharges associated with oil and gas operations. That discussion should include an analysis of potential impacts to subsistence resources and those who consume those resources.

D. The proposed EIS should analyze impacts associated with increases in vessel traffic associated with oil and gas operations in the Arctic.

Oil and gas activities in Arctic waters increase the level of vessel traffic transiting the Beaufort and Chukchi seas, and travelling to and from the Arctic from other regions. As noted above, vessel traffic can generate noise that triggers elicit avoidance behavior among certain marine mammals. Growth in vessel traffic also increases the risk of vessel strikes that could injure or kill marine mammals. Vessel strikes are a particular concern for the North Pacific right whales. The increased oil and gas activity in the Chukchi and Beaufort seas creates more vessel traffic through the Bering Sea, where North Pacific right whales are known to exist. Even a single ship strike of a right whale could be significant to the species. Given this species' perilous status, an activity that could potentially affect just one individual, or that could affect current or potential habitat, should be analyzed in the proposed EIS.

In addition to noise and ship strikes, higher levels of vessel traffic increase the risk of introducing to Arctic waters non-native species that could become invasive. This is especially true given that climate change is warming the Arctic, potentially making it more hospitable to exotic species. NMFS has recognized that "vessels engaged in transportation and oil exploration may introduce invasive species that could disrupt the balance of predator and prey relationships and diversity within the ecosystem." NMFS, Environmental Assessment for the Arctic Fishery Management Plan (August 2009) (Arctic FMP EA) at 205; see also *id.* at 76 ("With the increase of vessels traveling through the Arctic Management Area and the use of oil rigs from locations outside the Arctic Ocean, the risk of introducing an invasive species increases."). If exploration activities bring invasive species to Arctic waters, the nonnative species could "compete with or prey on Arctic marine fish or shellfish species, which may disrupt the ecosystem and predators that may depend on indigenous species." *Id.* at 76. Invasive species could "impact the biological structure of bottom habitat" or change habitat diversity, *id.* at 141, or "could compete with marine mammal prey, such as an invasive mollusk replacing the indigenous mollusk that walrus feed on." *Id.* at 188. Other invasive species, such as rats, could prey upon seabirds or their eggs. *Id.* at 150, 160.

MMS has acknowledged repeatedly that exploration activities could bring invasive species to Alaska's waters. See, e.g., MMS, 2007-2012 OCS Leasing Program Final Environmental Impact Statement (2007) at IV-15 (noting that exploratory

drilling uses rigs and/or vessels that could harbor invasive species “attached to the hull structure,” “on the vessel,” or in ballast water); 2008 Multisale DEIS at 2-20 (noting that invasive species could be introduced through “ballast-water discharge, hull fouling, and equipment placed overboard (e.g., anchors, seismic airguns, hydrophone arrays, ocean-bottom-survey cables).”).

The proposed EIS should include a thorough analysis of the impacts of increased vessel traffic due to oil and gas operations in Arctic waters. That analysis should encompass potential impacts from noise, ship strikes, and the introduction of non-native species that may become invasive.

E. The proposed EIS should analyze carefully the risk that oil and gas activities will adversely affect the availability of subsistence resources.

The MMPA requires that any authorized incidental take will not have “an unmitigatable adverse impact on the availability of such species or stock for taking for subsistence uses” by Alaska Natives. 16 U.S.C. § 1371(a)(5)(D)(i)(II). NMFS must ensure oil and gas activities do not reduce the availability of any affected population or species to a level insufficient to meet subsistence needs. 50 C.F.R. § 216.103.

As observed above, impacts from oil and gas activities may adversely affect the subsistence resources upon which many Alaska Natives rely. For example, noise from seismic operations, exploration drilling, and/or development and production activities may make bowhead whales skittish and more difficult to hunt. Aircraft associated with oil and gas operations may negatively affect other subsistence resources, including polar bears, walruses, seals, caribou, and coastal and marine migratory birds, making it more difficult for Native hunters to obtain these resources. Water pollution could release toxins that bioaccumulate in top predators, including humans. A large oil spill could have a disastrous impact on a range of subsistence resources per se, or on the willingness of Alaska Natives to consume what they harvest from areas affected by spilled oil.

Subsistence resources have long provided a source of healthy food for North Slope communities. Subsistence foods provide high nutritional value and protect against health problems like high blood pressure, obesity, diabetes, and cardiovascular disease. For many Native Alaskans, subsistence hunting is an important aspect of their culture. Negative impacts to subsistence resources could decrease food security, encourage consumption of store-bought foods with less nutritional value, and deteriorate the cultural fabric of Alaska Native communities. Thus, when industrial activities adversely affect subsistence resources, they also cause harm and stress to the people who depend on those resources. For all these reasons, the proposed EIS must take a careful look at potential impacts to subsistence resources.

VI. The proposed EIS should consider alternatives that address shortcomings in monitoring and mitigation measures.

“[T]o the fullest extent possible,” agencies must “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.” 42 U.S.C. § 4332(2)(E). Agencies must prepare EISs that “rigorously explore and objectively evaluate all reasonable alternatives” to the proposed action. 40 C.F.R. § 1502.14(a) (2003). The discussion of alternatives “is the heart of the [EIS].” *Id.* § 1502.14.

The proposed EIS should evaluate fully the effectiveness of monitoring and mitigation measures used to protect marine mammal species from the impacts associated with oil and gas activities, and should identify and discuss shortcomings of those measures. NMFS should work with stakeholders, including in North Slope communities and Native organizations, to develop alternatives that address those shortcomings, and the proposed EIS should include such alternatives. To the extent that mitigation measures do not remove the potential for serious injury from activities associated with oil and gas operations, NMFS must not issue IHAs.

NMFS must ensure that *ad hoc* management decisions do not foreclose conservation, protection, and management options in the Arctic. To do so, the alternatives included in the proposed EIS should adopt a precautionary approach like that which was used in the North Pacific Fishery Management Council’s Arctic FMP. The Arctic FMP defers commercial fishing in U.S. Arctic waters until scientific information is in place to ensure that such fishing will not harm the Arctic ecosystem or impair opportunities for the subsistence way of life. Under the MMPA, the alternatives included in the proposed EIS must take a similar approach: NMFS cannot issue IHAs unless and until science demonstrates affirmatively that NMFS can meet its obligations under the statute.

A. The proposed EIS should consider alternatives that include spatial and temporal restrictions, or “sound budgets” related to oil and gas activities.

NMFS should include alternatives that restrict oil and gas operations based on geographic location, season, and/or total volume of sound produced. NMFS should explore the extent to which such restrictions may be more effective in reducing impacts to marine mammals than more traditional techniques, such as the use of monitored safety and exclusion zones.

On September 21, 2009, NOAA sent a letter to MMS commenting on MMS’ Draft Proposed Outer Continental Shelf Oil and Gas Leasing Program for 2010-2015. NOAA, Comment Letter on Draft Proposed Plan for Oil and Gas Leasing for 2010 to 2015 (Sept. 21, 2009) (NOAA Comment Letter). In the letter, NOAA expressed concern “about potential impacts to living marine resources and their habitats, valuable

commercial and recreational fisheries, and subsistence uses of marine resources as a result of future lease sales, exploration, and development in the North Aleutian Basin Planning Area and Chukchi Sea Planning Area of Alaska.” NOAA Comment Letter at 5. To address some of these concerns, NOAA recommended that certain areas be excluded or deferred from lease sales in order to protect valuable fisheries and sensitive marine environments. *Id.* at 7-9.

NMFS should follow NOAA’s suggestion by including in the proposed EIS alternatives that exclude oil and gas activity from sensitive or important ecological areas (IEAs) in the Beaufort and Chukchi seas. IEAs are geographically delineated areas which by themselves or in a network have distinguishing ecological characteristics, are important for maintaining habitat heterogeneity or the viability of a species, or contribute disproportionately to an ecosystem’s health, including its biodiversity, function, structure, or resilience. For example, IEAs could include subsistence use areas; areas of high productivity or diversity; areas that are important for feeding, migration, or other parts of the life history of species; or areas of biogenic habitat, structure-forming habitat, or habitat for endangered or threatened species. IEAs might encompass critical or sensitive habitats such as the Ledyard Bay critical habitat area for spectacled eiders, or areas that are important for denning, feeding, and/or migration for other Arctic species such as Pacific walrus, bowhead whales, beluga whales, or polar bears.

The proposed EIS should consider alternatives that exclude oil and gas activities from IEAs at all times, based on the sensitivity of the geographic area. The EIS could also consider temporal restrictions, such as excluding oil and gas activities from known bowhead migration routes during the specific times of year when migrations take place. When delineating potential IEAs, NMFS should avail itself of Western science, but should also seek input and traditional knowledge from North Slope communities, organizations, and individuals. These sources are likely to provide valuable information about species and ecological processes in the Arctic. NMFS should apply such information as IEAs are being identified and defined.

In addition to spatial and temporal restrictions, NMFS should consider alternatives that restrict oil and gas operations based on the amount of noise those operations generate. For example, NMFS could create a “sound budget,” which would set a limit on the cumulative amount of industrial noise allowed per year, per sea. Under that sound budget, NMFS could authorize multiple oil and gas activities, but only if the total amount of noise generated by those activities over the course of the season did not exceed the “sound budget” for that season.

Spatial, temporal, and sound budget restrictions could be used to reduce impacts, including cumulative impacts, to marine mammals in the Arctic. Such restrictions could be used in place of or in conjunction with other mitigation measures, such as monitored exclusion and safety zones or aerial monitoring. The proposed EIS should include alternatives that incorporate these types of restrictions.

B. The EIS should discuss the limitations of using Marine Mammal Observers for monitoring, and should explore alternatives that address those limitations.

Marine mammal observers (MMOs) conduct monitoring to determine the presence of marine mammals so that oil and gas operators can modify activities to avoid harming or harassing those animals. To be effective, MMOs must be able to detect marine mammals within the distances NMFS has prescribed. There are many times, however, when MMOs are unable to detect marine mammals. MMOs cannot see animals at the surface when it is dark. Even during the day, the ability of MMOs to observe marine mammals from the deck of a vessel may be inhibited due to glare, fog, rain, snow, rough seas, the small size of animals such as seals, and the large proportion of time that animals spend submerged. MMOs are also unable to detect marine mammals at long distances, and therefore are of limited utility when safety radii are measured in thousands of meters. The shortcomings of monitoring were reiterated by an interagency task force:

visual monitoring under the best of conditions may detect less than 50 percent of most marine mammals and only 1-10 percent of some deep-diving mammals In poor weather and at night those percentages are reduced to effectively zero.

JSOST at 58.

Elsewhere, the Navy has estimated a five percent rate of detection for marine mammals using visual monitoring. See Taking Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar, 66 Fed. Reg. 15,375, 15,380, 15388 (Mar. 19, 2001). Researchers looking for beaked whales found that visual monitoring detects fewer than two percent of the animals if those animals are directly in the path of the ship. See J. Barlow and R. Gisiner, "Mitigating, Monitoring and Assessing the Effects of Anthropogenic Sound on Beaked Whales," J. Cetacean Res. Mgmt., 7(3):241 (2006). Even NMFS-trained observers have a hard time detecting such marine mammals. For example, in April 2009, the NOAA vessel Auk struck a right whale, despite the fact that three observers, a captain, and the mate were specifically looking for such whales. Observers spotted the right whale only when it had come within ten feet of the ship, giving the ship no time to avoid striking the animal.

NMFS has recognized that technologies such as infra-red goggles and night-vision binoculars are of limited effectiveness when visibility is low. Nor is using high-intensity lighting during periods of darkness or poor visibility a viable solution: such lighting poses a hazard to birds that are attracted by the light and become more vulnerable to striking vessels. 2007 DPEIS at III-63.

The proposed EIS should consider alternatives that require oil and gas activities that use MMOs to monitor for marine mammals to shut down their operations in

darkness and during periods of low visibility to decrease the risks of harm to marine mammals and birds. At a minimum, NMFS should require multiple observers working simultaneously in order to effectively monitor safety zones. The proposed EIS should also consider alternatives that would require oil and gas activities using MMOs to include alternate forms of monitoring, such as passive acoustic monitoring or aerial monitoring, to supplement observations from MMOs. NMFS should also consider alternatives that would require oil and gas operators to use the lowest practicable source levels, and to establish a process for independent verification of that standard. NMFS could also require research on noise reduction, including suppression of higher-frequency noise.

C. The proposed EIS should discuss the limitations of using exclusion areas and safety zones as mitigation measures, and should explore alternatives that address those limitations.

NMFS has often required oil and gas operators to use safety zones as mitigation measures to avoid injury and harassment of marine mammals such as bowhead whales. For example, NMFS has used a safety zone based on a sound threshold of 180 dB or 190 dB to avoid injury, and a zone based on a threshold of 160 dB or 120 dB to avoid harassment in the form of behavioral responses such as deflection.

Safety zones, however, are only as effective as the MMOs who monitor them. As described above, there are many times when MMOs are unable to conduct effective monitoring. Industry monitoring data from the 2006 seismic surveying season additionally confirm that even when animals are spotted, they are often not seen until they are close enough to the industrial noise to potentially sustain injury. NMFS should not rely on the imposition of safety zones to avoid injury to marine mammals without serious improvements in the efficacy of such zones.

Moreover, NMFS must examine all the relevant science and take a precautionary approach to the level of sound to which it will allow marine animals to be exposed. The proposed EIS should fully describe and disclose scientific studies regarding the sound level that represents the threshold for injury and evidence that safety zones intended to protect the most sensitive marine mammals from the behavioral disturbance from noise are not sufficiently protective.

NMFS has required exclusion zones based on 160 dB threshold and—at times—a 120 dB threshold for feeding, socializing, and/or migrating aggregations of bowhead and gray whales and bowhead cow/calf pairs. See, e.g., NMFS, Environmental Assessment for the Shell Offshore, Inc. Incidental Harassment Authorization to Take Marine Mammals Incidental to an Offshore Drilling Project in the U.S. Beaufort Sea Under the Marine Mammal Protection Act, at 9 (October 2007); LS 193 FEIS at IV-81. Indeed, questions surrounding the need to protect vulnerable bowhead whale mothers and calves from exposure to sound above 120 dB to avoid significant impacts to the bowhead population were one of the reasons motivating NMFS's preparation of a programmatic EIS for Arctic seismic exploration in 2006. See Taking Marine Mammals

Incidental to Conducting Oil and Gas Exploration Activities in the Arctic Ocean off Alaska, 71 Fed. Reg. 66,912, 66,912-13 (Nov. 17, 2006). The proposed EIS should examine these thresholds and consider whether more protective measures are required to avoid significant effects to the bowhead and gray whale populations.

NMFS itself has described that endangered bowhead whales have been documented to alter their behavior at sound levels as low as 107 dB. See NMFS, BiOp for Leasing and Exploration at 63; see *also* 74 Fed. Reg. at 26,226 (referencing studies that found migrating bowheads avoided seismic activities at distances of 20 to 30 kilometers). Studies reveal that female baleen whales show a heightened response to noise and disturbance and that fall migrating bowheads demonstrate greater avoidance than bowheads engaged in activities such as feeding. A 2005 report by the National Research Council cautioned that “[v]ery low thresholds should be considered for any disturbance that might separate a dependant infant from its caregivers.” NRC Ocean Noise at 82-83 (Box 4-1).

Bowhead whale deflections from their migratory paths, which can occur at levels at or less than 120dB, fit squarely within the MMPA’s definition of harassment: deflection can lead to adverse impacts, as bowhead whales may miss important feeding and resting opportunities and/or expend greater energy as they swim farther than they would otherwise. The resultant energy loss could impair the reproductive fitness or survival of individuals in the bowhead population. The MMPA’s definition of harassment specifically encompasses the potential disruption of marine mammal migration. 16 U.S.C. § 1362(18). Furthermore, observations indicate that harassment may occur at noise levels lower than levels that have caused bowhead whales to change course. As noted above, bowhead whales exposed to noise may become “skittish” before they deflect from their path of travel. Similarly, NMFS has acknowledged that bowhead calling behavior may be affected by sound levels that do not cause the whales to deflect.

Finally, regardless of the decibel threshold, NMFS should require that safety and exclusion zone distances be calculated based on peak levels of sound generated by the oil and gas equipment. Using peak sound values will result in a more conservative safety zone than NMFS’s current practice of calculating zones using an arbitrary 90% mean value. The proposed EIS should include alternatives that require calculation of safety zone distances based on peak sound values. At a minimum, it should require calculation of safety zone distances based on 95% mean values instead of 90% mean values.

D. The proposed EIS should consider alternatives that require industry coordination to minimize impacts to marine mammals.

The proposed EIS should include alternatives that require oil and gas operators to share information and coordinate their actions to reduce impacts to Arctic species.

NMFS should consider alternatives that require companies to share data and information to eliminate the need to conduct potentially duplicative seismic surveys. Consolidation of uncoordinated seismic surveys through a private or federal operator using a standardized methodology could meet industry objectives while reducing in-the-water impacts. If NMFS can encourage or require oil and gas companies to share vessels and/or data, fewer source vessels would be needed, and the likelihood of concurrent operations creating overlapping ensonified areas would be reduced or eliminated.

Similar to the “sound budget” described above, NMFS should also consider the inclusion of alternatives that limit the total number of oil and gas operations in a planning area in a given season. NMFS could consider restricting the number of source vessels allowed to operate in the Arctic Ocean to some small number. For example, the best available science combined with the precautionary approach dictated by the MMPA may suggest a limit of two source sources operating per season—one in the Beaufort Sea and one in the Chukchi. Putting a cap on the number of sound sources allowed in the Arctic would eliminate the possibility that multiple activities in a single region in a single season—such as 3D seismic, 2D seismic, exploration drilling, and site clearance surveys—would combine to cause significant impacts to marine mammals.

E. The proposed EIS should explore alternatives that require new technologies that reduce impacts from airguns, or that require alternative means of gathering seismic data.

A report on seismic airgun alternatives was completed following an August 31 to September 1, 2009 workshop held in Monterey, California and hosted by Okeanos – Foundation for the Sea. The report was edited by Dr. Lindy Weilgart and is titled “Alternative Technologies to Seismic Airgun Surveys for Oil and Gas Exploration and their Potential for Reducing Impacts on Marine Mammals.” This report may help NMFS prepare its EIS for oil and gas activities in the Arctic Ocean.

The aim of the Monterey workshop was to identify potential means of reducing impacts on marine mammals from oil and gas exploration activities. Workshop participants identified two avenues for reducing these impacts: reducing the amount of energy released into the marine environment from the use of airguns and using other technologies altogether for oil and gas exploration. With respect to the former, the report identifies several ways in which unwanted sound from seismic airguns may be reduced with little or no effect on the quality of data acquired. As for the latter, some airgun alternative technologies are available now or will be available in the next one to five years, depending on funding and technological advancement.

If NMFS maintains flexibility in its regulatory approaches and develops mechanisms for management that can adjust to the expected technological advances, it may be possible to account for and require current and future reductions in the impacts on marine mammals. NMFS could address this through the alternatives analysis in the proposed EIS. For example, NMFS could develop alternatives that would

accommodate vibroseis technology, a technology discussed in the report and which may be particularly applicable to the shallow waters of the Arctic. NMFS' alternatives analysis should account for the current and pending availability of this technology to reduce the impact from exploration on the marine environment. NMFS should also consider alternatives such as on-ice seismic data acquisition or newer electromagnetic imaging technology for geophysical applications. In other regulatory contexts (e.g., ESA), NMFS should consider requiring the use of such technology to ensure the least impact to sensitive species.

F. NMFS must not grant IHAs when mitigation measures do not remove the potential for serious injury or mortality to marine mammals.

In the Arctic, an IHA pursuant to 16 U.S.C. § 1371(a)(5)(D) is only available if the activity has no potential to result in serious injury or mortality to a marine mammal. 50 C.F.R. § 216.107 ("Except for activities that have the potential to result in serious injury or mortality, which must be authorized under § 216.105, incidental harassment authorizations may be issued[.]"). If there is even the possibility of serious injury, NMFS must establish that the "potential for serious injury can be negated through mitigation requirements[.]" *Small Takes of Marine Mammals; Harassment Takings Incidental to Specified Activities*, 60 Fed. Reg. 28,379, 28,380 (May 31, 1995).

Permanent hearing loss—or permanent threshold shift—qualifies as serious injury:

Serious injury for marine mammals, such as permanent hearing or eyesight loss, or severe trauma, could lead fairly quickly to the animal's death. NMFS does not believe that Congress intended to allow "incidental harassment" takings to include injuries that are likely to result in mortality, even where such incidental harassment involves only small numbers of marine mammals.

Id. If sound sources have "the potential to cause a permanent threshold shift in a marine mammal's hearing ability," they are "capable of causing serious injury to a marine mammal and would therefore not be appropriate for an incidental harassment authorization." *Id.* at 28,381.

Reports from previous surveys indicate that, despite monitored exclusion zones, marine mammals routinely stray too close to airguns that may cause serious injury, such as permanent hearing loss. See, e.g., LGL, *Marine Mammal Monitoring and Mitigation During Open Water Seismic Exploration by ConocoPhillips Alaska, Inc. in the Chukchi Sea, July-October 2006*, at 5-11-5-12 (Jan. 2007) (identifying 50 marine mammals likely exposed to potentially injurious sound levels); LGL, *Marine Mammal Monitoring and Mitigation During Open Water Seismic Exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July-September 2006: 90-Day Report*, at 6-13 (January 2007) (identifying 24 seals likely exposed to potentially injurious sound levels); LGL, *Marine Mammal Monitoring and Mitigation During Open Water Seismic*

Exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–November 2007: 90-Day Report, at 5-43 (January 2008) (identifying 26 sightings of 50 walrus within the exclusion zone); LGL, Marine Mammal Monitoring and Mitigation During Open Water Seismic Exploration by Shell Offshore Inc. in the Chukchi and Beaufort Seas, July–October 2008: 90-Day Report, at 7-14 (January 2009) (“Shell 2008 90-day Report”) (identifying 44 powerdowns involving 45 marine mammals).

These results indicate that the use of monitored exclusion zones does not remove the potential for serious injury. The proposed EIS should take a hard look at the effectiveness of using monitored exclusion zones as a mitigation measure to prevent serious injury. If monitored exclusion zones and other mitigation measures cannot remove the potential for serious injury from sound sources associated with oil and gas operations, NMFS must not issue IHAs.

G. The proposed EIS must carefully examine the appropriateness of developing five-year regulations under the MMPA for oil and gas activities in the rapidly changing Arctic Ocean.

NMFS has indicated that the proposed EIS will examine whether it is appropriate to promulgate five-year regulations governing oil and gas exploration in the Arctic Ocean. The MMPA allows NMFS to promulgate regulations allowing incidental take of marine mammals, under limited conditions, for periods not to exceed five consecutive years. 16 U.S.C. § 1371(a)(5)(A)(i). To issue such regulations, NMFS must ensure that the total incidental take over the period covered by the regulation will affect only small numbers of marine mammals, will have a negligible impact on protected species, and will not have an unmitigable adverse impact on the availability of such species for taking for subsistence uses. *Id.* The regulations must set forth permissible methods of taking that provide for the least practicable adverse impact and include monitoring and reporting requirements for such taking. *Id.*

Before proceeding with any proposed regulations, NMFS must determine carefully whether it can meet the MMPA’s requirements. Among other things, the agency should explore whether the rapidly growing and changing oil and gas activities in the Arctic provide sufficient certainty with respect to the level of activities and impacts to allow for five-year regulations. The agency should also consider whether and how rapidly shifting Arctic Ocean climate conditions could be addressed in regulations. It must also identify the activities subject to any regulations with specificity. Given the very different impact vectors of various exploration activities and variability among different geographic locations in the Arctic Ocean, it may be necessary to promulgate different regulations to cover different types of activities or different geographic regions.

Any alternative that considers promulgation of five-year regulations should provide for notice and public comment on an annual basis. It should also include mitigation measures, including geographic and/or temporal restrictions and restrictions on total activity—either by limiting the number of activities or by using a “sound budget” approach—as discussed above. Any five-year regulation alternative should also allow

for the revision of mitigation measures based on new information. It should also consider structuring the regulations in a manner that will foster the collection of adequate baseline data before activities proceed. For example regulations might require site-specific research and monitoring for some number of years before activity is permitted.

VII. Conclusion

Thank you for this opportunity to provide scoping comments on the proposed EIS. We look forward to working with NMFS in the coming months as it prepares its draft EIS.

Sincerely,

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April 9, 2010

VIA ELECTRONIC MAIL at arcticeis.comments@noaa.gov

Mr. P. Michael Payne
Chief
Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Springs, MD 20190-3225

Re: Scoping Comments – Notice of Intent to Prepare an Environmental Impact Statement on Effects of Oil and Gas Activities in the Arctic Ocean (75 Fed. Reg. 6175)

Dear Mr. Payne:

Please accept these comments on behalf of the Inupiat Community of the Arctic Slope (ICAS) regarding the Notice of Intent to prepare an EIS on oil and gas activities in the Beaufort and Chukchi Sea. ICAS appreciates the opportunity to provide these comments to the NMFS, on a government-to-government basis, with the goal of protecting the resource of the Arctic Ocean that support the Inupiat people. ICAS is a regional Native government organized in accordance with the Indian Reorganization Act of 1934. Pursuant to ICAS's Constitution and By-Laws, approved by the U.S. Department of Interior, ICAS's membership includes all person of Inupiat blood living within the Arctic Slope Borough in Alaska. We speak on behalf of the Inupiat people, who have relied upon marine mammals, birds, fish and other wildlife to carry on the subsistence traditions that have sustained our families and provided for our spiritual, mental and physical health since time immemorial.

ICAS requests a copy of the Draft Environmental Impact Statement as soon as it is available. Our address is P.O. Box 934; Barrow, AK 88723.

ICAS for many years has stated our opposition to offshore oil and gas activities because of the threats posed to marine mammals and other wildlife species as a result of a potential oil spill, underwater noise, air and water pollution, and the associated negative impacts to the health of our people and communities. Congress, in passing the Marine Mammal Protection Act, placed the highest priority on protecting our subsistence traditions, and NMFS carries the responsibility of ensuring that industrial activities do not interfere with these activities or injure the marine mammals that we rely upon. The decisions made by NMFS as to the regulation of oil and gas activities in the Arctic may have irreversible implications for our children and grandchildren and many generations to come, and NMFS must therefore take great care in considering whether and how offshore oil and gas activities should move forward.

In particular, as we have stated many times to your agency and others, the federal government lacks adequate baseline information about how the Arctic ecosystem works and the habitat needs of marine mammals and other key species. NMFS should not allow any industrial activity to move forward until it fills the existing data gaps and accurately assesses how bowhead whales and other marine mammals use the Arctic and how climate change and ocean acidification may present additional threats. Unless NMFS first establishes an accurate baseline, it will never be able to assess accurately the resulting impacts of oil and gas activities. By allowing industrial activity to move forward first, NMFS may foreclose the possibility of ever understanding fully how industrial activity may change the Arctic ecosystem.

We also urge NMFS to take a precautionary approach to regulation. There are many unknowns in determining how offshore oil and gas may impact marine mammals, including impacts resulting from the chronic exposure of marine mammals to sublethal levels of underwater noise, the cumulative impacts of multiple operations occurring simultaneously over numerous years and the impacts of discharging millions of gallons of cooling water, biocides, drilling fluids and other toxic chemicals into the Arctic ocean. When faced with these uncertainties, NMFS must err on the side of caution and limit the risk that an uninformed decision will result in unintended consequences for the Inupiat people. President Obama just announced that offshore activities will be guided by sound science, and if NMFS cannot demonstrate that proposed activities are known to be safe, then they should not move forward.

We are also very concerned that the Inupiat people are being forced to bear a disproportionate share of the burdens of our nation's energy consumption. NMFS's actions must be guided by Executive Order 12898 regarding environmental justice, and NMFS must disclose the disproportionate impact borne by our people. At the same time, NMFS should conduct a human health impact assessment and consider the cumulative and synergistic effects of potential interference with subsistence and cultural practices along with air and water pollution and other social dynamics. The combined impact of numerous seismic and exploratory operations over many years threatens the very fabric of our culture on the North Slope, and NMFS must provide a full and complete analysis of the potential impacts to our people.

ICAS also reiterates its request for formal government-to-government consultation at each stage of this process, and moreover those consultations must take place between ICAS and officials in the National Oceanic and Atmospheric Administration. On April 8, 2010, a contractor for the National Marine Fisheries Service purported to attend an ICAS board meeting via telephone for purposes of conducting a so-called government-to-government consultation. Private contractors have no place in a formal government-to-government consultation, and ICAS's board was frankly offended that NOAA would attempt to meet its obligations in this manner. As a result, no consultation took place at the scoping level, which already casts doubt on the validity of the process employed by NOAA. In the future, NOAA should make every effort to schedule consultations as early in the process as possible (as opposed to one day prior to

the close of the public comment process), and NOAA should be sending government officials to Barrow to meet with ICAS and its representatives in person regarding these important matter.

ICAS looks forward to reviewing and commenting on the DEIS when it is released. We also support the comments submitted by the Alaska Eskimo Whaling Commission and will expect NMFS to work closely with ICAS, AEWC and other Inupiat organizations and individuals in determining how best to regulate offshore activities in the Beaufort and Chukchi Seas. If you have any questions regarding these comments, please do not hesitate to contact me.

Sincerely,


George Edwardson
President

Subject:Harry Lord comment on Arctic Offshore Activities

Date:Tue, 16 Mar 2010 19:16:52 -0800

From:Harry Lord <h.henry.lord@live.com>

To:Michael.Payne@noaa.gov

DATE: 16 March 2010

TO: Mr. P. Michael Payne, Chief

Permits, Conservation and Education Division

Office of Protected Resources

National Marine Fisheries Service

1315 East-West Highway

Silver Spring, MD 20190-3225

Email: Arcticeis.comments@noaa.gov.

FROM: Harry H. Lord, Chief of Criminal Intelligence

Universal Intelligence Agency

Exiled Republic of the Arctic

P. O. Box 36

Kaktovik, AK 99747-0036

Email: h.henry.lord@live.com

RE: Arctic Offshore Energy Exploration Activities

Dear Mr. Payne:

The Universal Intelligence Agency was established to provide quality intelligence services for the Exiled Republic of the Arctic, for the purpose of non-violent civil resistance against the hostile military occupation of the Arctic Homeland of the Inuit Peoples.

Specifically, the agency is organized in accordance with Section 404 of the Restatement of the Law, Third Restatement, Foreign Relations Law of the United States, concerning Universal Jurisdiction over Universal Offenses, hence the agency title Universal Intelligence.

Education should always be our top priority, in that regard, careful attention is directed on Nelson Mandela- *“The educational policies of Apartheid is truly a crime against humanity.”* And, as such, has been the very best academics has allowed Inuit Society, and qualify as Universal Offenses subject to Universal Jurisdiction.

Stephen Lendman at Global Research Centre critically reviewed “Cracks in The Constitution” by Ferdinand Lundberg. Dr. Louis Henkin, Professor of Constitutional Law, reported in the Columbia Law Review; April 1979 “Rights: American and Human;

“Those wise men we now call the Constitutional Fathers came to Philadelphia under instructions to improve the Articles of Confederacy. But they went beyond their instructions, abandoned the Articles, and produced in its stead the United States Constitution.”

The U. S. Constitution was never the living document with legal enforceability as taught to us in *Apartheid education*. Technically, the sacred Constitution is in violation of the *Great Law of Peace of the Iroquois Confederacy*.

In view of the above facts, in particular, the illegality of the Constitution itself, equally careful attention is focused on the illegality of the 1867 Alaska Treaty of Cession; The transfer of the Charter of the Russian American Company and the legal description of real estate contained in the Kostlivzov Memorandum Descriptive which identified a total of 117,600 square feet of real estate, and not the territorial description of Alaska.

United Nations, General Assembly, Resolution 66(i). of 14 December 1946, posted Alaska on the list of Non-Self Governing Territories that placed specific international legal obligations on the United States to administer Alaska in accordance with Article 73 of the Charter of the United Nations.

Just as those wise men that abandoned the Articles of Confederacy earlier in history, the Charter of the U. N. was sacrificed in favor of the criminally contrived Statehood for Alaska.

The UN Convention on Non-Applicability of Statutory Limitations on War Crimes and Crimes Against Humanity explicitly condemns as international crime the violations of political as well as economic rights of Indigenous peoples on the one hand and the policies of Apartheid on the other.

Paragraph 8 of the UN General Assembly Resolution on Principles of International Cooperation on the Detection, Arrest, Extradition and Punishment of Individuals Guilty of War Crimes and Crimes Against Humanity prohibits the U.S. from relying on any legislative or other measures that are prejudicial to the obligations assumed under these principles, specifically the Constitution, Alaska Treaty of Cession, Statehood as well as Alaska Native Claim Settlement Act.

The Education of Apartheid has completely deluded the whole of human society. The events of 9/11/01 further crippled an already permanently impaired mind...

The Honorable Chief Oren Lyons testimony before the Senate Select Committee on Indian Affairs in support of Senate Concurrent Resolution 76; 2 December 1987: Acknowledging The Iroquois Confederacy of Six Nations contribution in the development of the U. S. Constitution.

The Prophet called The Peacemaker... He was a spiritual being,

Fulfilling the mission of organizing warring nations into a con-

federation under the Great Law of Peace.

The principles of this law are: peace, equity and justice, and the

power of the good minds.

The Peacemaker came to our lands, bringing the message of peace

supported by Hiyewatah. He began the great work of healing the

twisted minds of men.

