OCS EIS/EA
MMS 90-0095

Alaska Outer Continental Shelf

Chukchi Sea
Oil & Gas Lease Sale 126

Final Environmental Impact Statement

Volume II

MMS U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

January 1991

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REVIEW AND ANALYSIS OF COMMENTS RECEIVED

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A. Introduction

During the DEIS comment period, written comments and oral testimony were provided by various governmental agencies, petroleum companies, Alaska Native organizations, environmental organizations, other groups, and individuals. A total of 23 letters were received--7 from Federal agencies, 1 from the State of Alaska, 1 from the North Slope Borough, 4 from petroleum companies, 2 from Alaska Native organizations, 3 from environmental organizations, 2 from other groups, and 3 from individuals. Public hearings were held in the NSB communities of Barrow, Wainwright, and Point Lay and in Anchorage. A total of 22 individuals presented testimony at these hearings--16 in Barrow, none in Wainwright, 3 in Point Lay, and 3 in Anchorage. An Inupiaq language translator was available at each of the hearings in the NSB communities.

Most of the comments on the DEIS addressed concerns regarding (1) oil spills and oil-spill-cleanup technology; (2) effects of oil spills and industrial activities on the environment, biological resources, and subsistence harvesting; (3) adequacy of environmental information; (4) mitigating measures; (5) alternatives and areas to be deferred; and (6) adequacy of petroleum industry technology to operate in the arctic marine environment.

All written and oral comments on the Sale 126 DEIS were reviewed, and responses were prepared for 228 comments. Where comments warranted changes or presented new, substantive information, the text of the EIS was revised accordingly; a reference to the revised section(s) is made in the responses to the specific comments.

B. Letters, Comments, and Responses

The following section presents a reproduction of all letters received during the DEIS comment period. Specific comments in each letter are bracketed and numbered. The MMS responses to the specific comments follow each letter.

Commenter and Letter Designation

- Federal Agencies
  - Executive Branch--Departments
    - Commerce
      - National Oceanic and Atmospheric Administration - NOAA
    - Interior
      - Bureau of Indian Affairs - BIA
      - Bureau of Mines - BOM
      - Fish and Wildlife Service - FWS
      - National Park Service - NPS
  - Independent Establishments
    - Environmental Protection Agency - EPA
  - Boards, Committees, and Commissions
    - Marine Mammal Commission - MMC

- State and Local Governments
  - State of Alaska - AK
  - North Slope Borough - NSB

- Petroleum Companies
  - ARCO Alaska, Inc. - ARCO

BP Exploration (Alaska), Inc. (No response required)
Texaco, Inc. (No response required)
Unocal Corporation - UNO

Alaska Native Organizations
Alaska Eskimo Whaling Commission - AEWC
NANA Regional Corporation, Inc. - NANA

Environmental Organizations
Greenpeace USA - GP
Northern Alaska Environmental Center - NAEC
Trustees for Alaska - TFA

Other Groups
Bering Sea Fishermen's Association - BSFA
SEACO - SEA

Individuals
Joash Tukle - JT
John Luther Mohr - JLM
Scott Sunan (?) - SS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of the Chief Scientist
Washington, DC 20230

September 14, 1990

Mr. Alan D. Powers
Regional Director
Minerals Management Service
Alaska Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Dear Mr. Powers:

Enclosed are comments to your Draft Environmental Impact Statements for the proposed 1991 Outer Continental Shelf Oil and Gas Lease Sale 126 in the Chukchi Sea. We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

David Cottingham
Director
Ecology and Environmental Conservation Office

Enclosure

cc: Director, MMS
Richard Miller, MMS

**NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
PROPOSED 1991 OUTER CONTINENTAL SHELF (OCS)
OIL AND GAS LEASE SALE 126 IN THE CHUKCHI SEA**

The Alaska Region of the National Marine Fisheries Service (NMFS), the Alaska Office of the National Ocean Service (NOS) and the Office of Charting and Geodetic Services (C&GS) have reviewed the subject document and offer the following comments.

Please direct nautical charting questions to Mr. Charles Harrington at 301-443-8360, and biological questions to Dr. Jawed Hameedi at 907-271-3033 or Ron Morris at 907-271-5006.

General Comments

This sale is essentially a re-offering of tracts within this planning area, having been preceded by Sale 85 and Sale 109 (May 1988). Much of the information in the Draft Environmental Impact Statement (DEIS) is dated. The document does not include a very substantial amount of available scientific data, either in describing the affected environment or in the analysis of potential effects of Outer Continental Shelf (OCS) development. The DEIS ignores studies and facts that have taken place since the last DEIS was prepared for this region (OCS Sale 109): for example, study of the Chukchi Sea sediment and benthos (in Section III and elsewhere), and the fact that since early 1989 BP Exploration, and not Standard Alaska Production Company, has operated a portion of the Prudhoe Bay oil field (in Appendix E). NOAA 1

Given that the Minerals Management Service (MMS)-sponsored studies were conducted to establish information needed for the assessment and management of environmental impacts which may result from offshore oil and gas development (43 USC 1346), the non-inclusion of results from those studies in the DEIS is disappointing. Some of the omitted information may be critical in presenting a succinct description of the environment and offering a basis to judge environmental impacts of the proposed action.

Available information does indicate the marine fishery is characteristically composed of relatively few species, some of which may be seasonally abundant in certain areas such as coastal lagoons or river estuaries. We continue to find that the extant data do not support the impact assessments presented in the DEIS, and recommend additional research on the coastal, anadromous, and marine fishery resources within the planning area.

The DEIS describes exploration activities which would exclude drilling or seismic operations during the springtime, assuming NOAA 2 that ice-strengthened drillships and support vessels would operate for approximately a 90 day period in August through October. However, technology exists which would permit drilling operations throughout the year for some waters, and new technologies may allow year round operations throughout the sale area.

NOAA 2

Drilling activities in the spring lead system (SLS) could jeopardize the continued existence of the endangered bowhead whale. The proximity of the sale area to the SLS, and the possibility of springtime or year round activity are therefore of special concern. Echolocation and the importance of certain frequencies of sound may be critical concerns under ice-cover conditions, as migrating whales maintain communication between individuals or groups and as they navigate and locate thin ice or leads for breathing. The DEIS largely fails to discuss this issue or analyze the potential impact that drilling activity could present.

NOAA 3

We believe that Alternative IV, the Point Lay deferral, would be an effective mitigative measure in minimizing adverse impact to endangered whales and coastal resources. Adoption of this alternative would be consistent with the Arctic Region Biological Opinion and the regulations governing incidental taking.

Adequacy of Information

The DEIS states (p. I-14) that "it is the judgement of the MMS that the information currently available is adequate for environmental assessment and .... to make decisions concerning this lease sale." In essence, this statement preempts all questions concerning the adequacy of the environmental data for the proposed lease sale. Yet the lease sale area is virtually unstudied in terms of its biological productivity, fisheries resources, habitat use by birds and mammals, geotechnical framework, and ocean circulation.

The inadequacy of information is reflected in a number of statements scattered throughout the DEIS. For example, on p. IV-C-25, it is stated that "... paucity of information regarding stock sizes, fidelity of streams, and movements of anadromous fish in the Sale 126 region means that analysis is based primarily on generalizations from Beaufort Sea populations." But on p. III-21, the DEIS states "However Craig and Skvorac (1982) caution that extrapolation of fisheries data from the Beaufort Sea or Norton Sound may not be valid because of differences in oceanography, fish populations, and presumed use of coastal habitats." Further, on p. III-23 dealing with marine fishes, the DEIS

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states that information concerning the life history, population dynamics, distribution and ecological relationships .... is lacking.

NOAA 4

Scientific Basis for the DEIS

The DEIS repeatedly refers to numerous environmental studies conducted as part of the OCS leasing program. The bibliography is 33 pages long including nearly 500 references of published and unpublished reports. There is little evidence that results from these studies were indeed incorporated in the description of the affected environment or in the determination of potential effects. There are numerous statements of inclusion of scientific data by reference alone. The burden to review and judge the suitability of the studies data to statements on the DEIS is left to the reader. Such a task would be burdensome and virtually impossible for an ordinary citizen or organization.

Magnitude of Effects

There is very little in terms of logic or formalized analysis by which effects on various biota and other environmental entities have been categorized. Considering a dearth of data on biological populations on most species of interest in the Sale 124 area, assessment of relative effects of different scenarios remains unfounded. Relative effects on the biological resources indicate an assessment of lethal or sub-lethal damage to populations; yet population dynamics or other pertinent data are lacking from the DEIS. The assessment of cumulative impacts is even harder to accept. It is not clear as to why the effect of the proposed sale on subsistence harvest in the village of Nuiqsut will be high, and not so for Point Hope.

NOAA 4A

Ocean Circulation

Ocean circulation data from much of the proposed lease area are inadequate, as only a few, sporadic source of data exist. The area has not been studied with sufficient spatial and temporal resolution to determine ocean circulation patterns and their effect on spilled oil trajectories and mixing.

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Ocean circulation as illustrated in the DEIS is derived from a review of physical sciences data done by the U.S. Geological Survey in anticipation of OCS Sale 85 (Grantz, et al. 1982 b). The ocean circulation figures in Grantz et. al (1982 b) were redrawn from similar figures in Coachman, Aagaard and Tripp (1976); which, in turn, was a review of historic data incorporating information obtained up to 1974. A small amount of new information on the subject, which can

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be derived from the results of the NSF-funded ISHTAR study and the MMS-funded Research Unit 687, is not given in the DEIS.

NOAA 6

A large portion of a rather short text on ocean circulation is concerned with water properties and transport into the southern Chukchi Sea via Bering Strait. There is some discussion of waters originating in the Yukon River delta and the Gulf of Anadyr -- much farther south -- but none of water originating in Kotzebue Sound, which can and probably does influence water properties east of the proposed lease area.

NOAA 7

There is no basis for opposing currents of similar magnitude shown in the southwestern part of the proposed lease area (Figure III-A-7).
Recent data have indicated that the Anadyr/Bering Strait water, which occupies most of the proposed lease area in a mixed state, probably follows the Hope Sea Valley northward and may enter the Arctic Ocean east of Wrangel Island. Such a flow will not be consistent with the circulation pattern shown in the DEIS.

Polynyi

NOAA 8

Except for a brief mention in the context of the lead system between Pt. Hope and Barrow (p. III-7), the DEIS does not consider the existence, dynamics or importance of polynyi either to transport of spilled oil or to biological use. Several polynyi -- most of which are recurring type -- have been identified in the Chukchi Sea. Their formation, size at maximum ice cover, and disappearance have significant influence on the biological productivity as well as on regional circulation and heat transfer.

Sediment Geotechnical Properties

NOAA 9

Very little data exist on the strength and engineering properties of sediment on the bottom on the Chukchi Sea, such as those caused by gas-charging of sediment. Studies to obtain such data have not been performed as part of the MMS environmental studies program. On p. IV-A-19 the DEIS states that sediments' geotechnical properties must be determined to understand how the sediment will react under static or cyclic vertical and lateral loads. Yet such information is not provided. A regional description of geotechnical properties of sediment -- rather than site-specific data that are required of the petroleum industry for specific actions -- is necessary to assure that potential hazards or constraints to OCS development have been identified.

Causeways

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The DEIS dismisses the environmental effects of construction and existence of causeways because "causeways are not part of the development and production scenario for Sale 126." (p. I-14). Yet the DEIS does not offer the means or alternatives by which equipment, goods and shipments will be brought in or transferred to, for example, Pt. Belcher.

Point Belcher

NOAA 11

We do not believe there is an adequate basis to assume that produced oil will be transferred to Pt. Belcher, and from there to the Trans-Alaska Pipeline. In view of the vast acreage of the proposed lease sale area and the cost and environmental considerations of a buried pipeline on the seabed, one has to assume that the pipeline landfall would be the shortest and most economical direct route from a producing (or gathering) area offshore. We believe an examination and analysis of alternate terminal site(s) should be included in the DEIS. This would permit an evaluation of relative merits and environmental factors for each site.

Pt. Lay Deferral (Alternative IV)

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Statements referring to this alternative are not clear (Appendix B and elsewhere in the DEIS). Apparently deletion of 501 block (nearly 1.15 million hectares) does not markedly affect the base case resource estimate. Does it affect the high case resource estimate? Does deferral of this coastal region indicate a lack of commercially recoverable amounts of oil? If so, why lease it? But on page B-2 under the "Deferral Alternative" the DEIS states that MMS would "expect some block in the deferral to be leased and possibly drilled .... " When? As part of Sale 126 or some future sale??

These discussions should point out the specific difference between Alternative IV and the various full development scenarios. As presented, the DEIS basically finds no advantages to the Point Lay deferral. We believe this is an artifact of the assumptions used in the DEIS and the resolution of impact projections. By presenting figures and statistics for the entire sale area with the deferral, this analysis minimizes any advantages of Alternative IV. For instance, while the DEIS points out that leasing of the deferred blocks could produce greater adverse effects since the area incorporates an important pupping area for seals as well as a lead system important to many species as a spring migration corridor and is important foraging

NOAA 13

habitat used by seabirds during the open water season, both the Base Case and Alternative IV have the same projected impact to marine resources. NOAA 13

The DEIS further adds to this jumbled assessment by incorporating in Section IV G. an additional, separate analysis which "examines the effects of a minimum level of exploration, development, and production activities in the area to be deferred (not offered) by this alternative." If the DEIS is presenting this as an additional alternative, it should be specifically discussed in a separate section. NOAA 14 We question why the deferral is only compared to the base case and not the high case as well. It is also unclear whether certain features such as pipeline routing and seismic work would occur within the deferral. As pipeline rupture or leakage is a primary source of potential oil spill, no pipeline or other activity should occur in the deferral area (with the exception of vessel and air crossings). NOAA 15 On page II-41 paragraph 5 the DEIS states that no oil spills are projected for the Point Lay Alternative, while Section IV G. projects a probability of two spills greater than 1,000 bbl as a result of this alternative. NOAA 16

The Point Lay Deferral presents a meaningful mitigative measure which would minimize potential impact to endangered species, other marine mammals, and important coastal resources. We recommend the FEIS revise these discussions to present a meaningful analysis of this alternative.

Pt. Lay Subsistence

The DEIS states that an oil spill in the Pt. Lay subsistence use area during the normal period of harvest would have moderate effects on the Pt. Lay belukha whale harvest (p. IV-C-72 et seq.). One could easily argue that it would have high effect. An oil spill that occurred during the harvest period, which is only 2-3 weeks long, could quite conceivably affect or cancel the entire harvest. Even if the animals did not come in contact with oil, the villagers could perceive the animals as inedible and not proceed with the harvest. Oil spill response activities could also cause the animals to avoid the area, thereby eliminating the harvest for that year. If such an event succeeded or preceded a low harvest year (for example the year 1989), the availability of this food resource to the village could be substantially reduced for more than one year and could be very damaging. NOAA 17

Pt. Lay Harvest Data

There is very little quantitative data on the relative use of subsistence resources at Pt. Lay. This is unfortunate since Wainwright and Pt. Lay are the two principal NOAA 18

communities in the vicinity of the proposed lease sale area. It is understood that Stoker (1983) and ACI/Braund (1984) did not include either Atqasuk or Pt. Lay in their surveys. It is important that some effort be made to obtain information from this region, especially since it is not clear as to how much of the information obtained from Point Hope, Barrow and Nuiqsut was (or can be) used to describe the situation at Pt.Lay. NOAA 18

Belukha Whale Harvest

The major marine mammal subsistence resource of Pt. Lay is the belukha whale. The North Slope Borough has maintained harvest data for the past three years. It would be appropriate to include that data in the DEIS. The harvest of this animal at Pt. Lay is probably important to other communities as well, such as Barrow, as much of the belukha magtak is distributed to other communities. NOAA 19

Pelagic Bird Data

The DEIS provides good information on coastal birds, but data on pelagic birds is scanty. A large number of seabird transects were sampled as part of OCSEAP (see Research Unit 196 Final Report, 1987). At the least, data from those surveys should be included in the DEIS. NOAA 20

Specific Comments

Page I-17, Figure 1-3. The boundary limit between United States and the U.S.S.R. is not plotted correctly. As the result of the recent U.S.-U.S.S.R. boundary agreement, the northeast corner should be at 72°46'29" N, 168°58'37" W (North American Datum of 1983) and the entire western limit should stop at 168°58'37" W for the proposed area. This correction should be made to Figure 1-3 and any other figures or diagrams which depict the boundary. NOAA 21

Page II-21. (a) Bowhead and Gray Whales
We disagree with the assessment that most bowhead whales are unlikely to encounter noise associated with production operations during the spring migration. Without the Point Lay deferral, leasing activity would be situated in or adjacent to the SLS. Additionally, whales may travel through the ice covered margins seaward of the lead system and become exposed to drilling noise. NOAA 22

Page II-36 Alternative IV - Point Lay Deferral Alternative
Because of our concern expressed above for the spring migration of bowhead whales, we believe that alternative IV is an appropriate mitigation option for avoiding major long-term impacts to this endangered species. Although exploration could be conducted in the coastal area and be timed to avoid the spring migration, we cannot foresee how potential year-round development NOAA 23

and production activities can be so timed to avoid the spring migration. This alternative would effectively reduce the potential for disturbance to bowhead whales and may have beneficial impact on other coastal resources, as described on page II-39. NOAA 23

Page II-44 The idea that removing an area of heavy subsistence use from the sale will not modify effects on subsistence harvest patterns lacks logic. NOAA 24

Page II-51 <u>Stipulation No. 5 - Industry Site-Specific Bowhead Whale Monitoring Program</u>
We assume the blocks identified in this Stipulation are considered to be outside the SLS. Observations from such locations may provide valuable information on the extent of the bowhead spring migratory corridor and account for possible movement outside of the actual lead system. NOAA 25

Page II-57 <u>ITL No. 1 - Information on Bird and Marine Mammal Protection</u> paragraph 3, and
Page II-62 <u>ITL No. 6 - Information on Endangered Whales and MMS Monitoring Program</u> paragraph 4
NMFS published final regulations on July 18, 1990 under Section 101 (a) (5) of the Marine Mammal Protection Act and Section 7(b) (4) of the Endangered Species Act authorizing non-lethal incidental taking of bowhead, gray, and belukha whales and bearded, ringed, and spotted seals by U. S. citizens engaged in oil and gas exploration in the Chukchi and Beaufort Seas. These regulations provide measures necessary to minimize impacts and require applicants to monitor and report on the effects of exploration activities on these marine mammals. Taking of bowhead whales during the spring migration is not authorized by these regulations. NOAA 26

Page II-63 <u>ITL No. 7 - Information on Development and Production Phase Consultation with NMFS to Avoid Jeopardy to Bowhead Whales</u>
Under the "Purpose" discussion, the DEIS should also state that consultation will be required prior to <u>any</u> development and production activity. Consultation must also be initiated for exploration within the SLS, whenever new information reveals previously unconsidered adverse effects, whenever a new species may be listed, and for any modifications which may adversely effect these species. NOAA 27

Page II-64 <u>Effectiveness of ITL No. 7</u>
The second sentence in this paragraph suggests that a jeopardy situation regarding development and production operations would be avoided through the results of additional information and new technologies. While the NMFS will consider such information, there is no assurance that a jeopardy situation can be avoided with respect to drilling activities in the SLS. NOAA 28

Page III-20
Ecological relationships and trophic linkage diagrams, e.g., Figure III-B-3, are based on speculative data. More appropriate information is available from the Peard Bay region and some from the Kasegaluk Lagoon region. Information contained in Figure III-B-3 is much too simplistic to be of any analytical use in the environmental assessment process. NOAA 29

Page III-26 (first paragraph)
Statements regarding euphausiids are unclear at best, and they are not consistent with what is shown in Figure III-B-2. The reference citation for that figure (DOC NOAA 1988) is not included in the bibliography. NOAA 30

Page IV-A-4 (b) <u>Transportation Assumptions</u>
The assumption that produced oil would flow through an offshore gathering system and land-based pipeline to the Alyeska pipeline is fundamental in projecting the spill risk scenarios in the DEIS and in the type and magnitude of anticipated impact. With this scenario, a very large spill could occur within the nearshore portion of the pipeline, jeopardizing the bowhead migratory corridor and important coastal fishery resources. The DEIS projects a one in five probability of a large oil pipeline spill entering a major river system. The impact to freshwater fish is projected to be VERY HIGH. NOAA 31

Considering these projected consequences, the DEIS should discuss alternative delivery systems which may mitigate these impacts. This might include a marine transportation system or buried pipeline.

Page IV-A-8 (paragraph 4)
Are there not more current statistics on spills from TAPS than the pre-1981 data described here? A larger data set would be more representative. NOAA 32

Page IV-A-14 (6) <u>Effectiveness of Oil-Spill Cleanup in Ice</u>
This discussion should be expanded to provide a narrative on what procedures would be employed to contain and recover oil in an ice environment. Please provide a reference for the statement that experiments have shown burning to be a more effective cleanup technique than mechanical methods. NOAA 33

Page IV-B-10 paragraph 2
While the 50% criteria for definition of the response zone has practical and statistical significance, it has no basis in law. The DEIS should note that any such disturbance, unless previously authorized, may violate Federal law. Also, a significant number (i.e. up to 49%) of whales in an area outside of the response NOAA 34

zone could react to industrial noise. Thus the statement that only a small number of whales outside this zone would respond is misleading. NOAA 34

Page IV-B-20 <u>Summary</u>
We believe this summary should reflect that all observations of the interactions of bowheads and OCS noises have been made on animals in open water or in ice leads. Presently no data exists on the potential effects of drilling noise on animals moving through ice, nor the impacts of infrasonic noise on communication or echolocation. NOAA 35

Page IV-C-22
It is stated that fish in the nearshore areas will be most vulnerable to petroleum-related effects because this zone contains the highest densities of fish. No reference is provided for this statement. We do not believe there are supporting scientific data from Sale 126 for this statement. NOAA 36

Page IV-C-25 (2) <u>Marine Fish</u>
The arctic cod may be considered a keystone species in the marine environment of the central and northern Chukchi Sea, as it is typically the dominant species of marine fish occurring in these waters, is found throughout the year in the Chukchi Sea, is associated with the undersurface of sea ice, forms dense aggregations at or near the ocean surface (juveniles) which provide the major food source for offshore-feeding marine birds, and is the most important winter food source of the ringed seal and the principle prey item for a variety of other marine mammals. The DEIS should reflect this ecological significance, and discuss the potential impacts of exploration and development in greater depth. The current state of knowledge is not sufficient to fully assess the impact of development on this species. Basic information on summer and winter distribution, age class structure of the population, and spawning locations is necessary to support the conclusions in the DEIS. What is the toxicity of petroleum hydrocarbons to the various life history stages of arctic cod? Would wintering populations of cod associated with crevices, holes, and cracks on the underside of sea ice be more affected by spilled oil than in open water seasons? How might the release of formation waters impact the survival and distribution of juvenile cod? NOAA 37

Page IV-C-30 paragraph 2
While suspended sediments per se have very low direct toxicity values, the composition of sediments should be tested prior to assessing the potential impacts from dredging. In Norton Sound, for example, nearshore sediments contain high background levels of mercury and other metals. Dredging activities may resuspend such materials and make them available to aquatic organisms, with NOAA 38

resultant adverse effects. The EIS should provide data on the chemical composition of nearshore sediments for the Beaufort and Chukchi Seas. NOAA 38

Page IV-C-32
This section should include an overview of the probabilities of oil spill occurring in the pelagic portions of the proposed sale area during at least the open water season. NOAA 39

Page IV-C-47 (b) <u>Development and Production</u>
While most of this sale area is outside of the SLS, we do not agree that most bowhead whales would therefore not encounter noise from production operations in the spring. Unlike the fall migration, the spring corridor is relatively narrow, with a higher probability that a significant portion of the population would be present and may encounter noise. Also, some migration may occur outside of the lead system, through ice covered waters and in closer proximity to drilling operations. This section should present a statistical analysis of noise encounters for the spring migration, as it has for the fall period. NOAA 40

Page IV-C-55 paragraph 4
This discussion suggests that migrating whales would be only briefly exposed to oil spilled in the SLS unless stopping to feed or trapped in the lead where oil was present. Discussion is warranted regarding the potential impacts of an intensive and large scale cleanup operation within the lead system, as would likely occur following a large spill. The resultant high levels of sea and air traffic and cleanup activities would, of themselves, create a potential source of disturbance which could delay or interfere with the migration. NOAA 41

Page IV-C-56 <u>Development/Production</u>
See comment, Page IV-c-47. NOAA 42

Page IV-C-57
See comment, Page IV-C-55. NOAA 43

Page IV-G-11 paragraph 3
This paragraph suggests that adoption of Alternative IV - Point Lay Deferral could adversely effect bowhead whales in that potential oil spill sites would become concentrated nearer to the fall migration corridor with the deletion of southerly, nearshore tracts. The predictions regarding how and where oil exploration, development, and production would occur are not sufficiently accurate to infer that Alternative IV would increase activity in the remainder of the sale area. While spill sites in the deferral area would be farther from the fall migration corridor than the remainder of the sale area, with the deferral these sites would not exist at all (excluding pipeline spills). Therefore, the validity of this argument is questionable, and we NOAA 44

recommend it be deleted from the final statement. The adoption of Alternative IV would reduce potential impacts to endangered whales and should be adopted as the preferred plan. NOAA 44

Page IV-H-65
The omission of finback and humpback whales from the cumulative case discussion seems unwarranted given the fact that recent aerial and shipboard surveys have demonstrated that large fractions of their Pacific populations are seasonally present in the Gulf of Alaska. Those summering stocks could be affected by oil spills originating from tankers carrying TAPS crude oil because the animals are concentrated in coastal areas, e.g., Prince William Sound. NOAA 45

<u>Conclusion</u>

The DEIS for OCS Sale 126 is a voluminous document but it lacks substantive scientific basis for the description of the affected environment. Most of the inferences or conclusions regarding effects of oil and gas development on the environment can be questioned as having no validity or being based on arbitrary presumptions. A substantive revision of the DEIS will improve the quality and contents of the document.

National Oceanic and Atmospheric Administration

Response NOAA-1

The text in Section III.A has been amended to address this concern. The citation appears in the FEIS bibliography.

Response NOAA-2

Technology may exist or may be developed to allow year-round drilling in the Chukchi Sea, but the EIS analysis and underlying assumptions are consistent with Exploration Plans that have been approved by MMS for the Chukchi Sea to date. If a proposal is made (by means of an Exploration Plan) to conduct year-round exploration operations, such operations would be reviewed by MMS as to potential environmental effects and appropriate mitigating measures to protect the resources of the area.

Response NOAA-3

The EIS assesses the likely effects of the proposal based on the best available information to date. Information of this type (e.g., Richardson et al., 1985, 1990; Malme et al., 1983; 1984,1985, 1986; Ljungblad et al., 1985; Wartzok et al., 1989) consistently shows that whales encountering industrial noise are likely to experience the same local, short-term effects in the spring-lead system that they have exhibited everywhere else. Hence, the suggestion that industrial noise could "jeopardize the continued existence" of the bowhead whale appears conservative. Also, it has not been established that bowheads use echolocation as a means of navigation and communication, nor has it been established that whales are unable to compensate for noise of any type (including industrial noise). If bowhead whales use echolocation and other sounds to navigate and communicate through ice-impacted areas, industrial noise is not likely to adversely affect this anymore than naturally occurring noise would. If compensation is necessary, it is reasonable to assume that nonthreatening, passive noises, such as industrial noise, would be compensated for in the same manner as is done for naturally occurring nonthreatening noise.

Response NOAA-4

The key word in the sentence cited is "may." There is no data to the contrary that Chukchi Sea marine and anadromous fish populations are uniquely different from those found in the Beaufort Sea and Norton Sound or that the respective habitats differ markedly to an extent that the fish populations would also show variance to the effects of oil and gas exploration/development. Whether additional studies/surveys would show significant discrimination from other areas is conjectural--at least as regards oil and gas exploration/development.

Response NOAA-4A

Although the comment does not elaborate on what specific aspects of formalized effects analysis would be desirable to include in the EIS, MMS assures the commenter that standard analytical procedures were employed and rational biological logic was applied to the analysis of available information for each "environmental entity." The MMS recognizes that the quantity and quality of data available for such entities is variable, but feels that it is adequate for sufficient numbers of species/environmental situations to permit accurate overall conclusions to be drawn. Likewise, available population data, although not incorporated other than by citing the appropriate references where the data may be found, have been considered in the course of each analysis.

Response NOAA-5

The amount of data available is sufficient to run general ocean-circulation models for oil-spill-trajectory modeling on the mesoscale level. The data presented at an OCSEAP/MMS Chukchi Sea Information-Update Meeting held in Anchorage, Alaska, on March 27, 1986, and the published proceedings (1987) show the same figure from Coachman, Aagaard, and Trip (1975). This same data is shown in Figures III-A-6 and III-A-7; thus, it is presumed that the general information shown in Figures III-A-6 and III-A-7 is still pertinent, even though it is based on historic data. Currently there is a cooperative effort with NOAA and the U.S.S.R. Far Eastern Hydrometeorological Research Institute and the Arctic and Antarctic Research Institute to collect oceanographic data in the Chukchi Sea. This oceanographic-research cruise, the first since 1976, will collect data across political boundaries and will be valuable for verifying the data from Coachman, Aagaard, and Trip (1975).

Response NOAA-6

The text has been amended to include this information and the citation appears in the FEIS bibliography. Although this information provides a few more details, it does not change the overall description of the physical environment.

Response NOAA-7

The commenter is interpreting the figure incorrectly, because it shows only the Sale 126 area. The original figure is from Coachman, Aagaard, and Trip (1975). As suggested by the commenter, the flow moves northwest and enters the Arctic Ocean east of Wrangel Island. This flow is discussed in Section III.A.

Response NOAA-8

Appendix L addresses spilled oil in the polynya system. Discussions of the polynyi, as they relate to each environmental resource, are located throughout the FEIS.

Response NOAA-9

The regional distribution of shallow gas is shown in Figure III-A-5. The MMS regulations require preliminary activities such as geological, geophysical, and other surveys necessary to develop a comprehensive Exploration Plan or Development and Production Plan.

Response NOAA-10

The construction of a pipeline landfall at Point Belcher would be a relatively short-term phenomenon and should not require the expense to construct a causeway to accomplish this. Some temporary means for offloading may be called for rather than a causeway, which is a fairly permanent structure. The forward construction base for activities in the Chukchi Sea is specified in the scenario as being near Wainwright, where materials and equipment offloading would not be inconsistent with similar operations that now occur near the community. Barging could originate from Wainwright, or materials and equipment could be barged from some other community (such as Barrow or Kotzebue) for offloading at Point Belcher without the need for a causeway or other similar permanent structure.

Response NOAA-11

Point Belcher represents a reasonable location for a pipeline landfall to be used for prelease environmental assessment purposes. The MMS is not required to assess the environmental effects of pipeline landfalls at all possible locations. Should a different landfall be proposed at a later time for developmental purposes, an environmental assessment of the location would be performed as part of a NEPA document. .

Response NOAA-12

Deletion of the Point Lay deferral area will not markedly affect the base- or high-case estimates. This is due to the estimates being directed to only those prospects that are most likely to have a major discovery capable of creating infrastructure and being developed and produced for Sale 126. Since none of these higher potential prospects appear to lie within the Point Lay deferral area, the base- and high-case estimates remain unchanged. However, Appendix B does indicate that the blocks within the deferred area are important for the upcoming sale and that the blocks within the deferred area have prospects that may contain developable volumes of hydrocarbons. The current MMS data do not provide evidence to support a major discovery in the deferred area, but we still expect some blocks to be leased for Sale 126. The MMS data suggest that any prospects drilled within the deferred area would significantly contribute to area delineation of geology and that discovery of subeconomic volumes of hydrocarbons are possible from Sale 126. These subeconomic volumes would not be large enough to create infrastructure and thus were not included in the base- and high-case estimates; but these volumes may become economic if infrastructure is created by any of the higher potential prospects comprising the base and high cases.

It is very important to emphasize that the current interpretation of MMS data is only an indicator of what to expect from drilling activity in the deferred area; but it does not preclude a major discovery in the deferred area. Therefore, Appendix B correctly states that the blocks within the deferred area are important for Sale 126.

Response NOAA-13

The differences in effect between alternatives that the commenter points out are recognized in the EIS. The general level of effect, however, remains about the same within the effect level definitions used by MMS because each defined effect level represents a range of potential effects that adverse factors, in various combinations and degree of severity, may satisfy. Thus, although Alternative I (base case) is likely to result in greater effects thanAlternative IV (Point Lay Deferral),, the effects would not be sufficiently different to warrant different class levels.

Response NOAA-14

Analysis of the area not to be offered for lease in the Point Lay Deferral Alternative is not intended to represent analysis of an additional alternative but, rather, to show the potential environmental benefits that might accrue should the area not be leased.

Response NOAA-15

Effects of the Point Lay Deferral Alternative are compared with effects of the base case of the proposed action rather than with both the base and high cases to avoid the possible confusion caused by excessive analytical comparisons.

The area not to be offered (the area to be deferred) for leasing in the Point Lay Deferral Alternative should be able to accommodate a pipeline route to shore but would not accommodate any drilling or production activities. Seismic work necessary to locate an appropriate pipeline route would also have to be accommodated within the area to be deferred. Oil spills from a potential pipeline rupture have been factored into the OSRA. The commenter is correct that not offering the area to be deferred would not preclude the occurrence of environmental disturbances within the area to be deferred, should a pipeline that traversed the deferred area be used to transport oil to a landfall.

Response NOAA-16

The commenter is correct in pointing out the contradiction. The sentence referred to in Section II.E.3.d has been deleted.

Response NOAA-17

See Table S-2 for the definition of the effects term "moderate" and effects levels associated with that term. "Moderate" means that one or more important subsistence resources would become unavailable, undesirable, or available only in greatly reduced numbers for a period not exceeding 1 year. Under this rubric, much of the consequences and potential effects discussed in the comment still fall into a "moderate"-effects category. In the last sentence of the comment, the commenter states that should an oil spill occur after a low-harvest year, Point Lay could be denied a harvest for 2 consecutive years. While this statement may be true, the commenter's scenario of an oil spill coupled with a low harvest year represents a "worst-case scenario." The base-case effects of the proposed action are examined "standing alone," apart from other effects that may be due to other projects, weather, or the natural cycle of the subject species. Those issues are discussed in Section IV.H (cumulative effects).

Response NOAA-18

The commenter's observation is correct; additional subsistence-harvest data do need to be collected for Point Lay. The North Slope Borough has collected some data regarding the belukha harvest that has been added to Section III.C.2. This subject has also been discussed with the Environmental Studies Section (ESS) of the Alaska OCS Region. In the future, Point Lay needs to be added to the subsistence-harvest-data-gathering studies ESS is now conducting in Wainwright and Barrow.

Response NOAA-19

The text of Section III.C.2 has been revised to address this concern.

Response NOAA-20

Although an EIS seldom presents data as detailed and extensive as that typically found in the OCSEAP reports (e.g., Divoky, 1987), these reports were used extensively in compiling the generalized bird distribution map and in description and analysis sections.

Response NOAA-21

Since the precise western boundary value correctly given by NOAA cannot be distinguished from the approximate 169° line shown, Figure I-3 and others are correct as they appear in the EIS. The northern limit of the planning area is correct as shown at 73°. The recent U.S./U.S.S.R. boundary agreement does not place a northern limit on territorial claims, and we are not constrained by the 200-mile Exclusive Economic Zone line on the continental shelf.

Response NOAA-22

In order for bowhead whales to encounter industrial noise they must (by definition) enter an industrial-response zone. This zone is typically about 1 to 4 km in radius from sources of industrial noise. Since the distance from potential sites of exploration in the Sale 126 area is considerably beyond 4 km from the spring-migratory corridor, whales in the spring-migratory corridor are not likely to encounter industrial noise associated with Sale 126, as stated in the EIS. This is not to say that whales would not hear industrial noise.

Response NOAA-23

As indicated in the analysis, production activities and associated noise are not likely to affect the bowhead whale population although industrial activities in the spring lead system could disrupt normal bowhead activities. It is agreed that Alternative IV would remove any possibility of interference but it is assumed, because of ice conditions, that no exploration activities would occur until after the spring migration has occurred.

Response NOAA-24

Please compare OSRA Tables C-13 and C-16 (Appendix C, base case) with Tables C-17 and C-20 (Point Lay Deferral). There are virtually no differences in degree of risk between the Point Lay Deferral Alternative and the proposed action. Since much of the effects-level analysis is driven by the OSRA, it is difficult to justify a sharp reduction in effects when the main effects- causing agent remains at the same level of effect.

Response NOAA-25

The blocks identified in Stipulation No. 5 were intended to be outside of the spring-lead system. However, the spring-lead system moves about from year to year and may overlap the Sale 126 area in some years.

Response NOAA-26

No response is necessary.