The great work of healing the twisted minds... of all humanity injured by Apartheid Education is further complicated by hydrocarbon on the brain, scientifically known to be extremely dangerous, and recklessly driving the political economy. More Arctic oil development only worsens our human condition.

The Energy Crisis is a criminal contrivance that the transnational energy companies use to rig the high price fix on oil, under the cover of the fog of war that is used to deliberately confuse criminal responsibility for war crimes and war profiteering.

NASA Climatologist Dr. James Hansen has called for the criminal prosecution of the industry executives for Crimes Against Humanity for corruption of data on climate change, the pernicious effects of this conduct poses dire consequences on the future security of all humanity.

In equal importance is the National Aeronautics Space Administration-National Academies of Sciences (NASA-NAS) Super Geomagnetic Solar Storm forecast for 12/21/12 that poses an even greater threat to the future existence of all humanity.

Interestingly, the forecast cross triangulates by technical reference with the most ancient of traditional knowledge in Mayan Astronomy and calendar system, Hopi Prophecy, and the more contemporary Nostradamus Quatrains and Edgar Cayce Sleep Readings.

The criminally contrived artificial energy crisis is complicating our need for advanced emergency preparedness unnecessarily. Exxon Valdez Tanker wreck revealed the non-existent emergency preparedness in violation of the lease and license agreement to operate the Trans-Alaska Pipeline System safely. The false safety recertification and Right-of-Way reauthorization are doomed to a repeat offense.

21 December 2012 is fast approaching leaving precious little time to prepare for the ultimate consequences that will result from the event horizon of the severe space weather event.

N. Scott Momaday, Kiowa Historian and scholar, cited former Commissioner of Indian Affairs, John Collier in the Documentary Video *More Than Bows and Arrows*;

“What Humanity had, and lost, Native Americans have, and are loosing, and must be returned less all humanity perishes.”

United we stand, divided we fall, one and all, so come on people, lets get on the ball in full service of justice for all, and not just for those who can afford it, namely the executives of the energy industry transnational corporate criminal cartel.

Universal Intelligence Agency campaign for justice in the interest of all humanity for victims of crimes against all humanity... in the words of the song by Quincy Jones;

We Are The World:” after all we are saving our selves...”

Sonny Boy Williamson; *Help Me*;

“You got to help me baby, cause if you don’t help me darlin”

I’ll have to find myself somebody else...”

In closing I cite Legendary Bluesman Taj Mahal- *Take A Giant Step outside your mind...* and think about what is being done to all humanity and particularly to the Inuit of Arctic Alaska who were compelled to pay for the energy crisis in advance through extinguishment of rights in pursuit of what is perceived as your energy crisis needs.

I trust that the message in this comment will be incorporated within the framework of traditional knowledge, for much great work remains, in the spirit of one love for life and liberty, we remain respectfully and humbly at your service.

UNIVERSAL INTELLIGENCE AGENCY

/S/

Harry H. Lord, Chief of Criminal Intelligence

9 April 2010



Via Electronic Mail

Mr. P. Michael Payne
Chief, Permits, Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20190-3225
Email: arcticeis.comments@noaa.gov

Subject: Notice of Intent to Prepare an Environmental Impact Statement on the
Effects of Oil and Gas Activities in the Arctic Ocean

Dear Mr. Payne,

The International Association of Geophysical Contractors (IAGC) is pleased to submit the following response to the National Marine Fisheries Service's (NMFS) request for comments on the *Notice of Intent (NOI) to Prepare an Environmental Impact Statement (EIS) on the Effects of Oil and Gas Activities in the Arctic Ocean*. IAGC is the international trade association representing the industry that provides geophysical services (geophysical data acquisition, processing and interpretation, geophysical information ownership and licensing, associated services and product providers) to the oil and gas industry. Geophysical methods include: seismic, gravity, magnetic, and electromagnetic which all measure physical properties of the geology or subsurface of the Earth. These techniques are used for exploration both onshore and in marine environments. The gravity and magnetic methods are commonly collected on aircraft and on marine vessels either in conjunction with seismic surveys or independently. IAGC member companies play an integral role in the successful exploration and development of offshore hydrocarbon resources through the acquisition and processing of seismic data.

IAGC's members include the companies that will acquire the geophysical data that the oil and natural gas exploration and production (E&P) industry and the federal government will use in assessing and valuing the hydrocarbon resource potential underlying the Chukchi and Beaufort Seas. IAGC has long been engaged on behalf of our members regarding the potential impact of E&P sounds on marine life, and particularly on marine mammals. IAGC commends

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NMFS for determining that the 2007 DPEIS was in need of revision and in taking the necessary steps to reinstate the NEPA process. We welcome this opportunity to share our knowledge and expertise regarding marine geophysical operations and to provide comments on the NOI to NMFS.

IAGC strongly supports the comments of similar caption on this same subject submitted separately to NMFS by Industry, including the Alaska Oil and Gas Association (AOGA) and the American Petroleum Institute (API). In addition to those Industry comments, and not wishing to detract from them, we have the following additional comments.

General Comments

Global demand for energy will grow and, because existing and developing energy sources will struggle to keep up with demand, oil and gas resources will be needed for American consumers and the American economy for decades to come. The US has vast oil and gas resources on the Outer Continental Shelf (OCS) that can and must play a critical role in meeting that future energy demand, in fueling the economy, and providing jobs. Reliable estimates indicate that a significant portion of these resources may be found on the Chukchi and Beaufort Seas OCS.

Geophysical and sub-surface data such as seismic, well log, gravity/magnetic and electromagnetic data are the primary tools used in oil and gas exploration and, as such, are critical to the successful discovery and efficient development and production of hydrocarbons. Seismic, gravity, and magnetic data are some of the very first tools used in the exploration process and, without modern data, exploration for new hydrocarbon prospects would be far less likely to occur.

Geophysical data acquisition and processing technology has made huge advances over the last ten years allowing the E&P companies to be far more successful in finding hydrocarbons than ever before resulting in fewer dry holes and a smaller exploration, development and production footprint.

IAGC requests that the exemplary environmental and safety record of the offshore E&P industry be analyzed as part of the EIS. Geophysical surveys are not likely to have discernable adverse effects on the health, status, habitat, survival or recovery of marine mammal stocks. NMFS and the Minerals Management Service (MMS) have acknowledged in several NEPA documents that there have been no documented mortalities, physical injuries or physiological effects on marine mammals from seismic surveys. Data from the scientific literature, and not speculation, should be used when assessing potential impacts of geophysical activities on the environment.



The geophysical industry has over 40 years of experience in planning, acquiring, and processing seismic data in the US Arctic OCS and has done so in an environmentally responsible manner. During this time the Bering-Chukchi-Beaufort Seas (BCB) population of bowhead whales has been increasing at a rate of 3.2% per year ([NOAA Fisheries' website](#)) but the operating limitations, mitigation and monitoring requirements continue to be more restrictive, costly and onerous each year. For geophysical operations in the US Arctic OCS, the permit process is lengthy and uncertain, making it very difficult for industry to plan and execute a responsible and effective geophysical program.

As an industry we have worked cooperatively with community stakeholders and we have designed our operations and mitigation and monitoring plans in a manner that address stakeholder questions and mitigate concerns about the impacts of our operations on Alaska Native culture and subsistence lifestyle. Industry is committed to conducting its operations in an environmentally responsible manner and without any unmitigable adverse impact to the native Alaska communities' subsistence hunt.

Specific comments

For the purposes of responding to NMFS's request in the NOI for information regarding the geographic locations, types and number of geophysical activities estimated to occur over a 5-year time period (2011-2015), it was necessary for IAGC to assume the following:

- Current levels of interest, as expressed by E&P companies, in exploration and production activities on the Arctic OCS will continue or increase.
- For the foreseeable future (5-year period and beyond), the Arctic OCS will remain open for leasing and accessible for exploration (including geophysical surveys) and production activities.
- The proposed EIS on the Arctic OCS will be completed in a timely fashion and permits to conduct geophysical operations will be approved under reasonable conditions.
- The Preliminary Revised 5-Year OCS Oil and Gas Leasing Program for 2007-2012, the Proposed 5-year OCS Oil and Gas Leasing Program for 2012-2017, and the associated NEPA documents are finalized and allow for Arctic OCS lease sales to occur in the Beaufort and Chukchi Seas planning areas in a timely fashion.
- In addition to geophysical data being acquired as a service for E&P companies and provided to them on a proprietary basis, the non-exclusive (multi-client) geophysical data model (refer to item 3 for more information) is also utilized on the Arctic OCS.



1. Incorporating the assumptions above, IAGC's response to NMFS's request for information regarding the **geographic locations, types and number of geophysical activities estimated to occur over a 5-year time period (2011-2015)** is as follows:
 - a. Geographic areas of interest: IAGC member companies have indicated high levels of interest in conducting various types of geophysical surveys (listed in item 1.b. below) in Federal and state waters of the US Beaufort and Chukchi Seas.
 - b. Types of surveys: IAGC member companies anticipate conducting the following types of geophysical surveys in Federal and state waters of the US Beaufort and Chukchi Seas:
 - i. Seismic
 1. 2D
 2. 3D
 3. wide-azimuth or multi-azimuth
 4. ocean bottom systems
 - ii. Electromagnetic
 - iii. Gravity, magnetic, and gravity gradiometry
 - c. Estimated number of surveys: IAGC members provided information regarding the geographic locations, types, and estimated number of geophysical surveys their companies would be interested in conducting on either a non-exclusive or proprietary basis on the Arctic OCS. IAGC compiled and analyzed that information to develop the following estimated number of line kilometers or square kilometers of geophysical data to be acquired on the Arctic OCS for the 5-year time period, 2011-2015. IAGC members have informed us that the numbers listed below should be considered the *maximum* number of line kilometers and square kilometers of data that would be acquired. The following information is predicated on the five assumptions detailed previously. Those assumptions describe the best case scenario for exploration and therefore resulted in high estimates of survey activity. It is difficult to predict the location and number of geophysical surveys that will be conducted in the future; therefore, it is important to keep in mind that these are estimates and they will likely change downward. In light of the forgoing, we urge NMFS to consider these estimates as they are submitted, without applying an additional upward precautionary adjustment to them.



If complex geology is encountered or these types of surveys are requested by E&P companies, wide-azimuth or multi-azimuth seismic surveys *might* be conducted; therefore, at this time, it is not possible to estimate how many of these types of surveys might occur on the Arctic OCS. Also, IAGC members expressed interested in possibly conducting seismic surveys using ocean bottom recording systems in the future but were not able to provide an estimated number of surveys at this time.

Location	Survey Type	2011	2012	2013	2014	2015
Beaufort Sea Federal waters	2D seismic	17000	14000	9000	5000	5000
Chukchi Sea Federal waters	2D seismic	12000	12000	9000	5000	5000

Table 1: Estimated number of line kilometers (km) of 2D seismic data to be acquired each year in the 2011-2015 time period.

Location	Survey Type	2011	2012	2013	2014	2015
Beaufort Sea Federal waters	3D seismic	1500	3000	4500	5000	3500
Chukchi Sea Federal waters	3D seismic	2000	3000	5000	5500	3500

Table 2: Estimated number of square kilometers (km²) of 3D seismic data to be acquired each year in the time period 2011-2015.



Location	Survey Type	2011	2012	2013	2014	2015
Beaufort Sea Federal Waters	gravity & magnetic	50000	25000	25000	25000	25000
Chukchi Sea Federal Waters	gravity & magnetic	50000	25000	25000	25000	25000
Chukchi Sea Federal Waters	gravity gradiometry	0	14000	*	*	*

Table 3: Estimated number of line kilometers (km) of gravity and magnetic, and gravity gradiometry data to be acquired each year in the time period 2011-2015. *Estimates for gravity gradiometry surveys in 2013-2015 are not available at this time.

(Please note that the information contained in item 1 does not include high-resolution site surveys / shallow hazard surveys. These types of surveys are acquired by the E&P companies in specific areas of their lease blocks prior to drilling or other activities. IAGC members are not able to estimate the number of high-resolution / shallow hazard surveys that the E&P companies might wish to undertake in the US Arctic OCS.)

2. The Notice of Intent specifically states that the scope of the EIS will include 2D and 3D seismic surveys, high-resolution shallow hazard/site clearance surveys, and exploratory drilling activities. As indicated in item 1 above, IAGC members are interested in and anticipate conducting electromagnetic, gravity, magnetic, and gravity gradiometry surveys in the US Beaufort and Chukchi Seas over the next several years. Therefore, **IAGC requests that NMFS include electromagnetic, gravity, magnetic, and gravity gradiometry surveys in the scope of geophysical activities evaluated in this EIS.**

If gravity and magnetic data are acquired, the equipment could be co-located on a seismic vessel or seismic support vessel and acquired at the same time as a seismic survey or conducted independently on dedicated aircraft or vessels. Most likely, gravity gradiometry equipment would be co-located on a vessel associated with a seismic survey. It is important to note that gravity, magnetic and gravity gradiometry data collection are completely passive and non-intrusive measurements with no environmental effects other than the vessel that the equipment has been installed on. Gravity gradiometry, gravity and magnetic measurements are passive and



do not transmit a source signal into the Earth but measure the Earth's magnetic or gravitational fields.

Electromagnetic (EM) surveys are a geophysical exploration technique that is increasingly being used by oil companies to provide information on the likely presence of hydrocarbons in geological structures mapped from seismic data. EM surveys do not produce sound energy. The method uses an electric dipole to transmit an electromagnetic signal over a given frequency range into an array receivers. The source is towed at heights of approximately tens of meters above the seafloor. Typically, electromagnetic surveys are of short duration and the EM fields decay rapidly with distance from the source.

3. The Arctic Ocean to be assessed is in the earliest, frontier exploration phase of the oil and gas exploration and production cycle. Therefore, as NMFS develops the scope for the proposed EIS it should consider a key component of many IAGC member companies' business: **the non-exclusive data business model.**

In addition to geophysical data being acquired as a service for E&P companies and provided to them on a proprietary basis, IAGC members are in the business of acquiring the non-exclusive geophysical data in the US OCS at their own risk and expense, and making it available to E&P companies for license. Non-exclusive geophysical data is a common method of identifying and understanding the hydrocarbon resource potential in frontier exploration areas like the Alaska OCS; in particular, the Chukchi and Beaufort Seas. In acquiring the non-exclusive geophysical data, the geophysical contractor incurs the capital costs, carries the attendant risks associated with this investment and owns the data.

The business model for acquiring non-exclusive (also referred to as multi-client or spec) geophysical data (seismic, gravity and magnetic, etc.) takes advantage of economies of scale in our industry by spreading the costs of data acquisition and processing over time and multiple customers who desire to make use of the data. Under this model, the geophysical company initiates and conducts projects of general industry interest at its own financial risk. Obviously, as is expected with any other capital investment, geophysical companies expect to earn a reasonable return on their investments in non-exclusive data, and when successful they earn that return by selling numerous licenses to the same data.

[For a more detailed discussion on this topic, please go to IAGC's website:

<http://www.iagc.org/iagcwebdata/public/sops/sop3.pdf>



http://www.iagc.org/attachments/contentmanagers/976/IAGC_Comments_MM_S_Data_Confidentiality_2002_09_16.doc
<http://www.iagc.org/en/cms/?976>]

Access to cost effective geophysical data allows E&P companies of all sizes to compete in the same geographic area(s) (in this case a frontier exploration area), enables them to prospect across basins and to quickly follow up on trends and discoveries. This data is also valuable to MMS and the federal government because it helps ensure that a fair market value is obtained for leases which are awarded, and aids in preparing reliable estimates of the hydrocarbon resource potential of leased and un-leased acreage.

Where acquiring data on a non-exclusive basis is supported by the economics, market and other factors, and is otherwise justifiable, it can have an environmental benefit over acquiring data on a proprietary basis. That is, because non-exclusive geophysical surveys are acquired in areas in which E&P companies have expressed an exploration interest, and because the data are licensed to multiple E&P companies for their use in exploration of oil and gas, non-exclusive surveys can and often do reduce the ultimate number of geophysical surveys acquired throughout the exploration cycle. [Again, this contention is applicable to certain exploration regions – especially to frontier regions, and may well apply to the Arctic Ocean, but it is not applicable to all areas.] For this reason, the environmental benefits of non-exclusive geophysical surveys should be favorably considered in the drafting of the PEIS for the US Arctic.

Additionally, for a geophysical contractor, the economics of a given non-exclusive survey will fundamentally be significantly more fragile than the economics of the geophysical survey component (proprietary) of a much larger regional exploration play undertaken by an E&P company. And we expect non-exclusive data investments in the Chukchi and Beaufort Seas to be very risky relative to other similar investment opportunities around the world. Thus, a non-exclusive survey will be much more sensitive economically to the burden of external (non-productive) costs. For example, the costs of undertaking a significant fixed passive acoustic monitoring recording and analysis program for regional, long term monitoring of potential effects from seismic surveys, if imposed on non-exclusive surveys, would likely render them un-economic, thus eliminating their possibility before any such investment can be undertaken. Therefore, we urge NMFS to recognize and weigh the environmental benefits of non-exclusive surveys against those of long term



monitoring programs, and where possible, refrain from burdening them with that financial burden.

And while acquiring data on a non-exclusive basis can have an environmental benefit over acquiring data on a proprietary basis over a full exploration cycle, their value to the E&P process is limited. For example, a proprietary seismic survey is often needed to confirm the hydrocarbon resource potential of a prospect and to select the optimum drilling locations. As such, the E&P Industry (of which the geophysical industry is a part) should remain free to choose via the exercise of free market (competitive) forces (i.e. without government mandates) whether non-exclusive or proprietary geophysical surveys are employed in exploring for and producing oil and gas in the Chukchi and Beaufort Seas.

To encourage the non-exclusive (multi-client) model data to be utilized in the Arctic OCS, regularly scheduled lease sales must occur. Geophysical contractors experienced significant financial loss of their non-exclusive investments when acreage in OCS Sale 181 – Eastern Gulf of Mexico – was withdrawn. Geophysical contractors will not likely again expose themselves to such losses or take on the risk of providing geophysical data and products without the financial support of the oil and gas companies. Oil and gas companies are not likely to support seismic surveys in the Arctic OCS Planning Areas (beyond a limited number of early 2D exploratory surveys) unless they are confident that these areas will be available for leasing and open to drilling and production.

4. The effects of seismic exploration in the Beaufort and Chukchi Seas, particularly with respect to the **Bering-Chukchi-Beaufort Seas (BCB) population of bowhead whales**, have now been the subject of numerous recent detailed analyses by NMFS and MMS. Each successive analysis, performed under the auspices of the Outer Continental Shelf Lands Act (OCSLA), the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA), has comprehensively reviewed the available information regarding seismic impacts and the status of BCB Seas bowhead whale population, regarding which there has been essentially no change over the time period involved. In fact, according to the NOAA Fisheries website the BCB stock of bowhead whales is increasing at a rate of 3.2% per year.

MMS and NMFS have acknowledged that there have been no documented mortalities, physical injuries, or physiological effects on marine mammals from seismic surveys. The BCB Seas bowhead whale population has steadily



increased before, during, and after substantial seismic exploration activities in the Chukchi and Beaufort Seas. MMS and NMFS have also acknowledged that all oil and gas activity on the North Slope of Alaska and in the adjacent OCS has had no detectable adverse population-level effects on the health, current status, habitat, or recovery of any marine mammal stocks. The unlikelihood of population-level adverse effects from geophysical operations should be plainly stated in the EIS as the most reasonable conclusion based on the best available data.

Available information does not indicate that oil- and gas-related activity (or any recent activity) has had detectable long-term adverse population-level effects on the overall health, current status, or recovery of the BCB Seas bowhead population. Data indicate that the BCB Seas bowhead whale population has continued to increase over the timeframe that oil and gas activities has occurred (MMS 2006 Alaska OCS Biological Assessment; NMFS/MMS 2007 DPEIS; Lease Sale 193 DEIS).

IAGC strongly encourages NMFS to conduct a balanced and objective review of scientifically robust and peer-reviewed literature that examine the effects from oil and gas operations on marine mammals and the marine environment. The EIS to be prepared should avoid speculation about potential effects, and should describe effects with reference to documented incidents or scientific or technical reports. The document should examine the evidence in the literature showing seismic surveys have not affected the health or reproductive fitness of marine mammal populations. While numerous subjects remain for additional scientific research on marine mammal populations, the studies to date are very consistent in their conclusions on this topic. The EIS should consider the weight of evidence from over 40 years of offshore exploration monitoring that indicates that routine seismic surveys do not result in population-level impacts for any marine mammal species. With the application of risk-based mitigation measures, seismic surveys have, and will continue to be undertaken with little or no impact to marine mammals and to marine life in general.

5. At the public scoping meeting for the NOI to prepare an EIS for the Arctic on 23 March 2010 in Anchorage, Alaska, NMFS stated that the use of an exclusion zone based on the 120 dB isopleth would be analyzed in the EIS as a potential mitigation method. **IAGC strongly objects to the 120 dB exclusion zone mitigation option.** This proposed mitigation measure is based upon supposition and speculation that cannot be reconciled with decades of well-documented data regarding the sustained health of the BCB Seas bowhead whale population. Moreover, this measure is impracticable, presents



significant human safety risks, and undermines the purpose of geophysical survey programs. In the final analysis, this measure, however well-intended, lacks a rational scientific basis.

There is no scientific evidence to suggest that the seismic activities associated with Beaufort and Chukchi Seas exploration, with use of a 180dB/190dB exclusion zone and other routine mitigation and monitoring requirements, will have an adverse population-level impact on the BCB Seas stock by reducing annual rates of recruitment or survival, or will have anything more than a minor and transitory effect on individual whales. NMFS and MMS have been permitting offshore seismic activity in the Chukchi and Beaufort Seas subject to 180/190 dB monitoring and exclusion zone requirements for many years. Throughout this time, the bowhead whale population has continued to increase. The EIS should clearly identify and separate potential effects from seismic surveys on bowhead whale population health from potential effects on the availability of the bowhead whales for subsistence hunting. In addition to the mitigation and monitoring requirements specified by NMFS in Incidental Harassment Authorizations (IHAs), the Conflict Avoidance Agreements are designed specifically to avoid and minimize potential effects of offshore E&P operations on subsistence hunting.

Currently, it is impracticable, infeasible and unsafe to monitor a 120 dB exclusion zone in the US Chukchi and Beaufort Seas. Towed passive acoustic monitoring (PAM) is not a viable monitoring technology for the large exclusion zone associated with the 120 dB isopleth. Currently available real-time towed PAM systems are not able to reliably and consistently detect and localize marine mammals tens of kilometers away. Perhaps most importantly, PAM is not capable of identifying the age or sex of a whale and so cannot be used to monitor for cow/calf pairs.

MMS regulations (30 CFR Part 251) state that geological and geophysical activities cannot create or cause hazardous or unsafe conditions (NMFS/MMS 2007 DPEIS). Therefore, any mitigation and monitoring measures imposed on seismic surveys by NMFS and MMS must not result in hazardous or unsafe conditions. The mandate for large-scale manned aerial flights in the Beaufort and Chukchi Seas as proposed in the previous 2007 DPEIS to visually monitor the 120 dB exclusion zone for the presence of marine mammals places human personnel at extreme risk for serious injury or fatality. Manned aerial surveys are an impracticable mitigation and monitoring measure and clearly violate MMS regulations with regard to avoiding hazardous or unsafe conditions. Aerial monitoring is extremely unsafe due to the remote location of the survey areas, unpredictable weather conditions, unfavorable ocean



temperatures, and limited daylight hours, which make it unlikely that a rescue could be attempted in the event of mechanical problems. The EIS should address the very real risk to human life that aerial monitoring entails and reject this proposed form of mitigation as unsafe.

If, in spite of the foregoing, NMFS chooses to analyze a mitigation measure based upon the 120 dB isopleth exclusion zone, a detailed discussion of the policy, legal and scientific rationale used in support of such decision should be included in the EIS. Further, if any elements of a decision by NMFS to analyze an exclusion zone using the 120 dB isopleth are in any way based upon or influenced by real or possible effects on subsistence hunting of marine mammals, they should be specifically identified and thoroughly described, and a detailed discussion of the policy, legal and scientific rationale used in support of such decision should be included in the EIS. Regarding the foregoing, all scientific literature, data, information and reports, traditional ecologic knowledge, and any other data or information likewise used in support of such decisions should be thoroughly cited throughout the discussions in the most detailed manner practical.

- 6. In the EIS, NMFS should evaluate the effectiveness and feasibility of proposed mitigation and monitoring measures.** Although industry believes that towed PAM technology may provide a useful means of supporting marine mammal monitoring efforts in the future, further testing and technological improvements are needed before towed PAM can be reliably, consistently and cost-effectively used in Arctic waters. Industry experience with towed PAM systems has shown that the performance and reliability of currently available towed PAM systems is variable and not consistent. There is little or no standardization for either software or hardware, which makes it difficult to measure the effectiveness of a PAM system. The limited availability of experienced operators with the broad range of skills required to operate the systems is also a significant impediment that NMFS must evaluate.
(Please refer to Attachment I for additional information regarding PAM.)

As mentioned in item 5, manned aerial flights in the Beaufort and Chukchi Seas for marine mammals monitoring purposes places human personnel at extreme risk for serious injury or fatality. Manned aerial surveys are an impracticable mitigation and monitoring measure and clearly violate MMS regulations with regard to avoiding hazardous or unsafe conditions. Aerial monitoring is extremely unsafe due to the remote location of the survey areas, unpredictable weather conditions, and unfavorable ocean temperatures, which make it unlikely that a rescue could be attempted in the event of any problems. The EIS should address the very real risk to human life



that aerial monitoring entails and reject this proposed form of mitigation as unsafe.

7. **In developing the EIS, NMFS should recognize the importance of existing scientific research and utilize this vast store of knowledge in the EIS.** The government has played a leading role in performing scientific studies. Since 1973, federal agencies have performed more than 5,000 scientific studies on the environmental effects of offshore oil and gas activities. For example, the National Academy of Sciences has produced three reports focused directly on environmental science for offshore oil and gas, two with particular focus on Alaska. The Minerals Management Service's OCS Environmental Studies Program has spent more than \$600 million on scientific studies of offshore oil and gas – about half of that directed specifically to Alaska. Money is not a perfect measure for the applicability or credibility of the information, but it provides a metric of effort and breadth that many people will understand.

The industry also has a role to play. Oil and gas companies have worked on major scientific programs that supplement the research by government agencies. In the last 10 years, the industry has published studies on the effects of sound on marine life that includes whales and fish, environmental effects of and best management practices for pollution prevention technology, emissions from offshore platforms that include produced waters, drilling discharges, air emissions, and weather and oceanographic studies. In addition, ongoing studies of the Arctic marine environment include: distribution and ecology of fish species present in Arctic waters; population, distribution, migration patterns and feeding and foraging of marine mammals; research into social systems, subsistence uses and traditional knowledge of the indigenous peoples of the region; and physical oceanography and meteorology. Industry has supported the development of scientific knowledge about the Arctic and the Arctic marine environment through sharing of data, long term monitoring projects, collaborative funding, and logistical assistance to government researchers.

(This information was developed by API and is included in their 7 April 2010 letter to NMFS)

8. In previous NEPA documents prepared by NMFS and by the Minerals Management Service (MMS), the description of the **seismic sound sources** has not always been as thorough as it should be to correctly characterize Industry sound sources. Therefore, IAGC recommends the following information be incorporated in the EIS in the section describing seismic surveys.



The desirable characteristics of a seismic source are a pulse of energy with short time duration and a good frequency response within the traditional seismic bandwidth between 5 and 120 Hz. Due to the physical environment surrounding an active seismic array, it is difficult to measure the actual sound pressure level near a full source array as it is activated. Therefore, assumptions are made that enable the response of a given source array to be modeled.

A modern seismic source is not a true point source because the energy is emitted from various point sources that are distributed in space. Therefore, a seismic source array is a distributed source. However, seismic source arrays are designed to behave as point sources in the 'far field.' The 'far field' assumption suggests that at some distance from a source array, which is much greater than the dimensions of the source array, the peak energy pulses from the various individual source elements arrive at the same time and add together constructively to form the 'far field' response of the source. This response is back-projected to one meter from the source array to produce the 'far field' signature of the source at one meter, which is a standard *modeled* measure of a source array output. It is well known that the peak energy pulses from individual source elements do not align at locations close to the seismic source array (in the 'near field') because a seismic source array is a 'distributed', rather than a 'point' source. Therefore, the emitted sound pressure level close to the source array is lower than that calculated using the 'far field' calculation.

The output signature of a source array changes as a function of direction (horizontal angle) and emission angle (angle from the vertical) due to the distributed physical location of the individual source elements within an array. For example, the activation times for all the source elements in the array are synchronized to ensure that the primary pulses from each source element align with one another along the vertical axis of the array. This alignment produces the maximum far-field signature strength in the vertical downward direction.

In the horizontal plane of the array, there will be a delay in the peak arrival times between various source elements that is proportional to the inline spacing of the source elements. These types of arrival delays "smear" the signature thus reducing peak pressure output in the horizontal direction.

These differences in the array signature with respect to direction and angle from the vertical are referred to as the 'array response.' It means that the 'sound' (i.e. frequency content) and 'loudness' (i.e. pressure strength) of the



array signature will be different at different locations in the water. These differences are known as the acoustic radiation pattern or directivity.

9. **IAGC recommends that NMFS consider using the noise exposure criteria as proposed in Southall et al. (2007) to determine the thresholds for sound exposure and exclusion zones for cetaceans during seismic surveys.** In our view, Southall et al. (2007) is the best available peer-reviewed scientific paper on noise exposure criteria and associated metrics. NMFS should seriously consider applying the Southall et al. (2007) criteria and methodology when assessing the risk to marine mammals during marine seismic surveys. Southall et al. provides valuable information to assist in risk assessment of the potential for physical harm to individual animals during seismic operations. The criteria in this document can and should help inform whether there is a risk of physical harm to animals both during regular operation and soft-start of a source array. The International Association of Oil & Gas Producers (OGP) has sponsored an independent modeling effort to investigate the sound exposure level or SEL (cumulative sound energy) and zero-to-peak sound pressure levels at points in the water column several distances relative to the location of the onset of a typical soft-start procedure. The modeled sound exposure levels and sound pressure levels were analyzed and compared to the noise exposure criteria for marine mammals outlined in Southall et al. 2007. The preliminary results suggest that use of a soft-start procedure in deep water environments is very unlikely to expose cetaceans to sound levels which would result in auditory or physical injury (Hannay et al. 2010). Several conservative assumptions were made in the modeling study which add assurance that soft-starts undertaken during limited visibility conditions pose little to no risk of physical harm to cetaceans.

IAGC recommends that NMFS considering using the Southall et al. (2007) noise exposure criteria for cetaceans instead of the current 180 dB criteria.

IAGC appreciates the opportunity to provide comments on the *Notice of Intent to Prepare an Environmental Impact Statement (EIS) on the Effects of Oil and Gas Activities in the Arctic Ocean*. If you have any questions or require additional information, please contact Sarah Tsoflias (sarah.tsoflias@iagc.org; +1 281-940-7311) or Walt Rosenbusch (walt.rosenbusch@iagc.org; +1 713-957-8080).



Sincerely yours,

A handwritten signature in black ink that reads "S L Tsoflis". The letters are cursive and somewhat stylized.

Sarah L. Tsoflis
Vice President – Marine Environment

A handwritten signature in black ink that reads "W Rosenbusch". The letters are cursive and somewhat stylized.

Walt Rosenbusch
Vice President – Projects & Issues



Attachment I

Capabilities and Limitations of Passive Acoustic Monitoring Systems

Based on Industry experience and research conducted by academics (Gillespie et al. 2008), the following have been identified as commonly recognized limitations of current Passive Acoustic Monitoring (PAM) systems:

- Not all cetaceans vocalize all of the time and therefore cannot be reliably detected with a passive system.
- The actual range of the animal is determined by either:
 - Estimates of vocalization level and sound transmission loss models. Errors in either can affect the observed or detected range of the animal.
 - Graphical position fix using 'successive' vocalization detections
- The majority of currently available towed PAM systems is single streamer and has limited bearing resolution capabilities in the in-line direction (relative to streamer orientation).
- The current real-time towed PAM system capability for species recognition and auto-detection is limited and requires operator interpretation.

In recent years, recognizing the potential benefits offered by PAM technology, some Industry members have responded by introducing the use of PAM systems for seismic operations in various sensitive areas; for example offshore UK, Australia, Brazil, Canada, and West Africa. These activities have raised the following issues related to the use of towed PAM method with seismic surveys:

- Deployment platform (seismic/guard vessel). Past experience comes from deployments from both seismic and guard vessels.
 - Guard vessel
 - Fast and simple deployment/recovery.
 - Relatively low acoustic noise environment (compared to larger seismic vessel).
 - Guard vessels have other dedicated safety operational duties.
 - In order to minimize the significant risk to life and equipment from collision, guard vessels do not operate in close proximity to a seismic vessel during modern multi-streamer operations.
 - As guard vessels are commonly positioned some distance away from the source, they are not ideally located to monitor activity in a zone around the source.
 - Seismic vessel
 - Limited working space on back deck.
 - Slow, complicated deployment/recovery due to proximity to seismic equipment.
 - Interference with maintenance activities during line change.
 - No positional control of PAM hardware once deployed in-sea, which is problematic when in close proximity to expensive in-sea seismic equipment.