Response NOAA-27

The purpose statement of ITL No. 7 (Information on Development and Production Phase Consultation with NMFS to Avoid Jeopardy to Bowhead Whales) adequately covers the intent of the commenter without further revision.

Response NOAA-28

For the purpose of clarification, the referenced paragraph has been revised.

Response NOAA-29

Peard Bay and Kasegaluk Lagoon are embayments some distance from the proposed lease-sale area. The MMS believes that the ecological relationships and trophic linkage diagrams would differ from those in the larger Chukchi Sea. Figure III-B-3 has been simplified for clarity in the FEIS. We agree that the food web of the Chukchi Sea coastal ecosystem is more diverse and complex; however, this complexity is beyond the scope of this EIS.

Response NOAA-30

In the FEIS, the sentence dealing with euphausiids has been expanded to more thoroughly describe this group of crustaceans. The citation on corrected Figure III-B-1b appears in the FEIS bibliography.

Response NOAA-31

The overland pipeline transportation assumption represents a reasonable assumption to be used in a pre-lease environmental assessment for initiating the transportation of oil to market. The MMS is not required to assess the environmental effects of a variety of transportation scenarios. Should a different transportation method or route be proposed for developmental purposes at a later time, an environmental assessment of the transportation mode and its characteristics would be performed as part of a developmental EIS.

Response NOAA-32

The BLM has current spill data on the TAP. No analysis of this data has been completed at this time.

Response NOAA-33

Figure IV-A-12 show the applicability of oil-spill response in the proposed sale area in decaying ice; broken ice; widely scattered ice; and new, thin, broken slush ice. The text has been amended to address this concern and the citation appears in the FEIS bibliography.

Response NOAA-34

The referenced analysis discusses the likely effect of the proposal on endangered whales as required by ^FNEPA. The legal status of future actions will be analyzed on a-case-by-case basis if and when such action occurs. Also, it has yet to be established why most whales avoid close encounters (1-4km) with sources of industrial noise. Hence, it is premature to suggest that whales swim around industrial operations because they were disturbed by them. It is equally possible that avoidance occurs in order to prevent disturbance. Further, mammals subject to nonthreatening activities (natural or manmade) typically habituate to them. Since industrial noise is passive and nonthreatening, it is likely that whales would show less avoidance after habituation occurred.

Regarding the idea of whales reacting beyond the response zone, this is also speculative since at these distances, behavioral responses to acoustic stimuli cannot be attributed to their source. Hence, there is no data that support the idea that whales beyond the response zone would react to industrial noise (the data support the opposite). Since the analysis is based on substantiated information, speculation along these lines would not have enhanced it.

Response NOAA-35

Data concerning the effect of industrial noise on bowhead and belukha whales in the spring-lead system is available in Richardson et al. (1990), a 2-year study involving the response of whales to industrial noise in the spring-lead system (1991 report in process). These studies indicate that bowheads respond to industrial noise in the spring-lead system in the same way they do in open water (minor, short-term responses). This is not too surprising, since all whales, regardless of geographic area, have been observed to respond to industrial noise in essentially the same fashion. In general, it appears that passive stimuli (such as industrial noise) do not cause any perception of threat or long-term annoyance, as is common when marine mammals are subject to active stimuli (such as subsistence hunting). Regarding effects due to echolocation, see Response NOAA-3.

Response NOAA-36

The statement in the EIS is supported by discussion in the Chukchi Sea Sale 109 FEIS (USDOI, MMS, 1987b), herein incorporated by reference. Anadromous fishes were found in coastal waters, in brackish estuaries, and river mouths (Morrow, 1980; Maynard and Partch/Woodward-Clyde Consultants, 1984). Craig (1984) and Wolotira, Sample, and Mann (1977) characterize the anadromous fishes of the southeastern Chukchi Sea as using only estuarine and other nearshore environments. Morris (1981a) indicates that arctic flounder, starry flounder, and fourhorn sculpin frequent low-salinity waters near estuaries or river mouths. Other marine fish species, such as arctic cod, apparently prefer higher-salinity, offshore waters; but population-size estimates and densities are lacking for most species. Quast (1974) estimated that more than 20.9 million kg of arctic cod were present between Cape Lisburne and Icy Cape in 1970, with implication given in the geographic reference that these juveniles were nearshore.

Response NOAA-37

The importance of arctic cod as a keystone species is indicated in Section III.B.2.b. Additional information as to the importance of this species is contained in the Chukchi Sea Sale 109 FEIS (USDOI, MMS, 1987b), herein incorporated by reference. Arctic cod are most important as food for higher-trophic- level organisms, although size is smaller in the northern part of the Sale 126 area (Fechhelm et al., 1984). Young-of-the-year are normally found in the upper 50 m of water, while juveniles and adults are found more toward the benthos. Additional information on life history, distribution, and significance of this species is contained in the Sale 109 FEIS.

Response NOAA-38

Concentrations of trace metals within the Chukchi Sea sediments are similar to those for other coastal seas (USDOI, MMS, 1987b: Sale 109 FEIS, Table III-4). Unlike Norton Sound, mineralized deposits are not in evidence inshore or offshore; and locally, anomalously high trace-metal values are not found. Generally, trace-metal analyses of sediments are not required by permitting agencies prior to dredging unless sediment contamination is suspected.

Response NOAA-39

The probabilities of an oil spill occurring and contacting offshore resources in the sale area and vicinity are discussed in Section IV.C.5.

Response NOAA-40

See Response NOAA-22. Wherever studied, all species of whales have been observed to respond to industrial noise in a similar fashion (local, short-term effects). Hence, the important issue is really the effect of industrial noise on whales, not the location of the whales when they encounter industrial noise. Further, a statistical analysis of whales encountering noise in the spring-lead system is unnecessary, since the spring-lead system is mostly outside of the sale area.

Response NOAA-41

It is unlikely that there would be a "large scale cleanup operation within the spring lead system" when bowheads are present, since bowheads have passed through the spring lead system (mid-June) before industrial equipment could enter it (mid-July). It is possible that there could be long-term adverse effects from a production operation in the spring lead system. Hence, further consultation with NNMFS will be accomplished when production and development is contemplated.

Response NOAA-42

See Response NOAA-40.

Response NOAA-43

See Response NOAA-41.

Response NOAA-44

The rationale expressed in the EIS is correct as stated. It is based on the premise that the areas leased are leased with the intention of conducting exploratory drilling. If the deferred area is not leased, some of the industrial noise and potential spill sites that would have occurred in the deferred area (inshore) would occur farther offshore. If the deferred area is leased, then some of the industrial noise and potential spill sites that would have occurred in the remainder of the sale area (offshore) would occur farther inshore in the deferred area. The EIS does not state that oil-spill sites would become concentrated; rather, it states that potential sites of industrial noise and crude oil would be moved closer inshore or offshore, depending on whether the deferred area is leased.

Response NOAA-45

The Gulf of Alaska (GOA) is outside of the sale area, as are the many destinations of crude oil and its products. Oil originating from the sale area would be piped to a GOA port before leaving the GOA by tanker. However, this oil would be mixed with a much larger share of oil that comes from other sources before it leaves the GOA. Hence, it is difficult to know the origin of crude oil being transported at any given time, and even more difficult to know the origin of crude oil arriving at processing and distribution sources. For this reason, the GOA was not assessed in detail; and the many other destinations of Sale 126 crude oil were not addressed at all.

UNITED STATES GOVERNMENT

memorandum

BUREAU OF INDIAN AFFAIRS
JUNEAU AREA OFFICE

DATE: September 6, 1990

REPLY TO ATTN OF: Acting Area Director, Juneau Area

SUBJECT: Comments on Draft Environmental Impact Statement for Chukchi Sea Lease Sale, No. 126, Outer Continental Shelf

TO: Regional Director, Minerals Management Service

The subject proposed Oil and Gas Lease Sale should have negligible effects on the surfaces of allotted Alaska Native properties in the general geographic area known as the North Slope Borough Alaska.

The overall effects of the base case drilling activity of the Oil and Gas Lease Sale, if approved, are expected to be high on subsistence harvests in the Wainwright area and low to moderate in the remainder of the proposed lease area. The Bowhead Whale harvest, specifically, would be adversely impacted, with anticipated adverse effects expected to accrue on the subsistence walrus harvest. Very high effects are also anticipated on the freshwater habitats of the anadromous fishery at the base level drilling intensity level.

Stipulation No. 6 of the possible mitigating measures of subsistence whaling and other subsistence activities, appears to imply the intent is to minimize the net effects which any drilling or exploratory activity would have on whaling or other subsistence activities. Although as Stipulation No. 6 seems to address the issues surrounding subsistence whaling and other related subsistence activities, more precise language should be incorporated into the lease sale to provide for specific measures to protect the subsistence harvest and socioeconomic lifestyle of the Alaska Natives.

BIA 1

Utilizing the best current information available on Bowhead Whale migrations, seismic and other drilling related activities will be prohibited in the vicinity of migrating whales when it is likely that such activity would interfere with subsistence activities or jeopardize the availability of whales or other marine mammals for subsistence purposes.

In further regards to Stipulation No. 6, activity above the depth at which oil and gas bearing strata is likely to occur may be conducted on a year-round basis, but would be postponed or halted if such activity was likely to interfere with subsistence activities or affect the availability of whales or other marine mammals for such purposes. All nonessential sea and airborne traffic associated with drilling and/or completion activity under this lease sale is to be conducted prior to or following the normal whale migration time frames and is to be halted if found to interfere significantly with other subsistence activities.

It is further noted that Seasonal Drilling Restriction (SDR) was listed as a mitigating measure not recommended for further study (page I-16). We believe that this mitigating measure has very substantive value to the subsistence issue. Not as the Arctic Regional Biological Opinion relates it to a possible

BIA 2

RECEIVED
SEP 12 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

OPTIONAL FORM NO. 10
(REV. 7-76)
GSA FPMR (41 CFR) 101-11.6
5010-112

BIA 2

oil spill, but rather, as a mitigating measure directed at assuring that migrating Bowhead Whales and other marine mammals have sufficient time and space free of industrial noise and activity to complete their normal migrating patterns. The SDR would be involved when available current specific data indicated Bowhead and/or Gray Whales were in the process of migrating to or through the area of oil and gas exploration activity.

In reviewing the various alternatives to Sale 126, the Point Lay Deferral Alternative (No. IV), appears to offer the greatest opportunity for the discovery and development of hydrocarbons with the smallest amount of possibility of adverse effects on the overall environment and the Alaska Natives' subsistence and cultural-traditional way of life.

This alternative provides virtual exclusion of the Bowhead Whale and other marine mammals' migration routes. It also removes most of the traditional subsistence harvest areas from Sale 126, which effectively eliminates our greatest concerns in these areas. The remaining effects would be principally in the area of oil spills and their effects on anadromous fishes both in fresh and in salt water. These concerns appear to be adequately addressed in the Point Lay Deferral Alternative. Although fish would be severely impacted by the event of an oil spill, the possibility of such an expected occurrence appears to be quite low and the overall effects minor, compared to Alternative No. 1., as proposed.

In conclusion, the Bureau of Indian Affairs recommends the adoption of the Point Lay Deferral Alternative (IV). It is believed this alternative would present the least impact on the requirements and needs of the Alaska Natives, including their subsistence rights and their cultural-traditional way of life.

Loren J. Farmer

Loren J. Farmer

Bureau of Indian Affairs

Response BIA-1

Stipulation No. 6, Subsistence Whaling and Other Subsistence Activities, has been changed to incorporate more specific language regarding subsistence activities other than bowhead whale hunting. The specific language recommended by the commenter has not been incorporated into Stipulation No. 6 because the commenter's concerns are addressed by other mitigating measures, such as Stipulations No. 2 (Protection of Biological Resources), No. 3 (Orientation Program), and No. 5 (Industry Site-Specific Bowhead Whale-Monitoring Program).

The commenter's concerns are "to provide for specific measures to protect the subsistence harvest and socioeconomic lifestyle of the Alaska Natives," with the notion that offshore oil and gas activities must halt when potential conflict might ensue with subsistence activities. Stipulation No. 5, Industry Site-Specific Bowhead Whale-Monitoring Program is designed with specific reference to the migration of the bowhead whale. This Stipulation provides the authority for halting offshore activities should conflict exist with the migration of the bowhead whale. Stipulation No. 2, Protection of Biological Resources, addresses a means for protecting marine subsistence resources, whereas Stipulation No. 3, Orientation Program, emphasizes the special relationship that exists between man and nature in the Arctic.

Response BIA-2

The purpose of the seasonal drilling restriction (SDR) was to protect whales from what were then the unknown effects of an oil spill. Since that time studies have consistently shown that both crude oil and industrial noise are likely to have only minor, short-term effects on some cetaceans. In addition, because of prevailing ice conditions, no exploratory activities are assumed to occur in the spring lead system. Consequently, the SDR was dropped. However, in its place a measure was developed to ensure that the effects of industrial activities on bowhead whales would continue to be monitored. An additional measure was also developed to prevent potential conflicts between the oil industry and whalers. In addition further consultation with NMFS will be persued if and when production and development activities are contemplated.

United States Department of the Interior

BUREAU OF MINES

Alaska Field Operations Center
201 East 9th Avenue
Suite 101
Anchorage, Alaska 99501

August 20, 1990

RECEIVED
AUG 22 1990
REGIONAL ... ALASKA OCS

Regional Director
Minerals Management Service
Alaska Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Re: Draft Environmental Impact Statement (DEIS) for the Proposed OCS Chukchi Sea Oil and Gas Lease Sale 126

Staff from the Bureau of Mines, Alaska Field Operations Center have examined selected portions of the DEIS which could pertain to or describe possible impacts from the proposed Sale 126 on development of mineral resources. The DEIS is well written and relatively comprehensive. A few general suggestions for your consideration are outlined below.

1. Estimates of the quantity and identification of possible source areas for gravel needed for construction purposes associated with exploration, development and transportation of oil should be included in the DEIS. On page II-13 an estimate is quoted that 500,000 m^3 of gravel would be needed to construct land-fall facilities associated with offshore development at Point Belcher. However, it is unclear whether this estimate includes gravel needed for roads to connect Point Belcher with other communities in the region. Also, gravel would likely be required for construction of the pipeline from Point Belcher to the TAPS. Quantities would be very large if an all-weather road paralleling the pipeline was also built. BOM 1

2. A related consideration involves the application of the evolving wetlands policy and regulations by the Corps of Engineers and Environmental Protection Agency. Development of new on-shore infrastructure could become more expensive and/or difficult. BOM 2

3. On page II-23,24 there appears to be a contradiction between section 10 (Effects on the Economy of the North Slope Borough) and section 11 (Effects on Subsistence-Harvest Patterns) relative to the overall effect of the base case on subsistence harvest. BOM 3

   The overall effect of the base case on subsistence harvest patterns is rated as high (Wainwright), moderate (Barrow), and low (Point Hope) in section 11. However, the overall effect is rated as very high on the economy of the North Slope Borough (section 10) because of impacts on subsistence harvest. Other economic impacts are rated as moderate.

   This same comment applies to comparable sections for other alternatives (pp. II-34,35; II-43,44). BOM 3

Thank you for the opportunity to review the above well-written document. Please contact me at the above address or by calling FTS 868-2455 if you need clarification of these comments.

Robert B. Hoekzema
Chief, Anchorage Branch

cc: Director, Minerals Management Service
Paul Gates
Millie Gloster

RBH:mm:8/20/90:Sale126.ltr

Bureau of Mines

Response BOM-1

Information concerning the amount of gravel that might be needed to construct a typical facility is presented to provide the reader some indication of the quantities that may be required. While estimates of the amount of gravel that might be needed to construct the facilities noted in the hypothetical scenarios would be useful, the purpose of the EIS is to analyze the potential environmental effects of activities that might result from the lease sale. The effects of habitat alteration and destruction caused by gravel mining and construction activities can be analyzed without knowing the exact volume of gravel that might be used or the extent of potentially affected areas. If development occurs as a result of this lease sale, plans showing the locations of facilities, the amount of gravel required, and the gravel-mining sites will have to be submitted to the appropriate regulatory agencies for review and approval.

Response BOM-2

No response is necessary.

Response BOM-3

Based on a review of Section IV analyses and related sections, the very high effect on the economy for the base case has been changed to a high effect in the FEIS. However, the analyses for subsistence-harvest patterns and the economy of the NSB in Section IV of the DEIS--using the definitions in Table S-2--lead to the conclusion of different levels of effects and were consistent. It is possible to have a high effect on subsistence-harvest patterns and an even greater effect, very high, on the economy and still be consistent. These two environmental resource categories are related. However, in this case, the effects were increased when the high effect on subsistence-harvest patterns was translated to the effect on the economy. Subsistence-harvest patterns and the economy of the NSB are interrelated but separate environmental resource categories with their own analyses, definitions of effects, and, in this case, conclusions. Conceptually, the conclusion of high effects on subsistence-harvest patterns could have translated to a very high effect on the economy, as reflected in the DEIS.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD
ANCHORAGE, ALASKA 99503

IN REPLY REFER TO
NAES/MMM/DOS

Memorandum

SEP 11 1990

RECEIVED SEP 1 1 1990 REGIONAL DIRECTOR, ALASKA Minerals Management Service ANCHORAGE, ALASKA

To: Regional Director, Minerals Management Service Alaska

From: Regional Director Region 7

Subject: Comments on Draft Environmental Impact Statement, Lease Sale 126 (Chukchi Sea) (EC 90/86)

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Impact Statement (DEIS) for Outer Continental Shelf Oil and Gas Lease Sale 126 in the Chukchi Sea Planning Area. The proposed lease sale encompasses 23.7 million acres between three and 240 miles offshore from Point Belcher to Ledyard Bay. We provided comments on Lease Sale 109, also located in the Chukchi Sea, in letters dated May 7, and May 27, 1987, as well as on the Notice of Intent to Prepare an Environmental Impact Statement for this sale in a letter dated March 2, 1989. Copies of our earlier comments are attached.

General Comments

The northwest coast of Alaska adjacent to the proposed Lease Sale 126 area includes critical fish and wildlife habitats. Habitats in the vicinity of Cape Thompson, Cape Lisburne, Kasegaluk Lagoon, Icy Cape, Peard Bay, and Point Franklin are of national interest as portions of the Alaska Maritime National Wildlife Refuge system.

Mudflats and salt marshes at Icy Cape, in Kasegaluk Lagoon, provide feeding, molting, and staging habitat for large concentrations of brant, eiders, oldsquaw, and shorebirds using the Chukchi coast. Common eiders and Arctic terns nest on the barrier islands. Beluga whales feed and molt in Kasegaluk Lagoon and spotted seals use the islands as haulout areas. Kasegaluk Lagoon is also thought to be an important feeding area for anadromous fish.

FWS 1

The Kuk River (Wainwright Inlet) supports anadromous fish, including Arctic char, rainbow smelt, least, Arctic, and Bering ciscoes, and pink and chum salmon. Very little is known about their distribution, movements, overwintering areas or dependence upon protected coastal areas where the water is warmer and more brackish (Craig and Skvorc 1982). Much additional information is needed to adequately assess the potential impacts of offshore oil and gas development on anadromous fish and their nearshore habitats.

The Chukchi Polynya forms south of Point Hope when the prevailing easterly winds that usually occur in March and April separate the pack ice from the fast ice along the flaw zone (LaBelle et al. 1983). This polynya often provides the only open water habitat available in early spring before any major deterioration of the pack ice occurs. Migrating marine mammals and birds concentrate along this lead system in the spring and follow it as it progresses northward. Virtually the entire Alaskan and northwestern Canadian population of king eiders (more than one million birds), as well as thousands of common eiders and oldsquaws, migrate along these spring leads (Woodby and Divoky 1982).

FWS 2

We have a major concern for the document's treatment of marine mammals for which the Service is responsible. The document provides an incomplete seasonal description of sources of potential impact to marine mammals and underestimates the degree of impact to polar bear within the lease sale area. The document also, to a lesser degree, downplays the impacts to walrus, provides an incomplete description of potential impacts, and fails to incorporate findings of a recent study describing effects of drilling and support activities upon the distribution of walruses. The document's description of oil spill scenarios for the spring and fall periods and associated impacts to pinnipeds and polar bears is incomplete.

FWS 3

Mitigative measures to clean and rehabilitate polar bears and possibly walruses contaminated in a spill are stated to be the responsibility of individual operators. A more complete assessment of remedial actions to a spill is necessary to evaluate impacts to marine mammals.

FWS 4

Habitat alteration and the cumulative effect of long-term changes in quality and productivity of marine mammals is not adequately addressed. Given the nature of polar bears and other bear species it would appear that this family is intolerant to minor habitat changes. Polar bears, for example, may be attracted in concentrated numbers in certain areas at specific times not only by large marine mammal carcasses, but by the mere dynamics of their movements associated with polar ice. Such aggregations may likely occur in the lease area because it would logically serve as a staging area along the ice edge in the fall during rapid ice formation and advancement to the south.

FWS 5

Walruses make two large scale movements through the lease area and are present, albeit not as visible and possibly not as numerous as other times, during the open water phase. More importantly, the component of the population present is predominantly the nursery herds and younger males and females, which is the nucleus of the future population. The DEIS appears to place a great emphasis upon the adaptability and resilience of these populations to perturbation. Studies substantiating the conclusion of population recovery from disturbance, stress, oiling and other impacts are unavailable for walrus and polar bear. FWS 5

Most arctic species depend upon a migratory lifestyle. Bowhead, gray, and beluga whales, walruses, spotted and bearded seals, and marine birds pass through the Bering Strait and through the Chukchi Sea twice annually during spring and fall migrations. The critical nature of the Chukchi migratory corridor for many marine species warrants a conservative approach, at least until we know more about the vulnerability of fish and wildlife species during migration.

The marine environment of Ledyard Bay is highly productive and used extensively in spring, summer, and fall by seabirds. All of the gulls and common and thick-billed murres nesting in colonies at Cape Lisburne feed there. Ledyard Bay is especially important to tens of thousands (possibly hundreds of thousands) of king and common eiders, which molt there in July and August (Roseneau and Herter 1984). During this time, eiders are flightless, which renders them particularly vulnerable to oil spills and noise disturbance.

The Service believes that the Point Lay Deferral Alternative is the best compromise for allowing exploration while protecting the biologically sensitive coastal areas. The Chukchi coastal ecosystem has been little studied and many questions and information gaps remain on the importance of the lease area to fish and wildlife. This Deferral Alternative would afford some protection to the coastal ecosystem during the exploration phase. However, long-term research and adequate biological resource data is needed to provide for environmentally responsible decisions on how to produce and transport commercially recoverable oil that may be discovered.

The production phase calls for a network of subsea pipelines from remote leases to a landfall, possibly in the vicinity of Point Belcher. The biological importance of any landfall site should be determined and possible alternative sites will need to be considered. FWS 6

Detailed discussion of transportation scenarios and potential impacts on fish and wildlife will occur when a specific plan is proposed. We will be pleased to assist you with an impact analysis of the likely scenarios. From a Service perspective, the following resources should be addressed: (1) Western Arctic caribou; (2) nesting Arctic peregrine falcon; (3) migrating, nesting and staging shorebirds and waterfowl; (4) anadromous fish important to local commercial and subsistence users; and, (5) high-value wetlands and uplands that support these resources.

Specific Comments

Page I-7, paragraph 2: The specific incidental take provisions of the Marine Mammal Protection Act contained in Section 101(a)(5) should be discussed in general in this section, as well as on page II-57. FWS 7

Page I-14, paragraph 2: Missing from the DEIS is the issue of availability of adequate studies information. While the Minerals Management Service should be commended for the quantity of studies conducted in offshore areas, it remains that little site specific evaluation and information on the lease area's value to polar bear and walrus are included. Population dynamics information including size and trend are unavailable for polar bear in this area. Contemporary studies describing the long term and seasonal relationship of polar bear and walrus populations to the area should be conducted. FWS 8

Page I-15, paragraph 3: The orientation program should include a mandatory polar bear orientation training for all field employees and an approved Polar Bear Interaction Plan. The orientation program should include a summary of polar bear biology and life history information, relevance of the Marine Mammal Protection Act to the exploratory and production activities and the conduct of employees (e.g., feeding wildlife, waste disposal, deterrence activities, employee safety, Native use of polar bears, the Polar Bear Management Agreement between the North Slope Borough and the Inuvialuit Game Council of Canada, the International Agreement on the Conservation of Polar Bear). The interaction plan includes site design, site operations, offsite procedures and monitoring and reporting of polar bear interactions and sightings. The orientation program and interaction plan should address offshore activities, support activities, and shore based activities. FWS 9

Page I-15, paragraph 8-9: Areas of Special Biological Sensitivity. Notice to Lessees (NTL'S) and operators of Federal Oil and Gas Leases in the Outer Continental Shelf (OCS), Alaska OCS Region dated December 1, 1989, provides conditions helpful in minimizing the potential for incidental taking of polar bear and walrus. Recommendations for conducting preliminary and other OCS lease activities, including associated aircraft, support vessel and ice-breaking activity contained within the NTL are not mandatory. Therefore NTL's do not eliminate the potential for taking and that the liability of such taking continues to be borne by operators pending the development of incidental take regulations and accompanying Letters of Authorization. FWS 10

Page I-16, paragraphs 5-6: The dismissal of seasonal drilling restrictions as mitigative measures for further study is premature and inappropriate. Although inclusion of the Point Lay deferral alternative (I-17) addresses, to an extent, the concerns for the nearshore habitats associated with the Chukchi Polynya, and its importance to marine mammals, the resultant leasing of 22 FWS 11 blocks within the subarea continues to warrant the evaluation of seasonal restrictions, particularly during any production phase which may develop. Adoption of the Point Lay Deferral Alternative and withdrawal of the 22 leased tracts would greatly mitigate against concerns for the integrity of the spring lead system of the Chukchi Polynya. FWS 11

Page II-2, paragraph 3: Statements found in this paragraph provide few clues as to the actual scope and magnitude of effect of the planned activities. Given current technology and the ambiguity of development scenarios can accurate impact assessments be developed? FWS 12

Page II-3, paragraph 4: Exploratory drilling is ongoing (II-2, paragraph 1). FWS 13

Page II-5, paragraph 5: Effects on Pinnipeds and Polar Bear [Low Case]

The document presents effects for the exploratory phase only, yet seeks National Environmental Policy Act approval for the production phase as well. It is recommended that the document be modified to reflect technological advances which will allow for the production of hydrocarbon and portray expected effects to marine mammals. The expected effects of exploration on walrus underestimate the effect of frequent aircraft flights and disturbance and displacement of walrus herds and do not accurately portray the impact of underwater acoustical disturbance transmitted by drilling, accompanying vessel traffic or ice-breaking activities. Preclusion of marine mammal use of areas is of concern. Citation of the Ebasco Report, "1989 Walrus Monitoring Program: The Klondike, Burger, and Popcorn Prospects in the Chukchi Sea," (1990) is appropriate, particularly in relationship to ice-breaking activities and the potential for attraction of walrus to the drill ship and potential for mortality which is not indicated to occur in the DEIS. The document further indicates that, "Vessel traffic coinciding with animal movements may interfere temporarily with local movement or migrations within a lead system, but there is no evidence that vessels would block or significantly delay migration." The document earlier states that exploratory activities will occur only during the open-water phase (II-4). It is true that lead systems are comprised of open water and ice; however, they are generally considered to be in an ice-covered phase due to the predominance of the surrounding ice habitat. If vessel traffic does occur within the spring lead system, the associated impact of introducing additional stress would be greater than projected. Blockage of migrations may not necessarily have to occur in order for significant impacts to take place. In addition, polar bear may be present within the area even during the open water phase, either on solitary or scattered ice which frequently moves through the area or swimming to find ice platforms. Amstrup (1990) documented interactions of ice-breakers with polar bears in the Beaufort Sea under similar exploratory conditions. FWS 14

Page II-20, paragraph 3: Effects on Pinnipeds and Polar Bear [Base Case] Comments from the Low Case apply.

A further discussion of the effects of oiling on polar bears and seals during the fall spring period is necessary. Discussion is not included on the impacts of oiling to marine mammals during the fall period. Marine mammals in the region make two major migrations per year associated with the spring retreat of the pack ice and again in the fall with the advance of the polar ice pack. Region specific information on the distribution, composition and abundance of polar bears near the spring lead system should be presented. If the information is unavailable, additional studies should be conducted to provide data necessary to projecting valid impacts. Gardner (1989) points out that polar bear densities may become more concentrated during certain seasons and in specific areas. For example, polar bears appear to pulse across the North Slope in a westerly direction during the autumn and early winter as ice conditions move animals from the northern pack ice into proximity with the coast. Large numbers (40+) have been reported in the Point Franklin, Point Belcher and Atanik areas during the fall. Icy Cape has long been considered a favored gathering or migratory path of polar bears during this period. Similarly, residents of Point Lay report seeing numerous polar bears along coastal areas in the vicinity of the village and along the barrier islands adjacent to the Kasegaluk Lagoon. The location and amount of beach carrion and normal distribution and availability of ringed seals are believed to contribute to the attraction and local persistence of bears. The annual variability in deposition of carcasses and the severity of the fall weather combined with the accessibility of natural live prey may interact to determine polar bear distribution along coastal areas. It is believed that family groups of females and cubs having a greater nutritional demand may be represented in a greater proportion than other sex or age classes. Subadult animals just becoming proficient at securing prey may also be heavily represented in these areas. Polar bear have a low productive capability given a late age of first reproduction, small litter sizes and lengthy interval between litters. In short, the critical female component of the population may be at greater risk during this period in coastal areas. FWS 15

Even if the polar bear population were evenly distributed during this period, it is incorrect to assume that low densities equate to low level impacts. An understanding of the relative number of animals within the population (valid current estimates are unavailable and a predictive methodology to this estimate population size in this region has not been developed), population trend, and effects of annual non-natural mortality are required before impacts (mortalities) from oiling can be described.

Any spill and the attendant clean up effort may attract polar bears. Polar bears are curious and seek out novel visual stimuli or may be attracted by unusual smells associated with a clean up effort. A comprehensive discussion is not provided on oil spill contingency plans, securing the spill areas against further oiling or rehabilitation efforts for oiled animals. Further, a narrative on the persistence of oil within the environment should be included so the reader can assess the potential for residual oiling in other seasons or locations. Polar bears spend a great amount of time travelling across sea ice and traversing open water leads in search of food, primarily seal. They then become particularly susceptible to under-ice spills and the effects of "herding" of oil by wind and ice action, as well as to oil spreading on top of the ice. The possibility of ingesting oil fractions is real because ringed seals, their main food source, may accumulate petroleum hydrocarbons. As a major predator of seals, the polar bear may ingest bioaccumulated petroleum hydrocarbons in the event of an arctic oil spill. Because polar bears will eat ringed seals contaminated by oil, the impact of oiling may spread through the movement of oiled seals. Engelhardt (1981) found that bears showed no aversion to oil, and once oiled, would actively groom to eliminate oil in coated fur. They also would lick oil from cage walls. Amstrup et al. (1989) document a polar bear death after it ingested toxic antifreeze.

FWS 15

During the spring, bears are frequently distributed adjacent to the lead systems which support a higher density of ringed seals. Additionally, shore-fast habitats which afford more secure seal pupping habitat are intensively hunted by bears in search of food and during breeding season in May and June. The DEIS does little to evaluate the impact of an oil spill to polar bear in this zone during the spring period. Further, 200 miles of offshore trunk and lateral gathering pipelines and the effectiveness of leak or rupture proof operation is open to question. The proposed location of the main arterial trunk pipeline approximates the spring lead system. Are alternate locations possible which would allow a single subsea crossing of the lead or flaw zone? Information contained in II-15 indicates that installation would involve barges and that the normal operating period of 70 days could be extended through the use of ice-breakers. The effect of creating an artificial open water lead system in a portion of the migration pathway for marine mammal species is uncertain. Further, the effects to polar bears, seals and possibly walruses of an alternate approach of laying pipe from the shorefast ice during the winter is not known. Additional concerns for the integrity of the pipeline within this zone come from the following DEIS statement: "To protect the pipe from collisions with drifting ice masses, the pipeline is assumed to be laid in a trench cut into the sea floor. Pipeline placement below the level of ice gouging would be required in the areas where ice gouging could occur. If the trench were laid in unconsolidated sediments of the seafloor where ice scouring is evident, the pipeline might have to be covered with fill material. In areas where the sediment layer is thin or absent, the trench might have to be cut into the bedrock; a pipeline laid in a bedrock trench might not have to be covered." The Service believes it may be prudent to move the pipeline from areas of active ice scouring and to consider an alternate offshore route for the trunk line.

Denning of polar bears has been verified in the vicinity of Wainwright, Icy Cape and Point Lay. Because of an inadequate understanding of polar bear denning in northwestern Alaska, further evaluation is necessary to determine the magnitude and extent of denning in this area.

Although scenarios of activities associated with development and production (II-12) are "highly speculative," they warrant response. Support and logistic activities raise numerous concerns for the welfare of polar bear in the Peard Bay, Point Franklin, Icy Cape and areas between Wainwright and Point Belcher. On shore developments including roads from Wainwright to Point Belcher, potential dredging of Peard Bay and alternate airfield development at Icy Cape or Cape Beaufort pose a high probability of impacting polar bear to various degrees depending upon which development or combination of developments are actually pursued.

FWS 15

The document's projected impact of aircraft disturbance to walruses and polar bears presumes a greater understanding of the situation than is practical given the amount of published information on the topic. The number of helicopter flights alone is cause for concern. Between the year 2000 and 2004 a total of 9,630 helicopter flights to 214 production and service wells, .5 trip per well per day, are anticipated. Flights for the year 2002 to 2020 are estimated to average about 2 per week per platform and total 11,856 flights.

A greater discussion of the persistence of crude oil products in the arctic environment and latent effects on polar bear and their prey species is warranted. Also a discussion of the effects to lower level food chain organisms should be expanded II-17. A detailed description of the rationale for the following statement should be included. "Those organisms that inhabit nearshore, shallow environments are more at hazard from oil spills; however, the oil-spill-risk analysis does not show appreciable inshore areas as being contacted by oil spills." Near shore areas parallel the main subsea trunk pipeline. Therefore, any spill or leak from this pipeline structure would appear to place near shore areas at risk to oiling. Likewise, a spill during the spring would occur in the spring lead system. Walrus are dependent upon bivalve clams for food. Even though clams are distributed over the Chukchi Sea their population status is not certain. Some evidence indicates that walrus populations may be experiencing shortages in food prey and are undergoing stress as a result. If information is available on the status and trend of bivalve populations in the Chukchi Sea, it would be helpful to incorporate reference materials.

Walrus are gregarious and may be found in a clumped distribution seasonally. Since populations occurring within the area may be clumped, any local impact to prey species could have a substantial impact upon animals. Of particular concern are the reproductive females. The ingestion of oil contaminated clams by walrus should be discussed and any studies of the effects of oil ingestion incorporated by reference. FWS 15

The projected level of impact to pinnipeds and polar bears should be reconsidered.

Page II-31, paragraph 5 [High Case] comments from low and base cases apply FWS 16

Correspondingly higher levels of activities associated with exploration, development and transportation are cause to reconsider the projected level of impact.

Page II-57: ITL No. 1--Information on Bird and Marine Mammal Protection: Differences in the conditions contained within NTL No. 89-1 and this section should be explained. More protective conditions of NTL No. 89-1 should be incorporated within ITL No. 1. FWS 17

Page III-21, paragraph 2: This discussion of existing fisheries information available for the Chukchi Sea points out that the very limited fisheries data are based only on a few brief reconnaissance surveys. Similar points could be made related to the limited number of migratory bird and marine mammal studies of the Chukchi Sea area. The Service is concerned that inadequate baseline biological resource information for the Chukchi area will continue to hamper resource agency assessments of potential impacts resulting from offshore exploratory drilling and production.

In the absence of resource data specific to the Chukchi area, the document extrapolates resource information from areas in the Beaufort Sea and the Bering Sea areas. The Service believes that long-term studies of fish, birds, and marine mammals are needed in the Chukchi Sea, particularly in light of the fact that exploratory drilling is currently underway in these areas.

We appreciate the opportunity to comment on this draft document.

Attachments

Walt Stieglitz

REFERENCES

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FAIRBANKS FISH AND WILDLIFE ENHANCEMENT OFFICE
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Room 222, Federal Building, Box 20
101 12th Avenue
Fairbanks, Alaska 99701-6267
May 7, 1987

Regional Director
Minerals Management Service, Alaska Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302
Attention: Laura Yoesting

Re: Chukchi Sea Lease Sale 109

Dear Ms. Yoesting:

We appreciate the opportunity to review the Draft Environmental Impact Statement (DEIS) for the proposed 1988 Outer Continental Shelf Oil and Gas Lease Sale 109, Chukchi Sea. Unfortunately, due to funding and personnel limitations, we can only offer a cursory review of this document at this time.

We would like to call your attention to some inaccuracies and omissions, particularly in the cumulative effects assessment. The proposed State of Alaska Lease Sales, as depicted in Graphic 3, are inaccurate according to the State's current 5-year lease sale plan. We have previously called your attention to these inaccuracies in our comments on the DEIS for Beaufort Sea Sale 97. Also, since Beaufort Sea Sale 97 is being considered almost concurrently with Chukchi Sea Sale 109, the proposed pipeline routes and transportation corridors for Beaufort Sea Sale 97 should be included in the cumulative impacts assessment for the Chukchi Sea Sale, and their locations should be depicted on Graphic 3. The potential combined cumulative effects of both lease sales should be considered since they will be offered in the same year and in the same region.

In addition, we note that the Beaufort Sea Sale 97 DEIS discussed a proposed pipeline from Pt. Belcher across the southern portion of National Petroleum Reserve - Alaska (NPR-A) to the Trans-Alaska Pipeline (TAPS) Pump Station 3, while the Chukchi Sea Sale 109 DEIS proposes a pipeline from Pt. Belcher to the TAPS Pump Station 2. It seems unlikely that two different pipeline routes would be needed from Pt. Belcher to the TAPS. However, if separate pipelines are proposed, the two route locations should be depicted on Graphic 3 and the cumulative effects of the two pipelines should be discussed. In any case, the Chukchi Sea DEIS is deficient in its discussion of the environmental effects resulting from the construction of the 640 km pipeline and associated roads, support camps, and gravel sources. As stated in our comments on the Beaufort Sea Sale 97 DEIS, it is probably unrealistic to assume that this road would remain permanently closed to the public. Significant secondary impacts to fish and wildlife resources are likely to occur from opening the road to the public.

The overall impact assessment approach used in this DEIS, as well as in previous DEIS's for OCS oil and gas lease sales, can be misleading in that potential "MAJOR" impacts are apparently diluted by being averaged over a large area, or with other lesser effects. For example, the DEIS mentions several "MAJOR" potential effects on the regional populations of various bird species (murres, auklets, snow geese, brant) in the cumulative effects analysis (pp. IV-B-46 to 49), yet the conclusion states that the cumulative effects will be "MODERATE".

We appreciate the opportunity to review this DEIS, and regret that we are unable to give this document the full review it deserves at this time. We look forward to future opportunities to provide suggestions and input on this proposed lease sale. If you have any questions regarding our comments, please contact Kate Moitoret at 456-0209.

Sincerely,

Tony Booth
Acting Field Supervisor

cc: Director, MMS, Washington, D.C.
Ron Lambertson, Assistant Director, FWS-FWE, Washington, D.C.
Peter Escherich, Branch of Env. Coord., FWS, Washington, D.C.
Paul Gates, DOI Reg. Environmental Officer, Anchorage
Ron Morris, NMFS, Anchorage
Rich Sumner, EPA, Anchorage
John Warren, DO&G, Anchorage
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Patty Wightman, DGC, Fairbanks
Al Ott, ADF&G, Fairbanks
Larry Dietrick, ADEC, Fairbanks
Bob Cannon, ADLWM, Fairbanks

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Fairbanks, Alaska 99701-6267
May 27, 1987

Regional Director
Minerals Management Service, Alaska Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302
Attention: Laura Yoesting

Re: Chukchi Sea Lease Sale 109

Dear Ms. Yoesting:

In a letter dated May 7, 1987, we submitted comments on the Draft Environmental Impact Statement (DEIS) for the proposed 1988 Outer Continental Shelf Oil and Gas Lease Sale 109, Chukchi Sea. Since then, we have been apprised of additional information that may warrant inclusion in the DEIS and consideration in proposed leasing activities.

The proposed Chukchi Sea Lease Sale 109 is adjacent to several units of the Alaska Maritime National Wildlife Refuge, which contain important nesting and staging areas for several species of migratory birds. The attached map shows the locations of these units at Cape Thompson and Cape Lisburne, and on the barrier islands at Kasegaluk Lagoon, Icy Cape, and Peard Bay. Although the DEIS identifies major seabird colonies, waterfowl and shorebird feeding, staging, and molting areas at these locations, it does not mention that these areas are portions of the Alaska Maritime NWR. Inclusion of a map with this information in the EIS would be appropriate, since these are areas of national interest which could potentially be affected by the Lease Sale. The EIS should discuss the potential effects of the proposed dredging, road, and barge facilities at Peard Bay (p. II-7, last paragraph) on the adjacent National Wildlife Refuge unit at Point Franklin.

More detailed maps of the Alaska Maritime National Wildlife Refuge are in preparation, and may be obtained from the Refuge Manager, 202 West Pioneer Avenue, Homer, Alaska 99603; telephone: 235-6546. Thank you for considering these additional comments in your EIS preparation.

Sincerely,

Paul E. Gertler
Field Supervisor

cc: Director, MMS, Washington, D.C.
Ron Lambertson, Assistant Director, FWS-FWE, Washington, D.C.
Peter Eecherich, Branch of Env. Coord., FWS, Washington, D.C.
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Copy For Your Information

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

IN REPLY REFER TO:
DOS

MAR 2 1989

Memorandum

To: Regional Director, Minerals Management Service
Alaska OCS Region

From: Acting Regional Director
Region 7

Subject: Call for Information and Notice of Intent to Prepare an Environmental Impact Statement, Outer Continental Shelf Sale 126, Chukchi Sea

The Fish and Wildlife Service (Service) has reviewed the referenced Call and Notice for the Outer Continental Shelf Oil and Gas Lease Sale 126 - Chukchi Sea, which is expected to be held in May of 1991. The proposed lease sale covers 29.5 million acres between 3-240 miles offshore from Peard Bay southwest to Cape Thompson. We have previously commented on environmental documents prepared for proposed Lease Sales 85 and 109, also in areas of the Chukchi Sea. Many of the topics addressed in those comments represent concerns on which the Service will focus during review of the Draft Environmental Impact Statement for Lease Sale 126. These concerns include:

- The environmental effects of Outer Continental Shelf development and production scenarios that include the following features:
  - anticipated pipeline landfills (e.g., causeways or other structures at tidewater) and utility corridors within units of the Alaska Maritime National Wildlife Refuge at Cape Thompson, Cape Lisburne, and the barrier islands at Kasegaluk Lagoon, Icy Cape, and Peard Bay, as well as elsewhere along the Chukchi Sea coast;
  - expected port and oil transshipment facility requirements, with emphasis on the possible use of lagoons; and
  - potential combined effects of Outer Continental Shelf activities and other existing and future onshore and offshore oil and gas developments.

- The analysis of potential nearshore and onshore effects of Outer Continental Shelf development, with special attention to:
  - migratory birds (waterfowl, sea birds, and shorebirds) and their use of river deltas, coastal barrier islands, and other coastal habitats such as salt marshes;
  - anadromous fish stocks, particularly around principal river deltas and lagoons;
  - cumulative impacts of multiple facilities on fisheries, birds, marine mammals, caribou, musk ox, and subsistence use of these species; and
  - cumulative effects on fresh and marine water quality and aquatic food webs from various industrial activities, including chronic discharges of petroleum products, drilling effluents, and water treatment chemicals.

- The effects of increased air traffic over coastal areas during the exploration phase and the selection of staging sites for activities in the planning area.

- The consideration of tract deletion immediately seaward of environmentally sensitive areas, including:
  - Icy Cape to eastern limit of the planning area; and
  - Point Hope to Cape Beaufort.

In general, our greatest concern lies with the long-term cumulative effects of offshore development and production on the water, fish, and wildlife resources of the Chukchi Sea region, and how Outer Continental Shelf activities are likely to promote or intensify similar development affecting the biologically productive coastal zone.

We appreciate the opportunity to respond to the subject Call for Information, and will provide more detailed comments on the forthcoming Draft Environmental Impact Statement.

cc: Chief, Offshore Leasing
Minerals Management Service
Washington, D.C.

Fish and Wildlife Service

Response FWS-1

As analyzed, oil spills would be the major agent with potential to affect anadromous fish species in the nearshore zone and then only during the short, ice-free season. Oil-spill-risk probabilities, however, estimate oil spills to be most limited in number and volume and not to contact large, nearshore areas in any significant number over time. It is not anticipated that an oil spill during winter, some distance offshore, might reach overwintering or nearshore areas. An offshore-pipeline break could not affect any large area of fish habitat or its fish populations during winter or summer since; such spills are also of very small volume and very limited in number.

Response FWS-2

To the extent possible, potential sources of effects on marine mammals have been discussed with regard to season of most likely occurrence. The analysis of potential effects on the polar bear was made with regard to probable densities expected in the sale area, in turn based upon available data and conversations with FWS personnel. The analysis of potential effects of activities associated with this sale on walrus is valid within the framework of information available concerning their temporal and spatial distribution and abundance. For most Alaskan species, detailed information for much of the annual cycle period is fragmentary and specific knowledge of their vulnerability to oiling or activities associated with development is lacking; thus, conclusions regarding potential effects are to some extent likely to be speculative. The text of Section IV.C.6 has been revised to incorporate the findings of Brueggeman et al. (1990). Oil-spill scenarios for spring and fall periods are not subject to greater resolution than presented in the document because the oil-spill model used in this analysis does not separate contact-probability values for these periods from those for winter and summer, respectively.

Response FWS-3

A statement concerning mitigation of potential effects on polar bears and walrus by cleaning and rehabilitation does not appear in the document. Such actions, if pursued, while initially the responsibility of individual operators, would be carried out under the guidance of the appropriate regulatory agencies (e.g., FWS in this case) and under the overall authority of the U.S. Coast Guard. Unless proposed as a potential mitigating measure, this topic would be most appropriately covered in plans developed by the Natural Resource Trustees or Regional Response Team under the Oil Pollution Act of 1990. Since activities associated with oil-spill containment and cleanup could disturb portions of pinniped and polar bear populations in this area, the text of Section IV.C.6 has been revised to include this point.

Response FWS-4

The text of Sections IV.C.6 and IV.H.2.b(3) has been revised to address the concern for vulnerability of polar bear aggregations.

Response FWS-5

No attempt was made to de-emphasize potential effects of disturbance on walrus, but effects are likely to be rather localized and therefore not to affect a significant proportion of the population. The observations of Brueggeman et al. (1990) have been incorporated into Section IV.C.6.

Response FWS-6

Possible alternative sites for a landfall for the subsea-pipeline system most likely will be considered when a developmental EIS is prepared. Under these conditions, the locations of offshore production sites will be known, and specific alternative configurations for bringing product to shore (or to an offshore loading facility) will be investigated. For this prelease EIS, the Point Belcher site was chosen because it represented a reasonable location, for analysis purposes, where such a landfall might occur. The Point Belcher landfall site was also used in the Chukchi Sea Sale 109 EIS.

Response FWS-7

The incidental-take provisions of the MMPA are discussed in the EIS, and additional or lengthy discussions are not necessary for the purposes of NEPA compliance. The technical publication, "Legal Mandates, Authorities, and Federal Regulatory Responsibilities," (Rathbun, 1986) referenced in Section I.C generally discusses the provisions of the MMPA. Readers of the technical publication are directed to the MMPA for specific provisions. Also, the text of ITL No. 1 on Bird and Marine Mammal Protection discusses the specific provisions of the MMPA concerning incidental taking of marine mammals and references FWS' and NMFS' implementing regulations.

Response FWS-8

The MMS has funded research concerned with "Delineation, Faunal Composition, and Repeated Use of Benthic Feeding Areas by Walrus and Endangered Gray Whales in the Northeastern Chukchi Sea." In Fiscal Year 1991, the MMS will fund the first year of a study concerning "Development of Guidelines for OCS Operations in Polar Bear Habitats." In addition, the MMS currently is conducting a study on the "Use of Kasegaluk Lagoon by Marine Mammals and Birds" that, while not specifically targeting polar bears or walrus, will record seasonal distribution and abundance of these species as they occur. It is anticipated that this study will document critical marine mammal and bird use areas in this important lagoon system. Shell Western E & P Inc. recently contracted a walrus-monitoring program during its exploration activity on three Chukchi Sea prospects (Brueggeman et al., 1990).

Response FWS-9

A new stipulation or revision of an existing potential stipulation with regard to any unavoidable killing of polar bears is not necessary to protect polar bears, which already are protected from excessive takes or human-induced mortality under the MMPA. Concerns about harassment and taking also are covered under Stipulation No. 3, the Orientation Program, and under ITL No. 3, Information on Bird and Marine Mammal Protection. All of the measures under the Polar Bear Interaction Plan are covered under existing OCS regulations or would be covered under FWS review of OCS exploration and development plans. For example, existing regulations prohibit the dumping of garbage that would attract bears; and the organization and layout of buildings and work areas are confined to the offshore drill platform or gravel island, thus minimizing the chance of bear/human interactions.

The MMS agrees it is important that lessee activities not affect polar bears. It is MMS' understanding that Letters of Authorization (LOA's) are required for unintentional take of polar bear and that the LOA can or would further identify lessees' obligations or requirements to prevent disturbance to polar bears. Avoidance plans would not alleviate lessees from the responsibility of obtaining LOA's. The MMS will provide Exploration Plans to the FWS and will coordinate with FWS on LOA's and their requirements, eliminating the need for MMS to require separate plans.

Response FWS-10

No response is necessary.

Response FWS-11

The purpose of the seasonal drilling restriction (SDR) was to protect whales from what were at that time the unknown effects of an oil spill associated with activities (fall and spring) permitted by the MMS. Since that time, studies to date have shown that both crude oil and industrial noise are likely to have only local, short-term effects on some cetaceans (Richardson et al., 1985, 1990; Malme et al., 1983, 1984, 1985, 1986; Ljungblad et al., 1985; Wartzok et al., 1989). Due to heavy ice, exploratory operations are not likely to occur when cetaceans are present in the spring-lead system. Consultation with NMFS will be reinitiated if and when development and production is contemplated. Therefore, the continuation of the SDR is unnecessary. Nevertheless, in the interest of obtaining further effects-related information, a bowhead whale-monitoring stipulation was developed.

The 22 blocks lying within Deferral Alternative IV that were leased as part of Sale 109 are not a part of Deferral Alternative IV and are not subject to lease under Sale 126. The mitigating measures designed to protect endangered whales will continue to apply to the 22 blocks leased under Sale 109.

Response FWS-12

The paragraph cited contains a generalized introduction to the scenarios for the low, base, and high cases for Alternative I and the scenario for Alternative IV. The scenarios are described in detail in Section II.B.1.a for the low case, Section II.B.2.a for the base case, Section II.B.3.a for the high case, and Section II.E.1 for Alternative IV.

Response FWS-13

Exploratory drilling is not ongoing, as suggested by the commenter. A basic assumption for effect-assessment purposes is that exploration will take place only during open-water periods, as indicated in Section II.B.1.a (the reference cited by the commenter). In 1990, exploratory drilling as a result of Sale 109 terminated in the Chukchi Sea in mid-October.

Response FWS-14

It should be noted that the low case is discussed in Section IV.B; Section II, to which this comment refers, contains only summaries of the several cases and thus omits the more detailed discussion in Section IV. Because the resource estimate for the low case falls below that required for recovery with current technology and economics, potential effects of development and production are not considered. Should recoverable resources be discovered, potential effects of these phases are expected to be as discussed under the base case. Exploration activities are expected to take place primarily during the open-water season. However, some activities could take place when ice and ice habitats are present in early summer or fall; hence, the possibility of some vessel/marine mammal interaction is possible, although it is not anticipated that activities would occur sufficiently early to involve larger numbers of mammals migrating in the major eastern Chukchi spring-lead system. The proportion of the polar bear population that may occur either individually on pack ice or on isolated ice floes drifting into the vicinity of exploration activities and experience lethal effects is not likely to be significant. The reference in this comment (Brueggeman et al., 1990) has been added to Section IV.C.6.

Response FWS-15

It should be noted that the base case is discussed in Section IV.C; Section II, to which this comment refers, contains only summaries of the several cases and thus omits the more detailed discussion in Section IV. Section IV.C.6 has been revised to address several of the site-specific concerns expressed in this comment. It is evident that much information concerning various aspects of the polar bear annual cycle remain to be collected; such studies would be most appropriately carried out by the FWS within its ongoing polar bear research program. Regarding the concern for pipeline locations (e.g., Fig. IV-A-8), these locations are strictly hypothetical for purposes of discussing potential effects. If development occurs, a developmental EIS as well as a development plan will show planned pipeline locations; and the FWS will have ample opportunity to comment on both of these documents. Regarding potential indirect effects of locally decreased prey availability on walrus, or those effects that might occur as a result of ingestion of polluted prey, no substantiating evidence is cited to support the contention stated in the comment.

Response FWS-16

It should be noted that the high case is discussed in Section IV.D; Section II, to which this comment refers, contains only summaries of the several cases and thus omits the more detailed discussion in Section IV.

Response FWS-17

The differences in ITL No. 1 and NTL No. 89-1 are: (1) Information to Lessees (ITL's) are designed to either (a) state MMS policy and practices that are carried out and enforced, (b) inform lessees about special concerns in or near the lease area, or (c) advise or inform lessees of the existing legal requirements of MMS and other Federal agencies; and (2) Notice to Lessees (NTL's) are prepared for lessees and operators of Federal oil and gas leases in specific a OCS area. The NTL's are prepared to advise lessees and operators of changes made to requirements because of changing conditions or changes brought about by judicial proceedings. The NTL's are also used to provide clarification of the regulations. Therefore, the provisions of NTL 89-1 would apply to all lease activities resulting from this sale, and no additional protective language needs to be added to ITL No. 1.

United States Department of the Interior

NATIONAL PARK SERVICE
P.O. BOX 37127
WASHINGTON, D.C. 20013-7127

IN REPLY REFER TO
L7617(774)
DES 90/0019

SEP 18 1990

Mr. George H. Allen
EIS Coordinator
Minerals Management Service
Alaska OCS Region
949 East 36th
Anchorage, Alaska 99508-4302

Dear Mr. Allen:

The National Park Service (NPS) reviewed the draft environmental impact statement (DEIS) on proposed lease sale 126, Chukchi Sea. We fully appreciate acknowledgement of important archaeological resource concerns in Cape Krusenstern National Monument and Bering Land Bridge National Preserve. Nevertheless, as we expressed in our scoping letter of February 1989 (enclosed), our concerns also encompass the relatively pristine and extensive coastal resources of the areas. Of additional note, Bering Land Bridge National Preserve is included in a current joint U.S.-U.S.S.R. effort to create an international park that would also include a portion of the Chokotskiy Peninsula.

As currently presented in the DEIS, we are unable to find conditional or cumulative probabilities for oil spill contact on the Land Segments of direct interest to us, Land Segments 1-5 and 9-10. Nevertheless, it is noted in appendix IV-J-14 and 15 that a large spill would be likely to move outside of the sale area to the beach area of Cape Krusenstern. The Bering Land Bridge National Preserve on the Seward Peninsula also has a high likelihood that oil would damage the beach.

We think that the two national park areas, as well as the international project, should be described as environmentally sensitive or special areas within the affected environment of proposed lease sale 126. Moreover, we think it is necessary to have further discussion and analysis of the oil spill contact potential as alluded to in Appendix IV. Response capabilities south of Point Hope in the event of the migration of a major spill into the area of the park units should also be discussed. NPS 1

The National Park Service is willing to work with the Minerals Management Service (MMS) to ensure that appropriate information regarding the park units is integrated into appropriate stipulations, such as stipulation 2 for the identification of special areas or populations of biological concern, stipulation 3 for orientation, stipulation 4 on the transport of hydrocarbons, and in the Information to Lessees (ITLs), such as numbers 1,2, and 8. Please contact NPS Alaska Regional Director Boyd Evison for further coordination of this effort at 907-257-2690. NPS 2

We have the following specific comments and concerns regarding the treatment of cultural resources in the DEIS:

1. MMS's responsibilities under the National Historic Preservation Act (NHPA), as amended, should be acknowledged and cited (Section 106 and 36 CFR 800). NPS 3

2. In appendix G the potential for the occurrence of archaeological resources in the sale 126 area is cited as being low to moderate. Nevertheless, the report that is part of stipulation 1 (page II-6) should be prepared for tracts where archaeological and historic resources may exist. NPS 4

3. Ipiutak Site National Historic Landmark at Point Hope and Birnick Site National Historic Landmark at Barrow should be part of the discussion of onshore archaeological resources (III-66). National Historic Landmarks should also be identified in Figures III C-18 and III C-19. NPS 5

4. Side scan sonar or other remote sensing data collected for the sale 126 area should be interpreted by a qualified archaeologist. The data could show offshore locations of shipwrecks, aircraft or topographic features with archaeological potential. NPS 6

5. The potential for effects on archaeological resources (pages IV-B-26, IV-C-91, IV-D-42, and IV-H-17) assumes that submerged cultural resources have been destroyed by ice gouging and other marine processes. The maximum depth of ice gouging is two meters. Sites buried beneath that depth, such a s aircraft, shipwrecks, deeply stratified archaeological sites, caves, or similar features, should be intact. NPS 7

6. On page IV-B-28 it is stated that "Personnel and equipment transported over archaeological sites during clean-up training runs could cause low effects on archaeological sites in land OSRA Land Segments 14-24...." This determination needs to be fully discussed by indicating the number of personnel, types of equipment and the nature of the training runs. The locations of training runs should have the prior approval of the State Historic Preservation Officer. NPS 8

We appreciate this opportunity to comment. Please contact Kheryn Klubnikin, Environmental Quality Division if you need more information or assistance regarding our comments and concerns. She can be reached at FTS 268-5126 or 907-208-5126.

Sincerely,

Jacob Hoogland

for Denis P. Galvin
Associate Director
Planning and Development

Enclosure

National Park Service

Response NPS-1

The conditional probabilities for oil spill contact and the combined probabilities for oil-spill occurrence and contact are <0.5 percent for Land Segments 1 through 5, 9, and 10. The OSRA numbers in Section IV.J.13 are incorrectly cited and the text has been modified to include the correct numbers. The note on Tables C-4, C-5, C-6, C-10, C-11, C-12, C-14, C-15, C-18, C-19 has been modified to read: "All land/boundary segments having rows with all values <0.5 percent are not shown." Figures IV-A-4 and IV-A-5 have been modified to include the same note. Response capability south of Point Hope is discussed in Appendix L.

Response NPS-2

The MMS contacted NPS to discuss any missing appropriate information. The discussion included potential MMS mitigating measures for Sale 126 and existing NPS concerns over the identification of special-interest areas and their locations in reference to the sale area. The MMS appreciates the concern and interest of NPS and will ensure that they are contacted at the Call for Information step in the OCS leasing process to identify all potential areas of special interest.

Response NPS-3

The MMS Archaeological Resource Protection Program is conducted under the authority of several laws and regulatons, including the National Historic Preservation Act (NHPA), as amended (16 U.S.C. 470 et seq.). This authority is cited in Appendix G of this EIS.

Response NPS-4

The text of Appendix G has been revised to include a list of those blocks on which the archaeological stipulation will be invoked for both prehistoric and historic resources.

Response NPS-5

The text of Section III.C.4 has been revised to address this concern.

Response NPS-6

Review of the sidescan-sonar data, acquired through the geohazards survey, will be required by a qualified marine archaeologist in conjunction with a geophysicist in the event that the archaeological resources stipulation is invoked; and an archaeological report is required.

Response NPS-7

Most of the overlying sediments average 2 to 4 m in thickness. There are some areas north of Point Franklin and northwest of Icy Cape that are 10 to 12 m thick (thick enough to protect a shipwreck from 2-m-deep ice gouging). However, these areas are offshore beyond the 3-mile zone where, at most, two or three shipwrecks have been known to occur. Therefore, the possibility that shipwrecks are in that area of 10- to 12-m sediments is low. All of the other shipwrecks are within 3 miles of shore and onshore. The sediment level in nearshore areas is approximately 2 m. Here, the sediment thicknesses could not protect shipwrecks from ice gouging, and it is likely that shipwrecks or other cultural resources have been destroyed by ice gouging and other marine processes. In those areas of 10- to 12-m sediment thickness there could be prehistoric resources; the text in Sections IV.B.13, IV.C.13, and IV.D.13 has been revised to incorporate this possibility. Section IV.H.1.i of the cumulative case was not revised because activities other than OCS are summarized and refer generally to all cultural resources; thus, specific locations that do not contribute significantly to the overall cumulative effects, such as the two places of 10- to 12-m sediments, are not mentioned in detail.

Response NPS-8

There is no certainty that cleanup training will be undertaken. The MMS can only estimate the number of personnel and types of equipment involved based on cleanup of past spills and can only speculate on the nature of the training. Training locations will depend on decisions by multiple agencies (including the State Historic Preservation Officer) and involved oil industry. The assumption that OSRA Land Segments 14 through 24 would be affected means only that training could be done in the vicinity of lease-sale-area shores. Training could just as well be done elsewhere in a location similar to the Chukchi Sea shore. Such location would have to be selected by the above-mentioned parties. Therefore, it is not practical to discuss details in this EIS.

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle WA 98101
Alaska
Idaho
Oregon
Washington

Pa/4

EPA

REPLY TO ATTN OF: WD-136

SEP 04 1990

RECEIVED

SEP 10 1990

REGIONAL DIRECTOR, ALASKA
Minerals Management Service
ANCHORAGE, ALASKA

Barry Williamson, Director
Minerals Management Service
Department of Interior
Washington, D.C. 20240

Dear Mr. Williamson:

The Environmental Protection Agency (EPA) has reviewed the draft environmental impact statement (EIS) for the **Alaska Outer Continental Shelf (OCS) Chukchi Sea Oil and Gas Lease Sale 126**. Our review was conducted in accordance with the National Environmental Policy Act (NEPA) and our responsibilities under Section 309 of the Clean Air Act.

EPA requested to be a cooperating agency in the preparation of the EIS. EPA and the Minerals Management Service (MMS) have agreed that EPA's role as a cooperating agency would involve the preparation of an appendix for the EIS dealing with the fate and effects of deliberate exploratory phase oil and gas drilling discharges. In anticipation of the promulgation of new source performance standards (NSPS), EPA requested to be a cooperating agency because we will have a NEPA compliance responsibility for any new source National Pollutant Discharge Elimination System (NPDES) permits issued for oil and gas drilling discharges in accordance with Section 511(c)(1) of the Clean Water Act (CWA).

This Section of the CWA indicates that EPA must comply with NEPA when issuing an NPDES permit for the discharge of any pollutant by a new source. Final promulgation of effluent guidelines and NSPS for the Offshore Subcategory of the Oil and Gas Extraction Point Source Category are expected by the 1991 lease sale date. The NPDES permit that EPA Region 10 will develop for this particular lease sale will regulate sources that are subject to the NSPS. As a cooperating agency, EPA plans to adopt the final EIS for this sale to meet our NEPA compliance responsibility for our NPDES permit. This should prevent a duplication of effort by EPA and MMS and prevent undue delays in the issuance of our NPDES permit relative to this lease sale.

This draft EIS presents a comprehensive evaluation of the potential effects that could result from this lease sale. Overall, the draft EIS reflects the current state of knowledge about the physical, chemical, and biological characteristics of the Chukchi Sea planning basin. However, we have several concerns that are summarized in the paragraphs that follow. These concerns are fully described in the enclosed detailed review comments. We are providing these comments in an effort to improve the information presented in the draft EIS and to clarify issues that are important for making decisions on the leasing options for the proposed lease sale.

EPA continues to be concerned that the proposed action does not incorporate the protective stipulations described in the draft EIS. We object to the proposed leasing without inclusion of protective environmental stipulations until after the EIS process is complete. MMS concludes that the proposed stipulations do not represent meaningful mitigation. The majority of the stipulations provide no means of reducing the potential adverse effects. Many of the proposed stipulations and Information to Lessees (ITLs) presented in the draft EIS have been included in a number of past Alaska OCS lease sales. The discussions of the effectiveness of these stipulations in mitigating adverse effects could be improved if they provided a historical perspective on how well these mitigating measures have actually performed in the past. EPA 1

Additional explanation of how MMS analyzes the effects from the various activities associated with this lease sale is needed. Some species found in the Chukchi Sea could encounter a combination of lease sale activities or repeatedly encounter the same activity, which represents a variation on cumulative effects. The definition for cumulative impacts indicates there is an additive component to the evaluation process. An explanation of how MMS incorporates this additive process for assessing effects would provide useful information. EPA 2

With regard to the selection of a preferred alternative, EPA strongly supports selection of Alternative IV - Point Lay Deferral Alternative. This alternative provides protection to marine mammal habitat (migratory pathways), "additional protection for important coastal habitats, and an additional protective buffer for offshore subsistence-harvest areas". This deferral alternative provides localized protection to endangered whale migration paths and feeding areas.

Among the leasing alternatives, Alternative IV is the environmentally preferable alternative since, on a relative basis, it minimizes the adverse effects from oil and gas activities. In our scoping comments for Lease Sale 109 in the Chukchi Sea, EPA requested that the sensitive habitats protected by this alternative should be considered for deferral. Deferral of the 501 blocks in this alternative does not reduce the probability of finding hydrocarbon resources in the remainder of the sale area and deferring the blocks does not reduce MMS estimates of hydrocarbon resources for the sale area.

In conclusion, the draft EIS has identified environmental consequences associated with the proposed action. We believe that adverse effects could be reduced by implementation of the Point Lay deferral alternative in conjunction with implementation of appropriate mitigation. Due to uncertainty about whether stipulations will be included in the sale, uncertainty about the effectiveness of mitigating stipulations, and the potential long-term disturbance effects on endangered bowhead whales if leasing occurs anywhere in the spring migration area, we are rating the proposed action EO-2 (Environmental Objections-Insufficient Information). The insufficient information rating is based on the need for additional information or clarification about; the effectiveness of stipulations to lessen impacts, oil transportation assumptions, wetland impacts, the analysis of effects to endangered bowhead whales, and how the analysis adds the effects from exposure to several effect producing activities.

Thank you for the opportunity to review this draft EIS. If you have any questions about these comments, you may contact Sally Brough, in the Environmental Review Section at FTS 399-4012.

Sincerely,

Robert S. Burd

Robert S. Burd
Director, Water Division

Enclosure

cc: MMS Alaska OCS Region

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHUKCHI SEA OIL AND GAS LEASE SALE 126
DRAFT ENVIRONMENTAL IMPACT STATEMENT
DETAILED REVIEW COMMENTS

Introduction

As noted in our letter we have a number of concerns about the proposed action. We offer the following comments in an effort to develop a project with a minimum of delay and environmental harm. Some of the issues that we are commenting on in these detailed review comments we also included in our comments on the draft EISs for the Beaufort Sea Lease Sale 124 and the Navarin Basin Lease Sale 107. Since we have not had an opportunity to see the responses to our Sale 124 and Sale 107 comments, we are restating the issues that are common to this draft EIS and the Sale 124 and Sale 107 draft EISs.

Our objections with the proposed action are focused on the selection of a preferred alternative, clarification on the effectiveness of many stipulations and Information to Lessees (ITLs), the lack of commitment to environmentally protective stipulations, effects on wetlands, the potential need for causeways, and the combined effects of activities associated with this lease sale. Our concerns are outlined below.

Stipulations

The draft EIS presents and discusses several lease sale stipulations that are designed to mitigate potential adverse environmental consequences. The draft EIS states that the decision to include any or all of these mitigation measures will be made at the final Notice of Sale stage in the overall leasing process. The Notice of Sale occurs several steps after the final EIS has been reviewed. Thus, uncertainty exists about whether mitigation measures will be included in the proposed action. Our major concern regarding the stipulations is that unrestricted leasing could occur in biologically sensitive offshore habitats. Many of these sensitive habitats could be protected either through deletion (deferral) of those areas from the sale or through the inclusion of protective stipulations in the terms of the leases. The deferral and mitigation decisions will not be made during this EIS process for this lease sale.

EPA 3

The concept behind mitigation is to make the effects resulting from the proposed action less severe or intense. We are concerned that of the eight mitigating stipulations proposed for inclusion in the terms of the lease sale, the effectiveness of six of the stipulations would: "not likely change the overall effect levels", "would be minimally effective", "would not be expected to reduce the effects, or "would reduce effects somewhat but not enough to change the levels of effects" without mitigation. We are concerned that the MMS decision process does not provide a commitment to mitigation until after the EIS process is completed. We are also concerned that if the Secretary decides to include all of the stipulations in the terms of the lease sale, the stipulations do not represent true mitigation since according to the draft EIS they will not lessen the effects from the proposed action.

Many of the proposed stipulations have been included in past lease sales in the Beaufort Sea and Chukchi Sea planning areas. However, the discussion of the effectiveness of many of the stipulations does not provide a historical perspective for how well they have

EPA 4

worked in the past. Does a "track record" exist for stipulations that have been included in past lease sales, to use as a basis for the analysis of the effectiveness of these mitigating measures? For example, how effective has the Orientation Program been in making petroleum-industry personnel "aware of the unique environmental, social, and cultural values of local residents and their environment"? Has this stipulation resulted in the protection of environmental resources and cultural values? Has useful information about the effect of industrial noise on bowhead whales been gathered since the last Chukchi lease sale? Has this information been incorporated into this analysis of effects? How often is the mechanism provided by stipulation No. 2 been used to identify important or unique biological populations?

EPA 4

We suggest that Stipulation No. 5 should be extended to all blocks in the proposed sale area rather than only those in the spring lead migration pathway. This would provide useful information in several ways. It would increase the effectiveness of the stipulation. The purpose of the stipulation is to provide information about the extent of behavioral rsponses caused by exploratory operations. Observations from outside the spring lead system would provide information on the extent of the bowhead migratory corridor and movement of whales outside the lead system.

EPA 5

Transportation of Oil

The draft EIS states that the effects of causeways are not analyzed in this EIS because causeways are not part of the development and production scenario. The draft EIS assumes that oil will be brought to shore by pipeline rather than moving hydrocarbons by tanker. The draft EIS indicates that pipelines, used to bring oil to shore, must be specifically designed to withstand sea ice and other hazards. The draft EIS states that subsea permafrost " presents a set of engineering challenges to potential development" and that "the presence and distribution of subsea permafrost is largely unknown" in the area. Therefore, to suggest that causeways are not part of the development scenario, at least in shallow water where pipelines come ashore, may not be prudent. The final EIS should address the impacts of a causeway used to bring oil ashore.

The draft EIS assumption that subsea pipelines will be used to bring oil ashore is contrary to industry's assertion that the success of a subsea pipeline, especially in areas of unknown permafrost, is uncertain from both an operational and engineering perspective. Industry maintains that the cost involved in the construction of a subsea pipeline vs a causeway, severely cuts into the profit margin of a developing field. In addition, industry state that detection of leaks under ice and in open water, the ability to respond and mitigate environmental damage, and the cost of excavation and repair render subsea pipelines economically infeasible. Pile supported pipelines are viewed as having increased capitol costs for hardware and construction, operational and maintenance costs that would severely cut into the profit margin, and increased environmental risks from spills.

EPA 6

Based on EPA's experience on the north slope, we believe that the subsea pipeline assumption may be optimistic. The final EIS should present any new information regarding engineering feasibility and the cost of subsea pipelines that can account for using this assumption as a basis for the analysis of environmental consequences.

Endangered Species

We have several concerns about the analysis of effects on endangered bowhead whales. Our primary concern is the potential for long-term effects from noise and disturbance in the spring migration corridor. The Biological Opinion for Lease Sale 109 concluded that there are no effective mitigation measures currently available to avoid or minimize jeopardy to the bowhead whale population from year-round development and production activities in the spring lead system. Exploration activities are not likely to jeopardize the continued existence of the bowhead whale since they will occur after the spring migration. However, the leasing decision will determine where future development and production facilities will be located if a commercially producible field is discovered during exploration. Thus, the leasing decision, which determines where exploration and eventually development/production will occur, is important to the endangered bowhead whale population. EPA 7

The proposed stipulations offer no way to lessen the effects on bowhead whales. They do not provide a mechanism to effectively increase our understanding of the effects of noise and disturbance on the behavior of the whales. The effectiveness discussion for Stipulation No. 5 concludes that the stipulation will "be minimally effective in providing information on the interaction of the spring bowhead whale migration and offshore drilling operations and would not alter the effect of the proposal without the stipulation. EPA 8

Studies are referenced that indicate that industrial noise has only minor short-term effects on bowhead whales. Long-term effects could occur. Further, the analysis of noise effects is limited to open water conditions. No information is presented for ice cover. The acoustical environment with ice present would likely be different than when no ice is present. Since bowheads travel in and under ice during their spring and fall migrations their behavior and sensitivities to noise and disturbance could be different from open water conditions. EPA 9

Wetlands

The draft EIS does not evaluate the effects of the overland pipeline, associated access roads, and additional pumping facilities on wetlands. The draft EIS has no general discussion of the type of terrain that would be crossed by the pipeline before it connects with the Trans-Alaska Pipeline. If the EIS discusses the impacts of transportation of oil on caribou and land use classification, then it should also discuss the effects to special aquatic sites—wetlands. The discussion should include information on where and how the fill would be obtained. In light of the recent interest generated by the Memorandum of Agreement between the Corps of Engineers and EPA, wetlands are an important consideration. EPA 10

Conditional Probabilities

Past OCS lease sale EISs have stated that conditional probabilities are "useful in identifying those sites (launch points) that pose the highest risks to specific environmental resources if a spill occurs.". The conditional probabilities show that the launch points in the 200 meter isobath deferral area pose high risk to the biological resource areas along the shelfbreak and the St, Matthew Polynya. Were these conditional probabilities used to help EPA 11

determine the tracts to be leased or deferred and the stipulations that could minimize potential adverse effects?
Derivation of Impact Conclusions EPA 11

Cumulative Effects

Biological populations and individuals of populations can be exposed to a combination of effect producing activities. The effects analysis should cover (1) effects from a combination of activities associated with this lease sale and (2) effects from a combination of activities from the 18 past, present and future projects identified in the cumulative effects assessment (Appendix E).