- Relatively high acoustic noise environment (compared to smaller guard vessel).
- Communications between towed PAM system, existing visual efforts and seismic operation are important for overall integration but are more difficult if PAM is deployed from a vessel other than the main seismic vessel.
- System detection range is dependent on acoustic background noise levels.
- As with visual monitoring methods, procedures are required in order to integrate the use of PAM systems with the overall seismic operation.

Although deploying a single PAM streamer is relatively straight forward, particularly during 2D seismic operations, it becomes more difficult to deploy a streamer that does not have positional control in close proximity to seismic streamers during 3D multi-streamer seismic operations. In these operations, without positional control there is significant increased risk of loss or damage to either the PAM system or seismic in-sea equipment. Should a PAM system be lost or damaged, it would not be available for a time during a survey. This raises regulatory and contractual issues should the use of PAM become a mandatory requirement.

Towed PAM systems are an emerging commercial market. Currently, there are several PAM systems commercially available worldwide. The majority are based upon software/hardware systems that were used for the original trials several years ago. However, little or no standardization exists for either the software or hardware, which makes it difficult to establish a benchmark with which to measure the effectiveness of towed PAM systems. Availability of experienced PAM operators is also an issue; with a broad combination of skills being required in the fields of marine mammal biology, hardware/software engineering and seismic operations (particularly with regard to safety) in order to optimize the use of PAM with seismic operations.

The cost related to the use of a typical towed PAM system and one operator is currently in the order of \$1430-1640/day or greater (mobilization/demobilization costs are additional). Seismic vessels are in operation 24 hours a day, therefore PAM will be required to be in operation prior to the start of airguns at various times throughout the day (night-time operation of PAM is often quoted as a significant advantage over conventional day-time visual monitoring). At least two trained PAM operators are required, increasing the daily cost to over \$2500. With a typical seismic survey lasting between 30-90 days, the cost related to PAM will be \$75,000+ or greater when mobilization/demobilization and possible delays due to weather are also considered.

There are no 'true' 3D acoustic detection systems commercially available today for towed PAM systems. Although PAM streamers are able to detect sounds from all directions by using non-directional hydrophones, current available systems provide a vector range estimate to a detection and are not able to distinguish between horizontal or vertical position. There are many unknowns related to the range estimates provided by current PAM software systems. Providing these errors associated with a given range/bearing to the operator may aid the interpretation of true or false detections.



PAM software tools are currently available as separate freeware and proprietary modules, which provide various levels of integration between detection and logging systems. Industry is proactively supporting research initiatives for the development of standardized freeware software (PAMGuard) that is capable of interfacing with all currently available systems with software support available for operating problems. This will allow research to focus on enhancing the software capabilities to recognize and track animal movement rather than developing interfaces to the individual systems and to allow standardized operator training. A 3D detection methodology is also being developed with ongoing industry financial and technical support.

In summary, although industry believes that towed PAM technology may provide a useful means of supporting marine mammal monitoring efforts in the future, further testing and technological improvements are needed before towed PAM can be reliably and cost-effectively used in Arctic waters.

From  Jefferson Childs <Oceanauts@gci.net>

Sent Friday, April 9, 2010 11:04 pm

To Arcticeis.Comments@noaa.gov

Subject Scoping comments for the NMFS and MMS in Preparation of an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean (75FR6175)

4/9/2010 7:02 PM

TO: Mr. P. Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Silver Spring, MD 201190-3225

FROM: Jeff Childs, Marine Wildlife Ecologist, P.O.B. 111406, Anchorage, AK 99511-1406

SUBJ: Written Scoping Comments for the NMFS (and MMS) in Preparation of an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean (75FR6175)

Mr. Payne,

Please incorporate my concerns/comments in the preparation of the EIS on the effects of oil and gas activities in the Arctic Ocean noted in your notice of intent (75FR6175). If you have questions regarding my comments or seek additional scientific information regarding my comments, please contact me.

Thank you,

Jeff Childs

BioDiversity Analyses

As part of the environmental analyses concerning impacts to biological resources (e.g., ice seals, Pacific walrus, whales, arctic cod, etc.) and their habitats, please also analyze for impacts affecting different nested layers of biodiversity (e.g., taxonomic, population, genetic). For example, among the order Pinnipedia (pinnipeds), there are several members of the family

Phocidae inhabiting the Chukchi/Beaufort seas. Of those phocids, there is one member of the genus *Erignathus*; and three members of the genus *Phoca*. In contrast, another pinniped occurring in the Alaskan Arctic Ocean is the Pacific walrus, the only representative of the family Odobenidae; genus *Odobenus*. Impacts to the Pacific walrus occur not only at the species level, but also taxonomically higher as this species is the only extant member of the family Odobenidae occurring in the region...such impacts may be significant to the biodiversity of arctic pinnipeds. I request impact analyses be conducted for the nested layers of biodiversity of vertebrates (fishes, birds, mammals), occurring in the large marine ecosystems of the Alaskan sectors of the Chukchi and Beaufort seas. The CEQ issued guidance for incorporating biological diversity into environmental impact analyses prepared under NEPA in 1993 (CEQ, 1993). The scientific community has greatly expanded the science and theory regarding biodiversity analyses since CEQ's publication in 1993. I recommend reviewing the CEQ guidance and recent scientific literature; and drawing on such works to analyze impacts to biodiversity at the taxonomic, population, and genetic levels of vertebrate wildlife.

Analyses concerning Rare Vertebrate Species or of Unique Ecological Parameters (e.g., small range size)

It is common for federal agencies to analyze impacts to marine protected species (e.g., endangered species, marine mammals) or commercially valuable species (e.g., Pacific salmon), however, many vertebrate species are rare or little known and are NOT protected under the ESA or MMPA. The biological or ecological significance of rare or little known species is becoming more evident (e.g., Raphael and Molina, 2007); they may represent the only known member of a genus, family, or order, occurring in an ecosystem (revisit my request for biodiversity analyses).

Relative to the Arctic EIS under preparation, there are many fish species occurring in the Chukchi and/or Beaufort seas for which there is little information known of them; indeed, we only know of their occurrence from one to a few specimens ever collected; some from collected from only one location in the Chukchi or Beaufort seas. These species may be rare and/or cryptic; nonetheless, they may be important to the structure, function, and/ or biodiversity of the ecosystem. For example, there is at least one marine fish species occurring in the Chukchi Sea Planning Area that is endemic to the Alaskan Chukchi Sea.

The American Fisheries Society (AFS), the world's oldest and largest professional organization for fisheries science and conservation, has published criteria for extinction risk in marine fishes (Musick, 1999). In addition, Musick et al. (2000) use rarity, small range and endemics, specialized habitat requirements, and population decline, as criteria for assessing extinction risk in marine, estuarine, and diadromous fish stocks of North America. I request that the NMFS and MMS analyze for impacts to vertebrates (not just marine fishes) that are rare, cryptic, endemic, have a small range, have specialized habitat requirements, or whose population may be declining.

The AFS has also published a variety of policy papers addressing such issues as the protection of marine fish stocks, biodiversity, introduction of aquatic species, and modifications to habitat, that may be informative and helpful; please review such policy papers (http://www.fisheries.org/afs/policy_statements.html) and draw upon their findings and recommendations (as relevant) preparing the environmental analyses associated with the Arctic EIS.

Analysis of Introducing Aquatic Non-Native Species that may become Invasive

The MMS has selectively chosen not to analyze impacts stemming from aquatic invasive species (AIS) in recent past EIS's and EA's for lease sale activities it administers in the Arctic (e.g., Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activities; OCS EIS/EA MMS 2007-026). The MMS acknowledges that potential vectors of introducing AIS are via ballast-water discharge, hull fouling, and equipment placed overboard (e.g., anchors, seismic airguns, hydrophone arrays, ocean-bottom survey cables). The MMS notes that the USCG developed regulations (33CFR 151) that implement provisions of the NISA, citing that vessels brought into the State of Alaska or Federal waters would be subject to current USCG regulations at 33 CFR 151, which are intended to reduce the transfer of invasive species. Specifically, the MMS notes that USCG regulations Section 151.2035(a)(6) requires the "removal of fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, State, and Federal regulations." The MMS note the USCG regulations appear effective because no AIS have been documented in the Alaskan Chukchi or Beaufort seas. The MMS also regard the Chukchi and Beaufort seas as posing harsh and frigid environmental conditions that it believes are major and difficult challenges to successfully introducing AIS to the region; and conclude the likelihood of introducing AIS from lease sale associated activities to be very low, and do not consider it further in the EIS.

I find it irresponsible and disingenuous of the MMS to NOT analyze the potential introduction of aquatic non-native species (ANNS) that may become aquatic invasive species (AIS) relative to its leasing and permitting activities; particularly in light of (1) the wealth of scientific information available concerning the mechanisms for and harm posed by the introducing ANNS and AIS, and (2) the well-known loopholes existing in the current USCG regulations cited by the MMS as being "apparently effective." The MMS did not cite any scientific literature supporting their decision to scope out impacts stemming from the introduction of AIS to Alaska. The MMS disregarded the scientific literature concerning the introduction of ANNS/AIS. The MMS also intentionally disregarded concerns expressed by various scientists from within the MMS, the USFWS, ADF&G, and a national AIS expert (with Alaska experience) from the Marine Invasions Research Lab, Smithsonian Environmental Research Center (see GAO, 2010, for some background and context). Those scientists clearly expressed concerns to the MMS that industry activities associated with OCS lease sales in the Beaufort and Chukchi seas may introduce ANNS/AIS to Alaska (northern or southern waters off Alaska)! Those concerns were made known to MMS managers in the Alaska Region as well as managers at MMS headquarters in Herndon, VA.

The truth is that the USCG acknowledges that "all vessels" are capable of transporting ANNS or AIS via hull fouling or other vectors. And while the USCG has published regulations to stem the introduction of ANNS/AIS into the U.S., there are large loopholes whereby vessels engaging in OCS activities may easily introduce ANNS/AIS to Federal and coastal waters off Alaska.

Here is the current scenario regarding Arctic OCS activities in Alaska, based on the last few years of oil industry activities permitted by MMS for the exploration of hydrocarbons in the Arctic. Vessels involved in OCS operations prosecuted off Alaska must be brought to Alaska from elsewhere in the world, and have been... from many different regions of the world. The MMS does not acknowledge where vessels may come from in their "scoping out" explanation. Some, if not most, of these industry vessels, stop at ports in southcentral or southwestern Alaska to replenish supplies, do maintenance, conduct personal transfers, etc., before transiting north into the Chukchi and/or Beaufort seas to work (e.g., carry out seismic surveys,

conduct exploratory drilling, provide vessel support of some sort). And while in port, those vessels rub against piers, pilings, other vessels, etc., causing non-native organisms attached to their hull (or hiding among attached organisms as is also the case) to dislodge and settle to the sea floor. Colonization then may or may not occur in waters off Alaska. Again, the MMS makes no consideration of industry vessels making ports of call in Alaskan waters besides the operations to be conducted in the Chukchi and Beaufort seas. That is, there is no consideration that such vessels may visit and potentially impact marine ecosystems off southern Alaska, with respect to the introduction of ANNS/AIS.

USCG regulations Section 151.2035(a)(6) requires the “removal of fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, State, and Federal regulations.” The noteworthy loophole here involves the term “regular basis” as it is undefined. What does “regular basis” mean? Does “regular basis” mean once a year or once every X years (X= some other arbitrary time span)? The U.S. regularly conducts a Presidential election every four years; a national census is conducted on a regular basis...every 10 years. Does this mean that removing any fouling organisms from drill ships or seismic vessels on a “regular basis” occurs every four or ten years? Does removal on a “regular basis” of every four or ten years effectively prevent the introduction of ANNS/AIS to ports visited in southcentral or southwestern Alaska before such vessels transit north to work in the Chukchi and/or Beaufort seas? Likely not!

Scientific evidence of hull fouling rates indicate that hull cleaning even once a year may not be sufficient. For example, scientific divers from Texas A&M University and the University of Texas dove on an offshore production platform placed near the Flower Garden Banks National Marine Sanctuary several days after placement and found the legs of the platform to be newly fouled with several species of marine algae and invertebrates. (I was one of those divers). The rate at which vessels need be cleaned of hull fouling organisms will depend upon many factors, including water temperature, season of fouling, species present, etc. There is scientific literature supporting these concerns and the issue of hull fouling.

The MMS notes the USCG regulations “appear effective because no AIS have been documented in the Alaskan Chukchi or Beaufort seas.” Sampling studies for fish and lower trophics in the Chukchi and Beaufort seas are sparse and juxtaposed; fish and lower trophics in Arctic Alaska are poorly sampled relative to those occurring in other coastal and marine waters of the U.S. And while no AIS have yet to be found in the few surveys conducted in the Chukchi and Beaufort seas; Dr. Greg Ruiz, (Senior Scientist, Marine Invasions Research Lab, Smithsonian Environmental Research Center) has conducted surveys of ANNS/AIS in Alaskan waters and found ANNS in southcentral and southwestern Alaska! Dr. Ruiz expressed written concerns to the MMS regarding the introduction of ANNS and AIS in Alaska via OCS activities; his concerns (and those of other biologists) were disregarded by the MMS in its environmental assessments for lease sale activities in the Arctic Ocean (see GAO, 2010)!

If the MMS and NMFS were not issuing permits to Industry vessels participating in OCS activities, these vessels would not likely be coming to Alaska (whether to ports in southcentral or southwestern Alaska or working in the Chukchi and/or Beaufort seas) and the potential for their introducing ANNS/AIS to Alaska would be nonexistent. The issuance of permits for OCS

exploration/production activities, in effect, brings such vessels to Alaska and authorizes activities that may unintentionally introduce ANNS into marine or coastal waters and ecosystems of Alaska, such as via the hull fouling loophole. Executive Order 13112 specifies that each Federal agency (not just the USCG as the MMS has previously inferred) whose actions may affect the status of invasive species shall...

1. identify such actions;
2. subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and
3. not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions....

Not only do the MMS and NMFS need to analyze the impacts of introducing ANNS (which may be beneficial relative to NEPA standards) they must also fully analyze impacts of introducing ANNS that may become AIS (i.e., harmful relative to NEPA standards); use relevant programs and authorities to prevent the introduction of AIS; develop the means to detect and respond rapidly to and control populations of such species; and monitor AIS populations accurately and reliably;...not authorize, fund, or carry out actions it believes are likely to cause or promote the introduction or spread of AIS in the U.S. (to include Alaska)...

While the MMS appears intent to put the regulatory burden regarding potential ANNS/AIS introductions stemming from Arctic lease sale activities entirely upon the USCG, it is worthwhile also noting that a precedent has been set whereby the USCG is responsible for regulating offshore oil spills, has passed regulations regarding oil spills and response measures. Nonetheless, the MMS assesses impacts for potential oil spills associated with lease sale actions, has regulations regarding oil spill prevention and response, and imposes mitigation measures to reduce the risk and impacts stemming from oil spills. I recommend that the NMFS and MMS analyze potential impacts of introducing ANNS/AIS to Alaska due to OCS leasing/exploration/production/abandonment activities as part of environmental impact assessments; as well as work together with the USCG, USFWS, and the ADF&G to minimize the risk of introducing ANNS that may become AIS to Alaskan ecosystems.

The MMS stated in the Chukchi Lease Sale EIS that it regards the Chukchi and Beaufort seas as posing harsh and frigid environmental conditions that it believes are major and difficult challenges to successfully introducing AIS to the region; and conclude the likelihood of introducing AIS from lease sale associated activities to be very low. Available scientific literature clearly does not support MMS' position and risk assessment. For example, Gollasch (2002) reports on a study conducted in the North Sea (another Arctic region known to pose harsh and

frigid environmental conditions that one might presume to impose major and difficult challenges to the introduction of AIS) and found hull fouling on shipping vessels to be an important vector for introducing non-native species to the North Sea. Non-native species were recorded in 96% of all hulls sampled. Gollasch found that after classifying all non-native species into three categories of potential establishment (based on the degree of similarity of climatic conditions in the North Sea with the donor region) that 19 of the species found in the fouling communities on ships' hulls were deemed to have a high potential for establishment in the North Sea. Table II of Gollasch (2002) is a useful resource for assessing the potential introduction of ANNS into Alaskan waters; it is reproduced below for your use and to demonstrate the flawed conclusion perpetrated by the MMS.

TABLE II from Gollasch (2002): Probability of colonization of non-native species according to matching climate (temperature) in donor and recipient regions.

	DONOR Region			
RECIPIENT Region	Arctic & Antarctic	Cold-temperate	Warm-temperate	Tropics
Arctic & Antarctic	High	Medium	Low	Low
Cold-temperate	Medium	High	Medium	Low
Warm-temperate	Low	Medium	High	Medium
Tropics	Low	Low	Medium	High

Again, the MMS provided no information or analysis of where industry vessels may come from (i.e., DONOR region) in their brief explanation as to conclude a very low probability of introduction (which is different from a probability of colonization). Using the best available information presented by Gollasch (2002), the probability of introducing/colonizing of ANNS to Alaskan OCS/coastal waters (e.g., southern Alaska; northern Alaska) depends on where the industry vessels come from and whether their hulls and equipments were cleaned before transiting to Alaska! If the vessels (sans hull cleaning) come from a cold-temperate or arctic donor region (e.g., Sakhalin Island, Russia), then there is a high to medium probability of introduction/colonization in Arctic Alaska and a medium to high probability should the vessel(s) stop in ports of southcentral or southwestern Alaska!

One mitigation to avoid introducing ANNS/AIS to waters off Alaska involves requiring vessels to have their hulls professionally cleaned before departing for Alaska! The NMFS and MMS could require permit holders to also provide video documentation (with date/time stamps) of such cleaning. Commercial diving companies that provide hull cleaning services can/do provide clients with video documentation of vessels before and after hull cleaning; along with reports of any structural problems they observe underwater.

Overboard equipment (e.g., seismic arrays) used elsewhere in the world, and to be used in Alaskan waters should be cleaned before putting it over the side in Alaska waters.

I also recommend convening a workshop of ANNS/AIS science experts (e.g., Greg Ruiz), Federal, state, and affected community representatives/staff to fully investigate the how best to

avoid introducing ANNS/ AIS in marine and coastal water of Alaska via OCS activities. I recommend doing sooner rather than later, as their findings could be very important and useful relative to the EIS.

These are simple, proactive measures/mitigations that can literally save money, jobs, ecosystem services, and human sanity; for once an AIS colonizes an ecosystem, they are hellacious to eradicate.

Recommended Literature

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[GAO-10-276](http://www.gao.gov/new.items/d10276.pdf), March 08, 2010 (<http://www.gao.gov/new.items/d10276.pdf>)

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Ruiz, G.M. and J.T. Carlton. (Eds.) 2003. *Invasive Species: Vectors and Management Strategies*. Island Press, Washington, D.C.



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April 8, 2010

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Office of Protected Resources, NMFS
1315 East-West Highway
Silver Spring, MD 20190-3225

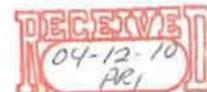
Re: Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, RIN 0648-XU06

The National Ocean Industries appreciates the opportunity to comment on the National Marine Fisheries Service (NMFS) Request for Comments on the preparation of an Environmental Impact Statement (EIS) to analyze the environmental impacts of issuing Incidental Take Authorizations (ITAs) pursuant to the Marine Mammal Protection Act (MMPA). The purpose of this EIS will be to support the issuance of ITAs to the oil and gas industry for the taking of marine mammals incidental to offshore exploration activities in the Chukchi and Beaufort Seas off Alaska.

NOIA is the only national trade association that represents all companies engaged in the exploration for, and production of, traditional and alternative energy on the nation's Outer Continental Shelf. The NOIA membership comprises more than 250 companies engaged in activities ranging from producing to drilling, engineering to marine and air transport, offshore construction to equipment manufacture and supply, shipyards to communications, and geophysical surveying to diving operations. As such, NOIA is particularly interested in this opportunity to comment.

NOIA endorses and wishes to associate ourselves with the comments offered by the Alaska Oil and Gas Association as well as the American Petroleum Institute, including the following premises:

- Global demand for energy will grow and, because existing and developing energy sources will struggle to keep up with demand, oil and gas resources will be needed for American consumers and the American economy for decades to come.

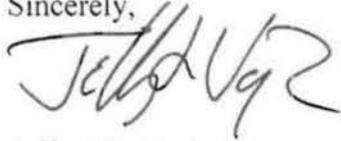


- The U.S. has vast oil and gas resources on the Outer Continental Shelf (OCS) that can and must play a critical role in meeting that future energy demand, in fueling the economy, and providing jobs. Reliable estimates indicate that a significant portion of these resources may be found in the OCS in the Chukchi and Beaufort Seas.
- Offshore development can occur in an environmentally responsible way.
- Americans do not have to choose between OCS development or the environment. The oil and gas industry possesses an unparalleled environmental record on the Outer Continental Shelf and in challenging cold water and Arctic operating environments, and continues to expand the role of technology and science in pursuit of environmental stewardship.
- Access to new resource basins remains necessary.
- Policymakers intended the OCS to provide energy supplies.
- Decisions on areas to be included or withheld from lease sales should be based on peer-reviewed science, objective assessment of risk, and public discussion.
- Current resource estimates may understate OCS supply potential.
- Potential Alaskan OCS resources are an important element of the U.S. supply picture.
- Encouraging the NMFS to conduct environmental analyses for all planning areas; and for those areas which already have existing work done, recommending a tiered approach to supplement that work.
- Technological advancements and specialized equipment have greatly enhanced industry's ability to safeguard the ocean with regard to oil spill prevention and preparedness.
- Encouraging NMFS to carry out a balanced and objective review of scientifically sound and peer-reviewed literature that examine the effects from oil and gas operations in the marine environment on marine mammals that inhabit that environment.
- Recognizing the importance of research, including industry-supported development of scientific knowledge about the Arctic and the Arctic marine environment through sharing of data, long term monitoring projects, collaborative funding, and logistical assistance to government researchers.

- Failure to expand access will adversely impact all Americans.

Should you have any questions regarding these comments please contact Jeff Vorberger at 202-347-6900 or jvorberger@noia.org.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeffrey Vorberger". The signature is written in a cursive style with a large, stylized "V" at the end.

Jeffrey L. Vorberger
Director, Government Relations

we be invited to participate as a cooperating agency in this process as well.

The NSB has the largest jurisdiction of any municipal government in the United States—an area larger than the State of Minnesota. We have multiple interests at stake in the Arctic Ocean OCS. First and foremost are NSB's interests related to the health and welfare of our residents, who are rightfully concerned about potential health impacts associated with oil and gas development on the North Slope. These impacts may be direct, indirect or cumulative in nature and relate to the contamination and degradation of the natural environment upon which our residents rely. There is also an increasing sense in NSB communities of being overwhelmed by multiple planning processes, both because of the lack of time and expertise on community and individual levels and because of a seeming inability to influence meaningfully the decisions being made.

These concerns are well-founded. Oil and gas activities are expanding rapidly in the Beaufort and Chukchi Seas. Production from the Northstar facility in the Beaufort Sea is ongoing. This summer, Shell intends to conduct exploration drilling in both the Beaufort and Chukchi Seas, and has proposed both a shallow hazard survey and a strudel scour survey in the Beaufort Sea. In addition, Statoil intends to conduct 3D seismic exploration on its leases in the Chukchi Sea this summer, while ION Geophysical has applied to conduct 2D seismic surveys that would cover vast areas of the Beaufort and Chukchi seas. It seems likely that industry will push for increased activity in the future. ConocoPhillips has already begun the permitting process to engage in exploration drilling in the Chukchi in 2012, and state waters in the Beaufort Sea may be subject to leasing and exploration in future years. In addition to oil and gas activities, commercial shipping and vessel traffic are increasing in Arctic waters as summer sea ice retreats. This growth in industrial activities comes at a time when a rapidly warming climate is causing profound changes to the region, and when ocean acidification will contribute additional stress to marine ecosystems.

The potential impacts of industrial activities and environmental changes—both individually and cumulatively—demand a comprehensive analysis. In addition to addressing the seismic specific scoping comments we've attached below, your analysis, or the alternatives it contains, should:

- Incorporate local and traditional knowledge and meaningfully involve Arctic communities with special attention to the guiding principles of Executive Order 12898 and federal trustee responsibilities;
- Account for environmental changes occurring in the Arctic, including thorough consideration of climate change and ocean acidification;
- Analyze fully the potential cumulative impacts of industrial activities, with particular attention to water and air quality impacts;
- Acknowledge data gaps and missing information;
- Adopt a precautionary approach similar to that expressly outlined in the North Pacific Fishery Management Council's Arctic Fishery Management Plan, approved by the Secretary of Commerce in August 2009;

- Consider through a formal health impact assessment (HIA) included in the EIS the broad range of potential human health and sociocultural impacts associated with Arctic oil and gas development, and
- Coordinate with future National Ocean Council processes such as the proposed Arctic strategic action plan.

This discussion should be just the beginning of NMFS's analysis of the complex interrelated, ongoing, and foreseeable cumulative effects on subsistence use patterns, sociocultural systems, and human health.

We appreciate the opportunity to submit these comments. If you have any questions regarding our comments, feel free to contact my office.

Sincerely,



Edward S. Itta
Mayor

cc: Taqulik Hepa, Director, NSB Wildlife Department
Dan Forster, Director, NSB Planning Department
Andy Mack, Special Assistant, Mayor's Office
Bessie O'Rourke, NSB Attorney
Karla Kolash, Special Assistant, Mayor's Office

Attachments A, B, C and D

Attachment A North Slope Borough Comments

Legal Background

A. THE NATIONAL ENVIRONMENTAL POLICY ACT

Section 101 of the National Environmental Policy Act (NEPA), 42 U.S.C. 4331, provides:

The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man declares that it is the continuing policy of the Federal Government * * * to use all practicable means and measures * * * in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

NEPA thus “declares a broad national commitment to protecting and promoting environmental quality.” *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 348 (1989). Its goal is “to use all practicable means and measures * * * to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.” 42 U.S.C. 4331(a).

NEPA's action-forcing procedures require agencies to consider environmental effects. “To ensure that this commitment [to protect and promote environmental quality] is infused into the ongoing programs and actions of the Federal Government, the act also establishes some important ‘action-forcing’ procedures” (citations omitted). *Robertson v. Methow Valley Citizens Council*, *supra*, 490 U.S. at 348. NEPA requires that federal agencies prepare environmental impact statements to be “include[d] in every recommendation or report on proposals for * * * major Federal actions significantly affecting the quality of the human environment.” 42 U.S.C. 4332(2)(C); *see also Robertson v. Method Valley Citizens Council*, *supra*, 490 U.S. at 348. “Major or Federal action” encompasses “new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies * * *.” 40 C.F.R. 1508.18(a) (regulations of the Council on Environmental Quality (CEQ)).

NEPA also requires the agency to consider human health impacts. Congress, in enacting NEPA, stated that the Act was intended, among other purposes (42 U.S.C. 4321):

To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; [and] to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man * * *. CEQ regulations require the agency to consider the effects of its actions on the “human

environment.” See 40 C.F.R. 1500.2. “Human environment” is intended to be “interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment.” 40 C.F.R. 1508.14. CEQ regulations direct the consideration of effects of the proposed action and reasonable alternatives, including effects that are “ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative.” 40 C.F.R. 1508.8. CEQ regulations also direct the agency to consider “the degree to which the proposed action affects public health or safety” when evaluating the intensity of impacts. 40 C.F.R. 1508.27.

NEPA also requires the agency to consider the impacts of the proposed action and reasonable alternatives to it. An environmental impact statement (EIS) under NEPA must include “a detailed statement by the responsible official on * * * (iii) alternatives to the proposed action.” 42 U.S.C. 4332(2)(C). This statement must “rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss their reasons for having been eliminated.” 40 C.F.R. 1502.14(a). The alternatives analysis “is the heart of the environmental impact statement.” 40 C.F.R. 1502.14.

The EIS requirement serves NEPA’s action-forcing purpose in two respects. First, it “ensures that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts * * *.” *Robertson v. Methow Valley Citizens Council*, *supra*, 490 U.S. at 349. Second, it “guarantees that the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision.” *Ibid.* Thus, “by focusing the agency’s attention on the environmental consequences of a proposed project, NEPA ensures that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast” (citations omitted). *Ibid.*

While NEPA and its regulations “set forth significant substantive goals,” they do not require substantive environmental results. *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, Inc.*, 435 U.S. 519, 558 (1978). Instead, they provide a procedural mandate agencies must follow. *Ibid.* However, these procedures “are not highly flexible. Indeed, they establish a strict standard of compliance.” *Calvert Cliffs’ Coordinating Committee, Inc. v. United States Atomic Energy Commission*, 449 F.2d 1109, 1112 (D.C. 1971). Writing for the Court of Appeals for the First Circuit, then-Judge Breyer explained (*Massachusetts v. Watt*, 716 F.2d 946, 952 (1st Cir. 1983)):

NEPA is not designed to prevent all possible harm to the environment; it foresees that decision makers may choose to inflict such harm, for perfectly good reasons. Rather, NEPA is designed to influence the decision making process; its aim is to make government officials notice environmental considerations and take them into account. Thus, when a decision to which NEPA obligations attach is made without the informed environmental consideration that NEPA requires, the harm that NEPA intends to prevent has been suffered.

CEQ regulations under NEPA recognize, however, that complete information is not always

available. In the case of uncertainty or incomplete or unavailable information, the agency must identify the missing information, but it still must make a decision. 40 C.F.R. 1502.22. In such a case, the agency must state the “relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment”; summarize “existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment”; and evaluate the reasonably foreseeable adverse impacts “based upon theoretical approaches or research methods generally accepted in the scientific community.” 40 C.F.R. 1502.22(b).

When undertaking the NEPA EIS process, the first step the agency must complete is scoping, as the National Marine Fisheries Service (NMFS) is doing here. The scoping process is “an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.” 40 C.F.R. 1501.7. The agency must use the scoping process to “[d]etermine the scope * * * and the significant issues to be analyzed in depth in the environmental impact statement.” 40 C.F.R. 1501.7(a)(2). “Scope consists of the range of actions, alternatives, and impacts to be considered in an environmental impact statement.” 40 C.F.R. 1508.25. To determine scope, the agency must consider actions including connected actions, cumulative actions, and similar actions; alternatives including no action, other reasonable courses of action, and mitigation measures; and impacts including direct, indirect, and cumulative impacts. *Ibid.*

National Oceanic and Atmospheric Administration (NOAA) Administrative Order 216-6 provides further guidance and policies for agencies under NOAA, including NMFS. This guidance notes that (NOAA Administrative Order 216-6 -- Environmental Review Procedures for Implementing the National Environmental Policy Act, May 20, 1999, Sec. 5.02(a)):

The purpose of scoping is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes, involve the public early in the decisionmaking process, facilitate an efficient EA/EIS preparation process, define the issues and alternatives that will be examined in detail, and save time by ensuring that draft documents adequately address relevant issues.

This guidance also states: “To the maximum extent practicable, comprehensive public involvement and interagency and Indian tribal consultation should be sought [during the scoping process] to ensure the early identification of significant environmental issues related to a proposed action.” *Id.*, Sec. 5.02(c)(2).

B. THE MARINE MAMMAL PROTECTION ACT

The Marine Mammal Protection Act, 16 U.S.C. 1361, *et seq.* (MMPA), provides protection for marine mammals, including the bowhead whale and other species likely to be affected by the proposed action. MMPA declares that marine mammals “should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem.” 16 U.S.C. 1361(a). Congress prohibited the taking, including the taking by

harassment, of any marine mammal, except when subject to certain restrictions and conditions. 16 U.S.C. 1371(a). The Court of Appeals for the Ninth Circuit has held that “Congress’ overriding purpose in enacting the MMPA was the protection of marine mammals.” *Balelo v. Baldrige*, 724 F.2d 753, 756 (9th Cir. 1984). One important reason for this protection was the preservation of marine mammals for subsistence use, a purpose that MMPA recognizes and protects. MMPA exempts “any Indian, Aleut, or Eskimo who resides in Alaska and who dwells on the coast of the North Pacific or Arctic Ocean” from the prohibition on taking marine mammals, provided that any takings under this exemption are done “for subsistence purposes.” 16 U.S.C. 1371(b)(1). MMPA also specifically gives the Secretary authority to “enter into cooperative agreements with Alaska Native organization to conserve marine mammals and provide co-management of subsistence use by Alaska Natives.” 16 U.S.C. 1388(a). The Act also requires the Secretary to find that any taking or harassment for which a letter of authorization or incidental harassment authorization is issued “will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses.” 16 U.S.C. 1371(a)(5)(A)(i) and (D)(i)(II).

Under MMPA, the Secretary of Commerce, through NMFS, may grant an Incidental Harassment Authorization (IHA), “subject to such conditions as the Secretary may impose,” for the harassment of marine mammals occurring as the incidental result of some other lawful activity. 16 U.S.C. 1371(a)(5)(D). However, to grant an IHA, NMFS must find that the harassment (16 U.S.C. 1371(a)(5)(D)(i)):

- (I) will have a negligible impact on such species or stock, and
- (II) will not have an unmitigable adverse impact on the availability of such species or stock for taking for subsistence uses * * *.

The IHA must prescribe (16 U.S.C. 1371(a)(5)(D)(ii)):

- (I) permissible methods of taking by harassment pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat * * * and on the availability of such species or stock for taking for subsistence uses * * * ,
- (II) the measures that the Secretary determines are necessary to ensure no unmitigable adverse impact on the availability of the species or stock for taking for subsistence uses * * * , and
- (III) requirements pertaining to the monitoring and reporting of such taking by harassment * * * .

These requirements are also established in NMFS’ own regulations. *See* 50 C.F.R. 216.102, 216.107. These regulations define negligible impact as “an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates or recruitment or survival.” 50 C.F.R. 216.103. Unmitigable adverse impact is defined as (*ibid.*):

- an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas * * * ; 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 NMFS regulations under MMPA further provide (50 C.F.R. 216.102):

The taking of small numbers of marine mammals under section 101(a)(5)(A) through (D) [16 U.S.C. 1371(a)(5)(A) through (D)] of the Marine Mammal Protection Act may be allowed only if the National Marine Fisheries Service: (a) Finds, based on the best scientific evidence available, that the total taking by the specified activity during the specified time period will have a negligible impact on species or stock of marine mammal(s) and will not have an unmitigable adverse impact on the availability of those species or stocks of marine mammals intended for subsistence uses.

The NMFS regulations also state (50 C.F.R. 216.107(b)):

Issuance of an incidental harassment authorization will be based on a determination that the number of marine mammals taken by harassment will be small, will have a negligible impact on the species or stock of marine mammal(s), and will not have an unmitigable adverse impact on the availability of species or stocks for taking for subsistence uses.

The regulations require that NMFS adequately estimate the number of marine mammals that will be taken, because it must determine that the number will be small. *Ibid.*

C. THE ENDANGERED SPECIES ACT

The Endangered Species Act, 16 U.S.C. 1531 *et seq.* (ESA), is intended to protect endangered species and the habitats on which they depend, including the bowhead whale, an endangered species likely to be affected by the proposed action. In enacting ESA, Congress declared that the purposes of ESA “are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species * * *.” 16 U.S.C. 1531(b). It further declared that “all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of this chapter.” 16 U.S.C. 1531(c)(1). ESA prohibits the taking of any endangered species “within the United States or the territorial sea of the United States” or “upon the high seas.” 16 U.S.C. 1538(a)(1)(B) and (C). Taking includes harassment. 16 U.S.C. 1532(19) (“The term ‘take’ means to harass * * *”). The Act accords to endangered species the highest level of protection; the Supreme Court has explicitly held that “Congress intended endangered species to be afforded the highest of priorities.” *TVA v. Hill*, 437 U.S. 153, 174 (1978).

D. THE BEST SCIENCE STANDARD OF MMPA AND ESA

ESA specifically provides that each agency, in fulfilling its obligations not to allow any activity authorized by it to jeopardize the continued existence of an endangered or threatened species, or to affect adversely the habitat of such a species, must use the “best scientific and

commercial data available.” 16 U.S.C. 1536(a)(2). MMPA also provides for the use of the best available science (16 U.S.C. 1371(a)(3)(A)):

The Secretary, on the basis of the best scientific evidence available * * * is authorized and directed * * * to determine when, to what extent, if at all, and by what means, it is compatible with this chapter * * * so as to allow taking * * * of any marine mammal * * * and to adopt suitable regulations, issue permits, and make determinations * * *.

NMFS regulations under MMPA echo this requirement to use the best available science, providing that the taking of “small numbers of marine mammals” may be allowed if negligible impact on the species and no unmitigable adverse impact of the availability of the species for subsistence use are found “based on the best scientific evidence available.” 50 C.F.R. 216.102.

When the best available science standard requires a decision to be made, even in the absence of complete information, Congress intended this standard “to give the benefit of the doubt to the species.” *Conner v. Burford*, 848 F.2d 1441, 1454 (9th Cir. 1988). The Court of Appeals for the Ninth Circuit has found that the benefit to the species is meant to be applied whenever there is uncertainty. In *Brower v. Evans*, 257 F.3d 1058, 1063-1064 (9th Cir. 2001), the court of appeals reviewed NMFS’s findings that the purse seine fishing industry had a suggested, but inconclusive, impact on two species of dolphin. Based on this information, NMFS decided that there was insufficient evidence to find a significant adverse impact. *Id.* at 1064. However, the court determined that “scientific findings in [the] marine mammal conservation area are often necessarily made from incomplete or imperfect information,” but ESA nonetheless “requires agencies to make determinations on the basis of the best scientific data available.” *Id.* at 1070. The court of appeals concluded that “with [the] best available data standard Congress required [the] agency to consider the scientific information presently available and intended to give ‘the benefit of the doubt to the species.’” *Ibid.* (citing *Conner v. Burford, supra*, 848 F.2d at 854). The finding of no significant impact, based on insufficient evidence, was held to be contrary to law and an abuse of discretion. 257 F.3d at 1070.

Other courts have also relied on *Conner* to find that “Congress has expressed a preference for the species in a context of uncertainty.” *Rock Creek Alliance v. United States Fish and Wildlife Service*, 390 F. Supp. 2d 993, 1009 (D. Mont. 2005). *See also Center for Biological Diversity v. Bureau of Land Management*, 422 F. Supp. 2d 1115, 1127 (N.D. Cal. 2006) (“To the extent that there is any uncertainty as to what constitutes the best available scientific information, Congress intended ‘to give the benefit of the doubt to the species’”); *Earth Island Institute v. Evans*, 2004 WL 1774221, 11 (N.D. Cal. 2004) (the best available science standard “is intended to give the benefit of the doubt to the species” (internal quotations omitted)); *Center for Biological Diversity v. Lohn*, 296 F. Supp. 2d 1223, 1239 (W.D. Wash. 2003) (“The best available science standard gives the benefit of the doubt to the species” (internal quotations omitted)).

Based on this legal background, we submit the following comments.

COMMENT: The Environmental Impact Statement Must Adequately Analyze Impacts to Marine Mammals, Particularly the Bowhead Whale, under All Proposed

Alternatives

Marine mammals, particularly the bowhead whale, are vital to the the North Slope Borough (NSB) and its residents. The majority of the residents of NSB are Native American Inupiat Eskimos.

The bowhead whale subsistence hunt is central to the traditional Eskimo culture of the NSB's residents. Most Alaskan native residents of the North Slope communities maintain their traditional subsistence lifestyle and culture and hunt animals, including the bowhead whale, for food. The bowhead whale is the most culturally significant subsistence food source in Inupiat culture. As noted above, the MMPA recognizes and protects the subsistence use of the bowhead whale and other marine mammals.

NMFS recognizes that seismic activity could have impacts on bowhead whales, and thus on the availability of subsistence resources. It is important to note that, although NEPA imposes no substantive requirements on NMFS' choice of preferred alternative, the MMPA and ESA, which both require protection for the bowhead whale and other marine species, do. The MMPA requires that NMFS make a choice that will result in negligible impact on the bowhead and other protected species and no unmitigable adverse impact on the availability of bowhead whales or other marine mammals for taking for subsistence use. 16 U.S.C. 1371(a)(5)(D)(i); *see* above. ESA requires that NMFS "seek to conserve endangered species," including the bowhead whale. 16 U.S.C. 1531(c)(1); *see* above. Both MMPA and ESA set standards that require that any uncertainty be interpreted in favor of greater protection for the affected species.

Given the importance of the bowhead whale to the Inupiat culture, and the high likelihood that the proposed action will have impacts on the bowhead whale and other marine mammals, particularly if an alternative is not carefully chosen after full analysis, the EIS must provide a thorough analysis of the impacts of the activities contemplated on marine mammals, including the bowhead whale.

COMMENT: The Environmental Impact Statement Must Adequately Analyze Impacts to Marine Mammals, Particularly Bowhead Whales, under All Potential Mitigation and Monitoring Requirements

MMPA requires that any IHA granted for incidental harassment include measures to effect "the least practicable impact" on protected species and on the availability of those species for subsistence use, as well as requirements pertaining to monitoring that impact. 16 U.S.C. 1371(a)(5)(D)(ii); *see* above. In analyzing the proposed mitigation and monitoring requirements, NMFS must ensure that these provisions of MMPA are satisfied. This will require a thorough analysis of the proposed measures and their potential effectiveness.

Moreover, the Programmatic Environmental Assessment (2006 PEA) for the 2006 Arctic Outer Continental Shelf (OCS) Seismic Surveys included mitigation measures only for bowhead and gray whales. *See* 2006 PEA, pp. 229-230 (detailing mitigation measures applying to bowhead and gray whales). This EIS must analyze impacts to all marine mammals, including beluga whales, walrus, seals, and polar bears, and provide mitigation measures as necessary.

NMFS must also ensure that the monitoring and mitigation measures imposed are implemented and performed effectively. During the 2006 season, measures were imposed, but there was little or no oversight to confirm that the required measures were implemented or to determine whether they were effective.

COMMENT: Since Uncertainty Is Likely to Remain, NMFS Should Adopt a Precautionary Approach in Choosing Its Preferred Alternative

Despite extensive research, much remains unknown about the bowhead whale, its biology, and its response to seismic noise. In the 2006 PEA, NMFS and the Minerals Management Service (MMS) set forth some of the sources of this uncertainty (2006 PEA, p. 111):

There are many sources of uncertainty in our analyses. These include, but are not limited to, uncertainty at the programmatic stage about the potential seismic surveys (where the seismic surveys will occur; how many will occur; how much noise will be produced by the firing of airguns; what the exact shape of related activities, such as support vessel type and activity will be); uncertainty about the potential effects of noise, especially repeated exposure to loud noise, on baleen whales; uncertainty about the current seasonal and temporal use of the Chukchi Sea evaluation area by bowhead and other whales, or to fully understand the importance of parts of the Beaufort Sea to bowhead whales. Thus, it is difficult to predict exposure in some parts of the area where the action could occur and to understand fully the potential effects of any exposure.

NMFS and MMS also acknowledged uncertainty as to their analysis of the bowhead whale population, the level of seismic noise that could be expected, the effects of seismic noise on the bowhead whale, and the effects that this could have on the subsistence hunt for the bowhead whale. For example, NMFS and MMS noted uncertainty about bowhead stock structure and the actual status of the population (2006 PEA, p. 83), uncertainty about the use bowhead whales make of the Chukchi Sea, especially during the summer (*id.*, pp. 88-89), about their feeding patterns (*id.*, p. 93), and about the potential overlap of bowhead use of the habitat and the area in which seismic surveys were to be conducted (*id.*, p. 133).

NMFS and MMS also acknowledged that there are conflicting studies regarding the received sound level at which bowhead whales demonstrate avoidance of seismic noise. 2006 PEA, pp. 24, 121-128. The agencies further noted that there is considerable uncertainty as to the potential effects of sound, including seismic sound, on marine mammals, and that there is great, and not thoroughly explained, variance in response among difference individuals of the same species. *Id.*, p. 114. They acknowledged uncertainty about bowhead whale hearing capabilities and the levels of sound that would be sufficient to cause temporary or permanent hearing loss or damage. *Id.*, pp. 115-116. They noted that bowhead whales have demonstrated sensitivity to noise, including seismic noise, in the form of strong avoidance at sound levels of 150 to 180 dB and significant levels of response at 120 dB. *Id.*, pp. 24, 125-126.

NMFS and MMS also noted uncertainty about the effects of seismic noise on female

bowhead whales with calves, a particularly vulnerable portion of the population, stating that “definite effects of anthropogenic noise on baleen (or other cetacean) calves, especially newborn calves, are uncertain.” 2006 PEA, p. 110. No direct studies on female bowhead whales are available, but studies indicating a potentially high cost of reproduction (*id.*, p. 87) and the importance of high levels of maternal investment, coupled with studies on other animals, including other baleen whales, showing greater sensitivity among mother/offspring pairs, suggested a need to be cautious (*id.*, pp. 110-111). NMFS and MMS concluded that they could not rule out the potential for biologically significant effects on the bowhead whale from seismic surveys (*id.*, p. 135):

Our primary concern is for potential effects on bowhead whales, especially cow/calf pairs, newborn and other calves, and females in general. * * * If seismic surveys resulted in the exclusion of large numbers of these classes of individuals from feeding areas, or if calves were exposed to large sounds from seismic surveys, we cannot rule out the potential for affecting biologically important behaviors. We believe the potential for such effects can be greatly reduced or avoided through careful application of mitigation measures.

NMFS and MMS also noted that there is uncertainty about bowhead response to seismic noise at the 160 dB level, in particular the effect that such a level has on feeding aggregations of bowhead whales. They first stated that NMFS considers received sound levels of 160 dB to be the point of Level B harassment, a level at which seismic noise is “likely to cause a behavioral response.” 2006 PEA, p. 2. NMFS and MMS also noted, however, that response may depend on the behaviors in which the whale is engaging at the time it hears the noise (*id.*, p. 117):

Available evidence * * * indicates that behavioral reaction to sound, even within a species, may depend on the * * * type of activity engaged in at the time or, in some cases, on group size. For example, reaction to sound may vary depending on * * * whether individuals are feeding or migrating * * *.

NMFS and MMS found evidence that feeding bowhead whales may not move away from sound sources, although there was not enough information to determine whether they were still affected by the sound, and, if so, how greatly they were affected (2006 PEA, p. 135):

Feeding bowheads tend to show less avoidance of sound sources than do migrating bowheads. This tolerance should not be interpreted as clear indication that they are not, or are, affected by the noise. Their motivation to remain feeding may outweigh any discomfort or normal response to leave the area. They could be suffering increased stress from staying where there is very loud noise.

Moreover, many years of study could be required to obtain this information (*id.*, p. 140):

[B]owheads are more tolerant of noise when feeding, and future work is needed to determine potential effects on hearing due to long periods over many years of exposure to loud noise at distances tolerated in feeding areas.

These uncertainties led NMFS and MMS to conclude that “[p]ossible harassment would be

most pronounced if large feeding aggregations of whales are affected” (2006 PEA, p. 142), and that there was thus a need for a caution (*id.*, pp. 142, 237).

Many of these uncertainties are likely to remain, even after NMFS completes the full EIS process for the 2007 and later seismic exploration seasons, because this information is simply unknown and cannot be immediately obtained. In light of this uncertainty, and in light of the legal standards of MMPA and ESA that require agencies to adopt a cautious approach when evaluating impacts to protected species based on uncertain science, AEWC and NSB urge NMFS to take a cautious approach in its evaluation of impacts to the bowhead whale and other species in the DPEIS and in choosing its preferred alternative.

Further, much of the biology of other species that occur in the Chukchi and Beaufort Seas is unknown. Lacking population data and information about abundance, distribution, and habitat use, it would be impossible for NMFS to determine that there were no significant impacts to other animals, because it will be impossible to ascertain whether these species will be displaced or harmed. *See, e.g.*, PEA, pp. 144-153 (noting the lack of reliable estimates for the size of populations of many different species and suggesting uncertainty as to impacts on marine mammals including seals, whales other than the bowhead whale, and polar bears, and stating that a “cautious approach” is necessary). Population level effects cannot be estimated without reliable population data. Therefore, AEWC and NSB urge NMFS to proceed cautiously in evaluating impacts to marine mammals when there is so much uncertainty.

COMMENT: The DPEIS Must Adequately Address Human Health and Sociocultural Impacts

Increased industrialization of the Arctic is likely to have long-term impacts on the human residents of the region that must be addressed in the cumulative effects analysis.

The issue of community health has become a prime concern for NSB. This issue must receive the same level of analysis accorded other environmental concerns through the NEPA process. For purposes of this discussion, NSB employs the World Health Organization’s definition of health, which is widely used and accepted: health is “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” Constitution of the World Health Organization, as amended October 2006, preamble (excerpt attached hereto as Exhibit 1).

The EIS should utilize the best available information to assess human health impacts. Available information that would help determine health impacts by allowing comparisons between NSB communities includes:

1. Arrest and social service records.
2. Baseline prevalence of respiratory illness.
3. Baseline elder mortality rates.
4. Rates of accidental injuries and death.
5. Epidemiology of mental illness, including, among other indicators, prevalence of depression and suicide rates.

NMFS should utilize accepted and best available methodology to assess human health impacts. Health Impact Assessment (HIA) is a methodology in wide use outside of the United States, and is increasingly employed within the United States by local planners and universities. *See, e.g.,* Why Use HIA?, by the World Health Organization, downloaded from “WHO - Why use HIA?” at <http://www.who.int/hia/about/why/en/index1.html> (last visited April 8, 2010) (noting international policies and recommendations on the use of HIA), pp. 2-3; (see attachment B) Health Impact Assessment, by the Centers for Disease Control and Prevention, downloaded from “CDC - Healthy Places - Health impact assessment (HIA)” at <http://www.cdc.gov/healthyplaces/hia.htm> (last visited April 8, 2010) (noting “numerous HIAs * * * performed in Europe, Canada, and elsewhere” and growing interest in the topic in the United States, including work done in the United States by universities). (see attachment C)

The World Health Organization has recognized the value of HIA for protecting human health and encouraging responsible development, and thus advocates strongly its use in evaluating any large industrial project. The World Bank has utilized it for large oil and gas projects such as the Chad Oil Export Project. *See* William Jobin, Health and equity impacts of a large oil project in Africa, *Bulletin of the World Health Organization*, 2003 81 (6). Canada regularly incorporates it into environmental impact assessments. Environmental Health Assessment, by Health Canada, downloaded from “Environmental Health Assessments - Main Page” at <http://www.hc-sc.gc.ca/ewh-semt/eval/index-eng.php> (last visited April 8, 2010). (see attachment D) Because of its value in guiding planning and development decisions to prevent adverse human health outcomes, the United States Centers for Disease Control and Prevention advocate its use. HIA must be used to satisfy requirements under NEPA to assess fully the potential impacts of agency action on the quality of the human environment, as well as to satisfy the federal trust responsibility for American Indian/Alaska Native culture and subsistence practices.

Sociocultural impacts resulting from Arctic industrialization, including from the production facility at Northstar, expanding and ongoing exploratory drilling, dramatically increased seismic activity, and the constant planning processes themselves, are already occurring. NMFS needs to take this into account in performing its analyses.



Why use HIA?

Values

HIA is based on four values that link the HIA to the policy environment in which it is being undertaken.

1. **Democracy** – allowing people to participate in the development and implementation of policies, programmes or projects that may impact on their lives.
2. **Equity** – HIA assesses the distribution of impacts from a proposal on the whole population, with a particular reference to how the proposal will affect vulnerable people (in terms of age, gender, ethnic background and socio-economic status).
3. **Sustainable development** – that both short and long term impacts are considered, along with the obvious, and less obvious impacts.
4. **Ethical use of evidence** – the best available quantitative and qualitative evidence must be identified and used in the assessment. A wide variety of evidence should be collected using the best possible methods.

Reasons to use HIA

Promotes cross-sectoral working

The health and well-being of people is determined by a wide range of economic, social and environmental influences. Activities in many sectors beyond the health sector influence these determinants of health. HIA is a participatory approach that helps people from multiple sectors to work together. HIA participants consider the impacts of the proposed action on their individual sector, and other sectors – and the potential impact on health from any change. Overlaps with other policy and project initiatives are often identified, providing a more integrated approach to policy making. "Joined up thinking" and "cross-sectoral working" are phrases that apply to the HIA way of working.

A participatory approach that values the views of the community

An initial stage within the HIA process is to identify the relevant stakeholders. This process usually produces a large number of relevant people, groups and organizations. The HIA can be used as a framework to implicate stakeholders in a meaningful way, allowing their messages to be heard.

Stakeholders commonly include:

- The local community/public, particularly vulnerable groups
- Developers
- Planners
- Local/national governments
- Voluntary agencies, nongovernmental organizations
- Health workers at local, national or international levels
- Employers and unions
- Representatives of other sectors affected by the proposal
- The commissioner(s) of the HIA
- The decision-makers
- The network of people and organisations who will carry out the HIA.

HIA provides a way to engage with members of the public affected by a particular proposal. An HIA can send a signal that an organization or partnership wants to involve a community and is willing to respond constructively to their concerns. Because the HIA process values many different types of evidence during the assessment of a proposal, the views of the public can be considered alongside expert opinion and scientific data, with each source of information being valued equally within the HIA. It is important to note that the decision makers may value certain types of evidence more than others, and community expectations must be managed to avoid 'over-promising what an HIA can deliver. An HIA does not make decisions; it provides information in a clear and transparent way for decision makers'.

The best available evidence is provided to decision-makers

The purpose of an HIA is to provide decision-makers with a set of evidence-based recommendations about the proposal. The decision-makers can then decide to accept, reject or amend the proposal, in the knowledge that they have the best available evidence before them. Evidence used in an HIA can be both qualitative and quantitative, and each is valuable. HIA should consider a range of different types of evidence – going beyond published reviews and research papers, to include the views and opinions of key players who are involved or affected by a proposal. Often, information of the quality and quantity demanded by decision-makers cannot be found, a note of this is made within the HIA and the best available evidence is provided.

Improves health and reduces inequalities

Addressing inequalities and improving health is a goal for many organisations and all governments. One way of contributing to the health and inequalities agenda is through the use of HIA. At the very least, HIA ensures that proposals do not inadvertently damage health or reinforce inequalities. HIA uses a wide model of health and works across sectors to provide a systematic approach for assessing how the proposal affects a population, with particular emphasis on the distribution of effects between different subgroups within the population. Recommendations can specifically target the improvement of health for vulnerable groups.

It is a positive approach

HIA looks not only for negative impacts (to prevent or reduce them), but also for impacts favourable to health. This provides decision-makers with options to strengthen and extend the positive features of a proposal, with a view to improving the health of the population.

Appropriate for policies, programmes and projects

HIA is suitable for use at many different levels. HIA can be used on projects, programmes (groupings of projects) and policies, though it has most commonly been used on projects. The flexibility of HIA allows these projects, programmes and policies to be assessed at either a local, regional, national or international level – making HIA suitable for almost any proposal. However, choosing the right moment to carry out an HIA is important (see [screening](#)).

Timeliness

To influence the decision-making process, HIA recommendations must reach the decision-makers well before any decisions about the proposal will be made. This basic principle of HIA highlights the practical nature of the approach. Experienced HIA practitioners can work within most timeframes, undertaking comprehensive (longer) or rapid (shorter) HIAs.

Links with sustainable development and resource management

If the HIA is undertaken at a sufficiently early stage in the project process, it can be used as a key tool for sustainable development. For example, an HIA on building a road would enable inclusion of health and other sustainability aspects - such as cycle lanes, noise and speed reduction interventions - to be included from the very beginning, rather than at a later date. This enables health objectives to be considered at the same level as socio-economic and environmental objectives, an important step towards sustainable development. Another feature of HIA is its possible combination with other impact assessment methods. This integration allows proposals to be assessed from a sustainable development perspective including: health, education, employment, business success, safety and security, culture, leisure and recreation, and the environment. Drawing on the wider determinants of health, and working across different sectors, HIA can play an important role in the sustainability agenda.

Many people can use HIA

Because it is a participatory approach, there are many potential users of HIA, including:

- Decision-makers who may use the information to select options more favourable to health;
- Commissioners of the HIA, who use it to consult widely and gather differing views, to build capacity and develop strong partnerships;
- HIA workers who carry out the individual components of the HIA, including consultants, local staff from a wide variety of organizations, and the community;
- Stakeholders, who want their views to be considered by decision-makers.

International policies and regulations for HIA

Several international policies and regulations make provisions for HIA or recommend its use, such as:

1. Strategic Environmental Assessment

Health effects are often poorly assessed within Environmental Impact Assessments (EIA), or not at all. The establishment of a Strategic Environment Assessment (SEA) Protocol – to supplement the UNECE Convention on EIA - has addressed this

problem. In Kiev, in May 2003, governments of 35 European United Nations members signed the SEA protocol, whose provisions place special emphasis on human health, going beyond existing legislation. This reflects the political will of the governments, and the technical support of the health sector including WHO. The protocol also recommends that SEA be undertaken early enough in the decision-making process of proposals for environmental and health issues to be considered as part of a wider sustainability agenda. [More information on this protocol.](#)

2. **Article 152 of the Amsterdam Treaty**

[The Treaty](#) calls for the European Union (EU) to examine the possible impact of major policies on health. The treaty states that "A high level of health protection shall be ensured in connection with the formulation and implementation of all Community policies and all Community measures". The European Commission's Health Strategy proposal states that policies must ensure that public health aspects be considered in all EU decisions and actions, therefore health impact assessments should be conducted.

3. **Environmental Impact Assessment**

Many countries have statutory requirements for an Environmental Impact Assessment (EIA) to be undertaken on every important project. The [EU directive](#) on EIA was introduced in 1985 and amended in 1997 and 2003. Country-specific links for environmental and strategic impact assessments can be found at the [Impact Assessment Research Centre at the University of Manchester](#) or the [International Association for Impact Assessment](#). Unfortunately, an EIA does not typically include an assessment of the health effects, and when it does, it may be narrowly focused and only quantitative in nature.

4. **EU Strategic Environmental Directive**

The European Commission began negotiations for a directive on the environmental assessment of plans and programmes in 1996. Several amendments to the proposal were made, leading to the SEA Directive being adopted by the European Council on 5 June 2001. The purpose of the SEA-Directive is to ensure that environmental consequences of certain plans and programmes are identified and assessed during their preparation and before their adoption. Member states were required to introduce the directive into their own legislation by 27 June 2004.

5. **Health21 – Health for all**

The 51 countries comprising the WHO European Region have a common policy framework for health development, which outlines strategies to transform national policies into practical operational programmes at the local level. After consultations with Member States and several important organizations in the Region, four main strategies for action were chosen to ensure that scientific, economic, social and political sustainability drive the implementation of [Health21](#). The first is that "multisectoral strategies tackle the determinants of health, taking into account physical, economic, social, cultural and gender perspectives and ensuring the use of health impact assessment".

6. **Environmental Health Conferences**

The 3rd ministerial conference on environmental health, held in London in 1999, recognized access to information, public participation and access to justice in environment and health as important issues. Several countries supported the idea of a protocol on strategic environment and health impact assessment, and the theme was submitted to the following environment and health conference in Budapest, in 2004.

7. **Libreville Declaration**

In 2008, the [Libreville Declaration on Health and Environment in Africa](#) encouraged governments to integrate health and the environment within public policies, poverty reduction strategies and national development plans. The implementation of health and environment intersectoral programmes at all levels is considered to be one of the decisive factors that may lead to the achievement of the [United Nations Millennium Development Goals](#).

ATTACHMENT C



Centers for Disease Control and Prevention
Your Online Source for Credible Health Information

Health Impact Assessment



Health impact assessment (HIA) is commonly defined as “a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population” (1999 Gothenburg consensus statement,

<http://www.euro.who.int/document/PAE/Gothenburgpaper.pdf>

 [PDF - 138 KB] .

HIA is used to evaluate objectively the potential health effects of a project or policy before it is built or implemented. HIA can provide recommendations to increase positive health outcomes and minimize adverse health outcomes. The HIA framework is used to bring potential public health impacts and considerations to the decision-making process for plans, projects, and policies that fall outside of traditional public health arenas, such as transportation and land use.

The major steps in conducting an HIA include

- Screening (identify projects or policies for which an HIA would be useful),
- Scoping (identify which health effects to consider),
- Assessing risks and benefits (identify which people may be affected and how they may be affected),
- Developing recommendations (suggest changes to proposals to promote positive or mitigate adverse health effects),
- Reporting (present the results to decision-makers), and
- Evaluating (determine the affect of the HIA on the decision).

HIA is similar in some ways to environmental impact assessment (EIA). The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impact of their proposed actions on social, cultural, economic, and natural resources prior to implementation. Proposed actions may include projects, programs, policies, or plans. HIA, unlike EIA can be a voluntary or a regulatory process that focuses on health outcomes such as obesity, physical inactivity, asthma, injuries, and social equity. HIA has been used within EIA processes to assess potential impacts to the human environment. For more information on NEPA, visit the U.S. Environmental Protection Agency Web site at <http://www.epa.gov/oecaerth/basics/nepa.html> .

For more information CDC's participation in the NEPA process, [click here](#).

HIA consists of a diverse array of qualitative and quantitative methods and tools. Desktop and rapid HIAs can be completed in a few days or weeks while comprehensive HIAs may require months. The decision to conduct a rapid or a full HIA is often determined by available time and resources.

In the United States, HIA is a rapidly emerging practice. HIA in the United States is being conducted and advanced through efforts at the San Francisco Department of Public Health,

Alaska Inter-Tribal Council, the University of California Los Angeles, King County in Washington state, Multnomah County in Oregon, the Robert Wood Johnson Foundation, Pew Charitable Trusts, CDC, and other federal, state, tribal, and local partners.

HIA is also regularly performed in Europe, Canada, and elsewhere. Some countries have mandated HIA as part of a regulatory process; others use it on a voluntary basis.

For more information about health impact assessment, refer to the following resources:

Fact Sheet

- [Health Impact Assessment fact sheet !\[\]\(751bfc1a702b768b982b21337734d5f4_img.jpg\) \[PDF - 80 KB\]](#)
This CDC fact sheet describes the Health Impact Assessment process and its value in objectively evaluating a project or policy before it is built or implemented.

HIA General Information and Clearinghouses

- [The UCLA Health Impact Assessment Clearinghouse Learning and Information Center !\[\]\(8dd0344ad09cd2efd87d54b962ccf62d_img.jpg\)](#)
This Website is designed to collect and disseminate information on health impact assessment (HIA) in the United States. The Website has summaries of HIAs conducted in the U.S., reviews of common pathways examined by HIAs, HIA-related news, and information about HIA methods and tools.
- [World Health Organization Health Impact Assessment !\[\]\(071543a7d9e6842bbf6a8c3c00cc5582_img.jpg\)](#)
This site provides general information about HIA, tools and methods to complete HIAs, examples of completed HIAs, discussion of the role of HIA in decision making, and information about the evidence base that can be used for HIAs.
- [Health Impact Assessment Gateway !\[\]\(73a5a1cac0818ccaa872d7a0891f0515_img.jpg\)](#)
This extensive site, created by the Health Development Agency in England, includes general information on HIA, networking, upcoming training and conferences, resources available to complete HIAs, and completed HIAs.
- [Health Impact Project !\[\]\(e9024b44ba27b17575327b24ba1b91c4_img.jpg\)](#)
- Kemm J, Parry J & Palmer S (2004) *Health Impact Assessment: Concepts, theory, techniques and applications*, Oxford University Press, ISBN 0198526296. 
- [National Association of County and City Health Officials !\[\]\(0968fe98535a458464d47de19072d670_img.jpg\)](#)

On-line Courses and University Education

- [Planning for Healthy Places with Health Impact Assessments !\[\]\(a46abcf238ee675b110411a21ad80c33_img.jpg\)](#)
This online course explains the value of conducting an HIA and the steps involved in conducting an HIA. The course, developed by the American Planning Association and the National Association of County & City Health Officials, was funded by the Centers for Disease Control and Prevention.
- [UC Berkeley Health Impact Group !\[\]\(a81a022353d7f43b29a5f551f6f8d1fb_img.jpg\)](#)
The UC Berkeley Health Impact Group (UCBHIG) is a non-partisan, independent collective whose mission is to promote the field of Health Impact Assessment through advocacy, education, research, and community outreach. UCBHIG's work focuses largely on the development of qualitative and quantitative tools.
- Botchwey N, Hobson S, Dannenberg AL, Mumford KG, Contant CK, McMillan TE, Jackson RJ, Lopez R, Winkle C. [A Model Built Environment and Public Health Course Curriculum: Training for an Interdisciplinary Workforce !\[\]\(771c6e847daf016892b3259dff6a8f02_img.jpg\)](#). *American Journal of Preventive Medicine*. 2009;36(2S):S63–S71.

- [Built Environment + Public Health : Course Curriculum](#)  This CDC-funded Web site an interdisciplinary undergraduate, graduate, or continuing education curriculum in public health and built environment. This curriculum is flexible enough to be offered as a full semester course, individual units or single class modules or individual assignments. This Web site also provides opportunity for faculty and other users to share comments, amendments and develop collaborations at the intersection of the built environment and health.

Methodology, Tools, and Evidence for Practice

- [Human Impact Partners](#)  A nonprofit project of the Tides Center, the purpose of this site is to raise awareness of and collaboratively use innovative data, processes and tools that evaluate health impacts and inequities in order to transform the policies, institutions and places people need to live healthy lives.
- [Healthy Development Measurement Tool](#)  This tool, created by San Francisco Department of Public Health, Program on Health, Equity and Sustainability, is a comprehensive evaluation metric to consider health needs in urban development plans and projects.
- [Design for Health](#)  A collaborative project between the [University of Minnesota](#)  , [Cornell University](#)  , and the [University of Colorado](#)  that serves to bridge the gap between the emerging research base on community design and healthy living and the everyday realities of local government planning.
- Cole BL, Shimkhada R, Fielding J, et al. Methodologies for Realizing the Potential of Health Impact Assessment. Am J Prev Med 2005;28(4):382–389.

Abstract: Health impact assessment (HIA), a systematic assessment of potential health impacts of proposed public polices, programs, and projects, offers a means to advance population health by bringing public health research to bear on questions of public policy. The United States has been slow to adopt HIA, but considerable strides have been made in many other countries, and under the auspices of the World Health Organization and World Bank. Varied applications in these diverse milieu have given rise to diverse approaches to HIA—quantitative/analytic, participatory, and procedural—each with distinct disciplinary foundations, goals, and methodologies. Suitability of these approaches for different applications and their challenges are highlighted, along with areas in which methodologic work is most needed and most likely to advance the field from theory and infrequent application to more routine practice in the United States.