For example, marine and coastal birds would likely be exposed to the following effect producing activities from this proposed lease sale: spilled oil; disturbance from aircraft, boat traffic, and drilling activity; and habitat alteration from offshore and onshore pipeline construction. Not only would the marine and coastal birds be exposed to these activities from this lease sale, they would also be exposed to a similar combination of activities from past federal and state lease sales, future federal and state lease sales, and existing and future pipelines. The cumulative case includes more activities with a greater spatial distribution.

The Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA provide a definition of cumulative effects (40 CFR 1508.7) This definition states that the cumulative impact is "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions..." This implies that there is an additive component in the effects evaluation process. It would seem reasonable to apply this additive concept to the cumulative effects assessment as well as the assessment of effects resulting from exposure to a combination of activities associated with this lease sale. EPA 12

We are concerned that the draft EIS evaluation of impacts resulting from exposure to multiple effect producing activities assumes that the combined or cumulative effect will be no greater, or less, than the effect from the most severe individual effect producing activity. The effect from all activities to which an organism is exposed could possibly exceed the sum of the effects from each individual activity. The final EIS should provide a description of the analytical approach used by MMS technical staff to determine the levels of impact and the "incremental contribution". The analysis of the "incremental contribution" should apply to resident species exposed to a combination of activities from this lease sale and from the 18 projects in the cumulative case and to migratory species that encounter a broader range of activities throughout their migratory range.

Effects on Subsistence-Harvest Patterns

The draft EIS indicates that the effects on the subsistence harvest are expected to impact the economy, due to the disruptions of the bowhead and belukha whales, walrus, fish, and caribou harvest. The overall effect on subsistence harvest is rated high and moderate. How is the impact conclusion for this category justified when the effects on the biological resource categories are low and very low? EPA 13

Selction of a Preferred Alternative

EPA strongly supports the selction of Alternative IV - the Point Lay Deferral Alternative as the preferred alternative for several reasons. This alternative removes the remainder of the bowhead spring migration pathway from the lease sale area. Deferral of the 501 blocks in this subarea will not reduce the probability of finding oil nor will it reduce the amount of oil estimated to be found in the lease sale area. The biological opinion, for the last Chukchi Sea lease sale, concluded that a likelihood of jeopardy exists if development/production occurs in the spring lead system. The proposed stipulations for this lease sale conclude that the mitigation measures will not be effective in lessening the potential adverse effects on bowhead whales or increasing our understanding of their behavioral response to industrial noise and disturbance. The Point Lay Alternative represents a meaningful mitigation measure that lessens the impacts to endangered bowhead and gray whales, other marine mammals, and important coastal resources.

Environmental Protection Agency

Response EPA-1

As indicated in Section II.F, all laws, regulations, and orders that provide mitigation are considered part of the proposal. The mitigating effect of these measures has been factored into the environmental-effects analysis. The potential stipulations and information to lessees (ITL's) listed and discussed in the DEIS are evaluated in the discussions of the effectiveness of stipulations or ITL's. It is MMS policy that decisions on whether or not to include a potential stipulation or ITL or to defer blocks from the proposed-lease-sale area are made after the FEIS has been published. The potential mitigating measures are not assumed to be in place for the purpose of analysis because this could distort and potentially would reduce the levels of effect that could result from the lease sale.

Although there is no formal method for measuring the effectiveness of the potential mitigating measures outlined in the Sale 126 DEIS, support for including these measures in the lease sale has been received from some of those individuals, organizations, and governmental agencies--including EPA--that have commented on the Sale 126 DEIS as well as the DEIS's for past lease sales. This support indicates that the measures are perceived as being effective. The Orientation Programs developed to date have been excellent, particularly those created more recently, and are rigorously presented to all workers.

Response EPA-2

See Response EPA-12.

Response EPA-3

As indicated in Section II.F, all laws, regulations, and orders that provide mitigation are considered part of the proposal. The mitigating effect of these measures has been factored into the environmental-effects analysis. The potential stipulations and information to lessees (ITL's) listed and discussed in the DEIS are evaluated in the discussions of the effectiveness of stipulations or ITL's. It is DOI policy that decisions on whether or not to include a potential stipulation or ITL or to defer blocks from the proposed-lease-sale area are made after the FEIS has been published. The potential mitigating measures are not assumed to be in place for the purpose of analysis because this could distort and potentially would reduce the levels of effect that could result from the lease sale. If such measures are adopted in whole or in part, their intention is to reduce environmental effects. Their effectiveness in achieving this may not be measurable, but their simple existence is a positive step in the right direction in all cases.

Response EPA-4

Although there is no formal method for measuring the effectiveness of the potential mitigating measures outlined in the Sale 126 DEIS, support for including these measures in the lease sale has been received from some of those individuals, organizations, and governmental agencies--including EPA--that have commented on the Sale 126 DEIS as well as the DEIS's for past lease sales. This support indicates that the measures are perceived as being effective.

There is no specific information available on how effective the Orientation Program has been in making petroleum industry personnel "aware of the unique environmental, social, and cultural values of local residents and their environment" or how successful this stipulation has been in protecting environmental resources and cultural values. However, the Orientation Programs developed to date have been excellent, particularly those created more recently, and are rigorously presented to all workers.

Response EPA-5

The MMS believes it unnecessary to expand potential Stipulation No. 5 to include leases in the fall bowhead whale migration area of the Chukchi Sea. The Sale 109 Biological Opinion did not include conservation recommendations for monitoring the fall migration, nor did the Arctic Region Biological Opinion make a recommendation for monitoring the fall migration in the Chukchi Sea. The monitoring stipulation adopted for Sale 109 is limited to the spring migration only. Unlike the fall migration in the Beaufort Sea, the fall migration through the Chukchi Sea does not follow a defined corridor. Due to the dispersed nature of the migration and the limited scope of exploratory-drilling activity, we do not believe monitoring would be appropriate or necessary.

Response EPA-6

Causeways are not part of the development and production scenario because all prospects included in the base case are more than 80 km from shore and in waters deeper than 30 m. Therefore, causeways are not a practical consideration for the development scenario.

The EIS assumes that buried offshore pipelines will bring oil ashore. Engineering studies indicate that a key consideration in the design of buried offshore pipelines in an arctic environment is to determine the optimum burial depths that maximize the pipeline's safety from rupture by ice gouging and minimize costs. The problem of ice scour has been investigated to considerable extent, and burial depths that will minimize the probability of scour are now specified and known. Continuous monitoring techniques will enable the operators of such pipelines to be forewarned of potential scour problems and to take corrective actions. Even if a discovery is made in the near future in the Chukchi Sea, production will not occur for 12 to 15 years. With such a lead period, production and transportation problems can be adequately resolved.

Response EPA-7

As shown in the EIS analysis, industrial noise has only a local, short-term effect on whales that actually respond to it (Richardson et al., 1985, 1990; Malme et al., 1983; 1984, 1985, 1986; Ljungblad et al., 1985; Wartzok et al., 1989). This combined with the assumed "no industrial activity during the spring migration" is why we have projected as the most likely case that industrial activities are not likely to jeopardize the continued existence of the species. It is possible that there could be long-term adverse effects from a production operation in the spring lead system, so the conservative approach has been adopted.

Response EPA-8

As indicated in the EIS analysis, crude oil and industrial noise associated with Sale 126 are likely to have no significant effects on whale populations. Hence, there is little need of mitigation. While it is true that the potential stipulation would not add to the body of information for spring-migrating whales, it is also true that there is already enough information to determine what the likely effect of spring operations would be, if they occurred in the lead system. In addition, the stipulation would provide information on the effects of operations on fall-migrating bowheads, if operations continued during that period.

Response EPA-9

There are no known studies pertaining to baleen whales that show industrial noise to have had anything other than local, short-term effects on whales. Consequently, while long-term effects are possible, it is much more probable that they would not occur and that habituation would take place, as occurs in response to other nonthreatening stimuli. Ongoing studies in the spring-lead system indicate that the effects of industrial noise there are similar to, or even less than, those anywhere else. For example, Richardson et al. (1990) states "Our preliminary impression is that bowheads are no more sensitive to fixed wing aircraft like the Twin Otter during the spring migration through pack ice than they are in the late summer in largely open waters."

Response EPA-10

Wetlands are an important consideration in evaluating the effects of the onshore-pipeline scenario. Wetlands has been included as a separate resource category in the Section IV analyses (Secs. IV.B.15, IV.C.15, IV.D.15, IV.G.15, and IV.H.1.k). The text of the base-case scenario (Sec. II.B.2.a) has also been amended to include information on where and how gravel-fill material would be obtained and a general discussion of the type of terrain crossed by the pipeline.

Response EPA-11

Many factors go into the analysis to determine the tracts to be leased and the stipulations that could minimize potential adverse effects. Conditional probabilities can be one of these factors, inasmuch as they are calculated from the path and destinations of an oil-spill trajectory, assuming an oil spill occurs at a given point in space. Conditional probabilities, therefore, are conditioned on the presence and discharge of oil from specified "launch points." Volume of oil or number of spills are not factors generating the results of conditional probabilities. The path (trajectory) and destinations of an oil slick are determined more by oceanographic and seasonal factors such as currents, wind patterns, etc. Launch points are distributed as uniformly as possible within the planning area as a means of determining areas of relative vulnerability to oil-spill effects. By this means, the results of modeling spill trajectories and calculating conditional spill probabilities can provide useful data for delineating seaward and coastal areas most vulnerable to oil-spill effects.

Response EPA-12

In the EIS, the approach is to use a systematic method of examining the individual potential effects on a species or species group from each effect-producing activity (oil spills, noise/disturbance, drilling discharges, etc.) and then to examine the potential effects from these activities in the aggregate. With this method, the conclusion for any species or species group can be no lower than the highest rating from any of the effects produced by any individual effect-producing activity. The variety of effect-producing activities is further considered in the oil-spill-risk and cumulative-case analyses for each resource. Most effect-producing activities are short-term, localized, and usually not additive; therefore, they are not working together. The probability of any two effects occurring at the same time, at the same place, and to the same individuals in the population are extremely remote. Also, not all the species or species groups are going to be affected by all the projects listed for the cumulative case.

The approach, per se, that the analysts use in analyzing the data is of lesser importance than is their consideration of relevant scientific data and other information in their analyses. Therefore, MMS does not believe it necessary to describe the analytical approaches used by the analysts. The data and information used to analyze the potential environmental effects of petroleum activities in the Chukchi Sea Planning Area are discussed and cited in the EIS. The review process should scrutinize this data and information--and the conclusions--and not analytical approaches.

As you suggest, the cumulative-effects analysis of marine and coastal birds and the analysis of marine mammals does factor in additively the combination of effects of oil spills; noise from aircraft, boats, and drilling activities; and habitat alteration from various potential development projects on the North Slope and in the Beaufort and Chukchi Seas.

Response EPA-13

Based on a review of Section IV analyses and related sections, the very high effect on the economy for the base case has been changed to a high effect in the FEIS. However, the conclusion of effects on the economy, subsistence-harvest patterns, and selected species can be different and still consistent. The analysis and conclusions of effects on the economy of the NSB in Section IV draw, in part, from the analysis and conclusions of effects on subsistence-harvest patterns--but not from endangered and threatened species. For example, the conclusion for the potential effect of oil spills (and other factors) on bowhead whales is low. However, the potential effect of an oil spill on subsistence-harvest patterns is high for Wainwright, in part because pulling whales up through oiled waters would result in an unusable whale. The high effect on subsistence-harvest patterns translates to a high effect on the economy because of the potential unavailability of an important resource for a significant proportion of households. The bowhead whale is an important part of the economy for Wainwright households. By this process of working through different components of the environment, the conclusion of high effects on subsistence-harvest patterns translated to a very high effect on the economy, as reflected in the DEIS.

MARINE MAMMAL COMMISSION
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WASHINGTON, DC 20009

10 September 1990

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ALASKA

Mr. Alan D. Powers
Regional Director, Alaska Region
Minerals Management Service
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Dear Mr. Powers:

By letter of 6 July 1990, the Marine Mammal Commission received a request to send you comments on the Draft Environmental Impact Statement for the proposed August 1991 Chukchi Sea Outer Continental Shelf Oil and Gas Lease Sale (Sale 126). The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the document and has the following comments and recommendations on the information and assessments in the document bearing on marine mammals.

General Comments

The Draft Environmental Impact Statement (DEIS) assesses possible effects of a proposed action to lease up to 4,319 blocks (approximately 23.68 million acres) of submerged lands in the Chukchi Sea for the purpose of oil and gas exploration and development. The lease area is located 3.5 to 200 miles off northwest Alaska and is scheduled tentatively for August 1991. Possible effects of exploration and development activities associated with the proposed sale are assessed assuming a low, base (i.e., expected), and high level of petroleum resource discovery. Effects also are considered for a no sale alternative, a delay sale alternative, and a track deferral alternative. Among other things, possible effects on four species of endangered whales, polar bears, pinnipeds, walrus, and belukha whales are considered.

With respect to endangered whales, the DEIS concludes that bowhead whales and gray whales are the species most likely to be affected. Under all leasing alternatives and resource discovery scenarios, the DEIS concludes impacts on these species likely would be very low (i.e., no discernible population decline, sublethal effects to some individuals, and recovery to pre-activity conditions within one year). For reasons noted below, we believe that the DEIS underestimates possible effects on bowhead whales.

The DEIS indicates that fin whales and humpback whales also occur in the sale area. However, because they are present only rarely, no significant effects on these species are expected.

In preparation for this sale, the DEIS indicates that, pursuant to section 7 of the Endangered Species Act, the Service asked the National Marine Fisheries Service for confirmation that formal consultations on possible effects of the proposed sale on endangered species should focus on bowhead and gray whales. Based on copies of correspondence in Appendix D, the National Marine Fisheries Service replied affirmatively on 27 November 1989. Since that time, Steller sea lions have been listed as threatened on an emergency basis. Although the species may not occur in the sale area, transportation of oil from the sale area may affect this species or habitat critical to its survival. Therefore, if it has not already done so, the Minerals Management Service should contact the National Marine Fisheries Service to ask if consultations should be expanded to consider this species. MMC 1

Regarding non-endangered marine mammals, the DEIS concludes that, for all leasing alternatives and resource development scenarios, impacts would be low (i.e., there would be no discernible population decline, no lethal effects, some individuals will experience sublethal effects, and recovery to pre-activity conditions within one to three years). The DEIS does not address the possibility of polar bears being attracted to offshore facilities and being killed or injured by operating equipment, by consuming toxic supplies, or by being shot to protect workers. As discussed below, the DEIS appears to underestimate possible effects on polar bears and it should be revised to indicate that effects could well range from very low to moderate levels. MMC 2

A number of potential stipulations and information to lessees notices to reduce possible impacts on marine mammals and other wildlife are described in the DEIS. These mitigation measures would be helpful and we recommend that they be modified as noted below and adopted as part of the proposed action. We also recommend that two additional mitigation measures be included. The first would require lessees to develop and implement polar bear interaction plans to: a) minimize the likelihood of interactions between bears and offshore workers, equipment, and supplies; and b) minimize adverse effects on bears and workers should any interactions occur. This recommended measure is discussed in greater detail in the enclosed letter and discussion paper sent to the Fish and Wildlife Service on 27 June 1990. MMC 3

The second is a seasonal drilling restriction as was recommended in the scoping process for this sale by the North Slope Borough and the State of Alaska. In this regard, we note that related regulations recently were published by the National Marine Fisheries Service concerning exploration activities in the MMC 4

Chukchi Sea and Beaufort Sea under section 101(a)(5) of the Marine Mammal Protection Act. The regulations prohibit exploration activities from incidentally taking any marine mammals in the bowhead whale migratory corridor during the species' spring migration. Because of uncertainties noted below, we believe such a measure is appropriate and should be included as a mitigation measure for any leasing action except the Point Lay Deferral Alternative, in which case the restriction would be moot. MMC 4

<u>Specific Comments</u>

<u>Page xx, Third Paragraph:</u> This paragraph refers to Table S-1 for a summary of possible effects likely to occur as a result of the proposed lease sale and alternative actions. The Table should be expanded to include possible effects on walrus. MMC 5 Also, for reasons noted below, the estimate of possible effects on polar bears (projected to be low) seems to be underestimated and should be revised. In addition, this estimate appears inconsistent with previous Minerals Management Service estimates. That is, cumulative effects on polar bears from this sale and other activities are estimated to be low in this DEIS, but they are projected to be moderate in the DEIS released earlier this year for the Beaufort Sea Sale (Sale 124) immediately east of the Chukchi Sea planning area. MMC 6

<u>Page I-3, Fourth Complete Paragraph:</u> This paragraph notes that studies and Information Transfer Meetings conducted by the Service's OCS Environmental Studies Program are an integral part of preparing Environmental Impact Statements. It refers to Appendix F for a more complete discussion of the Studies Program. The Marine Mammal Commission agrees that the Studies Program is vitally important for preparing Environmental Impact Statements. It also is important for verifying predicted effects and providing lease managers with information and analyses for making informed management decisions after lease sales. This paragraph and Appendix F are appropriate and very helpful in describing the Program's role in these matters. Because of its importance in assuring that necessary studies will be identified in a timely manner, an additional point which should be described either in this section or in the Appendix is the planning process whereby Program priorities are periodically reassessed and selected. MMC 7

<u>Page I-4, Endangered Species Consultation:</u> This section notes that the Minerals Management Service initiated consultations with the National Marine Fisheries Service pursuant to section 7 of the Endangered Species Act to assess the possible effects of the proposed sale on endangered and threatened species. The section notes that the two services have confirmed the list of species to be addressed during the consultations, but that a Biological Opinion had not been completed in time for inclusion in the DEIS. MMC 1

Copies of the supporting correspondence in Appendix D indicate that only gray whales and bowhead whales are to be considered. Since the date of the correspondence in Appendix D, the National Marine Fisheries Service has listed Steller sea lions as threatened on an emergency basis. Although the Chukchi leasing area is north of the usual range of Steller sea lions, transportation of oil from the lease area may affect this species or habitat critical to its survival. Therefore, if the Minerals Management Service has not already done so, the Marine Mammal Commission recommends that it contact the National Marine Fisheries Service to determine whether Steller sea lions should be considered during the consultation process for Sale 126. MMC 1

Elsewhere in the DEIS, reference is made to information and analyses in an Arctic Regional Biological Opinion prepared by the National Marine Fisheries Service. That Opinion should be included in Appendix D.

<u>Page I-5, Lease Operations:</u> This paragraph briefly describes responsibilities of the Service's Field Operations Office and other agencies in managing lease operations after a lease sale. Because of its importance in ensuring that the lease manager has accurate up-to-date information to meet his responsibilities, the paragraph should be expanded to note the role of the Service's Environmental Studies program in meeting the Service's legal mandate to monitor changes in human, marine, and coastal environments during and after oil exploration and development. In this regard, the section should refer readers to the discussion of the Program in Appendix F. MMC 8

<u>Page I-16, Mitigating Measures Not Recommended for Further Study:</u> This section notes that a recommendation by the North Slope Borough and the State of Alaska for a seasonal restriction on drilling, as well as seismic operations and tug and icebreaker operations, to protect migrating bowhead whales in the spring will not be considered a potential mitigating measure. The reasons cited for this decision are that "...the Arctic Region Biological Opinion does not find threat from oil spills to exist for bowhead whales during the exploration period"; "...analyses of other stipulations...suggest...the bulk of the bowhead spring migration would not occur within the sale area"; ..."the migration likely would be finished in the Chukchi Sea by the time exploration activities started"; and ..."no bowhead whale subsistence hunting areas exist...within the proposed 126 sale area." MMC 4

The rationale for rejecting further consideration of the recommended seasonal drilling restriction measure is incomplete and somewhat misleading. For example, while it is true that the lease area constitutes only a small segment of the bowhead whale migratory corridor, the length of corridor affected is relatively unimportant. Of greater importance is the proportion of the bowhead whale population passing through or immediately adjacent to the area. As noted elsewhere in the DEIS, the majority of the bowhead whale population apparently does pass through or immediately adjacent to the proposed lease area. In addition, the fact that the migration may well be finished by the time exploration activities begin does not eliminate concern for those instances when exploration activities commence before migrating animals have passed the area. Rather, if this is the case, it would suggest that restricting drilling until after the whales have passed would provide a useful measure of protection which would pose little, if any, inconvenience to lessees.

The analysis in this section also fails to consider possible effects other than those due to an oil spill. In the Beaufort Sea leasing area, seasonal drilling restrictions have been considered important for preventing noise and other types of disturbance that could alter the path of migrating bowhead whales, and, among other things, affect their availability to Eskimo subsistence whalers. Similar effects seem possible from activities in the Chukchi Sea leasing area. That is, although traditional subsistence hunting grounds may not occur within the Chukchi leasing area, slight shifts in migratory routes due to disturbance as whales pass through the Chukchi Sea leasing area may alter the migration route and affect the availability of whales for subsistence purposes east of the sale area.

The decision not to include a seasonal drilling restriction also appears to be inconsistent with analyses and actions taken by the National Marine Fisheries Service to protect whales from seasonal exploration activities in the spring lead system. That is, on 18 July 1990, the Service published a final rule pursuant to section 101(a)(5) of the Marine Mammal Protection Act regarding the allowable take of marine mammals in the spring migratory corridor incidental to exploration for oil and gas in the Chukchi Sea and the Beaufort Sea over the next five years. The regulation prohibits the incidental take of marine mammals by the oil and gas industry in the spring lead system used by bowhead whales until such time that it is determined that the whales have passed through leads off Point Barrow and the spring subsistence hunt for bowhead whales has been completed in all villages.

This section should be expanded to provide a more complete assessment of reasons for believing that a seasonal drilling restriction would not provide a useful measure for avoiding possible adverse impacts. It should include an explanation of the basis for concluding that migrating bowhead whales whose course is deflected due to exploration activity in the leasing area would return to the same track line they otherwise would have taken by the time they reach subsistence whaling areas located east of the leasing area. It also should indicate how the validity of this conclusion was ascertained. Alternatively,

MMC 4

the recommended measure should be included as a mitigating measure.

MMC 4

<u>Page II-20 to II-21, Effects on Pinnipeds and Polar Bears:</u> This section notes that the effects of the base case scenario on polar bears and walrus are not likely to exceed low levels. Analyses in the DEIS do not consider a number of factors that may increase the likelihood of adverse effects on these species. For example, polar bears may be attracted to work areas by smells, noise, or lights and be killed or injured as a result of interactions with workers or equipment; wide-ranging movements by foraging bears and walrus may bring substantial numbers of both species into contact with spilled oil or offshore activities even though overall densities in the lease sale area may be low; and oil spill cleanup and monitoring, as well as spilled oil itself, may affect both species indirectly as well as directly.

Such factors, in addition to those mentioned in the DEIS, suggest that effects on these species could reach or exceed moderate levels (<u>i.e.</u>, a portion of their respective populations would experience changes in abundance and/or distribution whose recovery would require one generation or more). Assessments upon which these conclusions are based should be reexamined in consultation with experts in the Fish and Wildlife Service and the Alaska Department of Fish and Game and the conclusions modified accordingly. This comment also applies to assessments for these species under the high case scenario.

MMC 2

<u>Page II-21, Second Complete Paragraph:</u> The third sentence of this paragraph states that "since the sale area is believed to be outside the spring lead-system, most bowhead whales are not likely to encounter noise associated with production operations." The premise of this conclusion is not consistent with information presented elsewhere in the DEIS. Figure III-B-5 indicates that the southeast portion of the sale area includes most of the migratory corridor off Point Lay through which bowhead whales pass in the spring. Production facilities in this area therefore could expose most of the bowhead whale population to noise. Indeed, the rationale for the Point Lay Deferral Alternative is, in part, to exclude portions of the bowhead migratory corridor. The third sentence of the paragraph should be deleted.

MMC 9

<u>Page II-42, Effects on Pinnipeds and Polar Bears:</u> This section concludes that the deferral of nearshore tracks from the proposed lease sale would be inconsequential in reducing risks to nearshore habitats of pinnipeds and polar bears or the probability of contact by an oil spill. Available information does not appear to be sufficient to justify this conclusion for polar bears. For example, some polar bear denning has been documented in nearshore areas along the Chukchi Sea, however, the extent to which polar bears den in this area is unknown. If the area is an important polar bear denning area, this deferral

MMC 10

alternative could reduce the risk of bears avoiding the area or causing females to abandon dens before their cubs are mature enough to survive. It also could prevent some bears from being killed or injured due to interactions with people, equipment, supplies, and/or oil spills.

In addition, by excluding development in nearshore areas adjacent to the State's three-mile jurisdictional boundary, it substantially reduces the risk that the expected oil spills will originate in the deferred area. Therefore, it follows that spills expected to occur under the proposed action would be much less likely to contact the deferral area if petroleum development is excluded from the area. The referenced statement should be deleted and replaced with a statement indicating that the potential significance of the deferral alternative for protecting polar bears is uncertain because of incomplete understanding of the area's importance for denning, feeding, and other purposes. MMC 10

Page II-45, Mitigating Measures That Are Part of the Proposed Action and Alternatives: A critical factor in deciding whether to proceed with the proposed action is confidence that lease managers will have accurate, up-to-date environmental information with which to make informed lease management decisions. To better reflect this point, the beginning of the second sentence of this section should be expanded to read something like the following: MMC 11

> "Examples include the OCS Lands Act, which grants broad authority to the Secretary of the Interior to control lease operations and mandates postlease environmental monitoring to help detect and determine how to respond to unforseen impacts on human, marine, and coastal environments;...".

Pages II-45 to II-65, Potential Mitigating Measures: This section includes a number of potential stipulations and Notices to Lessees that would improve protection of marine mammals and other wildlife. The Commission recommends that they be modified, as discussed below, and adopted as part of each leasing alternative.

As indicated earlier, the Marine Mammal Commission also recommends that the Minerals Management Service include an additional mitigation measure requiring lessees to prepare and implement polar bear interaction plans. The purpose of these plans is to ensure that lease operators identify and take steps to avoid or minimize encounters with bears and, in the event that encounters do occur, to respond in ways which will minimize possible adverse impacts on both bears and people. The purpose and scope of these plans is discussed in greater detail in the attached letter and discussion paper sent by the Commission to MMC 3

the Director of the Fish and Wildlife Service on 27 June 1990. Implementation will require cooperative efforts by the Minerals Management Service and the Fish and Wildlife Service, the State of Alaska, and the Alaska oil and gas industry. If consultations with appropriate officials of those organizations have not been initiated to discuss and agree on steps to develop and implement such plans, the Marine Mammal Commission recommends that the Minerals Management Service do so immediately. MMC 3

Pages II-47 to II-49, Stipulation No. 2 -- Protection of Biological Resources: This stipulation would authorize the Service's Regional Supervisor for Field Operations to require lessees to conduct biological surveys to determine the extent and composition of wildlife populations or habitats that may occur in lease areas. The Commission recommends that this stipulation or stipulation number 5 (Industry Site Specific Bowhead Whale Monitoring Program) be expanded to require that lessees conduct an on site observation program designed to detect, record, and report all sightings of, and interactions with, marine mammals and other protected wildlife that occur at or near the location of drilling platforms, seismic vessels, pipeline laying vessels, causeways, etc. MMC 12

Observations should be conducted during work periods to provide lease managers with an improved basis for identifying and assessing potential adverse impacts on protected species. Provisions for the wildlife observation and reporting program should be developed in consultation with representatives of the Fish and Wildlife Service, the National Marine Fisheries Service, and the Alaska Department of Fish and Game. If such an observation program is not incorporated into this stipulation or other mitigation measures, the FEIS should indicate how the Service expects to identify and assess unforeseen or inaccurately predicted interactions between field activities and marine mammals and other protected species.

Pages II-49 to II-50, Stipulation No. 3 -- Orientation Program: This section discusses a potential mitigating measure requiring lessees to provide an orientation program at least once a year for all employees, contractors, and subcontractors involved in field exploration, development, or production activities. Its purpose, in part, is to ensure that workers are aware of pertinent lease sale stipulations and provisions and the need to avoid harassing wildlife. In this regard, prohibitions on taking and penalties under the Marine Mammal Protection Act and the Endangered Species Act will be in effect for all such personnel. To ensure that provisions of these and other wildlife protection laws are addressed in the orientation programs, the orientation programs should be required to cover such information. To reflect this point, something like the following should be added as the last sentence of the first paragraph of the stipulation: MMC 13

MMC 13

"The program also shall include information on prohibitions and penalties under relevant laws and regulations to protect marine mammals and other wildlife."

<u>Pages II-51 to II-52, Stipulation No. 5 -- Industry Site-Specific Bowhead Whale Monitoring Program:</u> This potential stipulation would require lessees of certain blocks to conduct a site specific bowhead whale observation program during April and May of each year. The stated purpose of the program is to determine when bowhead whales are present in the vicinity of exploratory activities carried out in the spring months and the effect of those activities on whale behavior. A map showing the blocks to which this stipulation would apply should be provided. Also, this stipulation should be expanded as appropriate to cover the fall months and the lease areas where bowhead whales are likely to occur during the fall migratory period. As noted above, either this or another mitigation measure should require an observation and reporting system to detect and monitor interactions with important species of wildlife in addition to bowhead whales. MMC 14

<u>Pages II-55 to II-56, Stipulation No. 8 -- Density Restriction for Protection of Bowhead Whales from Potential Effects of Noise:</u> This stipulation provides that the Service's Regional Supervisor for Field Operations may prohibit exploratory drilling between April 15 and May 15 if it is determined that the density of drilling activity could impede the bowhead whale migration. As noted above, this stipulation appears to be inconsistent with regulations recently adopted by the National Marine Fisheries Service (<u>Federal Register</u> Vol 55, No. 138, pp 29207-29218) authorizing the incidental take of bowhead whales and other marine mammals during oil and gas exploration activities in the Chukchi and Beaufort Seas. Those regulations prohibit the taking of any marine mammals in the spring lead system incidental to such exploration until it is determined that migrating bowhead whales have passed through the area. If it has not already done so, the Minerals Management Service should consult with the National Marine Fisheries Service to determine the appropriate time frame and terms for this stipulation. In addition, a map should be included showing the blocks to which this stipulation would apply. MMC 15

<u>Pages II-60 to II-61, ITL No. 4 -- Information on Chukchi Sea Biological Task Force:</u> This proposed notice advises lessees that the Regional Supervisor for Field Operations will consider recommendations of the Chukchi Sea Biological Task Force (composed of representatives of the National Marine Fisheries Service, Fish and Wildlife Service, Environmental Protection Agency and Minerals Management Service) and consult with the Task Force on biological surveys conducted under Stipulation No. 2 and actions to be taken in light of survey results. The role of the MMC 16

Task Force is not very clear. For example, it is not clear whether the Task Force would be asked to review and comment on planned orientation programs (Stipulation No. 3), bowhead whale monitoring programs (Stipulation No.5), or the timing and restriction of drilling activity along the bowhead whale migratory route (Stipulation No. 8). Advice of the Task Force on these matters would be desirable and the Marine Mammal Commission recommends that this stipulation be expanded to note that the Regional Supervisor, Field Operations, also may consult the Task Force on steps to implement any stipulations bearing on the protection of biological resources. MMC 16

<u>Page III-30, Pacific Walrus:</u> The last paragraph of this section notes that, according to a 1980 source, U.S. and Soviet censuses of walrus over the preceding 20 years indicate that the size of the Pacific population has increased rapidly. More recent censuses discussed in Sease and Chapman, 1988 (reference cited in the DEIS) indicate that the population increase has slowed and that there is some evidence that the number of walrus may have declined recently. The Minerals Management Service should consult with the Fish and Wildlife Service to obtain the most recent population information and include that information in this section. In this regard, we note that the DEIS relies, in many cases, on information that was collected more than 10 years ago. For such cases, it should be recognized that substantial population changes may have occurred since the data were collected. MMC 17

<u>Pages III-30 to III-31, Carryover Paragraph:</u> The second sentence of this paragraph notes that radiotelemetry studies of polar bears suggest that interchange of animals between populations in northern and western Alaska occurs more often than previously suspected. A reference for this information should be provided. MMC 18

<u>Page III-31, Third Complete Paragraph:</u> This paragraph, citing 1972 and 1974 sources, suggests that polar bear denning along the Chukchi Sea coast appears to be less concentrated than at other denning areas in the Arctic. Information on polar bear distribution and occurrence along the Chukchi Sea coast is very incomplete. In the absence of more recent and detailed studies, this conclusion should be conditioned by noting that available information is not sufficient to verify the extent to which polar bear denning occurs in this area, to what extent the number of denning females varies from year to year, or what factors are responsible for annual variation. MMC 19

<u>Page III-32, First Complete Paragraph:</u> Although the second sentence of the paragraph states that no reliable data exist regarding bowhead whale population trends, the third sentence states that some people believe that the bowhead whale population has increased dramatically in recent years. References are not, but should be, provided or the statement should be deleted. MMC 20

<u>Page III-32, Third Complete Paragraph:</u> This paragraph discusses the timing and route of the bowhead whale migration through the lease area. It should be expanded to indicate the distribution of whales across the spring lead system, the extent to which whales appear to prefer inshore verses offshore leads, and whether there is any information regarding age/sex preferences for inshore or offshore leads. MMC 21

<u>Page III-34, Third Complete Paragraph:</u> This paragraph should be expanded to note that Seaman <u>et al</u>. 1985, as cited in the DEIS, suggest that the belukha whales in the Bering Sea may be composed of four stocks, one of which occurs in the eastern Chukchi Sea, including Kotzebue Sound and waters in and adjacent to Kasegaluk Lagoon. This paragraph also should note that belukha whales may move back and fourth during the summer between the pack ice and coastal waters (see pages 204-205 in J. Lentfer, 1988. Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Marine Mammal Commission. Washington, D.C. 275p.). Effects of development on belukha whales therefore could be greater than is stated in subsequent sections of the DEIS. MMC 22

<u>Pages III-41 to III-59, Subsistence Harvest Patterns:</u> Most of the data on subsistence harvests of marine mammals in this section are from periods prior to 1982. The section should be updated to identify and assess more recent harvest data. MMC 23

<u>Pages IV-B-1 to IV-B-29, Alternative 1 -- Low Case:</u> The comments noted below for specific parts of this section also apply to corresponding discussions under the base case and high case scenarios.

<u>Page IV-B-9, First Complete Paragraph:</u> The second sentence of this paragraph states that "...the effect of industrial noise on bowhead whales in or near the spring lead system is likely to be similar to that anywhere else, since the stimuli are the same." While effects may be similar to those during the spring migration and in other portions of the spring migratory corridor, the effects may not be the same in feeding areas, over wintering areas, or other areas where whales are not engaged in migrating or are confined by ice. Thus, something like the words "at the same time of year in comparable ice-covered areas along the migratory corridor" should be inserted after the words "anywhere else" in the second sentence. MMC 24

<u>Pages IV-B-11 to IV-B-21:</u> These pages discuss the effect of noise from vessels, drilling, and other offshore oil and gas associated activities on bowhead and gray whales. Available information suggests that whale "response zones" around noise sources (defined in the DEIS as the range of distances where a behavioral response to industrial noise can be expected from MMC 25

about one-half of the whales in the vicinity of the noise source) may range from less than a kilometer to over 20 kilometers depending on a number of factors and that responses may include changes in the direction of movement and other behavioral modifications that typically last a few minutes to an hour or more.

The discussion should be expanded to assess the extent to which data are available on the effect of noise on whale distribution in the hours and days following the initial response. That is, if migrating whales change direction to avoid noise sources, to what extent, if at all, are data available to show that disturbed migrating whales will return to their previous course, tract, <u>and</u> behavior immediately after passing the noise source. For example, if whales migrating east along shorefast ice change direction to avoid noise from a nearshore drill ship four or perhaps even 20 or more kilometers before reaching it, would they skirt the sound source and then return to their nearshore migratory tract once past the drill ship or, alternatively, would they resume a migratory course further offshore leaving nearshore areas further along the migratory corridor with comparatively fewer whales? In the latter case, the availability of whales at traditional subsistence hunting areas may be altered. Also, it seems possible that whales, whose normal movements might be briefly delayed due to industrial noise disturbance, may have a higher risk of being trapped in a rapidly closing ice lead causing the death or injury of some animals. MMC 25

The analysis also should be expanded to consider synergistic noise effects. For example, it should consider overlapping response zones around drill ships and associated ice breakers and supply vessels. Combined effects could create an area in which few or no whales occur that is larger than the size of the response zones alone. That is, the course of whales deflected away from a response zone may result in an absence of whales down-stream of the response zone even though noise levels in that area would not be sufficient to disturb many whales. For example, whales moving west during the fall migration may be deflected away from drilling-ice breaking operations leaving an area immediately east of response zones around a drilling site in which few or no whales would occur. If the area avoided had high concentrations of zooplankton, bowhead whales could be deprived of access to an important feeding opportunity during their fall migration.