HIA & Environmental Impact Assessment

- Bhatia, R and Wernham, A. Integrating Human Health into Environmental Impact Assessment: An Unrealized Opportunity for Environmental Health and Justice. Environmental Health Perspectives. 2008;116(8): 991-1000. <http://www.ehponline.org/docs/2008/11132/abstract.html> 
- **CDC and public health impact assessment in the National Environmental Policy Act (NEPA)**

The Centers for Disease Control and Prevention (CDC) participates in the U.S. environmental impact assessment process. CDC reviews NEPA documents, such as environmental impact statements, submitted by other agencies and comments on the potential public health effects of proposed federal actions. CDC conducts these

reviews on behalf of the U.S. Department of Health and Human Services (DHHS). More information on CDC's involvement in NEPA and helpful resources are [available at this link](#).

HIA & Public Policy Development

- [Health Impact Assessment Information & Insight for Policy Decisions](#) 
This joint endeavor of the Partnership for Prevention and researchers at the UCLA School of Public Health aims to assess the feasibility of HIA and to develop prototype HIAs that demonstrate methodologies, eventually enabling HIA to contribute to more informed decision-making about public policies impacting health in the U.S.

HIA Research for Practitioners

- Dannenberg AL, Bhatia R, Cole BL, et al. Growing the field of health impact assessment in the United States: an agenda for research and practice. *Am J Public Health*. 2006;96(2):262-70.

Abstract: Health impact assessment (HIA) methods are used to evaluate the impact on health of policies and projects in community design, transportation planning, and other areas outside traditional public health concerns. At an October 2004 workshop, domestic and international experts explored issues associated with advancing the use of HIA methods by local health departments, planning commissions, and other decision makers in the United States. Workshop participants recommended conducting pilot tests of existing HIA tools, developing a database of health impacts of common projects and policies, developing resources for HIA use, building workforce capacity to conduct HIAs, and evaluating HIAs. HIA methods can influence decision makers to adjust policies and projects to maximize benefits and minimize harm to the public's health.

- Dannenberg, et al. Use of Health Impact Assessment in the U.S.: 27 Case Studies, 1999-2007. *Am J Prev Med* 2008;34(3):241–256. [Use of Health Impact Assessment in the U.S. 27 Case Studies, 1999–2007](#)  [PDF - 390 KB]

CDC scientists examined 27 Health Impact Assessments (HIAs) that were completed in the U.S. between 1999 –2007. HIAs help planners and others consider the health consequences of their decisions

Page last reviewed: October 15, 2009

Page last updated: March 01, 2010

Content source: [National Center for Environmental Health](#)

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA
30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348, 24 Hours/Every Day -
cdcinfo@cdc.gov



ATTACHMENT D



Home > Environmental & Workplace Health > Environmental Health Assessment

Environmental and Workplace Health

Environmental Health Assessment

Health Canada is committed to making this country's population among the healthiest in the world and works closely with other federal departments, agencies and health stakeholders to reduce health and safety risks to Canadians.



What is Health Canada's role?

We are responsible for ensuring that human health is included as a component of [environmental assessments](#). The goal is to ensure that health implications of proposed development projects, including mines, highways and energy projects, which involve the federal government, are identified and evaluated to minimize risks to human health.

Through our Environmental Assessment Division (EAD), Health Canada provides single-window access to all departmental activities under the [Canadian Environmental Assessment Act \(CEAA\)](#).

Our responsibilities include:

- Coordinating and focusing the involvement of Health Canada in the environmental assessment process;
- Reviewing the health component of [federal environmental assessment projects](#);
- Coordinating the preparation and presentation of the Department's scientific health information for other federal departments, public review panels or mediators;
- Providing notice, through a [public registry](#), of Health Canada projects subject to CEAA;
- Sharing our knowledge with representatives of other countries to develop environmental health assessment processes, regulations and scientific knowledge at the [international level](#);
- and
- Promoting [health impact assessments](#).

Additional Resources

- [Publications](#)

Date Modified: 2008-01-11

Native Village of Kotzebue

Kotzebue IRA

February 26, 2010

Mr. P. Michael Payne, Chief
Permits, Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway, Silver Spring, MD 20910-3225

Knowledge of Language

Knowledge of Family Tree

Sharing

Humility

Respect for Others

Love for Children

Cooperation

Hard Work

Respect for Elders

Respect for Nature

Avoid Conflict

Family Roles

Humor

Spirituality

Domestic Skills

Hunter Success

Responsibility to Tribe

Re: National Marine Fisheries Service Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean

SCOPING COMMENTS

Dear Mr. Payne,

The Native Village of Kotzebue appreciates the opportunity to comment on the proposed seismic and exploratory activities that are subject to the federal permitting process. Overall, the Tribe is concerned with increased industrial activity that is expected to occur in conjunction with this effort, and in the near future, as development takes place in offshore lease areas. Our members continue to depend on the quality of the environment and abundance of the life that is found in the areas under consideration. A recent three year membership harvest survey that the Tribe conducted, underscored the importance of a healthy marine environment, in that 70% of the food produced locally comes from Kotzebue Sound and the Chukchi Sea. While understanding the need for the Nation to produce domestic energy, we believe that the Arctic offshore oil and gas development is premature and that it is being driven by considerations other than a sufficient understanding of the ecology of the area, or the scope of impacts that can reasonably be expected to occur with the proposed seismic activities. On the exploration and extraction front, the Tribe believes that the technical ability to pursue development in a way that allows for sufficient assurances that direct contamination of the waters will not occur, has not been reached. The demanding climatic conditions found offshore in the Chukchi Sea will compound any insufficient ability to prevent pollution releases and implement acceptable environmental controls, magnifying the normal risks of offshore development that are constantly present in even the most temperate locales.

While permitting agencies consider development in an isolated fashion for the purposes of trying to understand impacts, the Tribe has no choice but to view this activity (seismic/exploratory) in the broader context that this activity constitutes preliminary steps to full production of Arctic offshore oil and gas and all the concerns and risks that accompany such a scenario. Which is only one of many other threats facing the Chukchi environment, such as: warming waters, disappearing ice habitat, ocean acidification, increased shipping, potential commercial fishing and general global pollution (much of which ends up in Arctic waters already).

An additional threat posed by isolating activities from the larger development context for the purpose of impacts, is moving environmental baselines: that is as various development activities occur and are accompanied by environmental degradation, when future permits are requested they will use environmental conditions found at that time as a starting point for impacts and not on how the environment is now, before any significant development has occurred. The current sufficient lack of understanding of the ecological components and networks makes this all the more likely. In order to lessen this dynamic, it is incumbent on permitting agencies to take very conservative approaches to allowable impacts. Be that as it may, the Tribe would like to take this opportunity to suggest topics for consideration in relation to the scoping process for the proposed EIS.

Most important to keep in mind is that unlike the majority of development related projects, where pollution is created as an indirect result of activities, the proposed activity is a request to pollute, in this case noise pollution, as the main activity. Given the high reliance on sound by marine life and the very sensitive nature of sound related organs that are easily damaged and interfered with, noise pollution needs to be taken very serious. The federal government must do everything in its power to understand and regulate the impacts of this pollution and thus lower the cost of the environmental subsidy being requested. Those people that depend on this environment for their quality of life and continued existence along the coast of the Chukchi and Beaufort Seas are being asked to bear the largest share of risks and environmental costs, thus their concerns and requests in relation to the proposed activity should be given the most weight possible and addressed to the maximum extent feasible.

Many of our comments are representative of comments produced by other interested parties in past seismic permit processes, but they are ones which make sense to the Tribe and it is our hope that by echoing them we can add to the level of consideration given them by the current permitting process.

IMPACTS FROM NOISE - GENERAL

Include information on actual dB levels and extent over time (periodic and/or continuous) and geographic area to be impacted.

Include discussion of strandings and other non-auditory physical injuries; temporary or permanent loss of hearing; avoidance behavior, which can lead to abandonment of habitat or migratory pathways; disruption of biologically important behaviors such as mating, feeding, nursing, or migration, or loss of efficiency in conducting those behaviors; masking of biologically meaningful sounds, such as the call of predators or potential mates; chronic stress, which can compromise viability, suppress the immune system, and lower the rate of reproduction; and reasonably expected declines in the availability and viability of prey species, such as fish and shrimp as a result of this activity.

Require minimum noise levels; only that which can be defended as necessary and not wide open to whatever technology can be brought to bear. Require justification of the need to use the proposed methods as opposed to other, if any, less invasive means of obtaining the physical data.

Require minimization of horizontal propagation to the extent possible.

SURVEY CONTROL

Consider barring surveys during periods of low visibility to decrease the risks of harm to marine mammals and birds.

Include site-specific information on each resource and analyze the differential impacts that would occur for each location where activities may take place.

Designate closed areas based on ecological importance, exclude nearshore (within 50 miles) habitat from surveying.

Provide for specific geographic restrictions to protect resources, including establishing an adequate corridor for fish and imposing an exclusion zone for the bowhead whale's historic migration corridor.

Require fuel spill reporting and clean up protocols and sufficient equipment for worse case scenarios.

Avoid redundant surveys; share, or setup a program to purchase information collected by others.

Limit time of activities to the minimum required.

Require aircraft to maintain a 1,000 ft minimum altitude when flying over marine mammals observed on or near the surface.

FISH

Discuss fish auditory damage and eggs, larvae and fry damage.

Assess the potential to cause significant impacts to fish and fish stocks and require the use of fish finding equipment and procedures to shut down seismic activity when large schools of fish are encountered.

Discuss lack of baseline information on many species and steps being taken to address these deficiencies that will continue to come into play as exploration/extraction continues to advance.

MARINE MAMMALS

Discuss polar bear impacts from avoidance of survey areas and potential energy costs from having to deviate from reaching ice present in the area.

Reevaluate permanent threshold shift of auditory injury for marine mammals and defend with research results.

Describe the potential disturbance that seismic surveys may have on mother walrus and dependent young. Identify the range at which mother and dependent young may detect and avoid seismic operations or account for the possibility that dependent young may become separated from their mothers as a result of disturbance from seismic operations.

Describe impacts on bowhead migration routes.

Require passive acoustic monitoring for the real time effects of the activities to complement the marine mammal observer data collections.

Consider environmental stresses occurring from loss of ice habitat and how these activities may compound these effects.

Include a thorough discussion of beluga subsistence hunting, and potential impacts of seismic surveys and associated activities on that hunting and present clear conclusions about the likelihood of significant and/or adverse impacts on belugas. In order to accomplish this MMS and NOAA should prioritize beluga research.

Require and encourage industry support of research on marine mammals in the Chukchi Sea. All seismic surveys should be required to have scientifically sound monitoring programs to record the responses of marine mammals to seismic activities. Detailed results of these programs should be available for review within 90 days of the termination of the seismic surveys.

Reevaluate thresholds established for physical injury, hearing loss, and significant behavioral harassment of marine mammals. Recent literature indicates that very significant impacts to individuals and populations may occur at levels well below the 160 dB that MMS considers the minimum level at which behavioral harassment occurs. Thresholds employed should account for longer-term effects of noise exposure and not be based solely on immediate marine mammal responses, such as alteration of migration. Use of thresholds which ignore more subtle behavioral impacts on marine mammals, that occur after weeks, months, and indeed years of seismic activities in these waters is insufficient. Fully account for the problem of repetition: the way that apparently insignificant impacts, such as subtle changes in dive times or vocalization patterns, can become significant if experienced repeatedly or over time.

GENERAL

Consider cumulative impacts over time and between years – programmatic EIS.

Provide a summary document that is readable by the general public and that contains maps and graphics explaining its proposal, alternatives, and locations of key fish and wildlife resources and subsistence resources and activities.

Instead of relying on positions based on insufficient information, require continued research to obtain such information.

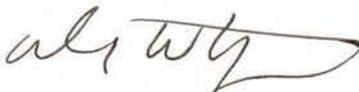
Address threats to species within the context of climate change and associated impacts, especially rapid loss of ice habitat. The lease 193 area is ice edge habitat for a substantial part of the open water season, which is at the same time as the proposed activities

INVASIVE SPECIES

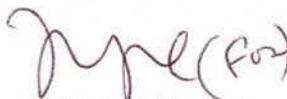
Since the vessels used in the proposed surveys would come from outside Alaska, MMS must analyze the potential impact of invasive species and means to avoid introducing such species into the Arctic. If there is a positive finding for the potential of introducing invasive species the permit must require ballast water exchange and the cleaning of hulls and survey equipment before entering the Chukchi Sea. Green crabs in the North Pacific and zebra mussels and gobies in the Great Lakes are examples of real world impacts from shipping that are causing great ecological harm.

Your consideration of these comments is appreciated.

Sincerely,



Alex Whiting
Environmental Specialist



Linda Joule
Executive Director

NORTHWEST ARCTIC BOROUGH

P.O. Box 1110

Kotzebue, Alaska 99752

(907) 442.2500 or (800) 478.1110

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March 4, 2010

Michael Payne

Chief, Permits, Conservation and Education Division

Office of Protected Resources, National Marine Fisheries Service

1315 East-West Highway

Silver Spring, MD 20190-3225

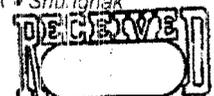
Subject: EIS Scoping Comments —Effects of Oil and Gas Activities in the Arctic

Dear Mr. Payne:

The Northwest Arctic Borough (Borough) submits these comments to the National Marine Fisheries Service (NMFS) on their intent to prepare an Environmental Impact Statement (EIS) to analyze the environmental impacts of outer continental shelf (OCS) exploration activities and the issuance of Incidental Take Authorizations (ITAs) to the oil and gas industry for the taking of marine mammals associated with offshore oil and gas exploration activities in federal and state waters of the U.S. Chukchi and Beaufort Seas. Overall, we would like to emphasize the significant lack of baseline marine environmental data in Arctic waters, and that any exploration and development activities by the oil and gas industry could seriously jeopardize the long-term health and survival of the Arctic ecosystem, and the residents and communities that uniquely and historically depend upon it.

As background, the residents and communities of the Borough proudly rely on marine mammals for food, cultural identity, and economic sustainability. The Northwest Arctic Borough Assembly expressed their opposition to OCS leasing in Resolution 08-04 (please see attached). This resolution emphasizes the importance of subsistence foods to the Inupiat way of life. It also recognized the critical need for baseline data, environmental and wildlife monitoring, and filling large data gaps for the area.

Ambler • Buckland • Candle • Deering • Kiana • Kivalina • Kobuk • Kotzebue • Noatak • Noorvik • Selawik • Shungnak



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The following provides more detailed information about what should be addressed in the EIS.

Incorporation of Local and Traditional Ecological Knowledge

The preparation of the EIS must include an inquiry and analysis into the local and traditional knowledge about impacts of previous offshore oil and gas activities on marine mammals as well as the impacts of other activities that may be relevant. This inquiry could be accomplished by (a) reviewing past EIS documents including the Alaska Coastal Zone Management Program EIS, and the Red Dog Mine Final Supplemental Environmental Impact Statement (US EPA, October 2009); and (b) holding community meetings in coastal villages to conduct personal interviews with subsistence users, and update previous testimony provided by residents.

It is very important to include first-hand experience with the Chukchi and Beaufort Seas, and Arctic residents have this unique understanding of the marine ecosystems as a result of many generations of subsistence use. As you may know, Iñupiat people have a special knowledge about the impacts of noise on marine mammals in the Arctic which has been critical to their continued survival in the harsh conditions of the Arctic. While the importance of scientific knowledge is widely recognized, the value of local and traditional knowledge should be equally recognized and included in the EIS process as validation to science.

Ecosystem Approach to Data and Monitoring Needs

The Borough is extremely concerned about the lack of scientific baseline data for the Chukchi Sea, and agencies such as NMFS making permit and other administrative actions based upon inadequate data therefore creating bad public decisions with unknown ramifications to the ecosystem. The Borough is also extremely concerned that the past and most recent scientific studies regarding seismic exploration, incidental take and marine ecosystem reports lack strong indigenous peoples' involvement in their research plans, methods and analysis. Scientists openly state that the Arctic marine ecosystem (Chukchi and Beaufort Seas included) are the least understood and lack even basic data to study and manage; yet indigenous people

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that have lived in the Arctic for over 10,000 years are inadequately involved for their valuable knowledge, scientific observations and understanding of the ecosystem. We encourage the NMFS to acknowledge the lack of data and facilitate cooperation between scientists and indigenous peoples' to complement each other's knowledge and understanding to best create an EIS framework for future administrative decision making.

As an example of acknowledged insufficient information, the Final Coastal Management Consistency Response for Chukchi Lease Sale 193 completed by the State of Alaska's Division of Coastal and Ocean Management (DCOM), acknowledged the need for more information for future oil and gas exploration and development in this area. Specifically, the Final Consistency Response identified the need for more information about spawning areas, productive habitats, vulnerable habitats, marine mammal rookeries and haul-out areas, migratory patterns for fish and wildlife, areas where oil exploration, spills and effluents could be controlled or contained, and areas of least biological productivity, diversity and vulnerability.

To support an ecosystem approach to data collection, the Borough encourages inclusion of a thorough discussion in the EIS about relevant studies of the impacts of oil and gas activities to marine mammals, including noise and other impacts from seismic surveys, drilling, vessels and aircraft. We encourage NMFS to include an analysis of data gaps and what kinds of future studies are needed. In addition, we recommend the EIS address what kinds of monitoring needs to be completed during future oil and gas exploration activities, including seismic surveys.

The scope of the EIS should include an analysis of potential impacts to marine mammals as well as socio-cultural impacts to subsistence users. The wide range habitat of many marine mammals results in potential impacts to subsistence users located far from the activities of a particular exploration project. For example, the Native Village of Kotzebue has tagged seals in Kotzebue Sounds and found that the seals swim thousands of miles both north and south; therefore subsistence impacts could include the North Slope, Northwest Arctic, Bering Strait, Calista and Bristol Bay regions. Taken together, all the information in the EIS will most likely support revoking exploration permits and ITAs in order to best protect this natural and pristine marine ecosystem.

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Consideration of Cumulative Impacts

Impacts from current and likely future activities in Beaufort and Chukchi seas can combine to have devastating and significant negative cumulative impacts. In addition to increased oil and gas activities, the Arctic is experiencing major climate change, ocean acidification and potentially invasive marine species. The question arises – can the Arctic marine environment sustain more change?

The Arctic is also experiencing an increase in commercial vessel traffic. This traffic is expected to increase even more as the summer ice pack retreats in response to a warming climate. While there is a temporary moratorium on commercial fisheries in federal waters off Alaska's coast (issued by the US Secretary of Commerce through NOAA and the North Pacific Fisheries Management Council), these waters may be opened in the future which would continue to stress the ecosystem and environment.

Due to various factors including those mentioned above, our residents and scientists completing Arctic studies have reported significant changes in the distribution and numbers of species in the Chukchi and Beaufort seas as well as the observation of species never seen before. Altered behavior of some species, such as whales, seals and walrus, have been attributed to changes in the distribution of sea ice. The EIS should consider the potential cumulative effects of climate change combined with oil and gas, increased vessel traffic and potential commercial fisheries.

Future Borough Consultation and Involvement

In response to the request *Federal Register* for preparation of this EIS, the Northwest Arctic Borough would appreciate future consultations, involvement and copies of the draft and final EIS documents. Please inform the Borough Planning Department about the progress of this EIS and we look forward to reviewing and providing input.

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Closing

This concludes the Borough's comments on the request for scoping comments for the proposed EIS. We appreciate the efforts of your agency to address potential impacts from oil and gas exploration to our communities and marine mammals. The people of our region have a close and intimate relationship to the Chukchi Sea and its resources. Risks from oil and gas exploration activities greatly outweigh potential impacts, and the considerable lack of baseline scientific information poses additional problems. The Borough looks forward to working with your agency during preparation and review of the EIS. Please contact me if you have any questions about this comment letter.

Sincerely,



Ukallaysaq Tom Okleasik, Planning Director

cc: Mayor Siikauraq Martha Whiting
Linc Saito, Economic Development Director
Bob Schaeffer, Public Services Director
Alagialq Grant Hildreth, Deputy Planning Director
Kill'aq John Chase, Community Planner & Coastal Area Specialist
Alex Whiting, Native Village of Kotzebue
Senator Donny Olson, Alaska State Legislature
Representative Reggie Joule, Alaska State Legislature
Dan Forester, North Slope Borough Planning Director

From ▶ [Shawna Larson <SLarson@pacificenvironment.org>](mailto:SLarson@pacificenvironment.org)

Sent Thursday, March 11, 2010 1:12 pm

To Arcticeis.Comments@noaa.gov

Subject submitting comments

To Whom It May Concern:

I attended the EIS scoping hearing at the heritage center in person in Barrow last night and wanted to submit my comments in writing. Please let me know if you need any additional information.

Thank you,

Shawna Larson

GENERAL COMMENTS

- Environmental justice has been an issue during recent NEPA processes and in discussions in the previous Draft EIS
- In this new process, it's important to be aware of the effects of multiple, overlapping and fast-tracked planning processes that have occurred in the past
- There are increasing concerns from local residents regarding human health impacts from proposed oil and gas exploration, development and production activities in the areas.
- The public review and comment periods have at times occurred during critical whaling and other subsistence activity seasons when many of the key individuals in the communities were likely unavailable, and they have all occurred in such rapid succession that thoughtful and meaningful reviews, which the agencies ask for and expect, have undoubtedly been constrained. More importantly, it is understandable that the pressure to review, comment on and ultimately live with the rapid pace of industrial activities creates stress and other adverse impacts to individuals living in the areas.

- It is important to be cognizant of this and not to repeat the past mistakes in the current process.

Seismic – Generally

- The impacts of high-intensity seismic exploration are potentially quite serious. A large seismic array can produce peak pressure levels higher than that of virtually any other man-made source, save explosives. Scientists agree, and the publicly available scientific literature shows, that intense anthropogenic underwater sound induces a range of adverse effects in whales, dolphins and other marine wildlife, including but not limited to:
 - • temporary or permanent loss of hearing, which impairs an animal's ability to communicate, avoid predators, and detect and capture prey;
 - • avoidance behavior, which can lead to abandonment of habitat or migratory pathways, energetic consequences, and disruption of mating, feeding, nursing, or migration;
 - • masking of biologically meaningful sounds, such as the call of predators or potential mates; and
 - • declines in the availability and viability of prey species, such as squid, fish and shrimp

(1) Effects of oil and gas exploration on marine mammal behavior and use of habitat

- **Gray whales** – rely on the Chukchi Sea as one of their primary feeding grounds, and they have been shown to abandon habitat in response to anthropogenic noise.
- **Beluga whales** – an important subsistence resource for Alaska Native communities – and harbor porpoises – unexpectedly spotted during recent industry surveys in the Chukchi – are both known to be particularly sensitive to noise disturbances.
- **Bowhead Whales** – The recent spike in seismic surveying means that individual bowheads may have been repeatedly exposed to

elevated noise levels, both within a single season and year-after-year. If bowhead whales are deflected from their migratory route, it can lead to adverse impacts, as they may miss important feeding and resting opportunities and expend greater energy as they swim farther than they would otherwise. The resultant energetic loss could impair the reproductive fitness or survival of individuals in the bowhead population.

- When assessing the potential impacts of noise, NMFS and MMS have recognized that bowhead cow-calf pairs merit special consideration.
- Bowhead whales are a long-lived, late maturing species with relatively low reproductive rates and extremely high maternal investment in the young.
- Studies reveal that female baleen whales show a heightened response to noise and disturbance and that fall migrating bowheads demonstrate greater avoidance than bowheads engaged activities such as feeding.
- A 2005 report by the National Research Council cautioned that “[v]ery low thresholds should be considered for any disturbance that might separate a dependant infant from its caregivers.”
- As NMFS acknowledged in 2008, more information is needed about the potential effects of even a single seismic survey on the health of females and young calves.

(2) Effects of oil and gas exploration on availability of species for subsistence uses;

- There is a pressing need for research to describe the cumulative effects of noise in the Beaufort and Chukchi as it may impact marine mammals, particularly the bowhead whale which is a vital component of the local Inupiat Eskimo culture and traditional diet.

- The bowhead whale has been found to be particularly sensitive to seismic noise.

Pacific walrus - (1) the uncertain status and trend of the Pacific walrus population make it difficult to detect and quantify any potential population level effects due to seismic survey operations; (2) the information available regarding walrus distributions and habitat use patterns in the Chukchi Sea Planning Area is insufficient to predict when and where walruses and seismic survey operations are likely to interact; and (3) the sensitivity of walruses to seismic survey operations and the potential long-term effects of offshore seismic operations on walrus distributions and habitat use patterns are largely unknown. Because of the uncertainty associated with potential impacts of seismic survey operations on walruses and subsistence walrus hunters, seismic exploration permits should not be approved until further research is done.

- Research should include evaluation of the impact of climate change on the habitat values within Arctic waters; changes in species and distribution due to these changes; and an evaluation of changes in nutrient regimes, coastal processes and oceanography (especially currents), and primary productivity

Shawna Larson

Alaska Program Co-Director

907.841-5163

slarson@pacificenvironment.org

Pacific Environment

308 G Street Suite 202

Anchorage, Alaska 99501

www.pacificenvironment.org

Protecting the living environment of the Pacific Rim.

Comments submitted by electronic mail to arcticeis.comments@noaa.gov

April 8, 2010

Mr. P. Michael Payne
Chief, Permits, Conservation and Education Division
Office of Protected Resources, NMFS
1315 East-West Highway
Silver Spring, Maryland 20190-3225

Dear Mr. Payne,

The Pew Environment Group U.S. Arctic Program respectfully submits the following comments for consideration for the scoping period on the National Marine Fisheries Service (NMFS) proposed Environmental Impact Statement (EIS) to analyze the impacts associated with issuing Incidental Take Authorizations (ITAs) for activities related to oil and gas activities in the Chukchi and Beaufort Seas as indicated in the Department of Commerce, National Oceanic and Atmospheric Administration Notice of Intent To Prepare an Environmental Impact Statement (EIS) on the Effects of Oil and Gas Activities in the Arctic Ocean pursuant to 75 Federal Register 6175-77 (February 8, 2010).

We commend the National Marine Fisheries Service (NMFS) for taking a comprehensive approach to incidental take of marine mammals and embarking on this proposed programmatic EIS. In June 2009 President Obama created the interagency ocean policy Task Force and charged this body with developing a national ocean policy and framework for coastal and marine spatial planning. In the September 10, 2009 Interim Report of the Task Force, the federal agencies who are responsible for our oceans declared their intention to usher in a new era of ocean management, one predicated on environmental stewardship and sustainable use of marine resources. We are particularly pleased that the Task Force highlighted the Arctic as a priority objective and recommended development of an Arctic strategic plan in addition to the marine spatial planning process. As NMFS is developing this EIS, we recommend close coordination with the National Ocean Council and marine spatial planning efforts to ensure that the EIS is compatible.

NOAA has a history of making science-based decisions based on the precautionary principle in the Arctic. The North Pacific Fishery Management Council has set an example of how to sustainably manage development of industrial activities in the Arctic (Arctic Fishery Management Plan 74 FR 56734, November 3, 2009). This is the type of forward-thinking that we believe NOAA could bring to this process of issuing ITAs for marine mammals.

The Pew Environment Group believes that decisions when, where, how and if drilling should go forward should be precautionary and science based with the full involvement of the people most affected. Below we address several issues we would like you to consider when developing this PEIS that work towards achieving an integrated approach to ecosystem based management in the

Arctic. This letter addresses impacts to a range of species, including species that are not under NOAA's immediate jurisdiction. The proposed EIS should address impacts to these species, as they serve an important role in the Arctic ecosystem and subsistence way of life.

Insufficient Information: The Need for a Gap Analysis

One of the principal challenges confronting Arctic managers and decision-makers is the lack of integrated and comprehensive information about the composition, structure, and functioning of Arctic marine ecosystems. Without adequate information about the Arctic marine environment, the ability of managers to guide development to protect ecosystem health is crippled. Managers cannot properly plan and make informed decisions concerning whether industrial activities should occur in the Arctic, and if so, when, where, and how.

Notwithstanding some important scientific research in varied disciplines and a handful of environmental surveys conducted in U.S. Arctic waters, numerous information gaps remain (see table below). A comprehensive gap analysis by a reputable independent body such as the National Research Council is needed to help evaluate the current level of understanding about the Arctic marine environment, particularly in relation to the levels of information required to make sound decisions and regulations that will protect Arctic ecosystems and people. This analysis will in turn provide the basis for developing a comprehensive research and monitoring plan designed to meet the needs of regulatory agencies and others responsible for managing human activity in the region. The gap analysis should:

- Synthesize and assess existing scientific understanding of the region and relevant research and monitoring programs and plans. The status and contributions of local and traditional knowledge should be addressed as part of this assessment;
- Identify priorities for additional information needed to effectively support quality environmental review, marine spatial and other planning (including identification of important ecological areas), decision-making, evaluation, and adaptive management with reference to industrial activity and climate change and their interactive and cumulative effects; and
- Recommend how the needed additional research and monitoring information can be gathered most effectively in the near-term and on an on-going basis (institutions, structure, priorities, duration, frequency, etc.).

Examples of gaps in current knowledge of the U.S. Arctic marine ecosystem

Type of Gap	Explanation	Examples of Gap
Topic	Some resources have not been studied in the Arctic or have very little basic, life history information.	Zooplankton, benthic organisms, fish
Abundance	For most species or species groups, there is little or no information on population size, relative abundance, and/or distribution. Furthermore, little is known about the ecological roles played by most species and thus which species are crucial for ecosystem health.	Zooplankton, Opilio crab, fish, ice seals, Chukchi polar bear population, Kittlitz's Murrelet
Spatial coverage	Many resources studied in depth still lack complete coverage across the Beaufort and Chukchi seas within the U.S. EEZ.	Benthic biomass, fish, Steller's Eider, pelagic birds, Arctic fox
Temporal coverage	Outside of remotely sensed satellite information (ice, temperature, chlorophyll-a, etc.), no resource in the Arctic has adequate data to detect change over annual or decadal time periods for the Beaufort and Chukchi seas.	Invertebrates, fish, pelagic birds, and mammals (surveyed in Beaufort only)
Seasonal coverage	Most surveys occur in July and August when weather, sea ice, and snow are optimal for human observers; direct observation is difficult at other times of the year. Most species lack adequate seasonal distribution data.	Invertebrates, benthic organisms, fish, polar bear, ribbon seal
Ecosystem structure and functioning	The physical, chemical and biological processes that help drive the composition of the food web, energy flow and spatial variability are not well understood,	Quantitative food web model, currents and winds, nutrient cycling, the effects of sea ice on productivity and species distribution
Applied research including understanding how the research is changing	Arctic marine ecosystems are poorly known to begin with, and are now changing in a myriad of ways. There is need for greater understanding of organismic and ecosystem-level responses to changes due to loss of sea ice, increased water temperature and acidification.	Effects of ocean acidification on benthic invertebrates, which are key part of the larger food web. Cumulative effects of disturbance and noise on bowhead whales and other marine mammals.

NMFS itself has observed that the “continued lack of basic audiometric data for key marine mammal species” that occur throughout the Chukchi Sea inhibits the “ability to determine the nature and biological significance of exposure to various levels of both continuous and impulsive oil and gas activity sounds.” (NMFS Comments on MMS Draft EIS for Chukchi Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea, at 2 (Jan. 30, 2007) (“NMFS LS 193 Comments”)). NMFS explained that the lack of information on the impacts of noise would make it “very difficult to permit and conduct seismic surveys in a manner that has no more than a

negligible impact to the stock and minimizes disturbance and harassment to the extent practicable.”

The proposed EIS should acknowledge these information gaps and identify the steps forward to develop an adequate research and monitoring plan. This scientific research program should lead to an ecosystem assessment to inform Arctic policies and to help determine the impacts of sound and exploration activity on marine mammals for incidental take.

Incorporate Traditional Knowledge

The EIS process should also document and incorporate local and traditional knowledge, a different but equally valid knowledge system that will help expand our understanding of Arctic ecosystems and supplement and enhance our overall understanding. People who live in an area for a long time develop a great deal of knowledge about that place. If they depend on local plants and animals for food, clothing and shelter, they learn a great deal about the species they use and see. If the environment is variable and potentially dangerous, they learn to identify and avoid hazardous places and conditions. In the Arctic, such knowledge has been known by various terms, including traditional knowledge, indigenous knowledge, local knowledge and Inuit *qaujimaqatuqangiit*. Such terms often incorporate the wisdom that has been gained alongside knowledge. We use the term “traditional knowledge” simply because it is widely recognized.

In recent years, a great deal of research has focused on traditional knowledge in the Arctic. Major projects such as the Arctic Climate Impact Assessment (ACIA 2004) have incorporated traditional knowledge in efforts to understand what is taking place in the region. Nonetheless, there is a great deal more to be done to make the knowledge of Arctic peoples more widely available, such as incorporating traditional knowledge in management processes that directly impact people, such as in this EIS process. Co-management organizations and institutes of public governance are one means of incorporating not just knowledge but also the holders of that knowledge in the decision-making process. Greater involvement by Arctic peoples in the governance of their regions and communities allows their knowledge to benefit modern institutions. These approaches can help in the development of long-term solutions to economic and environmental challenges in the Arctic.

Documenting knowledge in a report, however, is just one step towards fully incorporating what Arctic peoples have learned over generations. A report about traditional knowledge may put certain facts and observations before a larger audience. But using that knowledge appropriately entails the wisdom that many people associate with traditional perspectives. We’ve attached a bibliography with selected references that should help provide guidance and provide examples of situations where traditional knowledge has been effectively utilized.