The discussion in this section also should be expanded to consider possible effects that may not be readily observable by overt or conspicuous behavior changes. That is, some animals may experience physiological or psychological stress from exposure to noise that may not be readily detected by changes in respiration patterns, swimming direction, <u>etc</u>. Such stress could manifest itself through a general decline in health, lower reproductive rates, decreased survival, and/or other such changes. The absence of observed response, therefore, does not conclusively rule out possible adverse effects. This section should be expanded to identify and discuss such uncertainties. The possible existence and significance of effects other than those readily observable exemplifies the need for post lease monitoring programs.

MMC 25

<u>Page IV-B-12, First Complete Paragraph:</u> This paragraph states that "deflections in bowhead swimming paths, changes in surfacing/respiratory patterns, and temporary cessation or a change in activity are not expected to result in a significant effect on the bowhead population/migration." The meaning and basis of this conclusion are unclear. For example, it is not clear whether the term "deflections in bowhead swimming paths," refers only to the initial change in direction of a whale affected by noise or to longer-term changes in the routes followed after passing out of hearing range. Therefore, this conclusion should be deleted or the discussion should be expanded to indicate why concerns noted in the preceding comment can be discounted.

MMC 26

<u>Page IV-B-14, Third Complete Paragraph:</u> This paragraph concludes that, because some observers have seen bowhead whales less than one kilometer from an icebreaker, the avoidance of icebreakers by belukha whales and narwhals reported by Finley and Davis (1984) and Finley <u>et al</u>. (1984) to have occurred at distances of 35-50 kilometers "...apparently were the startle responses of 'industrially naive' animals." The conclusion is speculative and should be indicated as such. The proposed action should be expanded to include monitoring programs designed to verify the accuracy of such speculative conclusions.

MMC 27

<u>Page IV-B-18, Third Complete Paragraph:</u> This paragraph notes that a study of bowhead whale distribution off Alaska between 1982 and 1988 suggests that the distribution of animals appears to be related to variation in ice conditions "...rather than the presence of industrial activity." As evidence, the paragraph notes differences in the median depth of water through which whales migrated during light, moderate, and heavy ice years. While the information supports the conclusion that ice influences whale distribution, it does not indicate that industrial activity has not influenced whale distribution. Therefore, the reference that industrial activity has not influenced whale distribution should be deleted or the supporting information should be described.

MMC 28

<u>Page IV-B-19, Third Complete Paragraph:</u> This paragraph notes that exploratory operations generally do not begin until mid-July and, hence, the spring bowhead whale migration would not encounter exploration-related noise. Unless there is assurance that exploration activities would not begin until mid-July, it

MMC 29

cannot be stated with certainty that the whales migrating in the spring would not encounter exploration-associated noise. No such assurance is provided in the description of the proposed action and, unless it is, the paragraph should be revised to note that exposure of whales to exploration noise is possible but not expected given the usual annual exploration start-up date of mid-July.

MMC 29

<u>Page IV-B-19 to IV-B-20, Carryover Paragraph:</u> This paragraph states that, under the low case scenario, bowhead whale response zones (defined in the DEIS as the distance where a behavioral response to noise can be expected from about one half of the whales) could cover 25 percent of the width of the bowhead whale fall migratory corridor and, thus, 25 percent of the whale population (1950 animals) may come within this distance during the fall migration. Assuming one-half of the whales within that area respond, the paragraph concludes that 975 animals would be affected. While half the whales would react at or before reaching the perimeter of the response zone, others could or would respond at closer distances. Therefore, substantially more than 975 whales could be affected. The analysis should be revised to reflect this fact.

<u>Page IV-B-20, First Complete Paragraph:</u> This paragraph notes that "due to the conservative nature" of the estimate of 975 whales being affected by exploration noise, "the likely rate of bowhead...whales encountering exploratory noise in the low case is expected to be very low in 1992 and zero thereafter." For the reasons noted above, the Service's estimate of the expected number of whales affected may not be conservative. Also, 975 whales encountering noise does not constitute a "very low" rate.

MMC 30

<u>Pages IV-C-41 to IV-C-42:</u> This paragraph notes that any substantial increase in polar bear mortality above natural and subsistence causes could have severe consequences. Although contact between bears and spilled oil poses a risk of additional mortality, the paragraph concludes that substantial additional mortality is unlikely because the density of bears in the Chukchi Sea is low and therefore only a small number of bears would encounter spilled oil. This analysis does not consider the possibility that the movements of wide ranging bears over the course of a spill may result in more than small numbers of bears encountering a spill even though overall density may be low. In addition, it does not consider that bears may be attracted to a spill site. Such factors could cause oil spill impacts to exceed low levels for polar bears and this paragraph should be expanded to consider such possibilities.

MMC 31

<u>Pages IV-C-42 to IV-C-44, Effects of Disturbance:</u> This section discusses possible effects of disturbance on polar bears and pinnipeds. The section does not consider the possibility that

MMC 32

polar bears could be attracted to offshore facilities and activities by smells, lights, noise, or other factors. In addition to posing a threat to offshore workers, such attractions could result in the death or injury of bears through interactions with operating equipment, ingestion of toxic supplies, or being shot to protect workers. It is our understanding that at least one animal has already been shot and killed because it approached and was perceived as a threat to offshore oil workers. MMC 32

<u>Page IV-C-42, Third Complete Paragraph:</u> The penultimate sentence of this paragraph states that frequent or sustained disturbance due to industrial activity may cause pinnipeds and polar bears to avoid or abandon an area, but that the presence of substantial numbers of pinnipeds in the vicinity of intensive fishing operations suggests that these species can habituate to fairly high levels of human activity. We fail to see how the presence of pinnipeds in the vicinity of fishing operations provides any insights into how polar bears might be affected by human activities.

Further, the conclusion derived from the presence of seals in the vicinity of fishing activities is misleading. Pinnipeds likely occur near fishing activities because of the presence of fish. Their behavior when exposed to noise in the absence of concentrations of fish may well be entirely different. Also, there is evidence suggesting that noise associated with bottom trawler operations near Round Island in the Bering Sea has caused the number of walrus hauling out at that site to decrease dramatically. Finally, pinnipeds in the lease area are not the same species as occur in intensively fished areas and their responses to activity of any kind may differ. Thus, the suggestion that pinnipeds in the vicinity of fishing operations support the view that industrial noise is not likely to affect polar bears and pinnipeds in the lease area should be deleted. MMC 33

<u>Page IV-C-45, Conclusion:</u> This paragraph concludes that effects on pinnipeds and polar bears under the base case scenario are expected to be low. In view of the possibilities mentioned above that are not considered in the DEIS, we believe this conclusion underestimates possible effects on polar bears and should be revised. MMC 34

<u>Page IV-C-45, Fifth Complete Paragraph:</u> The second sentence states that the distance from a noise source where a response occurs represents the outer limit of the response zone. The third sentence states that the response zone is defined as the distance where a response is expected from about one-half of the whales. These statements appear inconsistent and should be clarified. MMC 35

<u>Page IV-C-47, First Complete Paragraph:</u> This paragraph, which assesses base case exploration-related impacts on bowhead whales, MMC 36

assumes that the level of exploration effort would be the same as the low case scenario (<u>i.e.</u>, two operations per year). To drill the number of exploratory wells projected for the base case scenario (39) between 1992 and 1998, it would appear that the number of exploratory operations would have to exceed two operations per year. Therefore, the paragraph should be clarified or deleted. MMC 36

<u>Pages IV-C-47 to IV-C-48, Carryover Paragraph:</u> The analysis in this paragraph of possible effects of noise from production platforms on bowhead whales fails to consider possible effects due to response zones of associated icebreaker operations. It also does not describe the basis for concluding that noise effects from associated supply boats might increase the total number of whales encountering noise only "slightly". Also, if the short-term response of whales to noise involves a course change that carries whales away from the sound source and whales do not return to the same course <u>and</u> track once past the noise source, it would appear that the result would be to exclude or at lease limit access to whale habitat both within the response zone and within an additional area of uncertain size east or west of the response zone depending on the direction of the whale migration. Affected areas may include important feeding areas. The likelihood, extent, and effect of such a habitat loss is not considered here or elsewhere in the DEIS. As presently drafted, the analysis appears to underestimate the likelihood and the extent of possible noise effects. The analysis should be expanded to better address the range of possibilities. MMC 37

<u>Page IV-C-49, First Paragraph:</u> The last sentence of this paragraph concludes that available information is considered adequate to determine the likely effect of crude oil associated with the base case on bowhead and gray whales. We do not agree that available information is adequate to predict likely effects, at least with reasonable certainty. For example, we are aware of no information on long-term lethal or sublethal effects of oil on individual free ranging cetaceans or any baleen whale. Consequently, there is little basis for predicting with certainty the possible or likely long-term effects on whale physiology, disease, reproduction, <u>etc</u>. While studies to date and the discussion of their results in this section of the DEIS help ease concern regarding short-term catastrophic effects, subtle long-term effects remain unstudied, uncertain, and potentially significant. The last sentence implies a degree of understanding not presently at hand and should be deleted. The detection of possible long-term as well as short-term effects should be one of the objectives for post lease monitoring programs. MMC 38

<u>Page IV-C-50, Fourth Paragraph:</u> The last sentence of this paragraph states that cetaceans confined to an area of an oil spill and inhaling vapors produced by the spill would sustain some damage, "...but the effect would depend more on the MMC 39

susceptibility of the animal, since the theoretically attainable concentrations of vapor are not high enough to pose a threat." While we are aware of no information regarding the inhalation of oil vapors by cetaceans during the Exxon Valdez oil spill, it is our understanding that there is evidence that a number of sea otters and perhaps some pinnipeds were killed as a result of inhaling toxic vapors associated with that oil spill. This paragraph should be expanded to include information on toxic effects of inhaled oil vapors derived from studies conducted during the Exxon Valdez oil spill. It also would be useful to note the effects of such vapors on humans. MMC 39

Page IV-C-56, Fourth Paragraph: The first sentence of this paragraph states that "[s]ince the sale area is offshore from the majority of the spring lead system,...spring-migrating bowheads are not likely to encounter noise associated with the production operations". This point is repeated in many parts of the DEIS yet all figures in the DEIS showing the spring migratory corridor indicate that virtually its entire width is included within parts of the sale area. If the referenced quote is true, all figures should be changed to more correctly indicate the boundary of the migratory corridor. Alternatively, if the figures are correct, the statement here and elsewhere in the DEIS suggesting that the migratory corridor does not pass through the sale area should be clarified or deleted. MMC 40

Page IV-G-10 to IV-G-11, Carryover Paragraph: The first two sentences of the paragraph state that since the same level of development is considered for the base case scenario of the Proposed Action and the Point Lay Deferral Alternative, the likelihood of whales encountering noise under the Deferral Alternative is the same as the Proposed Action. As is noted later in the paragraph, this is not true because the deferral area would exclude the spring migratory corridor of bowhead whales. The second sentence of the paragraph is misleading and should be deleted. MMC 41

Page IV-G-11, Conclusion: This paragraph concludes that exploration and development of the area deferred under the Point Lay Deferral Alternative would likely have an insignificant effect on bowhead whales. For reasons noted above, we believe the effects of oil and gas exploration and development in this area, which includes the bowhead whale spring migratory corridor, are uncertain and that available information is not sufficient to conclude that effects likely would be insignificant. The conclusion should be changed to indicate that effects under this alternative are uncertain, but that the alternative could significantly reduce the probability of oil and noise effects on migrating bowhead whales as compared to the Proposed Action. This point also appears to be true for belukha whales. For this reason, the Marine Mammal Commission believes the Point Lay Alternative is preferable to the proposed action.

Pages IV-H-55 to IV-H-59, Effects on Pinnipeds and Polar Bears: This section concludes that the cumulative effects of the proposed action and other human activities on polar bears are likely to be low. Elsewhere, the DEIS notes that substantial mortality above current natural and subsistence hunting levels would be significant. Given activities and spills expected from oil development already planned or underway on and adjacent to Alaska's north coast, we believe that cumulative effects on polar bears are underestimated in this section and that they may well be high. In addition, we note that the Service's assessment of cumulative effects on polar bears in the DEIS issued earlier this year for Beaufort Sea Sale 124 concluded cumulative effects on polar bears would be moderate. Therefore, the conclusion in this section also appears inconsistent with previous Service conclusions regarding this species. MMC 6

I hope these comments and recommendations are helpful. If you or your staff have any questions concerning them, please call.

Sincerely,

Robert J. Hofman, Ph.D.
Scientific Program Director

Enclosure

cc with enclosure: Mr. Barry A. Williamson

Marine Mammal Commission

Response MMC-1

The MMS corresponded with NMFS by letter dated July 26, 1990, regarding the potential effects of oil and gas leasing in Alaska on the Steller sea lion. By letter dated August 28, 1990, NMFS stated that there was no need to reinitiate consultation under Section 7 of the Endangered Species Act for Lease sale 126. A letter dated October 25, 1990, from the NMFS indicated agreement with the MMS determination that proposed Sale 126 is "not likely to affect the continued existence of the Steller sea lion."

As suggested, a copy of the Arctic Regional Biological Opinion prepared by the NMFS has been included as part of Appendix D.

Response MMC-2

Several of the criteria defining a low-level effect cited by the Commission are incorrect, e.g., there may be a population decline and lethal effects (see Table S-2). A statement addressing the possibility of polar bear attraction to offshore facilities has been added to Section IV.C.6. The record of arctic operations does not suggest that substantial polar bear mortality is likely to occur under these circumstances. Revision of an effect level requires the presentation of specific new information suggesting a significant elevation of risk. The discussion of potential effects on the polar bear includes a range of effect levels that could result in various circumstances; however, the MMS prefers to present the expected effect as a single effect level.

Response MMC-3

A new stipulation or revision of an existing potential stipulation with regard to any unavoidable killing of polar bears is not necessary to protect polar bears, which already are protected from excessive takes or human-induced mortality under the MMPA. Concerns about harassment and taking also are covered under Stipulation No. 3, the Orientation Program, and under ITL No. 3, Information on Bird and Marine Mammal Protection. All of the measures under the Polar Bear Interaction Plan are covered under existing OCS regulations or would be covered under FWS review of OCS exploration and development plans. For example, existing regulations prohibit the dumping of garbage that would attract bears; and the organization and layout of buildings and work areas are confined to the offshore drill platform or gravel island, thus minimizing the chance of bear/human interactions.

The MMS agrees it is important that lessee activities not affect polar bears. It is MMS' understanding that Letters of Authorization (LOA's) are required by FWS for unintentional take of polar bear and that the LOA can or would further identify lessees' obligations or requirements to prevent disturbance to polar bears. Avoidance plans would not alleviate lessees from the responsibility of obtaining LOA's. The MMS will provide Exploration Plans to the FWS and will coordinate with FWS on LOA's and their requirements, eliminating the need for MMS to require separate plans.

Response MMC-4

The EIS does not attach importance to the length of the migratory corridor. As noted in the EIS, most bowhead whales are expected to pass through the sale area in the fall in a dispersed fashion. However, very few (if any) are expected to pass through the sale area in the spring, since the spring migratory corridor is believed to be largely inshore of the sale area. Also, exploratory operations are not likely to occur when cetaceans are present in the spring-lead system (due to heavy ice).

The purpose of the seasonal drilling restriction (SDR) was to protect whales from what were then the unknown effects of an oil spill. No exploratory activities are assumed in the spring lead system due to ice conditions and incidental take regulations. Thus, the SDR is not necessary.

The regulation prohibiting the incidental taking of whales within the spring-lead system by exploratory activities is moot for three reasons. First, due to heavy-ice conditions, exploratory activities are not likely to occur until after the bowhead population has already passed the sale area. Second, the spring-lead system is outside (inshore) of the sale area and, hence, the area of MMS-permitted activity. Third, and most importantly, all studies to date have consistently shown that even if exploratory activities did take place within the spring-lead system, such activities would be likely to have little or no effect on the bowhead population, although some whales could be affected. The decision not to evaluate an SDR was based on this information.

Regarding the return of whales to their original swimming path following diversions around industrial operations, there is no data on this subject. However, there have been a few observations of bowheads that returned to their predisturbance location and behavior following an encounter with industrial noise (see Richardson et al., 1987; Ljungblad et al., 1985). Also, Malme et al. (1984) provides information (see Fig. 8.3. of that report) showing that while most gray whales avoid close approaches to seismic-airgun noise, they generally do not alter their course much to do so.

Response MMC-5

As requested, walrus has been added to Table S-1 as a separate resource category.

Response MMC-6

The expected effect level for the cumulative case has been changed to moderate for consistency with the 5-Year OCS Oil and Gas Leasing Program SEIS (USDOI, MMS, 1990b).

Response MMC-7

Section I.5 and Appendix F have been amended to address this concern.

Response MMC-8

The text of Section I.13 has been amended to address this concern.

Response MMC-9

The referenced sentence refers to the spring-lead system, which is generally nearshore, as being outside the sale area. It does not refer to the entire spring-bowhead-migratory corridor (as portrayed in Fig. III-B-5) as being outside the sale area. Although the spring-lead system does move about, the available information indicates that it is inshore of the sale area.

Response MMC-10

Satellite tracking data does not indicate that nearshore areas in the Chukchi Sea are important polar bear denning areas, nor does it support the contention that deferring selected nearshore blocks (Alternative IV) would reduce risk to polar bears significantly. The probability that an oil spill would contact the nearshore area, except in the vicinity of a pipeline to shore, is extremely low whether leasing in the indicated blocks were deferred or not. However, Section IV.G.6 has been revised to reflect the uncertainty of use of this area by polar bears.

Response MMC-11

Section II.F.1, Mitigating Measures That Are Part of the Proposed Action and the Alternatives, has been changed to include wording similar to that suggested by the commenter.

Response MMC-12

Stipulation No. 2 (Protection of Biological Resources) or No. 5 (Industry Site-Specific Bowhead Whale-Monitoring Program) have not been expanded "to require that lessees conduct an on site observation program designed to detect, record, and report all sightings of, and interactions with, marine mammals and other protected wildlife that occur at or near the location of drilling platforms, seismic vessels, pipeline laying vessels, causeways, etc." The MMS believes that such a monitoring program would provide no more than randomized, anecdotal information rather than scientifically based and systematically acquired data. The MMS funds an environmental studies program that would be much more useful in acquiring needed scientific information.

Response MMC-13

The Orientation Program stipulation notes that the program shall be formulated to ensure that personnel understand the importance of avoidance and nonharassment of wildlife resources. To accomplish this, the program presently includes a summary of environmental and cultural resource-protection requirements for the Chukchi Sea. This summary notes that all activities in areas leased are subject to the provisions of the MMPA, which prohibits the harassment of marine mammals; the ESA, which makes it unlawful to take endangered species; and some international treaties, which prohibit the harassment of species of international importance, such as migratory waterfowl and marine mammals. The MMS believes the content of the present program is adequate in making the workers aware of the laws protecting wildlife and does not believe the statement suggested in the comment needs to be added to the stipulation. In addition, MMS prefers to have as much of the program as possible presented in a positive manner and therefore does not believe a discussion of penalties that might be imposed for failure to comply with the wildlife-protection laws would be appropriate.

Response MMC-14

The MMS believes it unnecessary to expand potential Stipulation No. 5 to include leases in the fall bowhead whale-migration area of the Chukchi Sea. The Sale 109 Biological Opinion did not include conservation recommendations for monitoring the fall migration, nor did the Arctic Region Biological Opinion make a recommendation for monitoring the fall migration in the Chukchi Sea. The monitoring stipulation adopted for Sale 109 is limited to the spring migration only. Unlike the fall migration in the Beaufort Sea, the fall migration through the Chukchi Sea does not follow a defined corridor. Due to the dispersed nature of the migration and the limited scope of exploratory-drilling activity, we do not believe monitoring would be appropriate or necessary.

The blocks listed for Stipulation No. 5, Industry Site-Specific Bowhead Whale Monitoring Program, coincide exactly with the blocks to be deferred in the Point Lay Deferral Alternative. See Figure I-3 for a map of the Point Lay Deferral Alternative.

Response MMC-15

Stipulation No. 8, Density Restriction for Protection of Bowhead Whales from Potential Effects of Noise, has been deleted as a potential mitigating measure because it is inconsistent with recent NMFS regulations on incidental take of bowhead whale (as pointed out by the Commission) and not required by the Arctic Region Biological Opinion or the Sale 126 Biological Opinion.

Response MMC-16

The functions and responsibilities of the Biological Task Force (BTF) have been oriented toward identification and protection of unique benthic communities, such as the Boulder Patch community in the Beaufort Sea or other site-specific biological resources that may not have been identified or considered in the

EIS. Other biological resources, including whales and other mobile species that are known to exist in the area, are identified and potential effects addressed in the EIS. If oil and gas activities could have significant effects on these resources, stipulations, or ITL's are adopted, as appropriate, to mitigate potential effects.

If potential Stipulation No. 2 (Protection of Biological Resources) were adopted and implemented, the BTF would focus on benthic communities whose presence at a site-specific location of proposed operations--although unknown at the EIS stage--could be directly affected by proposed operations and might require additional protection. The BTF makes recommendations to the Regional Supervisor, Field Operations, on the need for and scope of surveys to determine the presence of these unique biological communities and how to protect such communities, if found.

In recent years, the BTF has used information from site-specific geohazard surveys, particularly sidescan-sonar records, to determine if there are any anomalies that might indicate the presence of unique biological communities. If anomalies are identified at the proposed site of operations, the site would be moved or additional studies conducted, including camera or diver surveys to determine if biological communities are present. The MMS would coordinate with the BTF for further recommendations. More elaborate surveys including trawls, grab samples, etc., were required in the Gulf of Alaska and Lower Cook Inlet and where deemed appropriate. These efforts were eventually discontinued because the findings were consistent with known information about the presence and distribution of biological resources and provided no information pertinent to the site-specific proposed activity.

A BTF was established for the previous Chukchi Sea Sale 109 area. That BTF has been involved in implementing a Biological Resource Stipulation for SWEPI's exploratory-drilling program following the principles described above.

Bowhead whale-monitoring programs required under potential Stipulation No. 5 would not be a responsibility of the BTF since these programs receive extensive review and comment through interagency and public review and consultation with NMFS for this endangered species. All exploration plans, including associated monitoring programs, are distributed for public review, including those agencies and organizations represented on the BTF.

The BTF was involved in developing early orientation programs for the Beaufort Sea and may become involved in a Sale 126 orientation program, should the potential stipulation be adopted. However, since biological issues comprise only a portion of the programs, the role of the BTF may be minimal. While MMS has no objection to a BTF review of the program, timing and logistics can make this difficult. The orientation program already developed for the Chukchi Sea Sale 109 area could most likely be used to satisfy the requirements for Sale 126. Historically, once a program has been approved for an area, the existing program is revised, if necessary, to include any new information related to the new sale area. Such an approach was used for Beaufort Sea lease sales subsequent to Sale 71.

Response MMC-17

The text of Section III.B.4 (Pacific walrus) has been revised to address the concern for a possible declining walrus population trend.

Response MMC-18

Some additional information concerning polar bear movements was obtained in a conversation with Gerald Garner, USFWS, Anchorage, in early 1990. This reference has been added to Section III.B.4.

Response MMC-19

Section III.B.4 has been revised to address the concern for polar bear denning along the Chukchi Sea coast.

Response MMC-20

The sentence provides a reference, as suggested.

Response MMC-21

The referenced paragraph refers to the fall bowhead migration in the Beaufort Sea, rather than to the spring migration in the Chukchi Sea.

Response MMC-22

Much effort has been expended to limit the amount of speculation in the NEPA analysis and to base the analysis on substantiated findings concerning what is known or is likely to occur. Consequently, adding speculation concerning the number of possible belukha stocks and possible ways in which belukhas might move between pack ice and coastal waters would not enhance the analysis.

Response MMC-23

In addition to the 1962-1982 ACI/Braund subsistence data cited in the text, the subsistence discussion also uses 1988-89 subsistence-harvest data for Barrow and Wainwright. The MMS studies program currently is continuing to acquire long-term subsistence-harvest data. However, the ACI/Braund information is still the most creditable long-term information available on subsistence-harvest levels.

Response MMC-24

The studies cited in the EIS involve observations of whales that were feeding, migrating, and socializing in many geographic areas. However, as indicated in the analysis, the responses of whales to industrial noise were found to be generally the same regardless of location. The factors that cause actual differences in response remain unclear. Differences in ice cover, the time of year, the quantity and quality of the noise environment, hunting pressure, and individual behavior (and any combination of the above) have all been suggested as possible causes. Nevertheless, whales generally respond in a predictable fashion to similar stimuli, as do other marine mammals. Further evidence that continues to support this finding was again noted in Richardson et al. (1990), where it states that "Our preliminary impression is that bowheads are no more sensitive to fixed wing aircraft like the Twin Otter during spring migration through pack ice than they are in late summer in largely open water".

Response MMC-25

The EIS analysis addresses the likely effect of industrial noise on bowhead and gray whales. The reference to a response zone of over 20 km comes from a predictive-modeling study (Miles, Malme, and Richardson, 1987). However, neither bowhead nor gray whales have been observed to respond to industrial noise at more than 10 km from the noise source. Consequently, it is unlikely that bowhead or gray whales would respond perceptibly at 20 km, although it is (based on the mathematical model from Miles' report) hypothetically possible.

There is no whale information that shows that "disturbed migrating whales will return to their previous course, tract, and behavior." However, there have been a few observations of bowheads that returned to their predisturbance location and behavior following an encounter with industrial noise (see Richardson, Wursig, and Miller, 1987; Ljungblad et al., 1985). Also, Malme et al. (1984) provide information (see Fig. 8.3 of that report) showing that, while most gray whales avoid close approaches to seismic-airgun noise, they generally do not alter their course much to do so. Regarding the possibility of whales being less available to subsistence hunters, it is unclear as to how this would adversely affect the bowhead whale population, if such diversions were to occur. Regarding the possibility of higher entrapment and death resulting from possible delays when whales divert around a source of noise, it should be remembered that a whale's migratory course is not pre-set from its initial to final destination. Deviations to avoid naturally occurring objects or phenomena (including noise) are necessary and routine, yet they do not create any significant adverse effect on whales. Diversions around industrial noise are likely to have the same result, and studies to date confirm this. The suggested idea of entrapment or death resulting from diversions around industrial operations is considered well beyond the realm of reasonable expectation.

Synergistic noise effects were discussed in Section IV.B.7(1)(e) (Whale Distribution in Response to Industrial Noise). Regarding the suggested possibility of industrial noise creating areas where whales could be absent and thereby miss feeding opportunities, this again is considered highly unlikely. Wartzok et al. (1989) documented over 180 feeding bowhead whales that voluntarily approached an active research vessel at ranges of only 15 to 500 m, and some of these animals even bumped into the vessel before moving off.

Possible adverse physiological or psychological effects such as stress and decreased health and possible beneficial physiological/psychological effects such as energy savings, increased access to feeding areas, and death prevention due to icebreaker action have not been studied to any extent. Hence, they are speculative and are considered inappropriate in a NEPA analysis. Most importantly, although discussion of such possibilities and uncertainties could occur, it would not alter conclusions regarding the likely effect of Sale 126 on whales.

Response MMC-26

The referenced sentence means that the bowhead population is not likely to experience a deflection in their migratory path that would significantly affect them as a population. This statement was based on the findings of the short-term-effects studies cited in the analysis.

Response MMC-27

The referenced paragraph does not have a conclusion concerning the observations of Finley and Davis (1984). Further, the statement made by Finley and Davis concerning industrially naive animals was not one of their conclusions.

Response MMC-28

The referenced statement does not indicate that "industrial activity has not influenced whale distribution." It indicates that the distribution of the bowhead population appears to be related to the severity of ice conditions rather than to the presence of industrial operations (based on Treacy, 1989). Additional supporting information has been added to the FEIS, as suggested.

Response MMC-29

The annual spring bowhead migration has passed Point Barrow around mid-June. Based on what has occurred to date, the earliest time during which exploratory operations can occur during light-ice years is the end of June. In heavy-ice years exploratory operations would commence much later, if at all. The EIS also indicates that the spring-lead system is essentially outside the sale area. Therefore, as indicated in the DEIS, the spring bowhead migration would not encounter noise associated with exploration. Additional wording was added to the FEIS to re-emphasize this point.

Response MMC-30

The definition for the response zone (Sec. IV.B.7.a(1)(a)) is defined as the range of distances where a behavioral response (attributable to the industrial noise) can be expected from about one-half of the whales in the vicinity of a given source of industrial noise. Hence, about one-half of the whales within the outer perimeter of this zone (in this case 975 whales) would be expected to exhibit minor, short-term responses to the industrial noise. The definition says nothing about whales that may respond beyond the response zone, since at distances beyond the response zone it is often difficult, or even impossible, to determine what a given response was attributable to. While it is probable that some whales would respond to industrial noise at distances beyond the response zone, it is also probable that the actual number of encounters within the response zone would be significantly less than 975. For example, only zero to one exploratory operations per year are likely. This alone would decrease the number of estimated encounters from 975 to somewhere between zero and 487. It is also unlikely that all exploratory operations would be conducted during the time when whales are nearby (which was assumed in the encounter scenario). This too would result in a further reduction in the number of estimated encounters. Consequently, while it is possible that there could be more than 975 whales affected due to those responding beyond the response zone, it is also probable that significantly less than this number would actually be affected within the response zone.

Response MMC-31

The text of Section IV.C.6 has been revised to address the potential for polar bears to become concentrated under certain circumstances. Likewise, the possibility of polar bears being attracted to the area of a spill is acknowledged.

Response MMC-32

The text of Section IV.C.6 has been revised to address the concern for polar bears being attracted to sites of human activity.

Response MMC-33

The statement noting the potential for habituation of pinnipeds to activity has been made specific to this group; it was not intended that this example be extrapolated to the polar bear. This information had no significant influence on determining the concluded effect level and has been qualified in revision of Section IV.C.6. Several examples of disturbance of pinnipeds by human activities, or apparent habituation, have been cited to show the range of potential response in this taxonomic group. We would prefer, of course, to cite studies on the particular species in question; however, in many cases such studies have not been performed. Under such circumstances we can only suggest that there may be some rationale for extrapolating between the various pinniped species.

Response MMC-34

The major factors of oil spills and substantial disturbance effects have been considered in concluding an overall effect level for pinnipeds and polar bear. Potentially minor disturbance effects (e.g., attraction of polar bears to offshore sites, temporary displacement of pinnipeds by icebreaking activities) are not considered sufficiently severe to result in a significant elevation of the concluded effect level.

Response MMC-35

For the purpose of clarification, the second sentence has been deleted.

Response MMC-36

Section IV.C.7.a(2)(a) of the DEIS states that five (not 2) exploratory operations are assumed for the base-case. Further, this paragraph does not assess base case exploration-related effects; it discusses only the level of exploration that has taken place to date in this area.

Response MMC-37

As indicated on Table II-A-1 of the DEIS, there are no icebreaker activities projected for the production phase (as would typically occur during exploration), only intermittent supply-vessel visits (about 1/month). While these visits would be performed by an icebreaker, most would occur during the time when whales were not present in the area. Hence, supply-vessel activities would increase the likelihood of bowhead encounters only slightly, as stated in the DEIS. Regarding the concern of possible adverse effects on whales due to their being deflected by production operations, this scenario is addressed in Response MMC-25.

It is unclear what is meant by "range of possibilities," as suggested by the commenter. In the past, possibilities have been discussed at length; however, since they have no scientific basis, they do not alter conclusions.

Response MMC-38

Gray whales have been swimming through and around oil slicks caused by man since the time when ocean-going vessels began to carry petroleum products for fuel and cargo. In the southern portion of their range, fuel and/or oil spills are common due to vast numbers of industrial, commercial, military, and pleasure vessels in that area. Further, gray whales have for centuries been exposed to naturally occurring oil spills in many locations along their migratory corridor. While it is true that there has been no formal study performed that spans a period of time sufficient to qualify as a long-term study, it does seem prudent to recognize the fact that no gray whale (or any other whale, for that matter) has ever been found to have died from petroleum exposure. This includes the period when the entire gray whale population swam through the Santa Barbara oil spill in 1969. Further, the MMS believes that the information concerning short-term effects is adequate, on its own merit, to determine the likely effect of crude oil on baleen whales. This information has consistently shown that crude oil results in from only minor effects to no effect on whales.

Response MMC-39

As the commenter stated, there is no available information on the inhalation of petroleum vapors by marine mammals during the Exxon Valdez oil spill. Hence, that information cannot be added to the analysis.

Response MMC-40

The spring-migratory corridor and the spring-lead system are not synonymous. The spring-lead system (not shown in the EIS) falls within the spring-migratory corridor, which is shown in Figure III-B-5. While most bowheads are believed to migrate in the spring-lead system, others are believed to migrate somewhat farther offshore. Both of these areas are collectively illustrated as the spring-migratory corridor in the DEIS. The analysis in the EIS refers only to the spring-lead system as being largely outside the sale area, not to the spring-migratory corridor. Hence, there is no conflict between the figures and the text.

Response MMC-41

For the purpose of clarification, the referenced sentence has been changed to read "similar to" rather than "the same as."

STEVE COWPER, GOVERNOR

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September 11, 1990

Alan Powers
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RECEIVED
SEP 17 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Dear Mr. Powers:

SUBJECT: CHUKCHI SEA LEASE SALE 126
DRAFT ENVIRONMENTAL IMPACT STATEMENT
STATE I.D. NUMBER AK90072416/A

The Division of Governmental Coordination (DGC) has completed coordinating the state's review of the Draft Environmental Impact Statement (DEIS) for proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 126 (Chukchi Sea). Our review focused on the lease sale configuration, the proposed mitigation measures, and the DEIS description of the affected environment and environmental consequences. Detailed comments on each of these items are found in Enclosure 1.

If you have questions regarding these comments, please contact me at 561-6131.

Sincerely,

EABenson

Elizabeth A. Benson
Project Review Coordinator

Enclosures

cc: Gayle Berger, ADNR, Fairbanks
Al Ott, ADF&G, Fairbanks
Mike Wheeler, ADEC, Anchorage
Wade Srock, ADNR/DO&G, Anchorage
Warren Matumeak, NSB, Barrow
Randall Weiner, TFA, Anchorage
Rex Blazer, NAEC, Fairbanks

ENCLOSURE 1
STATE OF ALASKA COMMENTS ON
DRAFT ENVIRONMENTAL IMPACT STATEMENT
OCS LEASE SALE 126
AK90072416/A

The state has consistently support environmentally sound exploration and development of the Alaska OCS. The first step in achieving a proper balance between OCS development and environmental protection is to appropriately schedule and configure lease sales. The state resource agencies have reviewed the DEIS for proposed OCS Lease Sale 126 and have developed the following comments and recommendations on the DEIS generally, and specifically on the proposed lease sale configuration and mitigating measure to assist MMS and the Department of the Interior in their planning efforts.

DESCRIPTION OF THE AFFECTED ENVIRONMENT (Section III)

Although most of the information describing marine mammal distribution is accurate, the distribution shown in Graphic No. 2 should be modified as follows:

1) Add the summer habitat used by Pacific walrus nursery herds;

2) The summer habitat of spotted seal and belukha is much more extensive than shown, and includes the area at least 20 nautical miles seaward from the south end of Kasegaluk Lagoon.

AK 1

Population numbers for marine mammals should be updated, or at least the numbers given in the text should be qualified to denote that they are late 1970's estimates. For walrus, cite the most recent reference on population abundance (Gilbert, 1989. Marine Mammal Science 5:17-28). Furthermore, there should be a clear statement that there are no current programs in place to monitor population abundance or trends for species discussed in the text, except ringed seals. AK 2 And finally, Stellar sea lions should be included in the discussion of "threatened and endangered species," as this species has been listed as "threatened" since April 5, 1990. AK 3

Likewise, the description of subsistence activities should be expanded. For example, maps depicting polar bear hunting areas are missing. Such information is available for Point Lay. Also, although Atqasuk is a community that will potentially be affected by oil development resulting from this sale, the DEIS does not include land use maps for that village. Some of the references for the subsistence discussion are missing (e.g., "North Slope Borough 1988") or are not available to the public (e.g., Steven A Braund and Associates 1989 a and b).

AK 4

ENVIRONMENTAL CONSEQUENCES

The DEIS underestimates the environmental consequences of the proposed lease sale for three reasons: (1) the assessment of the effects of oil spills underemphasizes the effects of a winter spill; (2) there is inadequate consideration for the different life history characteristics among species that would be affected by the spill; and (3) the effects of noise and disturbances, particularly in the spring lead system, are underestimated.