Identify Important Ecological Areas

Protection of subsistence resources and subsistence practices requires sound environmental management. One potentially effective management tool is the identification of Important

Ecological Areas (IEAs). IEAs are places that contribute disproportionately to ecological functioning and naturally warrant commensurate concern for promoting conservation goals and can help with spatial planning (DFO 2004, Ehler and Douvère 2009). Examples include areas of high productivity or biodiversity, habitat for rare or threatened species, crucial migration corridors, feeding and staging areas, birthing areas, etc. IEAs that contain important habitats with high ecological or biological significance and should also be a fundamental part of the EIS process. The EIS should define important ecological areas, including subsistence use areas. Identifying these IEAs will help with the planning process for the type, or the level of activity that should occur by area or time. It should also provide direction to ensure that important ecological areas are protected adequately such that the ecological characteristics and functions that make an area important are maintained or, if necessary, restored. In addition to mitigating and preventing impacts where possible, the identification of IEAs can help guide environmental policies and practices.

Given the importance of a healthy environment to North Slope Iñupiat, and given the extensive knowledge that Iñupiat hunters have acquired about their environment, it is essential to apply their knowledge when defining and identifying IEAs in their region. In the case of IEAs, this means connecting traditional knowledge about species and ecological processes with the concept of the IEA. The way that Iñupiat view the environment and the relationships among its components cannot be assumed to be the same as the way scientists view things.

Address Oil Spills

Oil spills in the Arctic are of great concern, and an issue that will need to be addressed within this EIS. In particular, NMFS will need to analyze the risk and impacts associated with oil spills from oil and gas exploration and or vessel traffic. While the probability of a large oil spill during exploration drilling may be relatively low, it is not zero, and the consequences of such a spill are enormous. Depending on where, time of year and animals affected, these spills can result in short- to long-term effects and could have population level impacts (MMS, Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea, Final Environmental Impact Statement, 2007 (FEIS 2007)). The second largest oil spill in history occurred as a blowout from an offshore exploration well in the Gulf of Mexico in 1979, spilling 3.5 million barrels of oil, nearly 1,000 times the largest spill modeled in the Lease Sale Chukchi 193 EIS, the most recent document to analyze oil spills in the Chukchi Sea, albeit incompletely and only generally. Major blowouts continue to this day. In fall 2009 in Australia a recent uncontrolled blowout flowed for 74 days until a rig could be located, brought to the spill-site to drill a successful relief well. Even in a non-frontier area in non-Arctic conditions of the Timor Sea, it took over two months to stop the leak (see Skytruth, Timor Sea Drilling Spill, <http://blog.skytruth.org/search?q=timor>). Proposed exploratory drilling in the Chukchi for summer 2010 do not have an onsite drill rig to drill a relief well (FEIS 2007). If one of the exploratory drilling wells in the Chukchi suffered an incident like the Montara blowout, a second drill rig would need to be located and then transported to Arctic waters before bringing the blowout under control. If a similar blowout occurred in remote Arctic waters, it could take significantly longer to bring a second drill rig on site, and harsh sea or weather conditions could cause additional delays. If such a spill happened in Arctic waters, it would be an environmental

catastrophe that would affect marine animals and subsistence users for years to come. Oil spilled when ice is present cannot successfully be cleaned up: “There has been little experience with under-ice or broken-ice oil spills, and there is little evidence to suggest that the capability exists currently to successfully clean up a spill of this type [] in a timely manner...” (FEIS 2007). The National Academy of Sciences has also determined that “No current cleanup methods remove more than a small fraction of oil spilled in marine waters, especially in the presence of broken ice.” (NRC-NAS 2003).

The proposed EIS should contain a detailed discussion about the potential impacts of oil spills on marine mammals and other Arctic ecosystem components important for marine mammals. It should also include an analysis of the potential impacts to subsistence resources, and the impacts to the people that utilize those resources. It should discuss the extent to which a lack of response capacity and lack of information on current, wind, ice, and weather patterns could adversely affect the ability to predict spill trajectories and/or the ability to mount an effective recovery effort. The EIS should explain the extent to which lack of baseline scientific information would hinder post-spill recovery and rehabilitation efforts, including efforts to detect adverse environmental impacts. NMFS should identify any potential risk reduction, spill prevention, and mitigation measures that could reduce impacts from an oil spill in the Arctic. Furthermore, to this end, understanding the basic ecological structure and the populations of marine mammal species is essential for detecting any adverse impacts caused by an oil spill. Without adequate information about the Arctic marine environment, managers are unable to gauge and understand the impacts of oil spills in the marine ecosystem and on subsistence and local use of the Arctic Ocean. This further supports the need for a gap analysis to examine the impacts and adverse effects of oil spills on marine mammals.

The context within which NMFS should examine the potential for oil spills should be a coordinated effort with other agencies that share responsibility for oil spill research, response, and prevention in the Arctic. In order for some of the potential impacts of oil spills on marine mammals to be determined, there will be key pieces of work/research that will need to be conducted by other agencies (than NMFS) or research institutions. In order for responsible oil and gas development to occur in the Arctic, there are four key actions that should be conducted by federal agencies to guide responsible management and ensure the best decisions are made to prevent and respond to oil spills in the Arctic Ocean.

1) Conduct an Arctic Oil Spill Risk Assessment.

An assessment should be conducted to (a) provide a comprehensive evaluation of the oil spill risks from Arctic oil and gas activity and shipping; and (b) identify the highest priority risk reduction measures that can be implemented to reduce oil spill risks.

2) Assess Arctic Oil Spill Response Capacity.

Evaluate the capacity of Arctic oil spill response systems (dedicated equipment, vessels, personnel, etc.) available to respond to an oil spill in the Arctic Ocean. Use scenario analyses to examine the capabilities and limits of available technologies to respond to the potential oil spills identified through the Arctic Oil Spill Risk Assessment. Establish an ongoing testing and evaluation program to further refine available technologies and develop new technologies for offshore Arctic oil spill response.

3) Conduct an Arctic Oil Spill Response Gap Analysis.

A “response gap” exists whenever environmental conditions exceed the operating limits of oil spill cleanup equipment, meaning that if a spill occurs during this time, it could not be contained or cleaned up. Conduct an Arctic oil spill response gap analysis to better understand the implications of harsh arctic environmental conditions (temperature, wind, sea ice, visibility) on the Arctic oil spill response capacity. An oil spill response gap analysis will quantify the operating limits of the oil spill response systems available in the arctic (building on research project #2) and will calculate how frequently those operating limits are reached in the area of oil and gas operations. Additional oil spill prevention or mitigation measures may then be put into place to reduce the likelihood of an oil spill occurring when no response is possible.

4) Ensure the Process is Transparent and Scientifically Rigorous.

All meetings, reports, and work products should be available for public and stakeholder review and input. All research projects should be developed using peer-reviewed methodologies, and all results should also be peer reviewed. The process would benefit from the appointment of a regional public advisory body made up of stakeholders in the Arctic that would advise the decisions being made on oil spill prevention and response capacity.

Public Health Analysis Under The National Environmental Policy Act

We were pleased to learn that NMFS is also considering Environmental Justice components in the form of a Health Impact Assessment in this EIS. We fully support the inclusion of a robust, systematic approach to public health is supported by NEPA, CEQ regulations, Executive Orders 12898 and 13045, and available guidance on NEPA and environmental justice (Cole et al. 2004).

We recommend that a NEPA-based health analysis should, at minimum, include:

1. A “description of the affected environment” for public health, in which the baseline health status of affected communities is described (with a focus on conditions that could be affected by, or could make the community vulnerable to, direct, indirect, or cumulative effects of the proposed action and alternatives).
2. An analysis of the potential public health consequences of the alternatives.
3. Identification of potential mitigation measures to address any significant health effects identified.
4. A discussion of the ways in which the health effects identified might disproportionately affect low income or minority populations (Executive Order 12898), or children (Executive Order 13045).
5. An analysis of the cumulative effects of the proposed action and alternatives in the setting of reasonably foreseeable past, present, and future actions.

In addition, we recognize that this level of health analysis is relatively new in the North Slope region, and consequently we would offer the following additional recommendations:

1. NMFS should identify appropriate data sets to inform the health analysis. Where data gaps are identified, additional data collection may be warranted. In particular, we recommend that NMFS consider whether there is adequate information available concerning the diet of North Slope Borough (NSB) residents. To our knowledge, there are few data available on the diet of NSB residents. Because incidental take has a potential to affect the harvest of marine mammals which constitute an important part of the diet of many NSB residents, adequate nutritional baseline information is essential to evaluating the significance of impacts from the alternatives, and to making a reasoned choice between the alternatives (40 CFR 1502.22). Fortunately, the cost of collecting adequate nutritional baseline information according to accepted nutritional epidemiological methods is not exorbitant. Reinforcing the need for NMFS to ensure that there are adequate data regarding the consumption of marine mammals in the region, Executive Order 12898 requires that agencies “collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence.”
2. Because this is a new area of work for NMFS, we also strongly suggest that NMFS ensure that the local health department (The North Slope Borough Department of Health and Social Services) and the statewide tribal health agency (which has considerable expertise in HIA) are consulted throughout the NEPA process.

Analyze Impacts to the Availability of Subsistence Resources

The Marine Mammal Protection Act (MMPA) requires that any incidental take authorized will not have “an unmitigatable adverse impact on the availability of such species or stock for taking for subsistence uses” by Alaska Natives (16 U.S.C. § 1371(a)(5)(D)(i)(II)). NMFS must ensure oil and gas activities do not reduce the availability of any affected population or species to a level insufficient to meet subsistence needs (50 C.F.R. § 216.103).

Impacts from oil and gas activities may adversely affect the subsistence resources upon which many Alaska Natives rely (See, e.g., Minerals Management Service, Chukchi Sea Oil and Gas Lease Sale 193 Final Environmental Impact Statement (OCS EIS/EA MMS 2007-026) at II-34-39 and IV-157). For example, noise from seismic operations, exploration drilling, and/or development and production activities may make bowhead whales skittish and more difficult to hunt. Aircraft associated with oil and gas operations may negatively affect other subsistence resources, including polar bears, walrus, seals, caribou, and coastal and marine birds, making it more difficult for Native hunters to obtain these resources. Water pollution could release toxins that bioaccumulate in top predators, including humans. A large oil spill could have a disastrous impact on a range of subsistence resources.

Subsistence resources have long provided a source of healthy food for North Slope communities. Subsistence foods provide high nutritional value and protect against health problems like high blood pressure, obesity, diabetes, and cardiovascular disease. For many Native Alaskans, subsistence hunting is an important aspect of their culture. Negative impacts to subsistence resources could decrease food security, encourage consumption of store-bought foods with less nutritional value, and deteriorate the cultural fabric of Alaska Native communities. Thus, when

industrial activities adversely affect subsistence resources, they also cause harm to the people who depend on those resources. For all these reasons, the proposed EIS must take a careful look at potential impacts to subsistence resources.

Include Rigorous Approach to Addressing Cumulative Effects

Threats from human activity or environmental change may have additive and/or synergistic effects on wildlife (MMC 2007). A number of authorities have recently emphasized the need to consider these sorts of cumulative impacts in the Arctic (e.g., bowhead whale stock assessment in Angliss and Allen 2009, MMC 2008, NRC 2005, Wartzok and Tyack 2008). A full characterization of risk to marine mammals from the impacts of noise will be a function of not only the characterization of the sources of noise in the marine environment (amount and length of sound; exposure time to marine mammal; response of marine mammal) but also the cumulative effects of multiple sources of noise and the interaction of other risk factors. This is particularly true in environments such as the Arctic that are undergoing rapid shifts due to climate change. Scientific literature emphasizes the need to ensure that the resiliency of ecosystems is maintained in light of the changing environmental conditions associated with climate change (e.g., Brander 2008, Chapin et al. 2006, Huntington 2009, Ragen et al. 2008, Olsson and Folke 2004, Walker and Salt 2006).

The need to consider cumulative impacts for the bowhead, walrus, and other Arctic species is particularly acute because of potential impacts from climate change on these species (e.g., Post et al. 2009). These changes must be added to species' known sensitivities to anthropogenic disturbance. For example, baleen whales use low-frequency sounds to communicate, and noise from exploratory drilling, seismic airguns, and vessel traffic could in combination affect their ability to communicate. Other risk factors may be additive or interact synergistically. For instance, researchers propose that species will shift poleward, including whales (Cheung et al. In press, Cheung et al. 2008, Cheung et al. 2009, Parmesan 2006, Parmesan and Yohe 2003, Moore 2008). Bowhead whales have adapted to an ice-covered environment and typically have long life lifespans and produce offspring in smaller intervals than do other whale species, such as the gray whale or minke whales. Researchers suggest that bowhead whales may face additional competition from whales like gray and minke whales that are better adapted to a more temperate environment (Ferguson and Higdon 2009). Bowhead whale migration routes may expose them to drilling activity in both drilling locations in the Beaufort Sea and Chukchi Sea (ADFG 2009, ADFG 2008, Quakenbush 2007).

Other ice-dependent species, including walrus, ringed seals, and polar bears, might experience effects from multi-sea and multi-year operations. Over winter, walrus remain in the Bering Sea along the sea ice edge. As the spring ice melt progresses females and calves move northward while males remain in the southeastern Bering Sea (Fay 1974, Fay 1985). The winter range and the summer range for males and subadults could place them within the region proposed for oil and gas drilling in the North Aleutian Basin (USFWS 2009). Furthermore, walrus have been affected by the recent loss in summer sea-ice (USFWS 2009); benthic feeding grounds in the Bering Sea may be transforming because of shifts in sub-Arctic communities (Post et al. 2009); and walrus are hauling out in large numbers on land-based sites, exposing them to potentially

more land-based sources of disturbance (e.g., polar bears, low-flying aircraft) (Thomas et al. 2009). Surveys conducted during the 2008 open water season (Brueggeman et al. 2009, Laidre et al. 2008, Post et al. 2009) documented 900 walrus in a proposed exploratory drilling (study) area, potentially exposing a large number of walrus to stresses associated with oil and gas activity, including drilling and vessel activity. Since a large proportion of these animals in the Chukchi Sea are comprised of females and calves, it is possible that the production of the population could be differentially affected. Both polar bears and ringed seals may be affected by multiple-year impacts from activities associated with drilling (including an associated increase in vessel traffic) given their dependence on sea-ice and its projected decline (Post et al. 2009, Laidre et al. 2009). Polar bears have been undergoing declines in both birth rates and survival rates (Post et al. 2009) and were listed as threatened with extinction under the Endangered Species Act because of their projected loss of habitat and access to their primary food, ringed seals. The additive impacts of drilling activity on polar bears and ringed seals could provide additional stress.

New predictive modeling techniques are becoming available to better describe and analyze the links between impacts experienced at the individual level to the population level. One such tool is the modeling tool for sound and marine mammals, Acoustic Integration Models (AIMs) that estimate how many animals might be exposed to specific levels of sound (Cordue 2006, Pascual et al. 2003, Frankel 2006, Frankel and Buchanan 2006, Frankel et al. 2002, Frankel and Vigness-Raposa 2006, Marine Acoustics Inc. 2004). Such tools should be considered in the EIS.

Cumulative impacts addressed in the EIS should also examine the potential impact from activities occurring in multi-sea, multi-year drilling plans as well as the myriad other reasonably foreseeable industrial activities in the Arctic Ocean. Viewed in the context of these other activities, any given proposed activity may have potentially significant effects.

Address and Analyze Impacts of Pollution to Air and Water Quality

The proposed EIS should address and fully analyze the impacts to air and water quality from oil and gas activities in the Arctic.

Activities associated with oil and gas exploration, including vessel traffic and exploration drilling, can emit measureable quantities of pollutants into the atmosphere. One major concern is the emission of fine particulate matter (PM 2.5), including black carbon. The emission of fine particulate matter is a human health threat. In addition, the emission of black carbon almost certainly exacerbates sea ice declines by reducing the albedo—or reflectivity—of snow and ice, thereby accelerating a positive-feedback loop that amplifies melting and warming in the Arctic. Oil and gas operations may also emit significant quantities of nitrogen oxides, coarse particulate matter, and carbon dioxide.

Vessels used to conduct seismic surveys or exploration drilling can discharge pollutants during refueling spills, or in other accidents. Exploration drilling may result in a variety of discharges, include drilling muds (fluids) and drilling cuttings, sanitary and domestic wastes, desalination unit wastes, test fluids, deck drainage, blowout preventer fluids, uncontaminated ballast and bilge

water, excess cement slurry, cooling water, fire control system test water, and excess cement slurry at the sea floor. Drilling mud or fluid may contain weighting materials, corrosion inhibitors, dispersants, flocculants, surfactants, and biocides. The toxins present in these discharges can bioaccumulate, affecting apex predators such as toothed whales and polar bears (USFWS 2008, NMFS 2008)). The discharges, which contain heavy metals, can create a blanket of mud that may adversely affect the benthic community. In the Chukchi Sea, walrus and gray whales feed on the benthos, and could be harmed by the presence of toxins and/or the decline of the benthic community.

Thermal discharge from cooling water may also impair water quality. “Thermal effluents in inshore habitat can cause severe problems by directly altering the benthic community or killing marine organisms, especially larval fish.” (Arctic Fishery Management Plan 74 FR 56734, November 3, 2009). Changes in temperature can affect behavior and physiology of marine organisms. Cooling water may also contain toxins that can cause adverse impacts.

Discharge of pollutants into certain Arctic waters may be especially harmful during the summer months, if water is stratified. The stratification may inhibit dispersal of the discharge, potentially confining it to the shallow upper section of the ocean, where marine mammals such as bowhead whales are more likely to encounter it.

The proposed EIS should include a full discussion of the potential impacts of air and water pollution associated with oil and gas operations including zero discharge of drilling muds. That discussion should include an analysis of potential impacts to subsistence resources and those who consume those resources.

Address Shortcomings in Monitoring and Mitigation Measures

“[T]o the fullest extent possible,” agencies must “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources” (42 U.S.C. § 4332(2)(E) 2000). Agencies must prepare EISs that “rigorously explore and objectively evaluate all reasonable alternatives” to the proposed action (40 C.F.R. § 1502.14(a) 2003). The discussion of alternatives “is the heart of the [EIS]” (Id. § 1502.14).

In this case, the proposed EIS should evaluate fully the effectiveness of monitoring and mitigation measures used to protect marine mammal species from the impacts associated with oil and gas activities, and should identify and discuss shortcomings of those measures. NMFS should work with stakeholders, including North Slope communities and Native organizations, to develop alternatives that address those shortcomings, and the proposed EIS should include such alternatives. To the extent that mitigation measures do not remove the potential for serious injury from activities associated with oil and gas operations, NMFS must not issue ITAs.

The EIS should discuss:

- limitations of Marine Mammals Observers in monitoring, and

- the limitations of exclusion areas and safety zones as mitigation measures, alternatives that include spatial, temporal, and/or sound budget restrictions on oil and gas activities.

Conclusions:

Oil and gas activities are expanding rapidly in the Beaufort and Chukchi seas. Production from the Northstar facility in the Beaufort Sea is ongoing. This summer, industrial activity from oil and gas activities may include some combination of the proposed activities: exploration drilling in both the Beaufort and Chukchi Seas, shallow hazard survey and a strudel scour survey in the Beaufort Sea, 3D seismic exploration in the Chukchi Sea lease area, and 2D seismic surveys that would cover vast areas of the Beaufort and Chukchi seas. In addition to oil and gas activities, commercial shipping and vessel traffic are increasing in Arctic waters as summer sea ice retreats. This growth in industrial activities comes at a time when a rapidly warming climate is causing profound changes to the region, and when ocean acidification will contribute additional stress to marine ecosystems. The potential impacts of these industrial activities and environmental changes—both individually and cumulatively—demand a comprehensive analysis. This analysis should: incorporate the principles of the precautionary approach, ensure that any management action is coordinated and conducted in a manner appropriate with the National Ocean Policy, and the incorporation of Traditional Knowledge is included and considered. In conclusion, we would like to thank NMFS for the opportunity to provide comments during the scoping phase of the EIS. We look forward to working with you as the process moves forward and in the meantime please don't hesitate to contact us for additional information or clarification.

Respectfully submitted,

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RESOURCE DEVELOPMENT COUNCIL

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April 9, 2010

Mr. P. Michael Payne

Chief, Permits, Conservation and Education Division

Office of Protected Resources

National Marine Fisheries Service

1315 East-West Highway

Silver Spring, MD 20190-3225

Re: Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, RIN 0648-XU06

Dear Mr. Payne:

The Resource Development Council (RDC) appreciates the opportunity to comment on the preparation of an Environmental Impact Statement (EIS) to analyze the impacts of issuing Incidental Take Authorizations (ITAs) pursuant to the Marine Mammal Protection Act.

RDC is a statewide business association comprised of individuals and companies from Alaska's oil and gas, mining, forest products, tourism, and fisheries industries. RDC's membership includes Alaska Native corporations, local governments, organized labor and industry support firms. Our purpose is to encourage a strong, diversified private sector in Alaska and expand the state's economic base through the responsible development of our natural resources.

RDC endorses the comments offered by the Alaska Oil and Gas Association (AOGA) and the American Petroleum Institute (API) in support of the issuance of ITAs for offshore exploration activities in the Chukchi and Beaufort Seas off Alaska. In addition, RDC agrees with the comments AOGA submitted July 30, 2007 on the Draft Programmatic Environmental Impact Statement (DPEIS) that was initiated and later terminated after a four-year effort. Many of the comments in that letter are relevant to this new scoping process and should be taken into consideration.

As the National Marine Fisheries Service (NMFS) prepares the EIS, RDC urges that it perform a balanced and objective review of science and peer-reviewed literature, including industry-funded research, on the effects of oil and gas operations in the marine environment and on marine mammals. The EIS should avoid speculating on potential effects and should base potential impacts on documented incidents or technical reports. The EIS should acknowledge the evidence in peer-reviewed literature, which indicates that seismic exploration operations have not affected the health or reproductive fitness of marine mammal populations. Studies to date have been consistent in their conclusions on this topic.

The government has played a leading role in scientific studies on the environmental effects of offshore oil and gas activities. The National Academy of Sciences has produced three reports focused on environmental science for offshore oil and gas, two of which had particular focus on Alaska waters. The Minerals Management Service has spent more than \$600 million on scientific studies on offshore areas, with about half of the funding directed to Alaska. The industry has also played a leading role, allocating millions of dollars for major scientific programs that supplement the research of government agencies.

RDC members support monitoring and scientific data collection that contributes to the ongoing successful recovery of the Bering, Chukchi and Beaufort Seas (BCB) bowhead whale stock. Our members also support voluntary negotiated agreements with North Slope whalers to ensure that conflicts between oil and gas activities and the subsistence hunt are avoided. However, our members do not support regulatory restrictions that would substantially burden or even preclude responsible development of Outer Continental Shelf (OCS) resources, especially when such restrictions are not based on sound science and are without any demonstrable benefit to any species. Unfortunately, most of the proposed alternatives contained in the DPEIS contained such restrictions. RDC would not support measures in the new EIS which are burdensome yet unnecessary, scientifically unsupported, and based on an implausible worst-case scenario.

As noted in AOGA's July 2007 comments on the DPEIS, the effects of seismic exploration in the Arctic, particularly with respect to the BCB stock of bowhead whales, have been the subject of numerous detailed analyses by the Minerals Management Service (MMS) and the NMFS. Each successive analysis has reviewed available information regarding seismic impacts and the status of the BCB Seas population and concluded there have essentially been no impacts over the period of time involved.

The AOGA 2007 comments stated: "What has changed in these analyses over time are: (i) increasingly unrealistic assumptions about the extent of expected survey activity (referred to in the DPEIS as the 'foreseeable level of activity'), (ii) increased significance accorded to speculative impacts for which there is no supporting data, (iii) decreased significance accorded to the highly credible scientific data demonstrating the continued health and growth of the BCB stock and the insignificant effects of seismic activity, (iv) decreased significance accorded to feasibility and practicability, and (v) increased stringency of proposed restrictions on seismic survey activity. Coupled with misperceptions of the underlying statutory standards, these trends have culminated in a worst-case scenario impacts analysis presented in the DPEIS, which stacks unreasonable assumptions one on top of another in efforts to support scientifically unwarranted and impracticable restrictions designed to mitigate highly improbable impacts. If MMS and NMFS proceed with regulatory actions premised upon the statutory misperceptions and speculative worst-case scenario effects analysis contained in the DPEIS, its decisions will likely be contrary to law."

The new EIS should craft realistic operating scenarios for future oil and gas activity and should not focus on unrealistic worst-case scenarios.

With regard to the imposition of 120 dB and 160 dB exclusion zones as mitigation measures for the benefit of bowhead whales, there is a lack of scientific evidence to support the implementation of such zones. In fact, there is no evidence that oil and gas exploration activities have resulted in a reduction of any marine mammal stock. The 120 dB and 160 dB exclusion zones cannot be reconciled with decades of data regarding the sustained health of the stock.

RDC members have serious concern with safety issues surrounding the 120 dB and 160 dB safety zone requirements identified in some of the past DPEIS alternatives. Both zones cannot be safely and effectively monitored. Aerial monitoring of these zones are unsafe due to their enormous size and the extreme and unpredictable weather conditions in this remote area. These exclusion zones present significant and unwarranted safety risks and are impracticable. The EIS should consider important safety and other relevant factors in its analysis of 120 dB and 160 dB safety zones. Despite statutory obligations, previous

analyses, including the DPEIS, contained little discussion and no actual analysis of feasibility issues. NMFS and MMS should consider only those measures that are implementable, which the agencies have defined to mean “feasible in the technical, environmental, economic and social senses.” (2006 PEIS at 13). Unfortunately, previous documents made no attempt to quantify costs, evaluate the availability of technologies, identify risks, or otherwise consider the feasibility of the 120/160 dB safety zone requirement or of time/area closures. This oversight should not occur in the new EIS.

Both NMFS and MMS have confirmed that the BCB Seas stock is adequately protected through the use of a 180 dB exclusion zone. With the use of the 190/180 dB exclusion zone and other routine mitigation and monitoring, our members are confident there will be no adverse impacts to the BCB Seas stock of bowhead whales.

With regard to cumulative impact analysis, while RDC understands such analysis is an important component of the NEPA process, we do not believe there is compelling data supporting a limit on the number of ITAs. Not only are marine mammals thoroughly protected under existing laws and mitigation measures, industry operations in the Alaska Arctic have had no negative impact on polar bears and other marine mammals. Overly restrictive measures and a limitation on ITAs would discourage industry investment, future exploration, and production of energy resources from the Arctic – with no added benefit to marine mammals. The agency should exercise its best judgment in granting ITAs. In addition, RDC recommends that the EIS provide for a categorical exclusion section that identifies activities not requiring ITAs.

RDC does not support including non-oil and gas activities in the Arctic into the cumulative impact analysis. The focus of the EIS is to study potential impacts of oil and gas activities. Other activities outside the industry do not fit in this EIS analysis. Likewise, the cumulative impact analysis should not take into account impacts occurring outside Alaska on marine mammals, given activities that may impact them abroad (for example, Russia) are managed under different laws and regulatory regimes, and may not be subject to the extensive mitigation measures we have in place in Alaska. Again, this is outside the scope of the EIS.

RDC is confident oil and gas production from the Chukchi and Beaufort can move forward in an environmentally-sensitive and responsible manner through a strong and proven regulatory regime, seasonal operating restrictions as needed, and reasonable mitigation measures to avoid conflicts with other resource users.

In addition to the issues raised up to this point in these comments, the EIS should consider and acknowledge the following important national interests:

- First, demand for energy in the U.S. and abroad will continue to grow. The U.S. Energy Information Administration (EIA) forecasts that by 2025, demand for oil will increase by 39% and demand for natural gas will rise by 34%. The EIA also estimates that oil and natural gas will account for nearly two-thirds of the energy consumed in 2025.
- Second, if oil and gas resources are not developed and produced domestically, they will be imported from abroad, increasing our reliance on foreign sources. Benefits of developing domestic oil and gas resources should be considered. OCS production will help grow and sustain our economy, create jobs and generate local, state and federal revenue – all while protecting the environment. Moreover, new natural gas production from the Beaufort and Chukchi Seas would enhance the economic viability of the proposed natural gas pipeline from Alaska to the Lower 48.
- Third, Alaska has vast oil and gas resources in the OCS that can and should play a major role in meeting future needs and offsetting production declines from mature basins. Current estimates

indicate the Chukchi and Beaufort Seas contain 122 trillion cubic feet (tcf) of natural gas and 25 billion barrels of oil. These estimates may actually prove to be conservative as the Alaska OCS is largely under explored and estimates have not incorporated the use of new seismic and computer modeling technology.

- Fourth, new offshore development and environmental protection are not mutually exclusive. OCS development has an outstanding safety and environmental record spanning decades. Development has coexisted with other industries, including fishing, in the North Sea, the Gulf of Mexico and Cook Inlet. With regard to the Alaskan OCS, exploration is not new. Approximately 30 wells have been drilled in the Beaufort Sea and five in the Chukchi Sea. Since 2005, the federal government has collected over \$3 billion for leases in these waters. These facts should be acknowledged in the EIS.

In conclusion, RDC members in the oil and gas industry have a track record of responsible development and protection of marine mammals. They are committed to maintaining this record while providing additional domestic energy, jobs and economic activity for America. As you know, it takes oil companies many years – 20 years in some cases – to develop leases once they are acquired. Long-term business decisions are made on the assumption that permits will be issued and responsible oil and gas development will be allowed to occur on those leases under reasonable mitigation measures that protect the environment. This includes timely and predictable issuance of ITAs for those companies investing in Alaska and producing needed oil and gas resources for America.

We urge NMFS and MMS to address in the EIS the concerns and recommendations identified in these comments, as well as the comments submitted by AOGA (April 2010 and July 2007) and API (April 2010). Thank you for the opportunity to comment on the preparation of the EIS.

Sincerely,



Carl Portman
Deputy Director

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April 9, 2010

Mr. P. Michael Payne
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1315 East-West Highway
Silver Spring, MD 20190-3225
Email Submittal via: arcticeis.comments@noaa.gov

Re: Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean, RIN 0648-XU06

Dear Mr. Payne:

Shell Exploration & Production Company, together with its affiliates engaged in offshore exploration and production (Shell), is pleased to provide information for the National Marine Fisheries Service (NMFS) Request for Comments on the preparation of an Environmental Impact Statement (EIS) to analyze the environmental impacts of issuing Incidental Take Authorizations (ITAs) pursuant to the Marine Mammal Protection Act (MMPA). The purpose of this EIS will be to support the issuance of ITAs to the oil and gas industry for the taking of marine mammals incidental to offshore exploration activities in the Chukchi and Beaufort Seas off Alaska (e.g., seismic surveys and exploratory drilling).

Shell is one of the largest leaseholders in the U.S. Outer Continental Shelf (OCS), including the Gulf of Mexico and Alaska, and one of the largest producers of oil and natural gas in the OCS. Shell owns outright or has an equity position in 427 lease blocks in the Alaska offshore.

The OCS is a significant source of oil and natural gas for the Nation's energy supply, and the 5-Year OCS leasing program is an important component of the U.S. energy strategy. The approximately 43 million leased OCS acres generally account for about 15 percent of America's domestic natural gas production and about 27 percent of America's domestic oil production. In fact, the offshore areas of the United States are estimated to contain significant quantities of resources in yet-to-be-discovered fields. MMS estimates oil and natural gas resources in undiscovered fields on the OCS (2006, mean estimates) total 86 billion barrels of oil and 420 trillion cubic feet of natural gas. These volumes

represent about 60 percent of the oil and 40 percent of the natural gas resources in remaining undiscovered fields of the United States. Included in these volumes is the Alaska OCS with estimated resources of 132 trillion cubic feet of natural gas and 27 billion barrels of oil or roughly one-third of OCS estimated reserves. Shell is the dominant player in the Alaska OCS, having bid \$2.1 billion USD on 275 leases in the Chukchi Sea in 2008. Shell believes that the Alaska OCS could contain some of the most prolific, undeveloped hydrocarbon basins in the United States.

New offshore oil & gas development in Alaska will generate thousands of new, high-paying jobs throughout the 50 states, from steel & pipe manufacturers in the Midwest to shipping on the coasts to advanced computer technology in California and Seattle, to Union Labor for pipeline construction and maintenance. A recent study by University of Alaska's Institute of Social and Economic Research University found that new offshore energy production in the State of Alaska would produce an annual average of 35,000 jobs over the next 50 years for the state of Alaska alone, with a total payroll of \$72 billion (2007\$) over the 50-year period.

We appreciate NMFS's desire to provide a comprehensive analysis for exploration activities in the Arctic Seas and hope that your analysis will include exploration and ancillary activities that occur both during open water and ice-covered seasons year-round. If exploration is successful, it is reasonable and foreseeable that development activities necessary to produce economical petroleum hydrocarbon discoveries and transport product to market will occur. As such, we recommend including potential development and production activities in the project description and evaluating the potential consequences of issuing ITAs for these activities. Examples of activities to consider would be nearshore and offshore construction operations, development drilling and production operations, and marine or aircraft traffic associated with resupply and crew transfers. We are confident that any mitigation measures designed will be science-based, adaptive, and of limited duration – reflecting the potential behavioral reactions of marine mammals exposed to our activities.

I would like a copy of the draft EIS when produced.

If you should have any questions, please contact me at (504) 728-4143.

Kind regards,
Shell Exploration & Production Company

A handwritten signature in black ink, appearing to read "Kent Satterlee". The signature is stylized and cursive.