The effects of a winter spill are apparently based on the assumption that oil entrained under the ice will essentially freeze in place and be released in less toxic form during spring and summer. To our knowledge, there are no data to support this assumption. In addition, the winter spill scenario does not account for a major spill in open water or broken ice -- for example, from the major pipeline that runs the length of the flaw zone (figures Iv-A-8 and 9) -- where oil can reach the surface.

In the flaw zone, where marine mammals and birds are concentrated during the spring, a spill would immediately reach the surface where it could effect these fish and wildlife resources. Our experiences with the Exxon Valdez oil spill gives us little reason to believe that the scenario described by MMS would be a realistic portrayal of the extent and severity of such a spill. This is especially the case because much of the Sale 126 discussion is a repeat of the Sale 109 discussion, which was prepared prior to the Exxon Valdez spill.

AK 5

With regards to the effects of a spill on wildlife species, the DEIS should not mix such diverse groups as polar bears and pinnipeds. Polar bears may be affected more adversely than, for example, bearded seals because polar bears are (a) very susceptible to mortality from contact with oil, (b) are relatively concentrated along the flaw zone especially during spring, (c) may be attracted to cleanup activities and thus encounter oil, and (d) may indirectly contact oil by preying on oiled seals. Furthermore, as the DEIS points out, the number of adult female polar bears that are available to maintain the population is relatively much fewer than the number of females for most pinniped species in the area.

AK 6

The DEIS also implies that the effects of disturbance would be relatively minor because most species are distributed widely; therefore, few individuals would be affected at any time. This assumption could be incorrect in spring and early summer when marine mammal and bird species are concentrated in the flaw zone, and marine vessel traffic could also be concentrated there. In addition, although the effects of disturbance may not be lethal, that does not mean they are unimportant.

AK 7

Therefore, we recommend that the assessment of impacts be modified as follows:

1. Base Case

   polar bear - moderate
   pinnipeds - low
   whales - moderate

2. High Case

   polar bear - high AK
   pinnipeds - moderate 8
   whales - moderate

3. Point Lay Deferral

   polar bears (as above, depending on the assumed base or high case)
   spotted seals - low
   belukhas - low

4. Cumulative Case

   polar bear - high
   whales - high
   Stellar sea lion, ringed seal, northern fur seal, bearded seal, harbor seal, sea otter -- moderate

LEASE SALE CONFIGURATION

The state has consistently supported deferring the coastal blocks known as the Chukchi polynya. The Chukchi polynya is an important spring migration corridor for waterbirds and bowhead and belukha whales. It is an open-water ice "lead system" that occurs along the eastern shore of the Chukchi Sea. The lead system is extremely important to marine mammals and sea ducks, particularly bowhead whales and king eiders, as a spring migration corridor. Oil spills in this lead system could directly and severely impact these species. Noise and other disturbance caused by industrial activities such as drilling, supply, and ice AK management activities, in this area also have the potential to disrupt the spring migration of bowhead whales, because whales 9 are restricted to the lead system during spring migration.

Although the risk of impacts caused by exploratory drilling would be minimized by the adoption of proposed Stipulation No. 8, this protection does not extend to production. While we understand that MMS may conduct additional comprehensive environmental studies prior to production we cannot rely on the actual

implementation of a seasonal restriction by MMS. MMS has failed to adopt a seasonal restriction as mitigation for both Lease Sales 97 and 109 and has waived such a restriction in the past for other exploratory operations in the Beaufort Sea. We continue to recommend a deferral of the Chukchi polynya (Alternative IV - Point Lay Deferral). If commercially producible quantities of oil are found in offshore leases, and if there emerge demonstrably practical technologies to explore and develop the Chukchi polynya area with negligible impact on fish and wildlife populations and their habitat use, and on subsistence uses, then additional lease sales including the nearshore area could be offered in the future.

In addition, while we are pleased that the DEIS includes a description of the coastal deferral (Alternative IV - Point Lay), we recommend that the deferral area be expanded in the Final EIS to include all the area devoted as the "flaw zone" in Graphic No. AK 2. 9

Furthermore, during review of the Call for Comments for Sale 126, the state recommended that the lease sale be limited to areas of hydrocarbon potential that receive industry nominations of medium to high priority. Generally, the proposed sale area appears to include most of the planning area with the exception of some coastal blocks (Figure I-2). If the conditional resource estimates are considered, the Alternative I Base Case and Alternative IV have identical oil production figures (Table II-A-1). Alternative IV defers leasing of 501 blocks located 25 to 75 miles offshore. These data indicate that the hydrocarbon estimate remains the same if this deferral is adopted and that the Point Lay deferral blocks have little oil resource potential. The Department of the Interior (DOI) has continued to publicly support a "focused" leasing policy, and that those areas where there is strong geological evidence or a potential oil strike would not be offered for lease. The state supports the DOI's continued commitment to reduce the size of lease offerings and focus on areas of high hydrocarbon potential while withdrawing those areas where there are serious environmental concerns, such as the Chukchi polynya.

MITIGATING MEASURES

As we have stated regarding past OCS lease sales, the state prefers the use of mitigating measures in lieu of deferrals whenever scientific information and technological capabilities enables leasing to proceed in an environmentally sound manner. Not only should stringent protective measures be in place prior to leasing in this area but development in the planning area should not occur until comprehensive environmental studies are conducted.

The mitigation measures proposed for Sale 126 generally include those proposed for Sale 109, with the exception of a seasonal drilling restriction during the spring bowhead whale migration. New stipulations deal with coordination with subsistence whaling (Stipulation 6, which was previously an Information to Lessee (ITL) measure in Sale 109), oil spill response preparedness (Stipulation 7), and density restriction for protection of bowhead whales (Stipulation 8). In addition to these stipulations, eight ITL's are proposed for Sale 126. The state supports adoption of all of these proposed mitigation measures with the following additional provisions:

Stipulation 6: Stipulation 6 should be expanded to include all subsistence activities, not just bowhead whaling. A useful model for such a stipulation is MMS Information to Lessees (ITL) No. 3 in the DEIS for Norton Sound Offshore Mining Leasing. AK 10

Stipulation 7: This proposed new stipulation on oil spill response preparedness does little more than restate oil spill response measures currently in existence. Oil Spill Contingency Plans (OSCPs) must already be submitted and drills are already required under MMS regulations. This stipulation was most likely proposed as a consequence of heightened public concern in response to some recent oil spills. However, the only new requirement in this stipulation is that drills must be conducted under realistic conditions (including solid-ice, open-water, and broken-ice), and must include deployment of onsite response equipment and additional cooperative equipment identified in the OSCP. To strengthen this stipulation, the state suggests the following three modifications:

1) prior to drilling in oil and/or gas bearing strata, the lessee must adequately demonstrate response preparedness for those conditions that may occur during the proposed drilling schedule (e.g., if drilling will occur during broken-ice conditions then the lessee must adequately demonstrate response preparedness in broken-ice conditions, if drilling will occur during open-water and broken-ice conditions then the lessee must demonstrate response preparedness in both open-water and broken-ice conditions); AK 11

2) if a lessee fails to adequately demonstrate response preparedness for a given condition (solid-ice, open-water, or broken-ice), then the drilling operation must not continue during that given condition until such time as inadequacies in the response preparedness are addressed and the lessee successfully passes a new spill drill; and

3) the decision on whether or not a lessee successfully passes a spill drill shall be made by a committee composed of representatives from those federal and state agencies currently required to review the OSCP.

We also request that the following language be added as a fourth modification to Stipulation 7: AK 11

4) The lessee shall be required to demonstrate same-season relief well drilling capability.

This addition, if adopted by MMS, will require operators to have a same-season relief well capability, and thus avoid a multi-year blow-out spill scenario.

We also recommend that MMS expand the stipulation to include state approval of all types of fuel and oil spill prevention programs, to fund prevention research, and provide for information transfer on prevention technology.

State of Alaska

Response AK-1

The text and/or Graphic No. 2 have been revised to reflect additional information concerning distribution of spotted seal and walrus. Although there appears to be no doubt that some spotted seals forage offshore, particularly when the ice front is located in the vicinity of coastal concentration areas, we have been unable to verify the 20-nautical-mile distance cited in this comment.

Response AK-2

Section III.B.4 has been updated with regard to the estimated size of the walrus population; population estimates for other species incorporate the best available information. Budgetary constraints preclude MMS from undertaking a comprehensive program of monitoring for all species. . The MMS currently is funding marine mammal and marine bird surveys in the Kasegaluk Lagoon area, and has funded ringed seal studies in recent years. Stipulation No. 2, Protection of Biological Resources, although concerned more with isolated animal concentrations than variations in distribution and abundance of populations determined over long periods, could provide information potentially useful in responding to, e.g., oil spills where population distribution and status information may be used to focus the response.

Response AK-3

The Steller sea lion analysis (Sec. IV.H.12.b(3) of the DEIS) appears in Section IV.H.2.b(5) (Endangered and Threatened Species) of the FEIS.

Response AK-4

The maps selected (Figs. III-C-6 - III-C-11 and IV-C-4) represent appropriate coverage of the harvest-concentration areas of the communities principally affected by Sale 126 activities. Although polar bear-harvest-concentration-area maps are not included in this EIS, a discussion of the locations in which they are hunted is included in the text (Sec. III.C.2).

The polar bear take represents a small fraction of the total subsistence harvest of the communities studied. Point Hope harvests the highest percentage of polar bear (1.1%) as a portion of total subsistence harvest. The marine mammal-harvest area for Atqasuk is subsumed under the marine-harvest regime of Barrow. A discussion of the reasons upon which this assumption is based can be found in Section IV.C.11.

The bibliographic citation "North Slope Borough, Planning Department. 1986" has been revised to "North Slope Borough, Planning Department. 1988."

The two referenced Braund reports can be obtained from the MMS Alaska OCS Region Library as Technical Report No's. 135 and 136. These reports are also available from the National Technical Information Service (NTIS). The MMS librarians can assist the general public in ordering any MMS publications.

Response AK-5

The effects of a winter spill are not based on the assumption that all the oil will be released in a less toxic form. Oil pooled on the surface of the ice will be toxic to animals and birds as it weathers. Section IV.J has been modified to clarify the difference between first-year and multiyear ice and the interaction with petroleum. Multiyear ice will discharge unweathered oil directly into the water column as it melts. First-year ice allows for brine-channel migration and weathering of the oil before subsequent release into the water column. The data was taken from an article by Martin (1979) entitled "A Field Study of Brine

Drainage and Oil Entrainment in First-Year Sea Ice." From field observations this paper describes the growth and development of first-year sea ice and its interaction with petroleum. Section IV.J discusses the interaction of a spill in a flaw-lead zone with marine and coastal birds, pinnipeds, polar bears, and endangered species.

The spill-scenario extent was calculated using an oil-in-ice-weathering model (Payne et al., 1987) and historical data. Most Exxon Valdez-spill data is not available for analysis at this time. Available, published reports from the Exxon Valdez spill are included where appropriate.

Response AK-6

Although the noncetacean marine mammals are a diverse group, the MMS believes that the analysis of potential effects has been kept sufficiently distinct by treating species or species groups in separate paragraphs, thereby providing separation of attributes and effects peculiar to a given species. In this regard, the text of Section IV.C.6 has been revised to include additional information on the polar bear.

Response AK-7

Nowhere in this analysis does it state that disturbance is unimportant; rather, it states that disturbance is not expected to be significant. Available evidence suggests that the likely level of disturbance and interaction with wildlife populations will not be sufficiently great in most instances to elevate the concluded effect to the next higher level. The text of Section IV.C.6 has been revised to include additional information on potential disturbance of polar bears in particular. The MMS would appreciate any further information that might be available.

Response AK-8

The overall environmental consequences determined in this analysis for each species or species group have incorporated the best available information. Regarding the concern for pipeline locations (e.g., Fig. IV-A-8), these locations are strictly hypothetical for purposes of discussing potential effects. If development occurs, a developmental EIS as well as a development plan will show planned pipeline locations; and there will be ample opportunity to comment on both of these documents. As noted in Response AK-6, we feel that the analysis of potential effects on noncetacean marine mammals has been kept sufficiently distinct by treating species or species groups in separate paragraphs, thereby providing separation of attributes and effects peculiar to a given species. As noted in Response AK-7, available evidence suggests that the likely level of disturbance and interaction with wildlife populations will not be sufficiently great in most instances to elevate the concluded effect to the next higher level. Thus, MMS considers that the appropriate conclusion regarding the expected effect level has been determined. In the cumulative case, the effect on the polar bear has been elevated to the moderate level to reflect the potential for concentrations to occur. The MMS disagrees that the Steller sea lion qualifies only for the moderate effect level, as suggested by the State; instead, we concluded a very high effect level, reflecting this species' recent precipitous population decline.

Response AK-9

A considerable number of factors enter into the decision process by which the boundaries of deferral alternatives are drawn, including the critical habitats and flaw zone of the Chukchi Sea. The western boundary of the flaw zone shown on Graphic No. 2 in the Sale 126 DEIS, however, is only indicative of possible annual and seasonal boundary locations and cannot be used with precision to describe a lease-sale boundary. This is why a cautionary note to readers is provided on Graphic No. 2 to underscore the imprecision of the data described.

Please note that Stipulation No. 8, Density Restriction for Protection of Bowhead Whales from Potential Effects of Noise, as described in the DEIS, has been deleted as a potential mitigating measure because it is inconsistent with recent NMFS regulations on incidental take of bowhead whale and not required by the Arctic Region Biological Opinion or the Sale 126 Biological Opinion.

Response AK-10

The wording of Stipulation No. 6 has been changed to include all subsistence activities.

Response AK-11

The stipulation is a summary of the detailed requirements for oil-spill preparedness and drills and training contained in 30 CFR 250.42 and 250.43. These or similar requirements have applied to all previous Alaska OCS lease sales and activities. We would also like to stress that, to date, only exploratory drilling has occurred on the Alaskan OCS; therefore, current practices for OSRD's are based on the type, location, season, and duration for each exploration activity. If development and production from the Alaska OCS Region were proposed, additional requirements and practices for conducting oil-spill-response drills (OSRD) would be developed commensurate with the type, location, and scope of proposed activities.

Item (1) of this comment suggests that MMS set a threshold depth before which the OSRD must be held. Although this specific point is not addressed in the stipulation, the Alaska OCS Region requires that drills be held before drilling below surface casing, to ensure that OSRD's are completed well above potential hydrocarbon accumulations. The following summarizes the requirements for timing and frequency of drills for exploration drilling: (1) when pollution-control equipment is initially put in place and, in the case of a new well, before drilling out of the surface casing; (2) at least every 12 months; (3) if environmental conditions change during exploratory operations (i.e., open water to solid ice); and (4) upon request of the RSFO. The MMS also requires a Table Top/Communications Exercise for testing the lessee's communications, knowledge of the Oil-Spill-Contingency Plan (OCSP), and ability to initiate a response to a major oil spill.

Item (2) of this comment suggests that MMS not allow drilling in a particular ice season until a satisfactory OSRD is conducted in that particular ice season. As indicated above, the Alaska OCS Region requires the lessee to demonstrate adequate response preparedness for each type of environmental condition that occurs during drilling operations. This also is reflected in potential Stipulation No. 7, which requires lessees "to conduct drills. . .for appropriate environmental conditions, e.g.: solid ice, open water, and broken ice conditions." If well-drilling activities should continue year-round in the Arctic, the operator would be required to conduct a drill in solid ice and in open water/broken ice. If, upon evaluation of the results of the OSRD, the RSFO finds the response inadequate, the RSFO may require the lessee to conduct additional drills to correct any deficiencies found.

Item (3) of this comment requests that MMS create a committee composed of representatives from State and Federal agencies to provide an adequacy decision for the OSRD. The RSFO is responsible for evaluating OCS OCSP's and related activities, and MMS cannot transfer this statutory responsibility. In the Alaska OCS Region, the principal State and Federal agencies involved in oil-spill response (U.S. Coast Guard and Alaska Department of Environmental Conservation) are involved through review and comment on OSCP's and through attending and observing the OSRD.

All advice and comments are incorporated into the RSFO's decision to approve or disapprove the plan and drills. This method has proven satisfactory, and we see no need to modify this process.

For the Alaska OCS Region, MMS requires lessees to submit, with an exploration plan, their contingency plans for drilling a relief well should a blowout occur. This includes information on the availability of backup equipment, including a relief-well rig and support craft (including icebreakers, when appropriate) and the timing to obtain, initiate, and complete a relief well. The lessee is required to provide the MMS with updated information on the location and availability of drilling rigs capable of operating in the environment where operations are proposed prior to each drilling season and of any changes during the drilling program. The MMS requires mutual assistance/relief-well-drilling-rig agreements between the two operators conducting concurrent operations in the same area to facilitate and expedite relief-well drilling. The adequacy of the relief-well plan is determined based on individual circumstances including the type and location of proposed activities, the type of drilling unit, other operations in the area, and company plans for monitoring environmental conditions and well status and curtailing operations and securing the well prior to the end of the drilling season.

In the Chukchi Sea, floating drilling units will be used for exploratory drilling. Floating drilling units are capable of moving offsite in the event of a blowout and starting a relief well almost immediately. There are currently four drilling units and associated icebreakers and ice-class support vessels that have been successfully used in the U.S. and Canadian Arctic, and that are available in the Arctic and can be mobilized to support a relief-well-drilling program in the Chukchi Sea.

The likelihood of an oil blowout occurring during exploration drilling is extremely low. There has never been an oil spill resulting from an OCS exploratory-well blowout. Blowouts typically are a result of shallow gas without any oil that lasts for short periods of time. Bridging (including depletion) of blowouts (oil and gas) occurs greater than 70 percent of the time, with bridging occurring shortly after the blowout. Relief-well drilling has been attempted for approximately 4 percent of those blowouts that did not naturally bridge (Norwegian Oil Review, 1985).

Prevention is the key to mitigating the risk of an oil spill resulting from a blowout. The MMS regulations establish strict requirements in the form of performance standards to ensure that operations will not result in an unsafe condition. Plans, equipment, equipment inspection and maintenance, testing, and training requirements all contribute to the low risk of a blowout on the OCS. Recent technological advances and continuing high levels of research are improving the safety of drilling in the Arctic, thus reducing the already negligible potential for a blowout.

The MMS maintains a near-continuous inspection presence at each exploratory-drilling location and monitors the progress and status of the well and environmental conditions on a daily basis, including well depth, type of operation (drilling, coring, logging), next planned operation, the timing for completing current operations, the next planned operation, downhole conditions, and potential problems in maintaining well control. The MMS has the authority to require that operations be suspended in the event that ongoing operations could increase the risk of well-control problems or, continuing with the next operations following completion of ongoing operations such as drilling to the next casing point following setting and cementing casing, could not be completed before the end of the drilling season.

The costs associated with drilling an exploratory well in the Chukchi Sea are high. Same-season relief-well capability significantly affects an already restrictive and short drilling season in the Sale 126 area, which could require a second season to complete the drilling of a single well or maintain a second drilling unit at the site. The costs associated with such a requirement would be substantial and would not significantly increase safety or reduce risk.

The MMS recognizes the importance of relief-well panning for exploratory-drilling activities in frontier areas such as the Chukchi Sea. The MMS believes that regulatory requirements for documenting relief-well capabilities in conjunction with MMS' inspections and monitoring of well status and environmental conditions on a real-time continuous basis for each site-specific activity, and authority to require operations be suspended, provide an effective and prudent mechanism to ensure that drilling activities are not continued if there is a significant risk of lost well control and remedial action, including drilling a relief well, could not be conducted.

In response to the State recommendation that "MMS expand the stipulation to include state approval of all types of fuel and oil-spill prevention programs, to fund prevention research, and provide for information transfer on prevention technology," we must point out that MMS cannot transfer the statutory responsibility for approval of oil-spill-contingency plans and related activities.

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George N. Ahmaogak, Sr., Mayor

September 11, 1990

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RECEIVED
SEP 14 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

RE: DRAFT EIS PROPOSED OCS LEASE SALE 126

Dear Mr. Powers:

As was the case with proposed Beaufort Sea Lease Sale 124, long and forceful testimony was heard at recent meetings in our North Slope villages in opposition to the leasing of Chukchi Sea blocks in proposed Lease Sale 126. The same strong concerns over the safety of drillship operations which were expressed at those hearings have been detailed in our May 8, 1990 comments to you on the Sale 124 Draft EIS. We attach and incorporate our Sale 124 comments here for reference, and have the following additional comments on the Sale 126 Draft EIS.

NSB 1

SECTION I. NEED FOR DRILLING RESTRICTION TO ENSURE SINGLE SEASON RELIEF WELL

The North Slope Borough does not believe that the oil industry has the capability to effectively respond to, contain, or clean up a major oil spill if one occurs in arctic waters. We have seen nothing in the Draft EIS or any exploration or oil spill contingency plan we have reviewed which changes this view.

NSB 2

A major concern in this regard is industry's apparent inability to substantially guarantee the completion of a same-season relief well in the event of a late season blowout, or even to plan to cease drilling early enough to provide the appropriate drilling window to accomplish such a task. Accepting, as we do, that same-season completion is essential in all cases when a relief well is called for, we believe that exploratory drilling should be halted no later than a date which would provide the minimum

operational window before ice and other environmental conditions can be expected to prevent safe drilling of a relief well. While this logic seems to us so elementary, it is not provided for in the Draft EIS or any contingency plan we have reviewed.

This failure to appropriately restrict operations to minimize the likelihood of what could be a devastating multi-year blowout gives us great cause to question a succession of other claims that oil spill threats are minimal. The Draft EIS discusses oil spill risk factors, including potential dispersion patterns of spilled oil, shoreline impacts, recovery techniques, localized and long-term wildlife and subsistence impacts, and appropriate measures to protect environmentally sensitive areas and vulnerable resources. These risk assessments are suspect if impacts from a multi-year blowout are more likely than they have been considered to be.

NSB 2

SECTION II. FAILURE TO PLAN FOR SPILL RESPONSE IN OFTEN OCCURRING COMBINATIONS OF ENVIRONMENTAL CONDITIONS

We also do not believe that MMS has adequately considered industry's inability to respond to a major spill in the combination of environmental conditions which can often occur in the proposed sale area. The Draft EIS and contingency plans we have reviewed contain extensive discussions of spill response techniques in varying ice conditions, but do not describe how these techniques would be affected by other conditions which our people know often occur in tandem with significant ice cover. This is particularly worrisome given that the same condition which would likely render on-site containment ineffective (e.g. high waves) would often bring with it other conditions which will impair secondary response. In other words, a raging October storm, with sea states of 4 or higher, with 20-30 knot winds, low visibility, and some broken ice for good measure would seem to us to hobble both primary and secondary response efforts.

NSB 3

Also absent from the Draft EIS is any discussion of the possibility that fog, wind, precipitation, waves, or ice conditions can severely hamper spill response efforts not only at the spill site, but also for long periods at locations where secondary equipment and personnel are to be mobilized and transported to the site. We believe that MMS should require exploration and contingency plans to contain a clear discussion of the effectiveness of suggested mechanical containment and recovery equipment in the specific environmental conditions or combination of conditions which are likely to occur at proposed drillsites.

Even before that point, however, MMS should include in the EIS the same analysis for various locations within the proposed sale area. To us it is simple; you should not lease a specific area unless you are certain that the best available response technology, applied most effectively, can perform adequately in the full range of conditions which can be expected to occur at that site with some frequency. Any claim that this region-specific capability analysis would be too burdensome an undertaking for such a large sale area just points out the inappropriateness of offering for lease an area so huge that it contains markedly different environmental conditions.

NSB 3

Despite what may be the best efforts of individual oil companies, we believe that if industry does not have the capability to prevent a major oil spill from having significant impacts on the arctic environment, wildlife resources, and our subsistence culture, then continued leasing should not occur. Simply requiring the use of state-of-the-art equipment and techniques is not good enough if those measures cannot achieve the goal of environmentally safe exploration.

SECTION III. NOISE THREATS

It is important to understand that questions of noise impacts and proper mitigation measures should not even be raised unless and until industry can meet its burden of establishing that it can operate without the threat of significant oil spill impacts. Only then must operations be further tailored to minimize disturbance of sensitive species and critical subsistence activities.

A variety of marine mammal species sensitive to noise disturbance utilize the proposed sale area. Bowhead and beluga whales migrate through the Chukchi Sea. Seals and walrus use the waters and ice for feeding, resting, and rearing their pups, and are in turn fed upon by polar bears, which are vulnerable to displacement from preferred denning areas with increased industrial activity. Likewise, critical waterfowl habitats could be impacted by the noise from support activities.

NSB 4

Recent observations of spotted seals in Kasegaluk Lagoon and the surrounding area by scientists from the North Slope Borough and the Alaska Department of Fish and Game reinforce concerns that these animals are particularly sensitive to aircraft noise. A large number of seals utilize the area during the open water season. Census attempts from heights of 1000 feet failed as the

animals quickly retreated to the water from haulout areas. From land, the observers witnessed approximately 450 seals flush back into the water in response to an overflight by an aircraft at about 500 feet. A very few seals (perhaps 30) did haul out again several hours after the overflight. Up to five hours after the disturbance, seals reacted twice to the sounds of planes flying well above 3000 feet by flushing into the water.

NSB 4

These observations conflict with the conclusions found on pages IV-C-42 and 43 of the Draft EIS that seals may habituate to fairly high levels of human activity and that site-specific effects of aircraft disturbance on seals are likely to be low. An increase in aircraft traffic associated with increased industrial activity or a large spill response effort could significantly increase the physiological stress in spotted seals by shortening or eliminating the duration of haulout and feeding periods. The disturbance would of course be more pronounced if it occurred in preferred haulout or feeding areas. Seals, already sensitive to noise disturbance, may be more vulnerable to harm from an oil spill if it occurs at a time of stress (Geraci and St. Aubin. 1980. NMFS Mar. Fish. Rev. 42:1-12). We would expect the same to hold true for all the pinniped species found in the proposed sale area.

SECTION IV. MISREPRESENTATION OF SCIENTIFIC RECORD

When the primary purpose of the EIS process is to provide a basis for the assessment of the environmental risks posed by a particular action, it should go without saying that it is essential that all references to the scientific record must be accurate. Few, if any, reviewers of a document the size of the Sale 126 Draft EIS have available the time or resources to examine the full text of each and every source cited.

NSB 5

We have found that this document does not accurately reflect the scientific record, and are particularly disturbed that certain inaccuracies concern one of the central issues surrounding the propriety of continuing to allow industrial activity in our waters. Only through careful examination of the referenced study report were the inaccuracies of Section 7a(3)(a) on pages IV-C-49 and IV-C-50 of the Draft EIS discovered. This section discusses the potential impacts of oil contact on endangered whales. Throughout the section's 7 paragraphs, the 1982 report by Geraci and St. Aubin is repeatedly cited as evidence of the lack of threat posed by exposure of bowhead whales to gasoline or crude oil. This "proof" of no impact oversimplifies the study and is misleading when compared to the actual data in the report. Consider the points noted below.

1. Paragraph 2 of the section indicates that even after 75 minutes of gasoline exposure dolphin skin was unharmed and "at no time was there any swelling, hemorrhage, or break in the continuity of the skin associated with exposure to gasoline". This is misleading because the report on page 90 states that 3 of the 4 tested dolphins developed blisters on the skin. Two developed skin blisters after 30 minutes exposure and the third developed skin blisters after 45 minutes exposure.

2. Paragraph 2 of the section also refers to a 17 hour exposure of the skin of a "living sperm whale" to crude oil. Paragraph 2 notes that "After 17 hours of exposure to crude oil, the contact sites were normal in appearance and the skin was only mildly affected". Paragraph 2 would not be so misleading if it also noted that it was not a 17 hour exposure study on a living whale, but rather was something much less. In this regard refer to pages 153-154 of the report. The whale was stranded and was dying. Although the oil was on the skin for 17 hours, the whale was dead for 5-10 of these hours. In reality the experiment was on a dying stranded whale and the period of "live" exposure was not 17 hours but rather was an unknown period of probably 7-12 hours. It would also have been helpful if the DEIS would have noted the effect of gasoline exposure after "17 hours". In that instance (page 157 of the report) there were "dramatic changes", and "the original skin surface could not be defined and the upper 1/2 to 1/3 of the epidermis was pale gray and had the consistency of thick paste".

NSB 5

This misstatement of the record on an issue at the heart of the debate is grounds we believe for a rejection of the Draft EIS's entire risk analysis. Before the document can be accepted in final form, we expect to see evidence that MMS has reviewed for accuracy not only the particular section highlighted above, but also every other cited reference on which conclusions of insignificant impacts are based.

NSB 6

CONCLUSION

We often hear comments when we raise objections to offshore industrial operations about the national security interest in exploring for new sources of domestic fuel. Any national security

interest must be weighed against the potential devastation of some of the country's very last unspoiled wildlife habitat, its many unique and vulnerable arctic species, and the traditional Native subsistence culture of the Inupiat people. Before anyone questions our commitment to domestic energy security, they should consider their own resolve to pursue long-term solutions of potentially far greater import than business-as-usual OCS development. No one can honestly dispute that a national energy policy, including relatively simple conservation measures, requiring fuel-efficient vehicles, and development of alternative energy sources, would go far beyond exploitation of the arctic OCS to reduce dependence on foreign oil.

Thank you for considering these comments.

Sincerely,

George N. Ahmaogak, Sr.
Mayor

cc: Steve Cowper, Governor
Ron Morris, NMFS
Mayor Don Long, Barrow
Mayor David Bodfish, Sr., Wainwright
Mayor David Stone, Sr., Point Hope
Mayor Amos Agnasagga, Point Lay
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Warren Matumeak, Director, Planning
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NORTH SLOPE BOROUGH

OFFICE OF THE MAYOR

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George N. Ahmaogak, Sr., Mayor

May 8, 1990

Alan D. Powers
Regional Director
Minerals Management Service
949 East 36th Avenue, Room 110
Anchorage, AK 99508-4302

RE: PROPOSED BEAUFORT SEA LEASE SALE 124

Dear Mr. Powers:

As should have been very evident from the testimony of our residents at the well-attended public hearings in Barrow, Kaktovik, and Nuiqsut on April 17, 18, & 19 respectively, the North Slope Borough remains strongly opposed to this proposed offshore lease sale. The reasons given for opposition to the sale by Borough and local officials, our elders, whaling captains and crews, wives and mothers, social and health workers, tribal representatives, biologists, and many others were varied, but together left little doubt about the local sentiment against offshore activities in the Beaufort Sea. We continue to believe that oil and gas leasing, exploration, and development should be restricted to onshore or shallow-water tracts, where proven techniques and technologies can be employed to significantly limit impacts from both day to day operations and catastrophic events. No one can yet make the same claim with respect to offshore operations requiring the use of drillships. These comments will be in two major parts: Section I will discuss our general position that leases should not be sold in the arctic OCS in waters which would require drilling from floating structures, and Section II will deal with specific provisions of the Sale 124 Draft EIS.

SECTION I. OCS LEASE SALES IN THE ARCTIC NOT SUPPORTABLE

We believe that the path from leasing to development is a downhill one; that a bias in the regulatory process increases the likelihood with each successive step that the following step will find approval. Recognizing this, we do not believe that the first

step (leasing) should be undertaken unless and until firm assurances can be made, based on good scientific evidence, that the intermediate step (exploration) and final steps (development and transportation) can be undertaken safely and with minimal disturbance of wildlife and subsistence activities. Without that essential base scientific evidence, including a much broader understanding of arctic ecosystems, noise impacts, and the effectiveness of oil spill clean-up techniques in the region, the leasing and regulatory agencies are playing a high stakes guessing game with our shared biological heritage and the Inupiat culture.

We are not alone in questioning the sufficiency and quality of the scientific information which has underlain federal and state decisions concerning offshore industrial activities. The Arctic Research Commission was created by the Arctic Research and Policy Act of 1984 (15 USCS § 4102) to "promote Arctic research and to recommend Arctic research policy", and is composed of five members appointed by the President. In December 1989 the Commission published a fourth in its series of FINDINGS AND RECOMMENDATIONS reports with the title IMPROVEMENTS TO THE SCIENTIFIC CONTENT OF THE ENVIRONMENTAL IMPACT STATEMENT PROCESS. The report states that the Commission undertook a review of the EIS process "[b]ecause accurate scientific and technical information and adequate data bases are such a fundamental requirement, and because the Arctic presents very unique environmental problems".(p. vii) The Commission identified an imperative need to improve the EIS process in several respects, but concluded that the "most critical deficiency is the absence of impartial external quality-control mechanisms for the data and information used in the stages of scoping, synthesis and EIS preparation, and the follow-up monitoring programs." (p. 1) While we urge you to carefully review and respond to the entire brief report before proceeding with this lease sale or permitting any other industrial activity on the Alaskan OCS, several of the document's findings and conclusions merit special mention here:

> p.5. The effects of man-made environmental insult are aggravated by the relatively small number of species in arctic ecosystems and the slowness of environmental recovery (environmental fragility). The result is that there are few comparable precedents on which to base EIS predictions in Alaska, and that the environmental consequences of erroneous predictions can be far more serious and long-lasting than in temperate regions.
>
> In the Arctic, including the Alaskan Arctic, there is a serious lack of data and information concerning the

physical and biological (ecological) environment covering long periods of time, on a decadal scale.

p.6. The scoping process is sometimes perceived to be organized to support decisions already made.

EIS's are often viewed as supporting agency opinions rather than being the basis for such opinions.

Too many nonverifiable hypotheses and unstated assumptions are included in the EIS, and much of the documentation is based on the "gray literature."

p.11. To improve the EIS process, impartial external scientific and engineering review mechanisms should be established for each of the following three stages: The scoping plan; Synthesis and preparation of the EIS; and Environmental monitoring programs.

Some decisions stipulate that an environmental monitoring program is to become part of the project. Peer review of the design of the monitoring procedures will help assure accurate and usable results.

Also instructive is the February 1990 final report of the Alaska Oil Spill Commission, entitled "SPILL: The Wreck of the Exxon Valdez". While this report focuses primarily on the Prince William Sound tragedy, it also contains several important general observations, as well as specific recommendations concerning continued industrial activities in the arctic. We ask that you consider the entire report and respond to these points before you proceed with this lease sale:

p.100. The consequences of the Exxon Valdez oil spill have brought into question the usefulness of existing oil spill containment and pollution-abatement technologies, not only for a catastrophic spill the size of that from the Exxon Valdez (10.8 million gallons) but also for any major oil spill in an offshore, remote or sensitive area.

In general, none of the currently available technologies are adequate for these incidents. In the United States, almost all existing technology has been developed for use in harbors and other protected waters, not in offshore, remote or environmentally sensitive waters.

p.125. Conclusions reached for Prudhoe Bay were that in summer the spill response would be effective for small spills, but that there was insufficient equipment to contain and recover a large spill. Contingency planning at Prudhoe Bay relies heavily on the ARCAT skimmer, but there have been no tests to see how well it recovers oil, specifically how well it would recover highly weathered Prudhoe Bay crude.

During fall at Prudhoe Bay the spill response in a growing offshore ice field would be only marginally effective with present equipment. Spill response on shorefast ice would not be easy, but there would be more time to marshal heavy equipment and personnel out on the ice where scrapers and front-end loaders could recover the pooled oil. During breakup there could be a period of several weeks in which the only action response crews could undertake would be to watch the interaction of the ice and the spilled oil....

The picture is bleak for remote areas. An effective response effort for a large spill from a drill ship or a tanker accident very far from Prudhoe Bay or Barrow would be extremely difficult...[u]sing airborne applications of chemicals, either dispersants or gelling agents, has received no testing whatsoever in these conditions, and none is known to work on heavy crude oils at typical arctic temperatures.

p.144. The long-term need to develop environmental safety regimes of great stringency cannot be ignored. Development of arctic oil discoveries dependent on maritime transportation should await the preparation of approved systems of oil transportation using experience gained from the trans-Alaska pipeline system.

p.201. The commission does not think that oil should be developed to production in any arctic area without a substantial planning effort on the transportation leg.

We have long argued that drilling from floating structures, and therefore lease sale terms which would permit such drilling, are insupportable in arctic waters. You simply do not have enough good baseline scientific data to appropriately assess the environmental risks posed. You do not know how bowhead (and belukha) whales are impacted by industrial noise; just how vital their ability to communicate is to navigation in heavy ice conditions, whether heavy seismic activity has damaged the hearing of individual whales, whether whales have already been driven from traditional migratory and feeding areas, or if intense localized drilling, support, or seismic noise could act as a migratory barrier and subject a large aggregation of animals to increased risk from environmental hazards. You are not certain how whales and other organisms would be affected by exposure to spilled oil in the arctic environment; whether an entire migratory pulse of whales could be harmed by even a comparatively small spill which could not be avoided due to environmental conditions, how long oil and its toxic byproducts would persist and migrate in the cold and ice of the arctic, or how spilled oil would affect krill, mollusk, and fish populations, and the higher organisms which feed on them, including seals, walrus, whales, and man. You are unsure of industry spill response, clean-up, and containment technologies under ideal conditions and in accessible locations, much less in the harsh and remote environment of this proposed sale. All this and more is the information which must be known before the true risks of oil exploration, development, and transportation can be determined. Without really understanding these variables, rather than just paying lip service to them, you cannot know whether the risks outweigh, or are outweighed by, the supposed benefits which you also accept with little basis. We strongly recommend that the final EIS contain as a preferred alternative a sale which would only offer for lease those tracts in water depths which could be explored and drilled from islands or bottom-founded drilling structures.

SECTION II. PREFERRED ALTERNATIVE AND PROPOSED MITIGATING MEASURES OF DEIS DO NOT ADEQUATELY PROTECT SALE AREA ENVIRONMENT OR SUBSISTENCE ACTIVITIES

As explained above, we do not believe any Beaufort Sea tracts should be leased which would require exploratory drilling to be conducted from floating structures. Drilling from floating structures, whether anticipated under the low, base, or high case scenarios offered in the DEIS, would not comply with the provisions of the North Slope Borough Coastal Management Program prohibiting (1) significant interference with subsistence whaling, (2) jeopardy to the continued availability of whales for subsistence, (3) depletion of subsistence resources below the needs of local residents, (4) preclusion of reasonable access to subsistence resources, and (5) noise disturbance in areas of concentrated wildlife, and those provisions requiring effective oil spill control and clean-up plans. Our belief that drilling cannot now be conducted from floating structures with the required assurances of safety and non-interference with wildlife and subsistence

activities is reflected in the Offshore Drilling Policy contained in the revised Land Management Regulations recently adopted by the Borough Assembly.

The debate over the need for, and scope of, any seasonal drilling restriction (SDR) to protect migrating bowhead whales has often dominated the discussions preceding previous Beaufort Sea lease sales, including Sale 97, held in March 1988. We have consistently argued that the burden falls on those desiring to lease and explore offshore tracts to prove that exploration, development, transportation and related activities will not have an adverse impact on these endangered animals or the subsistence harvest. To its credit, the State of Alaska has acknowledged the potential threats posed by industrial activities, and has recently adopted a revised Beaufort Sea SDR. This new policy, unfortunately, only addresses potential noise impacts, and has left to a later date further improvement of measures to minimize oil spill threats.

The SDR embodied in our Offshore Drilling Policy, though applicable directly only in State waters, addresses both noise and oil spill threats, and will be our guide in any consistency review of proposals in federal waters as well. The policy is as follows:

19.70.040 Offshore Development Policies. The following policies are intended to guide the approval of development and uses in the portion of the Beaufort Sea within the Borough boundary. Case by case extensions to the time periods below may be granted during approval or as a use permit if the activity will not significantly impact subsistence activities, will have minimal environmental risk, and all review agency comments have been addressed.

A. Drilling shall be conducted from bottom founded structures.

B. Drilling above threshold depth may occur year-round.

C. Drilling below threshold depth shall be conducted during the winter (November 1 through April 15) and be completed as early in this period as practicable.

D. Confirmation, extension or delineation drilling, well testing and other well completion activities shall be completed by June 15. Consistent with C above, any additional drilling or other activities shall not penetrate any new oil or gas bearing formations, or significantly increase the risk of an oil spill.

E. All nonessential boat, barge and air traffic associated with drilling activity shall occur prior to or after the period of whale migration through the area. Essential traffic (traffic that could not reasonably occur prior to or after the period of whale migration through the area) shall avoid disrupting the whale migration, subsistence activities, and be coordinated with the Alaska Eskimo Whaling Commission.

F. Year-round drilling can occur following the unitization and approval of the Plan of Operation and Borough approval of a Master Plan and rezoning to the Resource Development district for the proposed development.

By comparison, the proposed Stipulation 8 of the DEIS falls short of providing adequate protection for whales, other wildlife resources, and the subsistence harvest. While if imposed, the stipulation is an incremental step in the right direction for MMS, its time frames are not restrictive enough, drilling from floating structures is permitted when adequate spill response capability does not exist, and it fails to address the potential cumulative impacts of development.

Alternative I is unacceptable in other respects as well. Both the Barrow and Kaktovik Deferral Areas should be removed from consideration for this proposed sale and future sales. You should refer to our October 27, 1988 comments during the scoping process for Sale 124, and again to our Sale 97 comments, for extended discussions of the need to defer these areas. The Spring lead system around Barrow remains a unique and sensitive area of concentrated biological diversity and subsistence activities. Though the DEIS states that the risk of oil contact with bowheads is low, we think it is clear that the consequences of an oil release into the Spring lead system could be catastrophic. The Bering Sea stock of bowheads typically migrates though a very confined area (Pt. Franklin, Pt. Hope, Pt. Barrow) in a relatively short period of time. In some years (e.g. 1980 and 1988) more than 90% of the population may move past Point Barrow in less than two weeks. This behavior, and the nature of the confining lead system itself, could make a dangerously high percentage of the population vulnerable to harm should oil be released or persist in this migratory corridor.

As we stated in our previous comments, you should accept as true the long-held Inupiat belief that the waters to the east of Barter Island are an important bowhead feeding area. So often in

the past, outsiders were slow to accept Inupiat claims about their environment which were later proven correct only after much time-consuming and expensive research. In addition, information available only since our last comments has indicated the importance of the ANWR coastal plain and adjacent waters to denning polar bears. With the continued closure of ANWR to industrial activity, far greater consideration must also be given to the difficulties of oil transportation over extended distances offshore before tracts in the eastern Beaufort are leased.

In addition, the DEIS understates the potential negative cumulative impacts of oil exploration, development, and transportation. The document states that in the cumulative arctic case, there is a 99% chance of an oil spill in excess of 1000 barrels, with it most likely that there will be eight such spills. Looking at only the Beaufort Sea, the probability of one or more spills of at least 1000 barrels is stated to be 49% in the base case, and 91% in the high case. These are disturbing predictions to our coastal residents who subsist largely off the resources of the ocean.

The DEIS also states that since 1964, there have been twenty OCS spills of greater than 1000 barrels. While this is touted as an impressive statistic, it means to us that the eight spills predicted for the arctic represent a number of incidents equal to a full 40% of those occurring on the entire OCS over a period of 26 years. Unless arctic activity is expected to be at a level approaching 40% of all OCS activity over the past 26 years, it appears that MMS is anticipating greater difficulty in operating safely in the arctic than has been experienced elsewhere. Coupled with the far greater difficulty in responding to such significant spills in the arctic, we have little confidence that we should not expect significant cumulative impacts over the life of arctic OCS development.

There is also information available, but not discussed in the DEIS, which should raise serious concerns over the possibility that vastly increased vessel traffic associated with development could impact the bowhead population. The Borough has documented scarring on whales which is believed to be the result of collisions with ships. The incidence of bowhead/ship collisions appears to be low (ca. 2%), and is probably not a significant source of mortality for the Bering Sea stock. This low rate is most likely attributable to the low level of vessel traffic within their range. Socializing right whales, however, have been found particularly vulnerable to collisions when they become apparently oblivious to approaching vessels (Goodyear 1989).[1] That the same may be true of bowheads is evident in film recently shot by scientists having just completed a tagging effort in the eastern Beaufort Sea. Individual animals repeatedly collided with their vessel while the boat moved among a large aggregation of apparently socializing and feeding bowheads.

Ship collisions are not infrequent for the North Atlantic Right Whale (NARW), a species closely related to the bowhead. Kraus (1990) has found evidence that perhaps 33% of NARW mortality is human induced, and that ship collisions are a significant problem.[2] He suggests that such human-induced mortality may be preventing recovery of the NARW stock despite a more than 70-year ban on commercial hunting. Our concern is that increased vessel traffic, including ice breakers operating in lead systems, will lead to a dangerous increase in the incidence of bowhead/ship collisions.

SECTION III. CONCLUSION

We have discussed the State of Alaska's position on the Sale 124 DEIS with agency officials, and agree with much of their analysis regarding the shortcomings of the document's proposed mitigating measures and the need for the Barrow and Kaktovik Deferrals. Because our position, however, is that lease tracts should not be sold in waters which cannot be explored and drilled from bottom-founded structures, we find it unnecessary to comment on much of the DEIS. We do ask that you carefully consider and where appropriate, specifically respond to, the comments of those who testified at the public hearings in our villages. The elders who spoke particularly deserve a response to their concerns that bowheads and other subsistence resources have already been significantly displaced by industrial activity, and that current technology can neither withstand worst-case ice and weather conditions, nor deal with significant oil spills in this environment. You should respect the fact that no one knows this environment better than its Inupiat residents, and no one will

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[1] Goodyear, J. 1989. Feeding ecology, night behavior, and vessel collision risk of Bay of Fundy right whales. In: Abstracts of the Eight Biennial Conference on the Biology of Marine Mammals. Available from: The Marine Mammal Society.

[2] Kraus, S. 1990. Rates and potential causes of mortality in North Atlantic right whales. Marine Mammal Science. (In press).

suffer more if your best guesses as to the potential impacts of offshore oil development prove wrong.

Thank you for this opportunity to comment.

Sincerely,

George N. Ahmaogak, Sr.
Mayor

cc: Steve Cowper, Governor
Ron Morris, NMFS
Mayor Don Long, Barrow
Mayor Thomas Napageak, Nuiqsut
Mayor Herman Aishanna, Kaktovik
Dan Fauske, Acting CAO
Warren Matumeak, Director, Planning
Ben Nageak, Director, Wildlife Management
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Dennis Roper, Federal Affairs
Anthony Kesler, State Affairs
Eugene Brower, President, BWCA
Tom Albert, Borough Senior Scientist
Tom Lohman, Assistant Borough Attorney

mayor/powers5.gna/k

North Slope Borough

Response NSB-1

The responses prepared by MMS to the comments made by the North Slope Borough regarding Beaufort Sea OCS Lease Sale 124 are herein incorporated by reference.

Response NSB-2

For the Alaska OCS Region, MMS requires lessees to submit, with an exploration plan, their contingency plans for drilling a relief well should a blowout occur. This includes information on the availability of backup equipment, including a relief-well rig and support craft (including icebreakers, when appropriate) and the timing to obtain, initiate, and complete a relief well. The lessee is required to provide the MMS with updated information on the location and availability of drilling rigs capable of operating in the environment where operations are proposed prior to each drilling season and of any changes during the drilling program. The MMS requires mutual assistance/relief-well-drilling-rig agreements between the two operators conducting concurrent operations in the same area to facilitate and expedite relief-well drilling. The adequacy of the relief-well plan is determined based on individual circumstances including the type and location of proposed activities, the type of drilling unit, other operations in the area, and company plans for monitoring environmental conditions and well status and curtailing operations and securing the well prior to the end of the drilling season.

In the Chukchi Sea, floating drilling units will be used for exploratory drilling. Floating drilling units are capable of moving offsite in the event of a blowout and starting a relief well almost immediately. There are currently four drilling units and associated icebreakers and ice-class support vessels that have been successfully used in the U.S. and Canadian Arctic, and athat are available in the Arctic and can be mobilized to support a relief-well-drilling program in the Chukchi Sea.

The likelihood of an oil blowout occurring during exploration drilling is extremely low. There has never been an oil spill resulting from an OCS exploratory-well blowout. Blowouts typically are a result of shallow gas without any oil that lasts for short periods of time. Bridging (including depletion) of blowouts (oil and gas) occurs greater than 70 percent of the time, with bridging occurring shortly after the blowout. Relief-well drilling has been attempted for approximately 4 percent of those blowouts that did not naturally bridge (Norwegian Oil Review, 1985).

Prevention is the key to mitigating the risk of an oil spill resulting from a blowout. The MMS regulations establish strict requirements in the form of performance standards to ensure that operations will not result in an unsafe condition. Plans, equipment, equipment inspection and maintenance, testing, and training requirements all contribute to the low risk of a blowout on the OCS. Recent technological advances and continuing high levels of research are improving the safety of drilling in the Arctic, thus reducing the already negligible potential for a blowout.

The MMS maintains a near-continuous inspection presence at each exploratory-drilling location and monitors the progress and status of the well and environmental conditions on a daily basis, including well depth, type of operation (drilling, coring, logging), next planned operation, the timing for completing current operations, the next planned operation, downhole conditions, and potential problems in maintaining well control. The MMS has the authority to require that operations be suspended in the event that ongoing operations could increase the risk of well-control problems or, continuing with the next operations following completion of ongoing operations such as drilling to the next casing point following setting and cementing casing, could not be completed before the end of the drilling season.

The costs associated with drilling an exploratory well in the Chukchi Sea are high. Same-season relief-well capability significantly affects an already restrictive and short drilling season in the Sale 126 area, which could require a seconndseason to complete the drilling of a single well or maintain a second drilling unit at the site. The costs associated with such a requirement would be substantial and would not significantly increase safety or reduce risk.

The MMS recognizes the importance of relief-well planning for exploratory-drilling activities in frontier areas such as the Chukchi Sea. The MMS believes that regulatory requirements for documenting relief-well capabilities in conjunction with MMS' inspections and monitoring of well status and environmental conditions on a real-time continuous basis for each site-specific activity, and authority to require operations be suspended, provide an effective and prudent mechanism to ensure that drilling activities are not continued if there is a significant risk of lost well control and remedial action, including drilling a relief well, could not be conducted.

Response NSB-3

Appendix L, Section IV, addresses oil spills in Alaska in which no response effort was undertaken due to the environmental conditions. It is noted that sea states would exceed the capabilities of mechanical response equipment from 9 to 24 percent of the time in summer months, the range in occurrences of Sea States of 3 or greater in the Chukchi Sea. It is noted in Section IV.A.2(e)(5) that weather, sea conditions, and crew fatigue become critical factors in cleanup.

Partially as a result of the increased concern regarding spill response since the Exxon Valdez spill, the oil industry has upgraded its spill cooperative, ACS (Sec. IV.A.2); and the USDOI, MMS, OCS Oil-Spill Task Force has made recommendations to the Secretary of the Interior on improving evaluation of industry oil-spill-contingency plans (Sec. III.D, Appendix L). First production from the Chukchi Sea Planning Area would be preceded by a developmental EIS in which future, site-specific response capabilities will be evaluated.

Response NSB-4

The text of Section IV.C.6 has been revised to address the North Slope Borough's concern for disturbance of marine mammals. We thank the Borough for providing detailed documentation supporting their concern. Stipulation No. 2, Protection of Biological Resources, provides several options for avoiding areas of marine mammal concentration and thus potential disturbance situations. Stipulation No. 3, Orientation Program, alerts operators to environmental concerns in the sale and adjacent areas. Operators should be aware of provisions of the Marine Mammal Protection Act and Endangered Species Act and that disturbance of marine mammals could constitute taking and thus be in violation of these acts. In addition, operators are made aware of three ITL's relevant to animal disturbance: (1) Information on Bird and Marine Mammal Protection, (2) Information on Areas of Special Biological and Cultural Sensitivity, and (3) Information on Arctic Peregrine Falcon. If the provisions of these acts, stipulations, and ITL's are followed, MMS expects that the effects of disturbance on local animal concentrations would not exceed a low level.

Response NSB-5

The 1982 and 1985 Geraci and St. Aubin reports are repeatedly cited in the EIS analysis because they represent the best scientific information available from the leading authorities in this field . The information used in the analysis was based on conclusions taken directly from these reports. The first example concerns a chart showing (among other things) the effect of gasoline on four dolphins after 15, 30, 45, 60, and 75 minutes of exposure. The report indicates that the very same animals that had small blisters at 30 and 45 minutes showed no visible reaction later on at 75 minutes. That is why the report stated on Page 89, concerning the chart on Page 90, that "In some cases, the exposed skin had a faint hobnail texture that disappeared within 5 minutes. Normal color was always restored within 2 hours. At no time was there any swelling, hemorrhage, or break in the continuity of the skin associated with exposure." The report concluded that "We found that dolphin skin exposed to gasoline and crude oil turned pale gray, and otherwise showed no evidence of damage or loss of integrity." Since the EIS analysis quotes what the reports stated and concluded regarding cetacean-skin contact with gasoline, we feel we have accurately represented the reports.

The second example concerns the fact that the sperm whale being experimented upon was stranded and had been dead for 5 to 10 hours before the experiment was concluded. However, neither the stranding nor the death of the whale influenced the experimental results. This reality is borne out on Page 160 of the report, where it states that "The whale died during the course of the contact study. Yet the histological changes noted in the epidermis exposed to gasoline are noteworthy in that they are indicative of damage to living cells, and not postmortem autolysis." This represents a demonstration of effects on living tissue. Consequently, according to the report, the death of the sperm whale had no bearing on the outcome of the experiments. Wording to this effect has been added to the text of the FEIS.

Regarding the suggestion that the analysis should have described the "dramatic" effects of 17 hours of exposure to gasoline, the effects of gasoline were mentioned for comparative purposes only. Since it is unlikely that free-ranging cetaceans would be exposed to gasoline for 17 hours due to activities permitted by MMS, the effects of 75 minutes of exposure (a more realistic scenario) were discussed instead. Regarding the actual damage caused by 17 hours of exposure to gasoline, the report also indicated that damage occurred only to the medial and superficial layers of the epidermis and stated that "even this degree of damage seems to be reversible."

<u>Response NSB-6</u>

See Response NSB-5. The MMS has taken every effort, through re-examination of source materials and addition of new references, to ensure that the conclusions reached in this EIS are substantiated to the extent made possible by existing literature.

A#/12

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Post Office Box 100360
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Telephone 907 265 6101

Jerry L. Dees
Vice President

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SEP 11 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

September 11, 1990

Mr. Alan Powers
Regional Director
Minerals Management Service
Alaska Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Re: Proposed Chukchi Sea Lease Sale 126 - Draft Environmental Impact Statement

Dear Mr. Powers,

ARCO Alaska, Inc. has reviewed the Chukchi Sea Planning Area Oil and Gas Lease Sale 126 - Draft Environmental Impact Statement (DEIS). We have the following commentary that we urge the Minerals Management Service (MMS) to carefully consider. In addition to our comments, ARCO supports the comments that have been submitted by the Alaska Oil and Gas Association (AOGA) on the Chukchi Sea Lease Sale 126 - DEIS.

In general the DEIS reflects a very reasoned approach to the various aspects of the lease sale. The MMS should be commended for this approach as it reflects the use of recent information, recognition of advancing technology, and the balance required for prudent, environmentally sound oil and gas development. As stated many times in the past the need for continued oil and gas exploration is crucial, if the United States is to maintain an acceptable import / export balance. Without this exploration effort the probability of further dependance on foreign sources, to meet our energy needs, will be of greater significance than it is in 1990. We therefore urge and support the MMS to continue the process for this OCS Lease Sale 126 in a timely and deliberate manner for the Alternative 1 - Proposed Action.

There is some discussion in the DEIS which we believe inaccurately portrays the economic effects of the lease sale on the North Slope Borough (NSB). For each of the three cases (low, base, high), there is a discussion, under item 10, of the "effects on the economy of the North Slope Borough" of conducting the proposed lease sale. The conclusion drawn for the base case (page II-23) and the high case (page II-34) is that the effect on the economy of the NSB is expected to be not only detrimental, but "VERY HIGH" (emphasis in original). This very negative conclusion is not only unsupported by, but is in fact contradictory to the underlying facts and conclusions found elsewhere in the document.

ARCO
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Page II-23 states, in part, that the "(e)ffects on the subsistence harvest are expected to have significant adverse effects on the economy of the NSB." This is apparently based on the allegation later in the same paragraph that "oil spills and industrial activities are expected to cause disruptions of the bowhead and belukha whale, walrus, fish and caribou harvests in the communities." (Barrow, Wainwright, Atqasuk, Point Lay, Point Hope and Nuiqsut.)

This is not supported, and is in fact contradicted, by the discussion in the DEIS about the impact of leasing on these species. Pages II-21 and II-22 discuss bowhead and belukha whales. The conclusion drawn for each of these two species is that the effect of leasing is expected to be very low. Similarly, the slight possibility of an oil spill is expected to have a low level of effect on walruses (page II-20). The impacts on caribou (page II-22) and marine habitat fishes (page II-17-19) are expected to be low and very low, respectively. Only freshwater fishes are expected to suffer a very high effect (page II-17-19). Nevertheless, the DEIS concludes that the subsistence harvest of these species will be disrupted to a very high degree (page II-23). This conclusion is simply not supported.

The section of the DEIS discussing the effects of the leasing alternative on the economy of the NSB (page II-23, II-34) is comprised of two parts. The first paragraph addresses the employment and revenue effects on the NSB economy. The conclusion drawn is that the effects are expected to be moderate for the base case (page II-23) and very high for the high case (this would be a positive impact). The second paragraph addresses the subsistence harvest effects on the NSB economy, and concludes (inappropriately for the reasons discussed above) that the effects are expected to be very high for both the base and high cases (this would be a negative impact). The concluding paragraph summarizes the first two paragraphs by concluding that the overall effect of the base and high case on the economy of the NSB is expected to be "VERY HIGH" (emphasis in original). This is an incorrect conclusion, if it is based on the previously discussed DEIS rationale.

ARCO
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In summary, the conclusions that the proposed lease sale would have a very high detrimental effect on the economy of the NSB, are not supported by the facts presented, and contradict other portions of the DEIS. For example, when compared with the above referenced sections of the DEIS, section III.C.1, the "Economy of the North Slope Borough" paints a far more positive picture of the economic impact of oil and gas development on the NSB.

Based on our review and the above discussions, we would urge the MMS to consider changing some of their conclusions to more accurately reflect the information that is presented throughout the DEIS document.

If you have any questions with regard to the above comments, please feel free to call me at 265-6101.

Yours truly,

J. L. Dees

J. L. Dees

ARCO Alaska, Inc.

Response ARCO-1

Based on a review of Section IV analyses and related sections, the very high effect on the economy for the base case has been changed to a high effect in the FEIS. However, the conclusions for endangered and threatened species, subsistence-harvest patterns, and the economy of the NSB should be viewed in light of the analysis in Section IV and the definitions in Table S-2--not just the Section II summaries of effects. The conclusion of effects on these three resource categories can be different and still consistent. The analysis and conclusions of effects on the economy of the NSB in Section IV draw, in part, from the analysis and conclusions of effects on subsistence-harvest patterns--but not from endangered and threatened species. For example, the conclusion for the potential effect of oil spills (and other factors) on bowhead whales is low. However, the potential effect of an oil spill on subsistence-harvest patterns is high for Wainwright, in part because pulling whales up through oiled waters would result in an unusable whale. The high effect on subsistence-harvest patterns translates to a high effect on the economy because of the potential unavailability of an important resource for a significant proportion of households. The bowhead whale is an important part of the economy for the households of Wainwright. Conceptually, the conclusion of high effects on subsistence-harvest patterns could have translated to a very high effect on the economy, as reflected in the DEIS.

The analysis of effects on the economy relates to both positive aspects of employment and revenue to the NSB and to the potentially negative economic effects of diminished subsistence foods for Wainwright, Barrow, and Atqasuk. The Council on Environmental Quality (CEQ) regulations require that, where a particular type of environmental resource (in this case economic resources) incurs both positive and negative effects, the greatest negative effect--rather than an average of positive and negative effects--must be disclosed.

In the second paragraph of the ARCO-1 comment (para. 4 of the entire letter), five places are listed after a quote that inaccurately reflects the original text. The entire two sentences in the DEIS read: "Oil spills and industrial activities are expected to cause disruptions of bowhead and belukha whale, walrus, fish, and caribou harvests in the communities of Barrow, Wainwright, and Atqasuk. To a lesser extent, harvests in Point Lay, Point Hope, and Nuiqsut would be affected."

BP EXPLORATION

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September 10, 1990

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SEP 12 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Mr. Alan Powers
Regional Director
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue, Room 110
Anchorage, AK 99508-4302

Draft Environmental Impact Statement
<u>OCS Lease Sale 126, Chukchi Sea, Alaska</u>

Dear Mr. Powers:

BP Exploration (Alaska) Inc. (BP) appreciates the opportunity to comment on the Draft Environmental Impact Statement (DEIS), for Oil and Gas Lease Sale 126. As an important component of the lease sale planning process, it affords all concerned parties the occasion to express their views and concerns. To that end, we note herein our general positions regarding the DEIS.

BP strongly supports Alternative 1 of the DEIS which provides for an offering of the entire proposed sale area on schedule. The stated goals of the leasing program include (1) the orderly development of OCS oil and gas resources in an environmentally acceptable manner, (2) the maintenance of an adequate supply of OCS production to help meet the Nation's energy needs, and (3) the reduction of dependency on foreign oil. Additionally, as noted on page I-1 of the DEIS, Congress mandated the U.S. Department of the Interior to engage in "expedited exploration and development of" the OCS in order to "assure national security, reduce dependence on foreign sources, and maintain a favorable balance of payments in world trade." BP, therefore, believes it is in the best interests of industry, the public, the State of Alaska and the nation to proceed with the evaluation of hydrocarbon potential of the Chukchi Sea in a prompt manner. Further delay of the sale would contribute to the steadily growing dependence on foreign sources for energy and would serve to frustrate the stated goals and the Congressional mandate to the Department of Interior.

We request that these comments receive full and careful consideration.

Sincerely,

Steven D. Taylor, Manager
Environmental & Regulatory Affairs, Alaska

SDT:EPZ:jns

C P Cazalot Jr
General Manager

Texaco Inc

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September 6, 1990

COMMENTS ON DEIS OCS SALE 126
CHUKCHI SEA - ALASKA

Regional Director, Alaska OCS Region
Minerals Management Service
949 East 36th Ave., Room 110
Anchorage, Alaska 99508-4302
Attention: Mr. John Schindler

Gentlemen:

Texaco is pleased to have this opportunity to submit comments on the DEIS for Chukchi Sea OCS Sale 126. Texaco supports Alternative I which proposes that the sale be held as scheduled in August 1991 without deletions to the sale area. This alternative best represents the OCS sale program which is designed to make prospective offshore acreage available for exploration and production to help meet the energy needs of the nation.

Alternatives II (No Sale), and III (3-Year Delay) are not acceptable to Texaco. In order to provide additional reserves to our domestic supply of oil, the industry must be provided with timely access to prospective areas. Therefore, it is essential that the sale not be cancelled or delayed.

Alternative IV (Point Lay Deferral) is inappropriate in our opinion since offshore petroleum exploration and marine harvesting operations have proven to be compatible in the past. Also, the DEIS concludes that the potential adverse impacts do not decrease under any of the deferral alternatives.

In conclusion, I would like to emphasize that industry has a proven track record of operating safely in the Chukchi Sea as well as in the Beaufort and Bering Seas and there is no reason to believe that operations in the Chukchi Sea would pose an environmental hazard.

We appreciate this opportunity to present Texaco's comments on this document. Please contact this office should you require any further information.

Very truly yours,

C.P. Cazalot Jr.

ST\06-01

Unocal North American
Oil & Gas Division
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UNOCAL 76

August 31, 1990

Robert T. Anderson
Manager Lands
Alaska Region

Mr. Alan Powers
Minerals Management Service
Alaska OCS Region
949 E. 36th Ave., Rm. 110
Anchorage, AK 99508

CHUKCHI SEA AREA
State of Alaska
DEIS Sale 126

Dear Mr. Powers:

Union Oil Company of California has reviewed the (Draft) Environmental Impact Statement for proposed Chukchi Sea OCS Lease Sale 126 and has the following comments:

We support Alternative I for holding the sale as scheduled in August, 1991. It is felt that a deferral of an area consisting of 501 blocks from the sale area as proposed in Alternative IV would be inconsistent with the goals established for the five-year oil and gas leasing program, particularly since there are existing leases in the area representing exploratory interest for the sale area. Certain blocks in this area offered in Sale 109 already carry protective stipulations requiring site-specific whale monitoring programs. UNO 1

Although it may be perceived that only limited exploratory drilling has been conducted in the area since the last sale, with oil prices on the rise and the escalating tension in the Mideast our dependency on foreign oil has increased. We must maintain an adequate supply of readily available production to meet our ever increasing energy needs. Shortsightedness could be our Achilles heel.

In conclusion, the investment to date by industry in preparing for the challenges of the Arctic in an environmentally safe manner have been demonstrated and recognized by the Secretary of the Interior as adequate for environmental assessment. We at Union can see no evidence presented which lends credence to any other alternative than to hold the entire sale area in OCS Sale 126 as scheduled in August of 1991.

Very truly yours,

Kevin A. Tabler
Kevin A. Tabler
Supervisor of Leases

KAT/clh

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SEP 5 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Unocal Corporation

Response to UNO-1

Alternative IV, the Point Lay Deferral Alternative, is consistent with the goals established for the 5-Year OCS Oil and Gas Leasing Program. The deferral alternative offers one additional option for the Secretary to consider in evaluating an environmentally sound lease sale. Deferral of the area would in no way jeopardize the existing leases in the area as a result of OCS Lease Sale 109.

TESTIMONY
OF
ELIJAH ROCK
BARROW, ALASKA

August 27, 1990 at 7:00 Meeting

My name is Elijah Rock, Sr., I am an Inupiat Whaling Captain and Commissioner of Alaska Eskimo Whaling Commission of Pt. Hope. ("AEWC") Today I would like to share my knowledge of the Arctic coastal community's subsistence hunting of marine mammals and the effects that offshore oil and gas exploration are having on our use of these resources. I also would like to share our views on how the issues arising from these effects can be addressed.

Our whaling community consists of nine coastal villages along the Beaufort and Chukchi Seas. In 1977, the International Whaling Commission ("IWC") imposed a quota on our hunt of the bowhead whale. Since that time, our villages have become a community under the umbrella of the AEWC, working together to manage our hunt of the bowhead whale, and to protect our rights to continue that hunt. In this way we are carrying on the traditions of the conservation and management of renewable resources

Our people do not only hunt the bowhead whale. Our subsistence also depends on the beluga whale, walrus, several species of seals, polar bear, gray whale, sea birds, migratory birds of many species, fish of many species and delicate creatures at the bottom of the sea. These are some of the primary means of survival to the coastal natives of

~~of~~ the primary means of survival to the coastal natives of the Beaufort Sea, Chukchi Sea and Bering Sea. However, the bowhead whale is the resource most important to our nine whaling villages, not only for our subsistence, but for our culture.

It is my personal observation that bowheads are extremely sensitive to noise. In recent years oil industry seismic and exploratory drilling activity came into Barrow's hunting grounds. A vast amount of Beaufort Sea seismic work area is being done approximately 20-30 miles NNE off Cape Simpson and approximately 20-30 miles North off Pt. Barrow "Nuvuk, Alaska through the Beaufort Sea bowhead migration routes and the bowhead natural habitat area. Since this activity began, whaling crews have been reporting fewer bowhead whales or no bowhead whales in areas where Barrow always hunted. The eastern Beaufort Whaling villages, Nuiqsut and Kaktovik, have had the same experience. In spite of great danger to human life, the Barrow whalers have begun to hunt farther from shore, to look for whales beyond the near shore noise. But even when they can locate and take whales at these distance, they often lose the whale meat because of the time required for towing. This is very serious problem. It is very difficult and very risky to hunt bowhead whales. We also have a limit on how many whales we can take because of the IWC quota. If we take a whale bu lose the meat because of too much time towing, this still counts against our IWC quota. Last year :Barrow lost

AEWC
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AEWC 1

the meat from four whales because of this. This was almost one-third of Barrow's quota of 15 bowheads for the year.

Our whaling communities are very concerned that with more offshore exploration in the near shore waters, the whales will move too far out for us to hunt them.

AEWC 2

Therefore, we believe that plans for this activity must include safeguards to protect our subsistence resources and hunting.

AEWC 3

We also believe that more scientific research is needed on the impacts of this offshore activity on marine mammal resources.

AEWC 4

Our whaling communities are also very concerned about the possibility of oil spill in our Beaufort and Chukchi Sea hunting grounds. We believe that a spill in the Arctic could be very difficult, if not impossible to clean up. Such a spill could have a devastating impact on our marine mammal subsistence resources. Therefor, we believe that careful attention must be given to the development of effective containment and cleanup equipment for the Arctic.

Despite the hardship cause by noise impacts and our concerns about oil spill, the whaling communities has not tried to stop the offshore development. It is part of our culture to share resources. However, it also is part of our culture to protect our subsistence resources for future generations.

AEWC takes this responsibility seriously. As whaling captains, we are responsible for the cultural and subsistence livelihood of our people. It is part of our honor and dignity as whaling Captains. Without honor and dignity, a whaling captain loses face with the whaling community and loses the respect and prestige one attains through many years of involvement as a member of the whaling community.

At this time, the AEWC is negotiating with the oil and gas operators working in the Arctic to try to reach agreement on mutually acceptable regulations to place reasonable restrictions on offshore exploration during the next five years. These regulations will also provide specific protections for our bowhead whale subsistence hunt. In addition, the AEWC is planning to join together with the Bering Sea Fishermen's Association and with other local communities and organizations from coastal Alaska to form the Alaska Arctic oil Spill Prevention Commission. Through this Commission, we will be able to coordinate information and representation on OCS oil and gas issues for affected coastal communities.

Through this Commission, we also will be able to hire scientific experts in marine biology and acoustics , and in offshore drilling and oil spill containment and cleanup technology. These experts will be responsible for advising our people on the impacts of this offshore activity to our subsistence resources and on the international state of the art in offshore drilling and oil spill containment and cleanup technology. This Commission will provide our people with a better understanding of what is going on in our offshore hunting grounds. It will also provide us the opportunity to relay our informed opinions to the oil and gas companies and the Federal Government on how the impacts of oil and gas activity to our subsistence resources can b e minimized.

It is our experience, as rural Alaskans, that given the great distances between our communities and the difficulty of transportation, organizations such as this are very useful. They help us to deal in a coordinated and efficient way with specific issues that affect a number of communities. They also allow us to avoid or resolve conflicts before they become disruptive to the activities in question. The AEWC is a highly successful example of this type of organization.

CONCLUSION

In conclusion, I would like to stress that our people do not oppose the development of energy resources. As long standing resources manager, however, we strongly urge that this development be done on the basis of sound principles of resource management.

In our view, sound resource management in the Arctic requires the following:

1. On shore oil and gas resources should be developed and produced before offshore resources;

2. Off shore exploration and development should be accompanied by proven oil spill containment and cleanup technology;

3. Development in the vicinity of local communities should be undertaken so as to mitigate adverse impacts to local resources and cultural activities;

4. The protection of subsistence activities must be given top priority, and for our neighbors in southern Alaska, the protection of local commercial fisheries; and finally;

5. The Federal Government should encourage and support us in our creation of the Alaska Arctic Oil Spill Prevention Commission. This will help us to ensure an efficient information flow between our communities and the oil and gas companies and Federal Government. It also will provide us a means of avoiding disputes over the impacts of OS activities, and of resolving any disputes that do arise before they disrupt our activities or the important work of developing our nation's energy resources.

Alaska Eskimo Whaling Commission

Response AEWC-1

The MMS shares the commenter's concern for not disrupting subsistence-hunting activities through the industry activities it permits on the OCS. Information on noise effects from seismic or drilling activities on whales and on local subsistence-hunting patterns (traditional hunting areas) does not indicate that seismic or exploratory activities cause whales to move farther offshore or to become less available for subsistence-hunting activities. Based on analyses of subsistence-hunting activities and environmental conditions, ice conditions appear to have the greatest effect on the whale migration and the ability of whalers to get offshore. The MMS has monitored the pathway of the fall bowhead migration every year since 1979, primarily to detect any long-term changes. No migrations have been found to be significantly different from each other except during 1983, when there was very little seismic-survey or drilling activity during the open-water season. The following stipulations and ITL's are listed in this EIS: Stipulation No. 5 requires industry to monitor bowhead whale movements around its drilling sites (this is in addition to continued MMS monitoring under ITL No. 6), and Stipulation No. 6 specifies local input into industry exploration plans. Although there has been some seismic-survey work in the past 3 years north of Point Barrow and Point Simpson, it has not been a vast amount; actually only 2.5 percent of the Beaufort Sea monitoring program from 1987 to 1989 was conducted within 64 km of these points.

Response AEWC-2

The MMS understands the importance of subsistence activities to local communities and the need to protect subsistence resources and hunting from potential effects from oil and gas activities. The EIS analyses concluded that, except for potential high effects on Wainwright subsistence hunting resulting from activity in the spring-lead system, the potential effects would range from moderate to very low. The EIS identifies several potential mitigating measures to reduce these effects even further and a deferral alternative to remove blocks from the lease sale that have the highest potential for affecting subsistence use near Wainwright and Barrow. These measures include:

1. Stipulation No. 6 (Subsistence Whaling and Other Subsistence Activities) requires the lessee to conduct all activities in a manner that minimizes any potential for conflict between oil and gas activities and the bowhead whale hunt. Lessees would be required to contact potentially affected subsistence-whaling communities to discuss potential conflicts with siting, timing, and methods of proposed operations, and to document conflicts and resolutions and unresolved conflicts in the Exploration Plan (EP) or Development and Production Plans (DPP's) that must be filed with MMS. The EP is then subject to review by MMS and other Federal and State agencies and the public, including local communities, to ensure that lease activities will avoid unnecessary conflicts with subsistence-hunting activities.