Kent Satterlee
Manager Regulatory Policy – Offshore
Upstream Americas

Attachments

The “No Action” Alternative

As made clear in the Notice of Intent, the action alternatives analyzed will represent a range of levels of activities including the “no action” level, i.e. no seismic or exploratory drilling. We question NMFS’s reasoning for evaluating such a scenario, since this is beyond the authority of the participating agencies; the Secretary of Interior has the authority to nominate areas for oil and gas activities under the Outer Continental Shelf Lands Act.

In addition, similar to our comments to MMS on the draft EIS for Oil and Gas Lease Sales 209, 212, 217, and 221 in the Beaufort and Chukchi Sea Planning Areas, there are significant consequences to be examined in the “no action” scenario analysis. By not undertaking exploration activities in the Arctic and other areas of the OCS, the U.S. will be obliged to import additional oil from foreign sources. The development of these resources and subsequent tanker transport of imported oil have trans-boundary effects that have real environmental costs that should be properly estimated and weighed while considering different scenarios in this EIS.

Predicted Offshore Activity

Shell’s Exploration Plan and Oil Discharge Prevention and Contingency Plan for operations in the Beaufort Sea, along with MMS’s Environmental Assessment and Approval of those plans, are available at:

http://www.mms.gov/alaska/ref/ProjectHistory/Shell_BF/BF.HTM

In summary, MMS provided OCS EIS/EA MMS 2009-052, with a Finding of No Significant Impact (FONSI) on October 15, 2009. The EA evaluates the potential for significant impacts of the specific operations proposed in the Exploration Plan (EP), dated June 2009, submitted to MMS by Shell Offshore Inc. The EP is for exploratory drilling operations that would be conducted in accordance with the OCS Lands Act Amendments and MMS operating regulations (30 CFR 250 and 30 CFR 254). Shell proposes to drill two wells located on the company's leases in the Camden Bay area of the Alaskan Beaufort Sea to evaluate the Sivulliq and Torpedo prospects. The proposed drilling locations are Lease OCS-Y-1805 (Flaxman Island block 6658) and Lease OCS-Y-1941 (Flaxman Island block 6610). Drilling operations would be conducted from the drill ship M/V Frontier Discoverer during the July-October 2010 open-water period. Shell's proposal includes suspending all operations and removal of the drill ship and support vessels from the area beginning August 25 until completion of fall subsistence bowhead whaling by the Native Villages of Kaktovik and Nuiqsut, Alaska. Information about the methods by which the exploration activities would be conducted is detailed in the EP and the associated Environmental Impact Analysis and Oil Discharge Prevention and Contingency Plan.

Shell’s Exploration Plan and Oil Discharge Prevention and Contingency Plan for operations in the Chukchi Sea, along with MMS’s Environmental Assessment and Approval of those plans, are available at:

http://www.mms.gov/alaska/ref/ProjectHistory/2009_Chukchi_Shell/Chukchi_2009.HTM

In summary, MMS provided OCS EIS/EA MMS 2009-061, with a Finding of No Significant Impact on December 7, 2009. The EA evaluates the potential for significant impacts of the specific drilling operations proposed in Shell Gulf of Mexico Inc.'s Exploration Plan (EP), dated July 2009; deemed submitted October 20, 2009. The EP is for exploratory drilling operations that would be conducted in accordance with the OCS Lands Act Amendments and MMS operating regulations (30 CFR 250 and 30 CFR 254). Shell proposes to drill up to three wells at five potential drill sites on the company's leases in the Alaskan Chukchi Sea to evaluate the Burger, Crackerjack, and SW Shoebill prospects. The potential drill sites are on Lease OCS-Y-2280 (Posey block 6764), Lease OCS-Y-2267 (Posey block 6714), Lease OCS-Y-2321 (Posey block 6912), Lease OCS-Y-2111 (Karo block 6864), and Lease OCS-Y-

2142 (Karo block 7007). Drilling operations would be conducted from the drill ship M/V Frontier Discoverer during the July-October 2010 open-water period. Information about the methods by which the exploration activities would be conducted is detailed in the EP and in the associated Environmental Impact Analysis and Oil Discharge Prevention and Contingency Plan.

Shallow hazard and site surveys use sonic or mechanical tools to conduct gravity, magnetics, and electromagnetic surveys; surface geologic surveys; geotechnical site investigations; geochemical surveys; and other evaluations requiring access to the surface of the seafloor. Annually these surveys may be conducted throughout the OCS and state waters of the Beaufort Sea and Chukchi Sea OCS planning areas.

Since 2006 Shell has conducted such surveys in the OCS and state of Alaska waters and looking-forward through 2016, Shell will likely employ one, or more, marine vessels to conduct such marine surveys during each open water season. NMFS should be prepared to evaluate proposed marine surveys throughout the Beaufort and Chukchi Sea planning areas throughout the foreseeable period of the intended ITRs. Multiple prospective drill sites are cleared by shallow hazards surveys that include small-scale air gun acoustic surveys for medium and deep penetration high resolution profiling, side-scan sonar, multibeam and sub-bottom profilers for bathymetry, ice gouge, and strudel scour surveys. Geotechnical surveys may be conducted annually as well and these may include gravity-driven coring devices, or drilling units capable of deeper subsea borings. Surveys of this type will also occur in order to evaluate possible buried pipeline routes from the nearshore environment out to offshore prospects often tens of miles offshore. Shell has also begun to evaluate the use of Autonomous Underwater Vehicles (AUVs) to transport some sonar devices capable of surveying sea bottom features. In 2010 and beyond Shell may conduct surveys to deploy AUVs to conduct more marine surveys of this type.

Oil and gas exploration companies may also conduct winter, offshore exploration drilling from ice pads in the shallower waters of the Beaufort Sea. Through previous years of experience with on-ice exploration surveys, Shell is aware of the needs for clearance and avoidance of ice seal lairs, breathing holes, and resting locales. Access routes must be surveyed for the presence of these features and to precisely locate them in order to avoid disturbance of ice seals.

Winter, on-ice exploration has been conducted in the Alaskan Beaufort Sea as recently as 2002. The Steel Drilling Caisson (SDC), a bottom-founded drilling structure, is a "fit for purpose" drilling unit constructed typically by modifying the forward section of an ocean-going Very Large Crude Carrier. SDC is designed to conduct exploratory year-round drilling under arctic environmental conditions, and was used by EnCana on the McCovey Prospect offshore Prudhoe Bay in the winter of 2002/2003. The SDC can be deployed 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. The SDC is mobilized onto location in the open water season preceding the winter during which it is intended to drill.

Ice roads may be constructed to provide seasonal routes for heavy equipment and supplies to be moved to the offshore. These temporary, seasonal roads are constructed by spreading water from local sources (seawater) to create a rigid surface. 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. Support of offshore winter exploration may also include an airstrip if aircraft support is needed or anticipated during the winter exploration program.

Previous Science to Incorporate into the EIS

Offshore operations including seismic acquisition, shallow hazards and site surveys, and exploratory drilling in Alaska's Beaufort and Chukchi Seas has been supported by extensive scientific study and baseline development over many years. Since 1973, federal agencies have performed more than **5000** environmental studies to better understand the Alaskan OCS and coastal environment and document or predict the effects of offshore oil and gas activities¹. The National OCS Environmental Studies Program has spent more than \$600 million dollars (more than \$1 billion in inflation adjusted dollars) for studies under the guidance of the OCS Scientific Committee that advises the Secretary of Interior. About half of these funds have been directed to Alaska. At least three reports by the National Academy of Sciences directly on the environmental science that guides OCS activity, with particular focus on Alaska². The Department of Interior released its "Survey of Available Data on OCS Resources and Identification of Resource Gaps" in response to President Obama's vision for energy independence and found that, "Overall, an adequate baseline of information exists to address the environmental effects of the OCS oil and gas program and the renewable energy program in support of leasing decisions". It is Shell's position that there are sufficient baseline data to support an exploratory drilling program. It is fully our intent to conduct, foster, and facilitate an aggressive environmental assessment program in support of development, should we find economic reserves.

We look forward to an EIS that is rigorously based upon this scientific foundation, that also incorporates more recent advances such as those determined by Shell's 90 Day and Comprehensive Reports from our Marine Mammal Monitoring and Mitigation Program that has collected relevant information on the responses of marine mammals to different types of anthropogenic sound since 2007. We have attached a bibliography of important literature at the end of these comments for your consideration.

Negligible Impacts

Shell encourages NMFS to carry out a balanced and objective review of scientifically sound and peer-reviewed literature that examine the effects from offshore oil and gas operations on marine mammals. The EIS to be prepared should avoid speculation about potential effects, and should describe effects with reference to documented incidents or scientific or technical reports.

NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." All existing scientific research has indicated that exploration activities have no such effects. In its 2004 report, "*Marine Mammal Populations and Ocean Noise – Determining when Noise Causes Biologically Significant Effects*," the National Research Council concluded that "no scientific studies have conclusively demonstrated a link between exposure to sound and adverse effects on a marine mammal population."

¹ The actual number of scientific studies is likely even larger than expressed, which is based upon only two sources:

1) The Outer Continental Shelf Environmental Assessment Program, Comprehensive Bibliography June 1990, MMS OCS Study 90-0043, and 2) a list of MMS Alaska Environmental Studies since 1993 available online at: <http://www.mms.gov/alaska/ess/completedstudieslist/complete.pdf>

² The reports are: (i) Assessment of the U.S. Outer Continental Shelf Environmental Studies Program, Volumes I, II, III, IV; National Academy Press (1992), (ii) Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska, National Academy Press (1994), and (iii) Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, The National Academies Press (2003)

More specifically, no detrimental population-level effects of seismic exploration on the Bering-Chukchi-Beaufort Bowhead whale stock (BCBB) have ever been suggested in the scientific literature. To reinforce this point, year-by-year Bowhead population estimates and measures of seismic activity in the Beaufort Sea and Chukchi Sea are compiled in Table 1. During the late 1970s and 1980s, active seismic exploration in the Beaufort and Chukchi Seas occurred concurrently with a growth in BCBB population of ~ 3%/yr (George et al., 2002; Zeh et al., 1991). This rate of population growth appears consistent, whether during times of active seismic and drilling exploration, or not (Figure 1). A new population estimate is being attempted in 2010 that will be useful in assessing current trends in the bowhead population. The results of this assessment should be included in NMFS review, when it becomes available.

Recent data made available by the NSB Wildlife department indicate that the body condition of whales taken in recent years is excellent (Craig George, personal communication).

Biological Significance and Threshold for “Takes”

As recognized by the National Academy of Sciences in the report *Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects*, “activities resulting in only minor behavioral responses well within the range of natural variability are unlikely to cause biologically significant effects to an individual”, much less a population of animals. We also agree with the National Research Council report *Marine Mammals and Low-frequency Sound* that the Marine Mammal Protection Act definition of “Level B harassment should be limited to meaningful disruption of biologically significant activities that could affect demographically important variables such as reproduction and longevity.” Unfortunately, previous impact assessments have implied that deflection in the migration path of a Bowhead whale can lead to dire impacts on the survival of individual animals (so that the conditions of “potential biological removal” are met) presumably due to some combination of energetic cost, or missed feeding or mating opportunity. Such an implication is, however, questionable.

- **Energetic Cost of Deflection:** During the fall migration, BCBB whales travel from summer areas in the Canadian Beaufort, along the North Slope coast, around Pt. Barrow into the Chukchi Sea, and finally into the Bering Sea. In the central Beaufort Sea, during the time of year when migration deflections were identified, whales influenced by seismic exploration modify their migratory path out to a distance of ~20 km (Richardson et al., 1999). While the precise extent of this migratory deflection is not clear, it is clear that this does not represent a large scale disruption of the migration and that the deflection is limited to within 10-30 km of the industrial activity. Compared to an annual migration of thousands of kilometers, such an effect is unlikely to be significant.
- **Missed Opportunity:** But are deflected whales missing an important biological opportunity that could have important ramifications for the health of an individual? It is reasonable that migrating whales will feed opportunistically in the Alaskan Beaufort Sea (and elsewhere), when circumstances allow. Potential impacts would occur only during the whale's westward migration in the fall, separated in time from Bowhead mating and calving which occurs in late winter-spring in the Bering Sea (Nerini et al., 1984; Koski et al., 1993) and separated in space from the vast majority of feeding which occurs in the Canadian Beaufort Sea and the Bering Sea (Richardson and Thomson, 2002; Richardson et al., 1999; Lowry 1993). For example, Richardson and Thomson (2002) concluded that the BCBB stock derives an estimated 2.4% of annual dietary requirement in the eastern Alaskan Beaufort Sea, with an even smaller amount from the central Alaskan Beaufort Sea.

Furthermore, Bowhead whales that are engaged in an important biological opportunity, such as feeding, may be less likely to modify their behavior. The observations of Richardson

et al (1999) specifically noted that whales avoided seismic sound during migration. In comparison, when Bowheads feeding in the Canadian Beaufort Sea (summer) were approached by a seismic vessel undergoing a full-scale seismic survey (nominal source level of 248 dB re 1 μ Pa @ 1 m), some near bottom feeding continued until the vessel was only ~3 km away. Some Bowheads began to orient away from the ship when its airguns began to fire 7.5 km away (Richardson et al., 1986).

Shell requests that exclusion zones and other regulatory threshold criteria (e.g. 180/190) be adjusted upwards to 230 dB re: 1 uPa (peak, flat) for cetaceans and 218 dB re: 1 uPa (peak, flat) for pinnipeds, as suggested by the most recent assessment of exposure criteria:

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33(4): 411-522.

Table 1.

YEAR	BCB Bowhead Whale		Line-Miles of Seismic Acquired <i>(from Susan Banet, MMS Alaska)</i>	
	Population	(95% Confidence)	Reference	Beaufort Chukchi
1968				775
1969				374
1970				3002
1971				1482 3372
1972				289
1973				2325 798
1974				514 1847
1975				2178
1976				3752
1977				10544
1978	5189		Raftery et al. 1995	2184
1979				2361
1980	4198		Raftery et al. 1995	2303
1981	4956		Raftery et al. 1995	9683
1982	7074		Raftery et al. 1995	10425 7881
1983	6747		Raftery et al. 1995	7010
1984				7617 11913
1985	6039	(3300-11100)	Zeh et al 1995	10428 16463
1986	10300	(8100-12900)	Raftery & Zeh 1994	3681 27639
1987				4627 8771
1988	6579	(5300-8200)	Raftery & Zeh 1994	399
1989				885
1990				3369 861
1991				29
1992				117
1993	8200	(7200-9400)	Zeh et al 1995	986
1994				205
1995				205
1996				205
1997				205
1998				0
1999				0
2000				0
2001	9860	(7700-12600)	George et al 2002	0
2002				0
2003				0
2004				0
2005	10545		NOAA 2005	0

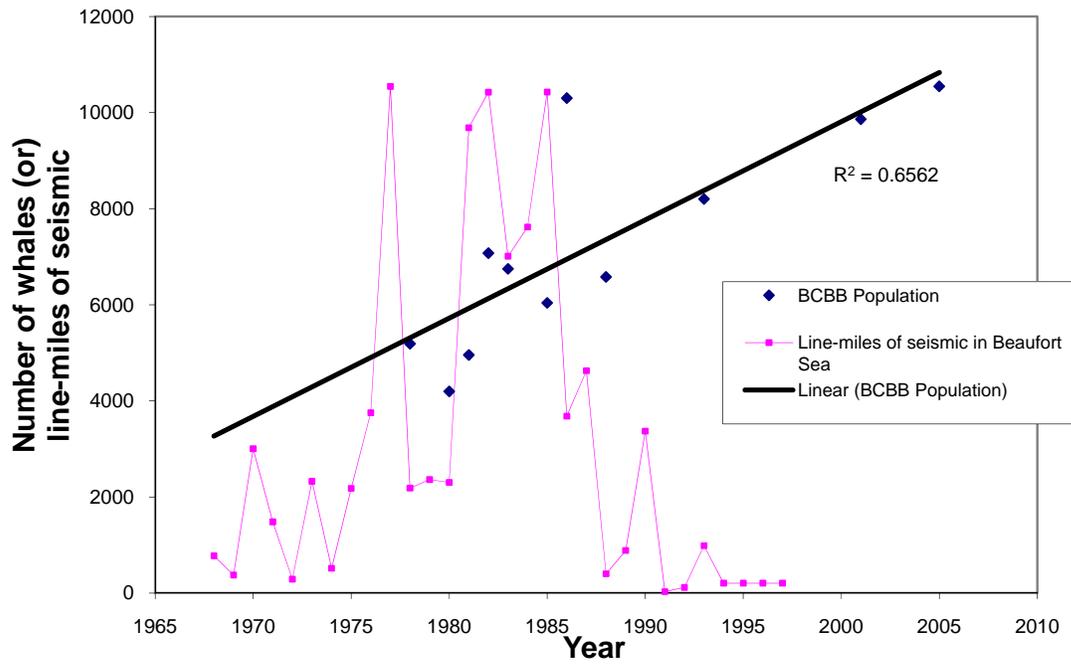


Figure 1. No Apparent Relationship Between Seismic Activity in the Beaufort Sea and BCB Bowhead Whale Population. References for data are provided in Table 1. Information for the Chukchi Sea is qualitatively similar to that shown for the Beaufort, line-miles peak in the mid-1980s, but was left off the figure for clarity.

There has been additional seismic activity between 2007-2009, but that information was not included on this figure.

New Science to Incorporate into the EIS

We have included a bibliography of research from our Alaska science program along with other pertinent papers at the end of these comments for your incorporation into the EIS. Shell's 2006-2009 Joint Monitoring Report (Funk et al. 2010, see Bibliography) comprehensively details the results of 4 seasons of our marine mammal work off Alaska, supports the conclusions we've suggested in the earlier section of our comments "Previous Science to Incorporate into the EIS", and is a critical resource for NMFS to incorporate into your analyses. Some of our findings include:

- Seismic activity does not interrupt the Bowhead whale migration through areas with exploration operations
- Deflection of Bowhead whales by sound is dependent on the activities of the whales. During migration, whales are particularly sensitive – tending to avoid areas with received sound levels above 120-130 dB re 1 uPa. During biologically-significant activities such as feeding, individual whales have been shown to utilize areas and tolerate sound levels up to 150-160 dB re 1 uPa.
- There is no evidence that Bowhead whale cow-calf pairs are especially reactive to sound, e.g. pairs continue feeding in areas with received sound levels of 150-160 dB re 1 uPa.
- Bowhead whale calling rates are reduced during periods with active seismic operations.
- Subsistence hunts can be successful, even when exploration activities occur, when based upon strong cooperation between hunters and industry, which has been the norm since the 1990s.

NMFS should also recognize the significant research and development around marine sound and environmental impact being conducted by the E&P Sound and Marine Life Joint Industry Programme administered by the International Association of Oil and Gas Producers. Shell will provide final reports from the JIP to NMFS and MMS as they become available. Significant information on the scope and breadth of the research program and the results are publically available online: <http://www.soundandmarinelife.org/Site/index.html>

There are five broad research categories: 1) Sound Source Characterization and Propagation, 2) Hearing, Physiological Effects, and Physical Effects, 3) Behavioral Reactions and Biologically-significant Effects, 4) Mitigation and Monitoring, and 5) Research Tools. Completed reports and peer-reviewed articles are available online at the link to "Research products of the JIP" from the main site. The following list provides the names and affiliations of all who have received Contracts from the JIP since its inception and the subject of those contracts. The list is complete as of December 2009 and indicates those contracts that are still in progress and those that have concluded.

Category 1: Sound Source Characterisation and Propagation

Fairfield Industries, Sugar Land, Texas, USA. Charter of the FAIRFIELD ENDEAVOR for deployment of an air gun array used in source measurements in 2007. [Completed]

Equipment and Technical Services, Houston Texas, USA. Positioning services for EARS buoys during collection of source measurements of an air gun array. [Completed]

University of New Orleans, Louisiana, USA. George Ioup. Experimental design for measuring output of an airgun array. [Completed]

Seiche Measurements Ltd, Torrington, UK. Roy Wyatt. Review of existing data on underwater sounds produced by industry. [Completed]

University of Southern Mississippi, USA. Deployment and retrieval of EARS buoys used to collect source measurements of an air gun array. [Ongoing]

University of Lafayette, Louisiana, USA. Natalia Sidorovskaya. Analysis of data collected during source measurements of an air gun array. [Ongoing]

University of New Orleans, Louisiana, USA. George Ioup. Analysis of data collected during source measurements of an air gun array. [Ongoing]

PGS Geophysical, Laysaker, Norway. Anders Mattssen. Creation of an experimental range, measurement of the output of single air guns, and analysis of resultant data. [Ongoing]

GeoSpectrum Technologies, Inc, Nova Scotia, Canada. Paul Yeatman. Implementation of Particle Velocity Sensors at the Hjørundfjord Range for single air gun measurements. [Ongoing]

Specialty Devices, Inc, Texas, USA. Paul Higley. Computation of hydrophone positions on the SCS07 mooring arrays using 3-D finite element hydrodynamic modelling. [Ongoing]

LGL Ltd, Sidney, British Columbia, Canada. Michelle Gilders. Environmental assessment of marine vibroseis technology. [Ongoing]

JASCO Applied Sciences, Nova Scotia, Canada. Scott Carr. Review of Acoustic Acquisition Metrics and Development of Acoustic Acquisition Methodology Report for the OGP. [Ongoing]

Category 2: Hearing, Physiological Effects, and Physical Effects

Scripps Institution of Oceanography, California, USA. Paul Ponganis. Blood nitrogen uptake and distribution in diving bottlenose dolphins (the “Bends” hypothesis). [Completed]

Aquatic Mammals, University of Western Illinois, USA. Jeanette Thomas, Editor. Publication of a special issue of AQUATIC MAMMALS [Vol. 33(1) 2007] on methods for measuring Auditory Evoked Potentials (also see <http://www.aquaticmammalsjournal.org>). [Completed]

University of California, Santa Cruz, USA. Colleen Reichmuth. A white paper entitled; Mysticete Hearing: A Research Strategy. [Completed]

University of Southern Denmark, Lee Miller, and, **University of Hawaii**, Paul Nachtigall. Live capture and measurement of hearing ability in the minke whale off Iceland. [Completed]

Environmental BioAcoustics, LLC, Maryland, USA. Art Popper. An experimental design for measuring tissue injury in fish exposed to air gun shots. [Completed]

Pennsylvania State University, USA. Mardi Hastings. A biomechanical numerical model for predicting the onset of auditory tissue damage in different species of fish. [Completed]

Woods Hole Oceanographic Institution, USA, Darlene Ketten, and Boston University, USA, David Mountain. Anatomical model of hearing in the minke whale (see <http://www.whoi.edu>). [Ongoing]

SPAWAR Laboratory, San Diego, California, USA. James Finneran. Temporary Threshold Shift in dolphins exposed to multiple air gun shots. [Ongoing]

Virginia Wesleyan University, USA. Soraya Bartol. Hearing ability in three life stages of the loggerhead sea turtle. [Ongoing]

Long Marine Laboratory, University of California, Santa Cruz, USA. Colleen Reichmuth. Airgun effects on Arctic seals: auditory detection, masking, and temporary threshold shift. [Ongoing]

Category 3: Behavioural Reactions and Biological Significance

Marine Acoustics, Inc., Arlington Virginia, USA. Behavioural responses of beaked whales to naval sonar, seismic air guns, and other sound stimuli. (Co-funded with ONR and US Navy). [Completed]

Sea Mammal Research Unit, St. Andrews University, UK. Nicola Quick. Cetacean population trends in relation to industry Exploration and Production sound. [Completed]

Centre for Environment, Fisheries, and Aquaculture Science (CEFAS), Lowestoft, UK. Frank Thomsen. Cetacean population trends in relation to industry Exploration and Production sound. [Completed]

LGL, Ltd, Sidney, British Columbia, Canada. Michelle Gilders. Cetacean population trends in relation to industry Exploration and Production sound. [Completed]

LGL, Ltd, Sidney, British Columbia, Canada. Michelle Gilders. Application of Risk Assessment for evaluating the effects of sound on marine life. [Completed]

Nova Southeastern University, Florida, USA. Edward Keith. Critical review of the literature on marine mammal population modelling. [Completed]

University of St Andrews, UK. John Harwood. Critical Review of the literature on marine mammal and fish population modelling. [Completed]

SeaWatch Foundation, Chalfont St. Peter, UK. Peter Evans. Cetacean population trends in relation to industry Exploration and Production sound. [Ongoing]

Florida State University Research Foundation, Tallahassee, Florida, USA, Douglas Nowacek, and **Murdoch University**, Western Australia, Lars Bejder. A review of literature to estimate PCAD-related transfer functions. [Ongoing]

Long Marine Laboratory, University of California, Santa Cruz, USA. Daniel Costa. Relating behaviour and life functions to populations level effects in marine mammals; an empirical & modelling effort to develop the PCAD model; Use of electronic tag data and analytical tools to identify and predict habitat utilization of marine mammals in a risk assessment framework. [Ongoing]

Scripps Institution of Oceanography, California, USA. Aaron Thode. Testing of potential alerting responses on tagged sperm and humpback whales off Sitka, Alaska. [Ongoing]

University of Queensland, Australia, Michael Noad, and **Curtin University of Technology**, Australia, Robert McCauley. Controlled Exposure Experiments to examine the effects of seismic airgun arrays on Humpback whales – workshop and project preparation. [Ongoing]

Category 4: Mitigation and Monitoring

SIMRAD AS, Horton, Norway. Frank Reier Knudsen. Evaluation of low and high frequency sonar for detecting whales in relation to seismic survey explorations. [Completed]

Noise Control Engineering, Billerica, Massachusetts, USA. Jesse Spence. Noise Control Technologies capable of reducing underwater sound production (noise attenuation technology and methods). [Completed]

RSK Environment Ltd, Aberdeen, UK. Robert Jaques. Collation and potential use of existing marine mammal observer data. [Completed]

Scripps Institution of Oceanography, California, USA. Aaron Thode. Converting, testing, and installing tracking software into the PAMGUARD system. [Completed]

Ecologic UK Ltd, St. Andrews, UK. Jonathan Gordon. Workshop and tutorial introducing PAMGUARD to potential users. [Completed]

Heriot-Watt University, Edinburgh, UK. Xiao Yan Deng. Developing basic architecture, configuring utilities, improving displays, and providing bug fixes for PAMGUARD. [Completed]

Oregon State University, USA. David Mellinger. Advice on system architecture and develop utilities for detection and localization in PAMGUARD. [Completed]

Sea Mammal Research Unit, St. Andrews, UK. Ian Boyd. PAMGUARD field testing during the 2007 CODA field trial. [Completed]

Akoostix Inc, Dartmouth, Nova Scotia, Canada. Joe Hood. PAMGUARD software development – detection, classification & localization capabilities focused on mysticetes and beaked whales. [Completed]

Innovations in Signal Processing (INSIG) Inc, Wakefield, Rhode Island, USA. David Moretti. Fixed Passive Acoustic Marine Mammal Monitoring for estimating species abundance and mitigating the effect of operations on the marine environment. [Completed]

Scripps Institution of Oceanography, California, USA. Aaron Thode. Testing use of a vector sensor for resolving right/left ambiguities in towed PAM systems. [Ongoing]

Sea Mammal Research Unit, St. Andrews University, UK. Len Thomas. Estimating marine mammal population densities from fixed PAM data (co-funded with NOAA Acoustics Program). [Ongoing]

Bio-Waves Inc, Encinitas, California, USA. Thomas Norris. Review & inventory of current fixed installation Passive Acoustic Monitoring methods & technologies. [Ongoing]

Sea Mammal Research Unit, University of St Andrews, UK. Douglas Gillespie. Provision of PAMGUARD support services through 2008 to 2010 including development of sustainable funding stream for longer-term maintenance. [Ongoing]

Sea Mammal Research Unit, St Andrews University, UK, Douglas Gillespie, and **Institute of Sound & Vibration Research,** Southampton, UK, Paul White. Development & implementation of acoustic classification of odontocetes with PAMGUARD. [Ongoing]

Hawaii Institute of Marine Biology, Kaneohe, Hawaii, USA. Whitlow Au. Development of software (ROCCA) for real-time acoustic identification of cetacean species. [Ongoing]

Sea Mammal Research Unit, St Andrews University, UK. Douglas Gillespie. PAMGUARD Industry Field Trial in Gulf of Mexico, 2008. [Ongoing]

Defence R&D Canada – Atlantic, Dartmouth, Nova Scotia, Canada. Jim Theriault. Review/inventory of current Active Acoustic Methods and Technologies. [Ongoing]

Category 5: Research Tools

Sea Mammal Research Unit, University of St. Andrews, UK. Ian Boyd. Workshop on technology (tags) needed to measure responses of wildlife to industry sound. [Completed]

LGL Ltd, Sidney, British Columbia, Canada. William Koski. Review/inventory of current technologies and applications of Unmanned Aerial Systems (UAS) for the detection & monitoring of key biological resources and physical parameters affecting marine life. [Completed]

Oregon State University, USA. Bruce Mate. Field testing of developed GPS/depth tags on Sperm whales in the Sea of Cortez in 2007 & 2008. [Ongoing]

Other Topics

University of Maryland, USA. Arthur Popper. Noise exposure criteria for fish and turtles (meeting of an ASA working group). [Completed]

University of Maryland, USA, Arthur Popper, and **Fjord & Baelt,** Kerteminda, Denmark, Magnus Wahlberg. Support for the International Conference on the Effects of Noise on Aquatic Life, Nyborg, Denmark 2007 (see <http://www.noiseeffects.umd.edu/>). [Completed]

Society for Marine Mammalogy, Mote Marine Laboratory, Florida. John Reynolds, President. Support for the 17th biennial Conference on the Biology of Marine Mammals, Cape Town, South Africa, December, 2007. [Completed]

University of Aberdeen, UK, David Lusseau, and **Murdoch University,** Western Australia, Lars Bejder. Support for Phase I (research design) of large-scale research initiative to inform PCAD Model. [Completed]

Ecological Effects of Drilling

We recognize that NEPA analyses of drilling activities are conducted by both EPA and MMS, and were uncertain if it is also NMFS intent to address these issues based upon the Federal Register notice. For Shell, Dr. Jerry M. Neff (Neff and Associates LLC) is finalizing a significant report on offshore drilling activities in the Arctic and other cold-water environments and the associated environmental impacts entitled "Fates and Effects of Water Based Drilling Muds and Cuttings in Cold-Water Environments". We will provide this report to NMFS and MMS as soon as complete, which we expect to be in May 2010. This report focuses on water-based drilling systems due to the restrictions already in place for the Chukchi and Beaufort Sea associated with US EPA Permit Number AK280000: AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) FOR OIL AND GAS EXPLORATION FACILITIES ON THE OUTER CONTINENTAL SHELF AND CONTIGUOUS STATE WATERS, available at:

<http://yosemite.epa.gov/R10/Water.NSF/NPDES+Permits/General+NPDES+Permits#Oil%20and%20Gas>

Dr. Neff's review covers the following topics, with emphasis on the large amounts of research and monitoring that has been performed in cold-water marine environments of Alaska, Canada, and Norway:

1. Background information about the history of exploration for and development of offshore oil and gas resources, with emphasis with activities off Alaska, Canada, and Arctic regions of Norway and Russia;
2. Short history of technology development for drilling in the harsh conditions of Arctic marine environments;
3. Description of the compositions and physical properties of modern water-based muds (WBM) and cuttings, including those proposed for use for exploratory drilling in the Beaufort and Chukchi Seas.
4. Summary of environmental regulations for WBM and cuttings discharges to Alaskan and other U.S. Federal waters, with a comparison to discharge regulations in Canada and the North Sea countries.
5. Review of the relevant scientific literature on the fates of WMB and cuttings following discharge to the ocean, particularly in Arctic Alaska and Canada.
6. Comparison of biological effects, including bioaccumulation and toxicity, of whole WBM and associated cuttings and individual ingredients of modern WBM in Alaskan marine organisms to biological effects in marine animals from Arctic and lower-latitude marine environments elsewhere in the world.
7. Characteristics of Arctic marine food webs in relation to possible pathways for exposure of valued marine resources to chemicals from drilling wastes; and
8. Field studies of the effects of drilling discharges on Arctic and subarctic marine ecosystems and valued marine resources.

Oil Spill Prevention and Preparedness

NMFS should be aware that significant research on oil spill prevention, detection, and response has occurred in the last few years. The oil industry actively promotes the prevention of spills in cold weather areas due to the difficulties associated with response, but the importance of readiness to respond to spills in these regions when possible is also recognised. Numerous projects are thus being undertaken by oil companies as well as other organizations either independently, through Joint Industry Projects (JIP) or as part of an industry association to enhance spill response capabilities in remote and challenging regions such as the Alaskan Arctic. A number of programs and results ought to be considered during development of this EIS, including:

- Minerals Management Service's "Arctic Oil Spill Response Research and Development Program – A Decade of Achievement" and associated reports, which are easily accessed at: <http://www.mms.gov/alaska/fo/MMSArcticResearch.pdf>

- The Joint Industry Project on Oil in Ice, information available at: <http://www.sintef.no/Projectweb/JIP-Oil-In-Ice/>

The overall objective of the program is to develop knowledge, tools and technologies for environmental beneficial oil spill response strategies for ice-covered waters. The program intends to improve our ability to protect the Arctic environment against oil spills, give improved basis for decision-making and enhance the state-of-the-art in Arctic oil spill response.

The program was initiated in September 2006 after a comprehensive preparation phase and was completed early 2010. The program covers R&D areas including mechanical recovery, use of dispersants, remote sensing of oil on water and under ice, and numerical modeling.

Two field tests involving release of oil in broken ice were performed during this JIP. The processes of the drift, spreading and weathering of oil have been monitored by multiple sampling throughout a six-day offshore field experiment in the marginal ice zone around the Svalbard archipelago. Some of the important measurements were:

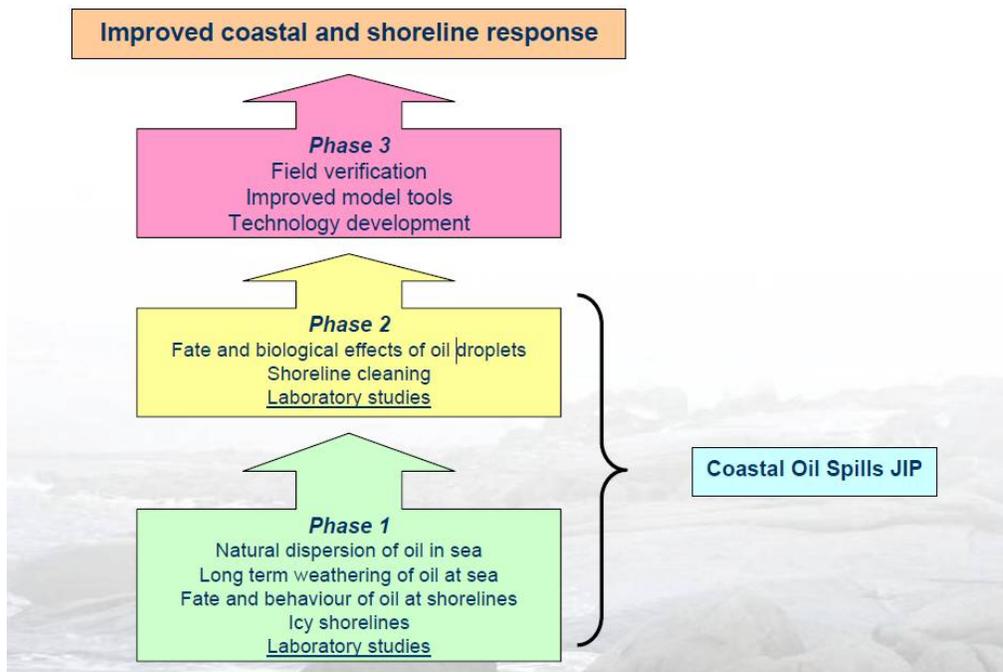
- Data on the potential bioaccumulation of oil components in the water column.
- Dissolved hydrocarbons in the water column.
- Oil droplet size distribution.
- The recording of ice drift and ice field deformation

There are also a number of collaborative projects currently underway, the results of which will be useful in development of this EIS. Though not complete yet, Shell will forward all results to NMFS and MMS when they are finalized. The following programs are directly applicable:

- The JIP on Toxicity and Biodegradation Rates of Dispersed Oil in Arctic Environment. This research encompasses an in-depth cooperative research project to determine the toxic effects and biodegradation rates of dispersed oil under Arctic open water conditions. The three main objectives of this study are to 1) determine relative sensitivity of Arctic species relatively to temperate species, 2) determine the toxicity of dispersed Alaska North Slope (ANS) crude oil to indigenous copepods (*Calanus glacialis*) and Arctic cod (*Boreogadus saida*) compared to non-dispersed oil, and 3) determine the biodegradation rates of dispersed oil compared to non-dispersed oil.
- The JIP on Detecting Oil on and Under Sea Ice Using Ground-Penetrating Radar, sponsored by Shell, Statoil, Exxon, MMS, ACS scheduled for completion in 2011. JIP members seek to design and fabricate two new GPR systems specifically for the application of detecting oil under snow and ice. Based on previous work by the project team over the past five years, a frequency range of 0.5–2 GHz appears optimal for this application depending on oil film

thickness, ice thickness and ice properties. The new systems will provide more directionality of the transmitted signal (a more focused beam), to increase the signal to noise ratio of our measurements. This improvement will allow more accurate detection of oil under snow and ice and potentially permit higher-altitude and higher-groundspeed measurements. Two systems are planned, 1 system using horn-based antennas, and a second system using a horn-fed reflector dish. In the second phase of this project GPR unit will be tested in the field for oil detection under ice.

- The JIP on Coastal Oil Spills, sponsored by ENI Norge, Statoil, Shell, the Norwegian Coastal Administration, and Det norske oljeselskap, scheduled for Phase 1 completion in 2008 and Phase 2 completion in 2011.



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April 9, 2010

Mr. P. Michael Payne, Chief, Permits
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Re: RIN 0648–XU06 – Comments in Response to Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean

Dear Mr. Payne:

Statoil USA E&P appreciates the opportunity to provide the following comments in response to the National Marine Fisheries Service's (NMFS) Notice of Intent (NOI) to Prepare an Environmental Impact Statement (EIS) on the Effects of Oil and Gas Activities in the Arctic Ocean. 75 Fed. Reg. 6175 (Feb. 8, 2010). Our understanding is that the EIS will analyze the environmental impacts of issuing Incidental Take Authorizations (ITAs) pursuant to the Marine Mammal Protection Act (MMPA) to the oil and gas industry for the taking of marine mammals incidental to offshore exploration activities (e.g., seismic surveys and exploratory drilling) in Federal and state waters of the U.S. Chukchi and Beaufort Seas off Alaska. The Minerals Management Service (MMS) will be a cooperating agency in preparing the EIS.

Statoil is an international energy company with operations in 40 countries. Building on more than 35 years of experience from oil and gas production on the Norwegian continental shelf, we are committed to accommodating the world's energy needs in a responsible manner, applying technology and creating innovative business solutions. We are headquartered in Norway with 30,000 employees worldwide, and are listed on the New York and Oslo stock exchanges.

By way of comparison, Statoil has a market capitalization of nearly \$80 billion, about the same as ConocoPhillips. Statoil produced about 2 million barrels of oil equivalent per day in 2009. We are the operator of 39 producing fields worldwide and have about 22 billion barrels of oil equivalent in proven reserves (5.6 billion barrels of booked reserves). We are one of the world's largest net sellers of crude oil.

Statoil is a relative newcomer to Alaska but we have active projects in the Arctic areas of Norway, Russia, Greenland and Canada. We also have a large acreage position in the Gulf of Mexico where we are operator with ongoing drilling activities.

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We believe our experience and financial strength are essential attributes to work in an area as complex as the Alaska Arctic, and the way we work is as important as the goals we achieve. Safe and efficient operations are our first priority. We are confident we can work with all the regulatory agencies to find a suitable balance between operational efficiency and environmental protection.

Statoil has a strong interest in NMFS's environmental review of oil and gas exploration activities in the Arctic Ocean, especially in the Chukchi Sea. In 2008, Statoil acquired 16 leases during MMS's Outer Continental Shelf Lease Sale 193. The leases comprise 5,354 blocks in water depths from 66 to 262 feet (20 to 80 meters), roughly 37 miles (60 kilometers) north of the Shell operated Burger prospect in the Chukchi Sea. Statoil is planning a 3D marine seismic program on its leases covering 593,083 acres (2,400 square kilometers), which it hopes to commence in August 2010 and continue through October 2010. Statoil's exploration plans also include preparation for exploration drilling if the seismic interpretation concludes that there are attractive prospects on the leases.

Statoil supports the type of comprehensive environmental review that NMFS will be undertaking for the Chukchi and Beaufort Seas. Statoil is committed to the development of energy resources in an environmentally sound and sustainable basis and subject to public review and comment.

Statoil also recognizes the importance, particularly in Alaska, of consultation and coordination with the people and communities that are most affected by these activities. Statoil has engaged and will continue to engage in direct discussions with the residents of the villages along the coast of the Chukchi Sea and with the organizations that represent these interests, including the co-management groups. Statoil believes consultation and communication of this nature is necessary to take advantage of the important information that can be learned through both scientific and traditional knowledge. Statoil strongly encourages NMFS to follow the same approach in developing the draft EIS (DEIS) and related actions.

The EIS outlined in the NOI will facilitate the review of future oil and gas seismic activity in the Arctic Ocean. We hope the EIS review can be conducted expeditiously. We trust that until the EIS is completed, individual projects will be reviewed on a case-by-case basis. Companies have a limited window during which to conduct operations, and those operations themselves require detailed planning and substantial investment. Several major projects have been under development prior to NMFS's Notice of Withdrawal of the Draft Programmatic Environmental Impact Statement on October 28, 2009 and, of course, the February 8, 2010, NOI. Those projects, and others for which companies are prepared to commence exploration activities, should not be delayed until the completion of the EIS.

Indeed, in other energy resource development contexts, several agencies have taken the position that for projects in the pipeline before a programmatic EIS (PEIS) is proposed, review should not be deferred until after the PEIS is completed. For example, the Bureau of Land Management (BLM) continued its review of individual wind energy facilities while it developed a

programmatic EIS (PEIS) for the establishment of a Wind Energy Development Program. BLM processed wind energy development applications in accordance with the terms and conditions of its Interim Wind Energy Development Policy until it issued its Record of Decision for the PEIS, and it is currently following the same approach for onshore solar energy projects. In this case, it is highly appropriate to proceed with individual project review, as the regulatory program has long been in place, and the agencies have years of experience with offshore oil and gas exploration activities.

Historically, in the Chukchi Sea, five wells have previously been drilled and thousands of miles of seismic data have been acquired.

In the meantime, Statoil would like to contribute to the development of the EIS and consult with NMFS, as well as other stakeholders, regarding the impacts of oil and gas activities on the ecosystems of the Arctic Ocean. As part of its internal environmental policies and practices, Statoil has developed substantial experience in preparing environmental assessments and thus has a wide breadth of knowledge on which to base its suggestions. To that end, Statoil hopes to maintain communications with NMFS regarding the company's activities in Alaska. In furtherance of that goal, Statoil respectfully submits the following comments in response to the NOI on the next pages.

Thank you for considering these comments. Statoil looks forward to participating in the EIS process and providing additional information, as it becomes available. We are readily available for further dialogue and look forward to contributing to the process in a constructive way.

Very truly yours,



Martin Cohen,
Alaska Exploration Manager

ATTACHMENT - COMMENTS

General Comments

A. Purpose and Need Statement for the EIS

As stated in the NOI, the EIS will analyze the potential effects of both geophysical surveys and exploratory drilling, address cumulative effects over a longer time frame, consider a more reasonable range of alternatives consistent with our statutory mandates, and reanalyze the range of practicable mitigation and monitoring measures for protecting marine mammals and availability of subsistence uses. 75 Fed. Reg. at 6175.

Developing such data is critical. However, in analyzing these data, NMFS should take into account the goals of the Obama Administration and the increased emphasis it has placed on the development of domestic energy resources. The Obama Administration announced on March 31, 2010 “that the Administration will expand oil and gas development and exploration on the U.S. Outer Continental Shelf (OCS) to enhance our nation’s energy independence while protecting fisheries, tourism, and places off U.S. coasts that are not appropriate for development.”

<<http://www.whitehouse.gov/the-press-office/obama-administration-announces-comprehensive-strategy-energy-security>>. Secretary Salazar explained:

By responsibly expanding conventional energy development and exploration here at home we can strengthen our energy security, create jobs, and help rebuild our economy. Our strategy calls for developing new areas offshore, exploring frontier areas, and protecting places that are too special to drill. By providing order and certainty to offshore exploration and development and ensuring we are drilling in the right ways and the right places, we are opening a new chapter for balanced and responsible oil and gas development here at home.

Id. The Administration specifically determined that the Chukchi Sea and the Beaufort Sea should be open to exploration and development, including the Lease Sale 193 area. *See* <<http://www.doi.gov/whatwedo/energy/ocs/AlaskaRegion.cfm>>. In light of the Administration’s mandate, and its decision to leave open significant areas in the Chukchi and Beaufort Seas, the purpose and need statement to be used to define the scope of the DEIS should reflect the balance that the Administration has advised must be struck between the need for development and the need to protect the nation’s natural resources. Thus, the purpose and need statement should focus on the issuance of incidental take authorizations that are in accordance with the MMPA, but are also consistent with the Administration's energy exploration and development policies and requirements.

B. Alternatives

Alternatives are, of course, the “heart of an EIS,” and Statoil encourages NMFS to adopt a sufficient range of alternatives to provide for maximum flexibility in determining the final course of action pursuant to the purpose and need statement. In addition to the points raised below, there are two specific issues regarding alternatives that Statoil addresses.

Treat Chukchi and Beaufort Separately. The Chukchi and Beaufort areas vary significantly in terms of the potential impacts to the environment and to subsistence activities. Many of the Chukchi lease areas are 100 or more miles offshore, well beyond the limits of subsistence activities. Similarly, whale migration patterns and the potential impact of open water activities on whale migration and other marine mammals vary significantly from the Beaufort to the Chukchi. The EIS should clearly delineate between these two very different areas so that it is clear which issues and impacts are – and are not – associated with a given area.

Adopt a Flexible Program with Realistic Operating Scenarios. Statoil fully supports NMFS’s efforts to consider “a more reasonable range of alternatives” in this EIS. Those alternatives should adopt a flexible approach to the various seismic and drilling activities taking place within a defined area and evaluate the impacts of proposed operations on an annual basis. Statoil believes that mitigation measures should be based on a realistic assessment of concurrent operation scenarios. Given the long lead time for drilling and the relatively short timeframe for conducting operations (due to weather and ice conditions) under the lease, arbitrary restrictions on concurrent operations could undermine a lessee’s ability to explore its leases. For the Chukchi, the EIS should analyze various realistic drilling alternatives. Assessments of seismic alternatives should reflect the reality that there will be limited, if any, large-scale seismic programs in the Chukchi Sea in the foreseeable future beyond the 2010 season.¹ NMFS should reach out to potential drilling operators prior to developing the draft to ensure that the alternatives reflect the best possible information based on realistic operational alternatives and the best technology available.

C. Cumulative Effects

The EIS should evaluate *probable* exploration scenarios and their cumulative effects. The 2007 draft assumed that there would be twelve concurrent seismic surveys undertaken in the Chukchi and Beaufort. History has proven that these estimates significantly overstated that actual amount of surveys conducted during any one season, and consequently, also overstated the impacts from the seismic activities. Projections for seismic and drilling activities must be based on realistic projects according to input from operators. Based on the status of ConocoPhillips’ and Shells’

¹ This was certainly true even before the recent statements by the President. Given the postponement of future lease sales in Chukchi/Beaufort, we assume no additional large-scale seismic programs are likely to be scheduled.

programs, large seismic programs in the Chukchi Sea in the next five years are unlikely. Aside from BP's Liberty project, only three companies contemplate drilling in the foreseeable future. Thus, we assume that the anticipated cumulative impacts associated with these projects for the foreseeable future will be reasonably easy to identify and evaluate. In our operations, we plan to include monitoring and other measures to ensure that the impacts to marine mammals and other resources, including cumulative impacts, are likely to fall well within the permissible range under the MMPA.

Specific Comments

The following comments respond specifically to issues NMFS identifies in the NOI.

A. NMFS Comment Area 1. Assess the environmental impacts to the physical, biological, cultural, economic, and social resources from deep-penetration, two-dimensional (2D) and three-dimensional (3D) streamer and ocean bottom cable surveys (hereafter referred to as seismic surveys) and shallow hazard and site clearance surveys.

1. Scope of Impacts Evaluated

Ecosystem Approach

Statoil believes that there is substantial value in following an ecosystem approach in the EIS, rather than just single species evaluations. Key species, in particular some marine mammals, obviously will require detailed evaluation, but an ecosystem approach will add significant value by enabling an assessment of the overall impacts of the exploration activities. NMFS should consult the research program initiated by ConocoPhillips and Shell, of which Statoil is now a participant. Results of data collected so far clearly indicate a significant variation in the species and biomasses encountered from year to year in the Chukchi Sea. Such significant natural variations normally indicate that the organisms living in the area are adapted to a rapidly changing environment, and such ecosystems are thus quite resilient to disturbances.

All Exploration Activities Should be Addressed

The EIS for oil and gas activities in the Arctic Ocean should consider all exploration activities foreseen in the area in the near future, including shallow hazards and site clearance surveys and exploration drilling in our area (lease sale 193), and should include:

- assessment of potential impacts of sound on marine life,
- impacts of discharges from exploration drilling (drilling fluids and cuttings),

- potential oil spills, based on realistic risk evaluations and modeling of distribution/discharge plumes, and
- disturbance from relevant facilities, support vessels and aerial traffic linked to the operations.

2. E&P Sound and Marine Life Joint Industry Program Data

Assessment of potential impacts of sound on marine life should be based on best available knowledge. Assessments of alternative mitigation measures, including the definition of safety and disturbance zones and monitoring to protect marine mammals, should also be based on best information available rather than old standards. Additionally, the monitoring and mitigation alternatives should be realistic with respect to practical implementation and added value in relation to the conservation of relevant species stock(s) and subsistence harvesting.

In particular, Statoil believes that it is not appropriate to establish a predetermined limit on the number of concurrent activities that could occur in the Chukchi or Beaufort Sea or both. The question of the impacts associated with concurrent activities is highly dependent on site-specific information and activity/project design and operations. The DEIS should not seek to establish any such limit, but instead should propose data development and an evaluation system, to be carried out in cooperation with the permit applicants, that would provide sufficient information to make these judgments on an annual basis.

Statoil, as well as a number of other companies, has been participating in the E&P Sound and Marine Life Joint Industry Program (JIP). The purpose of the JIP is to identify specific, operationally-focused questions that relate to the effects of sound generated by the offshore E & P industry on marine life and to pursue a research program that tests scientific hypotheses and produces the data needed to address these questions. *See* <<http://www.soundandmarinelife.org/Site/index.html>>. The program scope supports research on all sources of sound produced by the offshore oil and gas industries including seismic airguns, drilling, dredging, pile driving, construction equipment, removal of offshore structures using explosives, shipping and others. The species on which the research has focused includes marine mammals, fish (all life stages) turtles and invertebrates.

As data are obtained, Statoil will provide NMFS with updates regarding the JIPs research and conclusions.

3. Mitigation During Seismic Operations

Pre Defined Safety and Disturbance Zones Are Not Appropriate

Statoil understands that there has been discussion regarding the implementation of various dB-defined and other pre-defined safety and disturbance zones. As an initial matter, the practicability of implementing some of the suggested safety and disturbance zones is

questionable, as would be the conservation value of monitoring the extensive areas such disturbance zones would require. In addition, the various proposals for expansive aerial monitoring would entail serious safety risks, in violation of the Outer Continental Shelf Lands Act (OCSLA) requirement that operations “be conducted in a safe manner.” The risk to human safety to address what are speculative impacts is not consistent with the OCSLA requirements and would not be acceptable as a business practice.

Operations More than 100 Miles from Shore Have Limited Effect on Subsistence Hunting

Statoil questions the documentation supporting the position that activities throughout the Chukchi Sea are potentially adverse to subsistence harvest. There should be little to no impact on subsistence use of marine mammals 100 miles from any village because subsistence hunting activities generally do not take place that far from shore. Minor and temporary deflections of whales at such great distances from subsistence hunting areas have had and will have very little effect on the subsistence harvest.

B. NMFS Comment Area 2: Assess the environmental impacts to the physical, biological, cultural, economic, and social resources from open water offshore exploratory drilling operations during the open water season in order for the industry to drill priority exploration drill sites on MMS OCS leases in the Chukchi and Beaufort Seas.

Also, as part of this EIS, NMFS will analyze the effects of obtaining geotechnical data for pre-feasibility analyses of shallow sub-sea sediments as part of its proposed exploratory drilling operations.

1. Assessment of Oil Spill Risk and Cleaning up Oil in Broken Ice

Assessment of potential impacts from oil spills should be based on realistic spill scenarios and distribution modeling, taking current state of the art technologies for preventing spills into consideration. As part of this assessment, Statoil recommends that NMFS review the recent JIP on Oil in Ice, which includes studies of different spill contingency measures and response methods. The research work has been performed by the research institute SINTEF² and the Norwegian Government allowed actual oil to be spilled in the sea off the coast of Svalbard as part of the field evaluation research. Statoil and the other industry parties will be happy to share the results and report that is expected to be published shortly.

² SINTEF, headquartered in Trondheim, Norway, is the largest independent research organization in Scandinavia. Every year, SINTEF supports research and development at 2,100 or so Norwegian and overseas companies via its research and development activity. SINTEF was originally an acronym for “The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (NTH)”, but is now simply “Stiftelsen SINTEF.”

2. Addressing Invasive Species

With respect to the potential of introducing invasive species, the International Petroleum Industry Environmental Conservation Association/The International Association of Oil and Gas Producers (IPIECA/OGP) Biodiversity Working Group, and Statoil have been involved in the development of a guide regarding how to deal with invasive species in the oil and gas industry. The guide includes evaluations of both possible pathways for spreading invasive species and possible mitigation measures. Statoil would be happy to provide the guide during the EIS process for NMFS's and MMS's consideration.

3. Some Standards Applicable in Norway May Not Be Suitable in Alaska

The standards required for exploration and development (including waste disposal) in Norway have sometimes been discussed as a “model” to be followed in Alaska. Exploration drilling uses “mud” to cool the drill bit and produces cuttings (rock chips) and other wastes. Although Norway imposes rigorous standards for discharging these materials, it is premature to conclude that the solutions applied in Norway would be appropriate in the Chukchi Sea without further evaluation. Statoil would be happy to provide information on drilling standards employed by the industry in Norway and their potential relevance in Alaska. If NMFS feels that an evaluation of drilling standards is warranted, Statoil recommends that NMFS host a workshop or outreach process with other interested stakeholders to ensure that all relevant information is addressed prior to the draft EIS.

C) **NMFS Comment Area 3: Assess whether alternatives developed would allow for the implementation of a long-term planning process pursuant to section 101(a)(5)(A) of the MMPA through the development and implementation of regulations that would be in place for 5 year time periods.**

Statoil recommends that NMFS follow the intent of Congress in developing the two alternative approaches to incidental take authorization under the MMPA by adopting a five-year regulation/letter of authorization (LOA) approach. Congress built flexibility into the MMPA to accommodate various permitting scenarios. For activities that meet the small number/negligible impact/not unmitigable impact on subsistence standards and are reasonably predictable over a five-year period, the MMPA allows a five-year regulation/ LOA approach. The exploration activities addressed in this EIS fall within that category of activities. The use of five-year regulations in such circumstances is a more efficient approach for the agencies, applicants and public, as it will avoid repetitious and costly annual review procedures. The annual incidental harassment authorization approach would remain available, and would be particularly appropriate for certain activities that are discrete in nature and occur during a single year. Such an approach certainly *can* be used for the EIS activities, but it would cause greater expense and administrative burden and provide repeated opportunities for litigation on an annual basis.

Conclusion

Statoil looks forward to providing NMFS with additional information as it becomes available and to answer any questions as they arise. Our primary contact will be:

Karin Berentsen
Alaska HSE and Stakeholder Advisor

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MARINE MAMMAL COMMISSION

9 April 2010

Mr. P. Michael Payne, Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20190-3225

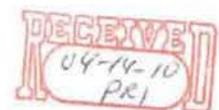
Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the National Marine Fisheries Service's Notice of Intent to Prepare an Environmental Impact Statement on the Effects of Oil and Gas Activities in the Arctic Ocean (75 Fed. Reg. 6175). The Commission does not normally comment on notices of intent. However, in this case, the Commission has three main concerns regarding such activities, and it believes that those concerns must be addressed if the environmental impact statement is to be considered complete. With those concerns in mind, the Commission provides the following recommendation and rationale.

RECOMMENDATION

The Marine Mammal Commission recommends that the National Marine Fisheries Service include in any environmental impact statement on the effects of oil and gas activities in the Arctic Ocean—

- a more robust approach that involves convening the responsible agencies, industries, and interested stakeholders to develop and then implement a coordinated and comprehensive assessment of ecosystem baseline conditions before oil and gas operations (including exploration) progress further;
- a means for coordinating seismic surveys in the Chukchi and Beaufort Seas in such a way that needed seismic information will be obtained with the least amount of seismic activity and resulting disturbance; and
- a mechanism to ensure coordinated efforts by all agencies, industries, communities, non-governmental organizations, and stakeholders to integrate all the biological, physical, and social information pertinent to oil and gas exploration and production into a spatially and temporally explicit framework for analyzing and modeling the resulting effects on Arctic marine ecosystems.



RATIONALE

The rationale for the above recommendation is as follows.

Baseline Information

For conservation and subsistence purposes, the primary concern with regard to oil and gas development in the Chukchi and Beaufort Seas is that, over time, those activities will adversely modify coastal and offshore ecosystems by disturbing wildlife or degrading habitat. The primary basis for assessing such changes is through comparison of baseline conditions (that is, conditions prior to the increase in activity) versus conditions after operations have begun.

Because the biological and physical properties of the potentially affected ecosystems vary, describing baseline conditions is not a trivial task; it requires an ability to characterize both measures of central tendency (e.g., mean, median values) as well as patterns in and variability about those measures. The most obvious patterns are apparent over space and time (e.g., coastal versus pelagic, shallow versus deep, open water versus ice-covered). Furthermore, baseline conditions are exhibiting directional trends as a function of climate change. Thus, accurately characterizing "baseline" conditions is a significant challenge. It is true that some characteristics of these ecosystems have been altered already, but to fail now to conduct the best possible baseline assessment simply perpetuates the sliding baseline phenomenon.

That being said, the current mode of operation is to assess conditions in limited areas and periods during breaks in exploration activities and then to use that information as a reliable indication of baseline conditions. Although the data collected in that manner may be useful, those data may not reflect baseline conditions at all if the effects of a survey are widely distributed over space and persist for periods longer than the typical shutdown. If the data collected do not really reflect baseline conditions and if they are never integrated into a more robust, comprehensive assessment of the affected ecosystem, then such studies are, in essence, little more than perfunctory costs of doing business in the region.

Indeed, in the Commission's view, this current mode of operation is not sufficient to support a robust evaluation of the real effects of oil and gas operations on marine ecosystems. Therefore, the Marine Mammal Commission recommends that the subject environmental impact statement include a more robust approach that involves convening the responsible agencies, industries, and interested stakeholders to develop and then implement a coordinated and comprehensive assessment of ecosystem baseline conditions before oil and gas operations (including exploration) progress further.

Seismic Surveys

In the course of oil and gas operations, seismic surveys are used for at least four purposes: (1) to explore broadly for oil and gas reservoirs, (2) to investigate in detail an area where exploratory drilling may be attempted, (3) to guide drilling activities, and (4) to monitor changes in reservoirs as

extraction proceeds. These surveys are among the most disturbing elements of oil and gas activities, particularly for organisms such as marine mammals, as they introduce extensive sound energy into the water. The amount of disturbance is a function of multiple factors, including the frequency and intensity of surveys conducted in a particular area. Currently, each oil and gas company either conducts its own seismic surveys or contracts with another company to conduct the surveys on its behalf. If multiple companies are interested in the same or adjacent areas, then, over the course of oil and gas development, a given area may be surveyed on multiple occasions, thus generating—at least to a degree—redundant data. In essence, the lack of coordination in conducting surveys, and the failure to share the resulting data, may well be causing unnecessary disturbance to ecosystems and their associated biological communities. In other words, marine seismic surveys are not being managed to achieve the least practicable environmental impact.

With that concern in mind, the Marine Mammal Commission recommends that the National Marine Fisheries Service include in the environmental impact statement a means for coordinating seismic surveys in the Chukchi and Beaufort Seas in such a way that needed seismic information will be obtained with the least amount of seismic activity and resulting disturbance.

Data Integration and Synthesis

At the recent “Open Water” meeting in Anchorage, it was apparent that the involved agencies, industries, and Alaska Native communities had collected extensive data that could be useful for assessing the effects of oil and gas development in the Chukchi and Beaufort Seas. However, it was equally apparent that the data had not been well integrated into a comprehensive ecosystem assessment. The potential for such integration was most apparent with regard to changes in the physical environment (e.g., formation and break-up of sea ice), the spatial and temporal distribution of biological or ecological processes (e.g., bowhead whale migration and feeding), and the seasonal round of human activities (e.g., subsistence harvesting, industrial operations). With a coordinated effort, all the information could be integrated into a spatial/temporal analytical framework with which to characterize the interactions among physical, biological, and human components. The end result would provide not only a clearer picture of how the various activities and processes are related but also a clearer indication of the cumulative effects of industrial activities and ways to manage them. In addition, a robust integration and synthesis of data could provide a basis for modeling or predicting the effects of future activities under different scenarios of climate change and development. Such a tool could be valuable in guiding future management decisions.

In natural resource management, we rarely have such an opportunity to integrate physical, biological, and social information into a broad ecosystem synthesis and use the results to guide management processes. If ever there was an opportunity to highlight the value of ecosystem-based management, this must surely be it. The Marine Mammal Commission recommends that the National Marine Fisheries Service take full advantage of this opportunity and include in its environmental impact statement a mechanism to ensure coordinated efforts by all agencies, industries, communities, non-governmental organizations, and stakeholders to integrate all the biological, physical, and social information pertinent to oil and gas exploration and production into a

Mr. P. Michael Payne
9 April 2010
Page 4

spatially and temporally explicit framework for analyzing and modeling the resulting effects on Arctic marine ecosystems.

Please contact me if you have questions regarding the above recommendations.

Sincerely,



Timothy J. Ragen, Ph.D.
Executive Director

Cc: James Kendall, Minerals Management Service



Written Comment Form

Environmental Impact Statement (EIS) on Effects of Oil and Gas
Exploratory Activities (Seismic and Drilling) on U.S. Arctic (Chukchi
and Beaufort Seas)

Your input is important to us. Please use this form to tell us about the environmental issues and alternatives that you think should be analyzed in the Draft EIS. Please feel free to use additional comment sheets if more space is needed. To ensure that your comments are considered in the Draft EIS, we must receive them by April 9, 2010.

past activities in off shore
Drilling methods showed that active
DRM comments noise at 47 db numbers
and the seismic to be conducted is set at
150 - 190 db.

mid 1980's drill ship was operating
during the fall whaling just the noise
at 47 db was bad enough for whales to
be 13 - 17 miles north of the drill ship and
the way they were coming up for air was
mind boggling in an up right position
as if they were barely swimming and
allowing the current to take them away from
the drill ship noise activity.

160 - 190 db is too much for Marine
Mammals to take

Page 1 of 2

JKB924@xci.net

Your Name & Email Address:

Mailing Address:

City, State, Zip Code:

Jessie Kunaq Brown
Box 983
BRW, AK, 99723

This form can be submitted to:

P. Michael Payne
Chief of the Permits, Conservation, and
Education Division
Office of Protected Resources
NMFS 1315 East-West Highway
Silver Spring, MD 20910
Email: michael.payne@noaa.gov
Fax: 301-427-2583

For Office Use Only



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Environmental Impact Statement (EIS) on Effects of Oil and Gas Exploratory Activities (Seismic and Drilling) on U.S. Arctic (Chukchi and Beaufort Seas)

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when our animals that we hunt
are under the Federal laws, why does
our country allow the IWC to do what
ever they want, when they are not even
a country.

Page 2 of 2

Your Name & Email Address:

Mailing Address:

City, State, Zip Code:

This form can be submitted to:

P. Michael Payne
Chief of the Permits, Conservation, and
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Dear Minerals Management Services: President Obama

I would very much like to see better management of my natural resources, in your relentless pursuit of all the minerals, oil, and gas in the most pristine Arctic Ocean in all of Gods great universe.

I am very sorry to see we need to go to such extremes as to hire or acquire attorneys for lawsuits to put in place better management practices of my natural resources graciously provided by our Great creator God Almighty, and our prescious Saviour Jesus Christ.

The governments through out the World pursue the minerals, oil, gas with very little regard to Indigenous Peoples through out our planet earth. Remember Australias giagantic oil spill, exxon valdez oil spill, no government responsibility or follow-up in cleaning our environment to sustain the mmmimals that depend on an oil free un-contaminated environment. Please follow-up

Your Name & Email Address: Doreen Lampe Doreen.Lampe@Barrow.com

Mailing Address: P.O. Box 1121

City, State, Zip Code: Barrow, AK 99723

This form can be submitted to:

P. Michael Payne
Chief of the Permits, Conservation, and Education Division
Office of Protected Resources
NMFS 1315 East-West Highway
Silver Spring, MD 20910
Email: michael.payne@noaa.gov
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P.S. Do a test run & leave a crew out there one whole winter, The ice is very dangerous and the difficult to deal with year round. Share the

If you cannot place a 100 million dollar Bond in place the local people can do it! and clean the Prince William Sound we need it back the way it was!



Written Comment Form

Environmental Impact Statement (EIS) on Effects of Oil and Gas Exploratory Activities (Seismic and Drilling) on U.S. Arctic (Chukchi and Beaufort Seas)

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March 9 - 2010 7:00pm

I was looking at one of pictures and I bump into one look very good what one of Elder say. I saw this picture of a man rising his arm and praising GOD in Inupig word and say. GOD GOD in Eskimo prayer's. What are we going down in the last's Day's. And GOD spoken to him the world have change. No matter what we gonna do. All you do is praising too GOD oh pray to GOD for the answer. So that what I've be been dreaming about that same picture that I've keep thinking

Home Thank's

763-2044- phone miss: Marjorie K. Angashuk
call P.O. Box 54-

925-1179 phone Wainwright, Alaska 99782

P.S. I'll Never Never forget what my Dad say The Last Day we go eat is fish

Your Name & Email Address:

Mailing Address:

City, State, Zip Code:

This form can be submitted to:

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