2. Stipulation No. 3 (Orientation Program) requires all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) to participate in an MMS-approved orientation program designed to inform personnel about biological resources and habitats and to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles, including subsistence activities.

3. Stipulation No. 5 (Site-Specific Bowhead Whale Monitoring Program), designed to provide protection to the bowhead whale, requires the lessee to conduct a monitoring program to determine when whales are in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these activities. If monitoring indicates that drilling activity could cause serious, irreparable, or immediate harm to the species, MMS has the authority and intends to require that operations be suspended.

Several ITL's are proposed to provide further information to lessees concerning protection of birds and marine mammals, including applicable laws, regulations, guidelines for vessel and aircraft traffic, and areas of

special biological and cultural sensitivity. The MMS has also issued Notices to Lessees regarding vessel- and aircraft-traffic guidelines to protect polar bears, walrus, and endangered whales in the area.
In addition to the stipulations and ITL's, the nearshore area, which includes the spring-lead system, is a proposed deferral option for the sale that, if adopted, would provide further protection to subsistence resources and subsistence-hunting activities in the spring-lead system.

Recent Lease Sales 97 and 109 and proposed Lease Sale 124 have adopted measures similar to potential lease Stipulations No's. 5 and 6. Cooperative programs between industry and local subsistence communities, such as the 1986 Oil/Whalers Group, provide for communication and coordination between oil and gas activities and subsistence activities and have been successful in minimizing and avoiding potential conflicts.

Lessees' EP/DPP's will also be subject to coastal zone consistency review, including applicable policies related to subsistence activities under approved coastal zone management programs. No drilling or other activity can be conducted until an EP/DPP has been approved and the State has concurred with the consistency certification.

Lease activities will also be subject to the provisions of the Marine Mammals Protection Act and the Endangered Species Act for incidental take. The NMFS and FWS are responsible for implementing these laws that allow for incidental take under certain conditions and, subject to a Letter of Authorization, can also identify or establish restrictions, limitations, or other permit conditions to protect both subsistence resources and subsistence activities.

Response AEWC-3

See Appendix F for a discussion of the MMS Alaska OCS Region Studies Programs.

Response AEWC-4

The commenter's interpretation is in agreement with the analysis in Appendix L. Since the Exxon Valdez spill, oil-spill research and development has been in the spotlight. The Oil Pollution Act of 1990, Public Law 101-380, establishes an interagency coordinating committee on oil-pollution research. Membership of the Committee includes representatives of NOAA, DOE, DOI (includes MMS and FWS), DOT, DOD, EPA, National Aeronautics and Space Administration, and the United States Fire Administration in the Federal Emergency Management Agency, and other Federal Agencies that may be designated by the President. In addition to Federal research, Marine Spill Response Corporation (MSRC)--a consortium of oil companies and shippers, will administer a comprehensive research and development program to improve the knowledge and technology used to respond to and clean up spills. This program will complement programs in government, academia, and industry.

NANA REGIONAL CORPORATION, INC.

4706 HARDING DRIVE, ANCHORAGE, ALASKA 99517
TELEPHONE (907) 248-3030
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September 11, 1990

Mr. Alan D. Powers
Regional Director
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue, Room 110
Anchorage, AK 99508-4302

RECEIVED
SEP 11 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Attn: Paul Dubsky

Dear Sir:

NANA Regional Corporation, Inc. has reviewed the draft Environmental Impact Statement for the proposed Chukchi Sea OCS Lease Sale #126. As a regional Native corporation whose shareholders and land base are located in Northwest Alaska south of the proposed lease area, we are greatly interested in this sale and the potential development that might subsequently occur. Our interest centers on the impacts that OCS and related onshore development might pose to our shareholders and to the animal and natural resources vital to the livelihood of our people. We share an equal degree of interest in the economic opportunities that OCS development might offer the people of the NANA region.

Based on the DEIS, we prefer that better technologies and response scenarios be presented before Chukchi Sea exploration proceeds. In any case, development and production should <u>not</u> proceed until the technology for safe operation is in place. We acknowledge the need to know what the economic potential of an area is before massive amounts of money are spent developing specific technologies. While not opposed to exploration, we do think that the DEIS is lacking in number of areas that should be improved before activity proceeds.

NANA's experience with the mining operation at Red Dog has afforded us an opportunity to actively participate in a world class mineral development while balancing the cultural and economic needs of our shareholders. Any OCS development that occurs in Alaska must consider the economics of the development, the people involved and the environment. The peoples most affected by the potential development must be afforded the opportunity to participate in all

stages of planning. This is particularly important with respect to the monitoring of environmental impacts and to the planning required to properly mitigate negative impacts and hazardous conditions.

NANA requests that the NANA region be involved in any offshore planning efforts. The region encourages the use of local people to monitor the environmental impacts of OCS development and the effects on migratory marine and terrestrial wildlife. We furthermore encourage the use of local people to work with the oil industry and federal government to ensure that adequate training and employment opportunities are offered to the residents of the areas most affected by OCS development. All committees should be composed of residents of the communities and regions that will be impacted by OCS and related onshore development. This would include the NANA region as our people rely on marine mammals that migrate through the lease area and on the caribou that likewise migrate through the areas that may be developed for support facilities or pipelines.

NANA 1

The issue of OCS revenue sharing to offset the impacts of OCS development should be addressed in the sociocultural section. This is particularly critical to the Northwest Arctic Borough since a potentially significant proportion of the impacts may occur there. Workers may locate in and/or mobilize out of Kotzebue, rather than the North Slope Borough as the DEIS postulates. In fact, the DEIS makes little if any mention of the potential impacts to the Northwest Arctic Borough. This is a serious oversight because Kotzebue has climate and ice-free season advantages when compared to places north of Point Hope.

Beyond the more general comments offered above, NANA Regional Corporation has several specific concerns about this proposed lease sale. Our major concern centers on the unproven ability of the oil industry to safely drill in Arctic waters, to prevent significant accidents or oil spills, and lastly to clean up a spill of any magnitude effectively and quickly. There is little information presented in the DEIS to dispel our concerns.

NANA 2

In fact, the DEIS is quite pessimistic about the ability of the oil industry to clean up an oil spill in Arctic waters, particularly in the presence of ice. As noted in Appendix L, MMS' own evaluation of the response and cleanup capabilities of the industry found that the majority of the equipment tested performed below ratings. In the case of application in the Chukchi Sea, summer sea conditions would preclude effective use of response equipment for 9% to 24% of the time. Ice cover, which typically occurs 9 months of the year, eliminates standard application of most mechanical response equipment.

The scenarios for mobilizing spill response teams and equipment center on transporting said teams from Barrow, Deadhorse or the Canadian Arctic. However, the minimum response times often exceed the critical initial response time required to contain and clean up the oil. In other words, the response teams will arrive too late. And once they get to the scene of the spill, they will be using equipment and techniques that, by MMS' own admission, are likely to be ineffective and made even more so by the extreme weather and sea conditions that are common to this part of the Chukchi Sea.

One technique discussed for dealing with oil spills in pack ice is to burn the oil when it reaches the top of the ice. However, as the DEIS notes, the requirements for dealing with a multitude of melted pools of ice and oil would be a "logistical nightmare". Moreover, oil spilled in the early winter is likely to remain underneath the ice for the entire winter before the ice starts melting. There was little discussion addressing the effects of significant quantities of oil trapped underneath pack ice for extended periods of time. It was noted, however, that oil trapped in pack ice may move considerable distances before the ice melts, further complicating the oil spill cleanup.

NANA 2

To quote the findings of the DEIS, "industry could effectively clean up an oil spill in moving ice only if the spill is a platform blowout that could be set on fire without endangering platform integrity." The implications of this statement are that the industry is severely limited in its ability to respond to oil spills of any other source or cause. In light of the severe weather conditions commonly experienced in the Chukchi Sea, this admission is quite unsettling. As noted in the DEIS (page II-55), even recovery of most of the oil spilled from a platform is unlikely.

We recognize that the oil industry has a good record in offshore United States. We are still wary of the technical problems associated with ice. Rather than relying on a good track record in non-iced areas, we think Chukchi exploration should proceed when the means for spill response has been developed. More specifically, we are not convinced that platform-type drilling islands can be safely utilized in the Arctic. We think bottom-founded structures should be used since these have been tested in the Arctic.

NANA 3

The DEIS says that an undersea pipeline from the drilling platforms to landfall is the most likely scenario for transporting oil. The DEIS goes on to describe the uncertainties regarding the safety of undersea pipelines in light of the potential for bottom scouring by ice. The DEIS notes that "experience with arctic-petroleum-transportation systems is limited; new problems must be solved". Other than to mention that more research must be done in this area, the DEIS offers little guidance as to the best means by which to deal with the potential problems associated with undersea pipelines. The most likely failure of the undersea pipeline system would be a result of ice scouring and rupturing the pipeline. This would occur in winter, the precise time of year when the oil industry's response capabilities are the most limited and ineffective. The DEIS treatment of this dilemma and the resultant effects is inadequate.

NANA 4

The DEIS mentions the large amounts of drilling muds and drill cuttings that will be produced and disposed during exploration, development and production phases. The maximum amount of drilling muds and cuttings that may be produced is in excess of 320,000 short tons in the base case. Since these products contain some toxic trace elements, careful disposal is essential. A number of key points are not clearly discussed in the DEIS; for example, whether the disposal of these muds and cuttings occurs all year or only in the summer months. If this is a year-round operation, then disposing of these waste materials by transporting them to land, as suggested in the DEIS ostensibly to comply with NPDES permit requirements, would be difficult if not impractical.

NANA 5

In conclusion, we believe the DEIS practically ignores the potential social and physical impact of offshore Chukchi activity on the NANA region. This needs to be considered. The DEIS also should present better scenarios for spill control. Also, more consideration should be given to the type of rigs used and to transportation pipeline problems. If petroleum resources are discovered, the industry should have to demonstrate an even higher level of technology and knowhow before proceeding to production.

NANA 6

NANA 7

We appreciate the opportunity to comment and trust that our comments will be useful.

Sincerely,

John A. L. Rense

John A. L. Rense
Vice President, Minerals

EB/45

cc: Christina Westlake
Chairman

Roswell L. Schaeffer
President

Walter Sampson
Vice President, Lands

Chuck Greene
Mayor, NWAB

NANA Regional Corporation, Inc.

Response NANA-1

OCS impact assistance could offset the effects of OCS development. Congress has considered this often in the past and may consider it in the future. At this writing, a system for OCS revenue sharing has not been established. Establishment of OCS revenue sharing is, in any case, a Congressional decision.

The OCS Lands Act was amended in 1986 to provide for revenue sharing to coastal states. Coastal states receive 27 percent of all monies from OCS oil and gas leases that are between 3 and 6 miles from the coast. OCS revenue sharing could offset the effects of OCS development. The State of Alaska has received $389 million from the OCS for oil and gas leases that are between 3 and 6 miles from the coast.

Effects could occur in the Northwest Arctic Borough if were workers located in and/or mobilized out of Kotzebue. The EIS anaylsis assumes that economic effects would occur in the North Slope Borough. When and if plans are submitted by lessees, potential effects on the Northwest Arctic Borough would be considered in the NEPA review.

Response NANA-2

Historically, mechanical recovery of spilled oil is low (U.S. Congress, OTA, 1990). The interpretation of the commenter is in agreement with this analysis in Appendix L. Most spill responses in Alaska are logistically difficult, as in the case of the Exxon Valdez. However, logistical difficulty does not preclude response. Unlike transportation-related spills, such as the Exxon Valdez, or highly-publicized spills, such as Ixtoc I, OCS exploration and development and production activities require approved Oil-Spill- Contingency Plans that establish and commit equipment, manpower, logistical support, and communications resources for each specific activity. The MMS believes that response capability for specific OCS activities with a known and stationary location (well site or platform) and with a pre-established response plan (equipment, trained personnel, and logistical support) will ensure greater response than has been experienced in previous transportation or non-OCS spills. Oil-spill-contingency plans are approved by the MMS when industry has submitted evidence of the resources to respond to an oil spill under the conditions of the region. A very-large-winter-spill scenario and its effects are discussed in Section IV.J. Burning is a response method to a spill in moving pack ice or floes. Exploration drilling in the Chukchi Sea is currently accompanied by response barges and work vessels that provide additional platforms for working upon during an oil-spill response.

Response NANA-3

We agree that exploration should proceed when the means for spill response have been developed. Experts from outside the oil industry, as well as within, have found that the oil industry in Alaska is capable of effective response during any season of the year in the Arctic. This includes decaying-ice, broken-ice, open-water, freeze-up, and winter conditions.

Since exploration in the Chukchi Sea is planned to occur only during open-water or possibly broken-ice conditions, the current drilling technique seems appropriate. Regarding any potential production, ice researchers have stated that a Chukchi Sea structure would be similar to that designed for the Beaufort Sea. Industry's preference is an inverted cone-shaped, gravity-based production system; but other economic alternatives are available. Any discovery would take 12 to 15 years to bring into production. Such a lead period will allow considerable time to evaluate production alternatives.

Response NANA-4

Engineering studies indicate that a key consideration in the design of buried offshore pipelines in an arctic environment is to determine the optimum burial depths that maximize the pipeline's safety from rupture by ice gouging and minimize costs. Prior to construction of subsea pipelines, operators would be required to conduct geological and geophysical surveys to determine potential hazards to the pipeline, including ice scouring. The density, age, depth, and reoccurrence rate of ice gouging must be fully evaluated and considered in the design, construction, and placement of a pipeline. Any pipeline design must include devices to monitor damage or leaks, and redundant automatic- and manual-shutdown valves to shut off the pipeline and stop a continuous leak if a break in the pipeline occurred. Continuous monitoring techniques will enable the operators of such pipelines to be forewarned of potential scour problems and to take corrective actions.

Response NANA-5

The EIS states that the muds and cuttings from the drill holes will be disposed of at the drill site under conditions in compliance with EPA's NPDES.

In Appendix J, prepared by the EPA, they state that land disposal of drilling muds and cuttings is generally undesirable. They also state that if the drilling-mud composition is such that ocean disposal would violate the conditions of the NPDES permit, on-land disposal would be the only option. It is expected that the drill muds used will meet the NPDES requirements, and on-land disposal will not be necessary.

Response NANA-6

The proposed Sale 126 area is located north of Point Hope and is considerably removed from the coast, except in the Point Lay area. Based on published data, the MMS believes that the residents of NANA Region communities do not harvest resources within the lease-sale area but may harvest resources, such as caribou, walrus, seals, and birds that migrate through the lease-sale area or may be affected by an onshore oil pipeline. The effects levels on these migratory subsistence resources from Sale 126 activities are relatively low for populations as a whole. There could be effects to subsistence harvests by NANA Region residents of these migratory species, but the level of such effects cannot be determined with any degree of precision under these conditions of relatively low overall biological effects and vast distances over which considerable natural variability exists that could effect local hunting conditions.

Response NANA-7

See Responses NANA-3 and NANA-4.

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BY FAX

September 18, 1990

John Schindler
Minerals Management Service
Alaska Region
Office of Leasing and Environment

Dear Mr. Schindler,

This is to confirm that MMS will accept the enclosed comments on Lease Sale 126. I had requested and received a one week extension on the comment deadline until September 17; however, as I explained on the telephone this morning, I was unable to meet this extension because of a computer failure. In the interest of clarity, would you please let me know that MMS has accepted these comments and will treat them equally with any submitted within the deadline.

A hard copy of these comments will be sent to your office by mail.

Thank you for your cooperation.

Sincerely,
Dorothy Smith
Dorothy Smith
OCS Campaign Coordinator

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COMMENTS ON THE DRAFT EIS

FOR PROPOSED CHUKCHI SEA LEASE SALE 126

SEPTEMBER 17, 1990

Prepared by Pamela Miller

Introduction

Greenpeace USA respectfully submits the following comments on the proposed Chukchi Sea Lease Sale 126 Draft Environmental Impact Statement (DEIS) on behalf of over 2 million supporters nationwide, 3000 of whom reside in the state of Alaska. Greenpeace strongly recommends that the Minerals Management Service (MMS) take the NO ACTION Alternative II for proposed Lease Sale 126 to prevent serious long-term inevitable and unmitigable impacts on the fragile Arctic environment. The proposed deferral alternative is too meager to provide adequate protection, although we note advocacy by other federal agencies should have resulted in immediate deletion of this area rather than mere "deferral".

The Lease Sale 126 DEIS and MMS' zeal for drilling in this and other Arctic areas demonstrates its arrogant indifference toward environmental protection -- despite valid public concerns and skepticism on the part of other agencies and Congress. The DEIS reflects poor understanding of the Arctic marine, freshwater and terrestrial ecosystems under threat from proposed oil and gas development.

It is our position that further proposed leasing in Arctic planning areas is being carried out hastily and without deserved consideration of the effect accelerated exploration and development will have on wildlife, habitat and Native cultural values, and without a critical eye toward the energy future of the United States. It has been our experience that MMS has only one goal -- to provide as much offshore land to the oil industry as possible.

MMS is single-minded in promoting offshore drilling in even the areas most widely regarded as "sensitive." The south Florida leases, for example, are located in close proximity to living coral reefs and the Everglades both of which are known to be highly vulnerable to spilled oil and pollution from the toxic constituents of drilling wastes. Yet MMS continues to advocate exploration on those leases and is resisting cancellation of the sale. As another example, the Bristol Bay lease sale was held in 1988 in spite of the region's unsurpassed marine biological diversity and the risk to world class fisheries. This persistence by MMS leads to the conclusion that the agency is not basing decisions on science, public concerns, or prudence. GP A1

The proposed Lease Sale 126 threatens the Arctic environment with massive industrial development. The combination of large scale offshore operations and traffic from shorebased facilities, potential oil spills, and the onshore pipeline system proposed across the North Slope to the Trans-Alaska pipeline will unleash unmitigable damage to this fragile region of the world.

1. <u>MMS has inadequate information on which to base sound environmental decisions.</u>

We refute MMS' judgement that "the information base currently available is adequate for environmental assessment and for the Secretary of the Interior to make a decision concerning this lease sale." The National Academy of Sciences states "information on oil impact on polar environments is still fragmentary, with large knowledge gaps making the spill impact assessment more guesswork than sound appraisal. Underlying much of the uncertainty is the absence of data about the basic biology of many important polar marine species. Thus, studies are needed, not only on the effects of oil, but perhaps more so on ecological relationships and on the precise ecological significance of such aspects as the several unique polar habitats -- leads, polynyas, ice edge and the under ice (1)." GP A2

The National Academy of Sciences report to the President's task force on offshore drilling in California and Florida stated that MMS has inadequate information on which to make sound environmental decisions regarding proposed offshore drilling in those areas. The report also stated that less information is available for other OCS planning areas where public opposition has been less vocal (2).

We question the validity of many of the conclusions in the DEIS since a large percentage of references cited are unavailable for review, were completed for government agencies or the oil industry and have not been published in peer-reviewed literature. GP 1 Statements in the FEIS should be supported by data and analyses of references cited in the document, rather than by other documents "incorporated by reference". In addition, MMS' failure to include federal agency biological opinions further frustrates careful consideration of the proposed action. GP 2

In its 1987 report to Congress, the U.S. Fish and Wildlife Service concluded: "fish and wildlife habitat losses resulting from the Pipeline System and Prudhoe Bay oilfields were greatly underestimated in the EIS. The qualitative nature of the EIS predictions made comparison of actual with predicted impacts difficult, and assessment of actual impacts was further confounded by the lack of baseline information and studies designed to specifically address EIS predictions. Monitoring efforts during construction focused on crisis-level responses to the most visible and immediate impacts, and did not address the more subtle or latent effects on biological systems. Long-term and cumulative impacts have yet to be assessed, while additional impacts will continue to occur... The chain of events initiated by these developments continues, and it is difficult to separate their effects from those caused by the many other developments they have set in motion (3)." The Lease Sale 126 DEIS makes the same dangerous errors in trivializing potential impacts from the GP 3

GP 3

proposed pipeline system and lacks the information necessary to assess cumulative, long-term and synergistic effects.

2. Technologies for safe operations in Arctic ice conditions are seriously lacking.

GP 4

In 1985, Lease Sale 85 was deleted from the 5-year schedule "to provide for further assessment of operations in heavy ice conditions." Lease Sale 109 was held in 1988 and Lease Sale 126 is scheduled for 1991, yet the DEIS does not explain what new information is available now regarding operations in heavy ice conditions. Indeed, the lack of referenced material post-1985 regarding this issue raises our concerns as to why Lease Sale 109 went forward and the current lease sale scheduled.

GP 5

Uncertainties of offshore production technologies are illustrated in the DEIS -- "if ice island impact probability is very low and an oil spill could be contained, a production platform could be designed and installed in the pack ice zone." The technologies for production operations in the pack ice are not developed, so it is impossible to assess whether these operations can be done safely. The DEIS notes the following with regard to exploratory rigs: "with icebreaker assistance, the floating units are capable of operating in the limited sea-ice conditions." Seasonal operations of exploratory rigs are a far cry from safe operation of production platforms in areas of multiyear ice. Production and transporation spill probabilities are not drawn from realistic conditions for this lease sale area, and are vastly underestimated.

GP 6

The elaborate scenario used for pipeline transporation of oil ashore to Point Belcher is technologically unfeasible and unsafe. The DEIS admits that experience with arctic petroleum transportation is limited -- a gross understatement. Ice floe movements of 8 km/hour over a 5-hour period associated with winds of 90 km/hr have been recorded at Barrow. Ice gouges in the sea floor of 3-8 meters depth are made by deep keels of drifting pack ice pressure ridges (4). The environmental consequences of burying subsea pipelines in Arctic waters to avoid ice gouging are unknown and largely unpredictable. Poor understanding of distribution and behavior of subsea permafrost and potential long-term disturbance of benthic communities make subsea pipelines a questionable proposition.

Stipulation no. 4 in the DEIS states that "pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable...." Proceeding with Lease Sale 126 under blind faith that these massive technological and safety questions will be overcome is unacceptable and further reveals how the leasing process is predisposed to development and

GP 6

production. MMS is not likely to allow environmental imperatives to stand in the way of exploration or production after industry has made a substantial financial investment in the lease.

GP 7

MMS has failed miserably in enforcing environmental and safety rules for offshore drilling as evidenced by a Congressional report of the Subcommittee on Water, Power, and Offshore Energy Resources (5). The report documentnts that MMS found over 16,000 violations of environmental and safety rules in the years 1985-1989, yet has not assessed a single civil penalty. "The nature of these violations range from extremely serious matters such as failure to test critical safety valves to lesser violations such as unsafe working conditions." The report further stated that "the administration has acknowledged the lack of enforcement and has done nothing to correct it, clearly demonstrating they are not serious about enforcing it." These violations were found offshore California and in the Gulf of Mexico. Given this record in geographically accessable regions, we cannot assume that MMS will effectively monitor and enforce environmental and safety regulations in remote, harsh arctic conditions? This is further evidence to us that the lease sale process is driven by oil industry interest in league with MMS promotion and acquiescence without due regard for environmental protection.

GP 8

Also, under the Technology Assessment and Research Program discussed in Apendix F of the DEIS, MMS supports many joint federal-industry studies which focus on arctic engineering technologies. The proprietary nature of these studies belies an unholy union between the oil industry and the government agency assigned to regulate that industry.

3. The Chukchi Sea marine ecosystem and adiacent tundra are highly sensitive and vulnerable to long-term damage from the proposed action. The DEIS demonstrates a serious lack of understanding of these ecosystems and draws unfounded qualitative conclusions that minimize potential impacts on many species.

GP 9

The DEIS reveals a serious paucity of data necessary to assess impacts on biological features unique to arctic marine environments. "The Arctic presents special problems because of nearly year-round ice cover and inaccessibility. These are compounded by the large gaps in the data base on arctic biology, there existing only slim understanding of biological events during the brief open-water season and virtually no understanding of winter events. The Arctic possesses unique features such as marine mammals, under-ice algal/crustacean communities and seabird nesting areas... The threat of ice and ice scouring, the apparently slower degradation of stranded oil by arctic hydrocarbon-utilizing microbes and inaccessibility place this region near the top of environmental concerns (1)." Sublethal effects "have more serious ecological consequences for polar species, many of which experience extreme oscillations in food supply. Any interference with the very abbreviated period of summer production may be critical for overwintering and reproductive success (1)." These biological realities are given inadequate consideration in the DEIS.

In addition, the DIES fails to adequately consider the consequences of damage to the highly productive under-ice community which is critical in supplementing the brief season of water-column productivity when many species are releasing young. Studies have shown ice algae communities to be highly sensitive to Prudhoe Bay and Cook Inlet crude (1).

To date, there has been little research done on the biology of the ocean in shore leads and polynyas, largely due to inaccessibility (6). The authors of the DEIS take excessive liberties in the making arbitrary and qualitative assessments of VERY LOW to LOW impacts to most wildlife species given the lack of data on abundance and distribution of wildlife in the shore leads and polynyas of the Chukchi Sea. The average lead-system width is less than 1 km between February and April, limiting the area into which and through which migratory species can move and making them extremely vulnerable to disturbance and/or spills. Persistence and subsequent release of spills through winter and several seasons is possible, placing large concentrations of arriving migratory species at considerable risk. GP 9

Even given the information we do know, many of the species populations and habitats discussed are vulnerable to much greater risk than the DEIS would lead us to believe. Conclusions on population recovery rates for seabirds and marine mammals used to justify LOW impacts are largely unsupported. Reduced fecundity, dispersal and growth rates limits recovery rates in arctic environments (1).

These population effects are not adequately considered in recovery predictions. In addition, probabilities of contamination of productive coastal lagoons, and kelp beds heavily used by birds and fish are grossly underestimated given the proximity of proposed developments (even with the meager Point Lay deferral alternative) and support activities. Specifically, we take issue with the following:

a.) Air Quality

The assertion in the DEIS that only "short-term, local effects on vegetation from a coating of soot" (base and high cases) dismisses potential for severe impacts to delicate tundra lichens from sulfurous air pollutants and toxic particulates in soot. The very rich, but understudied lichen flora of the North Slope is of considerable ecological importance as winter forage for caribou and in nitrogen-fixation (7). Similar low predicted levels of impact for the cumulative case are not believable. Though air GP 10

quality standards for NOx and other pollutants will be exceeded, only MODERATE overall impacts are predicted. The cumulative case fails to consider pollutant levels caused by transport from industrialized Europe and Asia and potential impacts from oil and gas development of the Soviet Arctic continental shelf. GP 10

b.) Effects on Lower Trophic Levels

The authors of the DEIS have the audacity to proclaim that "substrate changes may enhance habitats for some species" with no documentation or explanation. Habitat changes are only likley to promote colonization by opportunistic and undesirable species. Given the volume and extent of drilling muds and other discharges, as well as lack of information on the behavior of these wastes in arctic marine systems, the potential impacts on water quality and benthic communities are considerably understated. GP 11

The DEIS acknowledges the vulnerability of kelp beds and associated communities, but underestimates probabilities of oil contact. Kelp bed distributions should be included on resource maps in the FEIS. GP 12

c.) Effects on Marine Fishes

The DEIS predicts low impacts even though it cites references stating that comprehensive information concerning the life history, population dynamics, distributions and ecological relationships of most of these species in lacking. This is not logical. GP 13

d.) Effects from Pipeline

The DEIS acknowledges VERY HIGH potential to fishes of the ten major rivers traversed by the proposed onshore pipeline, but ignores potential habitat destruction and direct impacts on nesting birds and other wildlife inhabiting the river corridors and associated wetlands. The DEIS notes 40% of the pipeline length would traverse wetlands, the vulnerabilities of which are poorly considered. Please note also the assesment of USFWS qouted in section 1 of these comments regarding pipeline impacts. GP 14

The DEIS also notes that development at Point Belcher for the pipeline landfall is "highly incompatable" with current uses (subsistence hunting base). This incompatibility betrays the intention of the federal Coastal Zone Management Act. GP 15 The USFWS also expressed concern in the scoping process for "environmental effects caused by pipeline landfalls; utility corridors within units of Alaska Maritime National Wildlife Refuge; the barrier islands; and the combined effects of OCS activities and other onshore and offshore oil and gas developments -- existing and potential." These concerns are not adequately addressed in the DEIS. GP 16

e.) Birds

As stated above, recovery rates for birds affected by oil spills are grossly underestimated given the major population concentra- GP 17 tions in lead-systems and coastal lagoons, vulnerabilities and low reproductive rates. Probabilities of contact are also under-estimated. Because activities from supply and support vessels are underrepresented, effects of disturbances are underestimated. Dr. George Hunt, eminent seabird biologist, has stated that a major spill could damage a world population of seabird species (8). Given the concentrations of eider, brant, lesser snow geese, murres, and other species of seabirds in coastal lagoons and leads, this is entirely possible. Many erroneous and contradictory statements are made including:

1)"Spills that occurred during winter would have no immediate effect on birds (IV C-32)." This ignores overwintering species occupying polynyas -- a poorly studied phenomenon. It should also be noted that spilled oil locked in ice can be released in the spring presenting new dangers to wildlife long after the initial spill event.

2)"The presence of surplus [sic] murres could speed replacement (IV C-34)." Where will these "surplus" murres come from? An MMS surplus murre farm? The U.S. Army Surplus Murre Department? Wildlife does not occur in surplus and the fact that MMS would describe populations in this way indicates not only a lack of understanding of wildlife ecology but a lack of sensitivity for the value of the individuals which make up a population.

3) The DEIS states Ross' gull is at considerable risk, then contradicts this by predicting LOW impacts.

4) The DEIS concludes that there is an abundance of uncontaminated habitats, so that local feeding and nesting habitat destruction represents no measurable effect (IV C-35). This is totally unfounded.

5) Cleanup activities in the event of a spill were presented as mitigation measures to drive birds away from contaminated areas. This is also unfounded. In fact, disturbances from cleanup activities after the Exxon Valdez spill caused significant nest abandonment and reproductive failures.

6) The DEIS states that bird densities in offshore migration corridors during open water are "relatively low", but gives no data to support that conclusion (IV C-32).

7) Regarding murre impacts from the Exxon Valdez, the DEIS asserts that an "even higher level of murre mortality would not represent a threat to the species on a regional basis." This is totally unfounded. Murres accounted for 74% of the 100,000 to 300,000 birds killed by the Exxon Valdez, and are suffering a population decline on the west coast. Population impacts on murres should not be so easily dismissed.

GP 17

f.) Endangered Species and Other Cetaceans

The bowhead whale population remains dangerously low despite the decades of protection from commercial exploitation. NMFS acknowledges that "present and proposed OCS exploratory and development activities in the Arctic region may eventually adversely affect the successful life cycle of bowhead whales (8)." Long-term displacement of bowheads from industrial areas has been documented. From 1984-86, significantly fewer animals were found in the industrial zone near the Mackenzie Delta -- an area of artificial island construction, drilling, overflights -- than in 1979-83 (9).

The DEIS fails to address possible long-term behavioral changes that may result from planned OCS activities -- the absence of short-term effects is extrapolated to mean the absence of effects. Almost all studies have used the following endpoints to measure bowhead response: 1)change in heading, 2)change in respiration rate, 3) change in dive profile (9). Short-term observations of these parameters from areal surveys, the results of which were not published in peer-reviewed literature, does not constitute adequate consideration of potential long-term disturbance effects which could occur by displacement form primary migration and feeding areas.

The DEIS fails to discuss key behavioral and distributional information critical to impact assessment. Bowheads are calving on the northbound migration through the Chukchi Sea. Little is known of the southbound route after they pass Barrow, though they have been seen at Wrangel Island. the DEIS makes the false assumption that "the effect of industrial noise in or near to the spring lead is likely to be similar to that anywhere else, since the stimuli are the same (IV B-9)." In the final rule for an incidental take permit under the Marine Mammal Protection Act, even Shell Western has agreed to not operate in the spring lead. It would seem that MMS could at the very least acknowledge the sensitivity of whales during this extremely vulnerable season.

Another false assumption in the DEIS is that bowhead and gray whales can "be discussed together due to their simularities in their response to similar stimuli (IV B-8)." The two whales differ considerably in feeding behavior and migration patterns, to say the least. Vulnerability of gray whales in areas of concentration near Point Belcher and other significant feeding areas in not considered.

The bowhead whale, which by virtue of its low population numbers and annual migration through the lead systems of the Bering, Chukchi, and Beaufort Seas, is at considerable risk from existing and proposed OCS activities (1). It is entirely irresponsible for the DEIS to conclude VERY LOW risks in the base and high cases and MODERATE in the cumulative case, since "the entire population of bowhead whales is susceptible to impacts in this area during their spring migration through nearshore leads (1)."

GP 18

The DEIS fails to consider extenuating circumstances presented by arctic conditions in assessing potential impacts on marine mammals, such as beluga whales and other cetaceans. For example, oil could be very difficult for marine mammals to detect and avoid in arctic waters because of widespread ice cover and darkness (10). Movements of belugas and other marine mammals are directed and concentrated by location of leads and polynyas, thus inhibiting their ability to avoid contaminated areas. GP 18

g.) Polar Bears and Pinnipeds
As with wildlife discussed above, probabilities of oil contact and habitat destruction from oil spills for polar bears and pinnipeds is grossly underestimated. Lead systems (over water depths 20-50 meters) are the main seasonal migration route for polar bears moving back and forth between their summering areas and winter hunting habitat. Consequently, a significant proportion of the population is susceptible to impacts in these prime feeding areas (6). Significant habitat alterations from the creation of artificial leads by offshore rigs in winter would serve to concentrate polar bears and pinnipeds, and greatly increase potential impacts in the event of a spill. There is no reliable polulation estimate for the Chukchi Sea (6). Significant numbers of polar bears attracted to exploratory rigs have had to be shot because of preceived threats to humans (11). The DEIS fails to adequately consider these serious threats to the polar bear. Since the population of polar bears in the Chucki Sea migrates back and forth between the U.S. and U.S.S.R., and is protected by the International Agreement on the Conservation of Polar Bears and Their Habitats, international consequences of damage to polar bears may result. Wrangel Island, and important denning area for polar bear, has a high percentage chance of oil contact (18%), as well as other productive areas or marine mammals and seabirds along the Siberian coast (Chukchi Peninsula, Herald Island). GP 19

The DEIS concedes that a few thousand walrus, mainly cows and calves, could be "contacted" with oil in the event of a spill and more if the walrus are concentrated by food supply. Given the fact that nearly all pregnant females and those with calves migrate into the Chukchi Sea in large nursery herds in summer and the Chukchi Sea is their primary summer feeding ground, potential for devastation of the population exists. The DEIS fails to consider the loss of reproductive potential that would result if large numbers of breeding females were lost from the population. It is entirely incomprehensible that the DEIS concludes that impacts on Pacific walrus will be LOW. Significant impacts on polar bears and pinnipeds are inevitable from exploration and development of offshore oil and gas in this and other areas of the Arctic.

h.) Sociocultural
Local communities and subsistence lifestyles will suffer

extremely negative consequences from oil and gas development in the Chukchi and Beaufort Seas. The DEIS predicts curtailment and multiyear suspensions of subsistence activities in some areas, as well as other VERY HIGH negative impacts that boom and bust industrial development inevitably brings. A growing number of villages and Native subsistence and fishing groups have expressed serious concerns, and indeed, opposition to further leasing in the Chukchi Sea.

4. <u>Oil spill probabilities underestimated, contingency plans and capabilities are inadequate and ineffective.</u>

The DEIS states (p. xix) that "effects from oil spills would be mitigated by the extent to which weathering occurred at sea and by effectiveness of any oil spill cleanup measures." The idea of mitigation is a dangerous myth. As discussed above, weathering of oil in Arctic waters is extremely slow, especially if entrained in ice. The oil spill response described in the DEIS is grossly inadequate. MMS requires that industry respond within 6-12 hours, geography permitting. This qualifier is an admission that response is not expected to be possible under common conditions in the Arctic. GP 20

In the article "Offshore Oil in the Alaskan Arctic," the authors "doubt that there will ever be completely satisfactory response to cleanup of an arctic oil spill other than preventing it from occurring (4)." The report by the Alaska Oil Spill Commission described cleanup capability in the Arctic as "bleak (12)." Prevention of oil spill under severe arctic conditions is also impossible.

We question the efficacy of the spill rate data used. The DEIS states, "due to data limitations, tanker spill data rates were derived from worldwide spill data from 1974-1985." This produces underestimates of the risks of transporting oil in the Arctic and north Pacific. High risks of spills from offshore oil production in the Arctic are not reflected from generic OCS production data, and results in conservative estimates of potential spills. The worst case scenario, an uncontrolled blowout, is not presented. The impact of a catastrophic event should not be disregarded because of the statistical manipulation that "predicts" it should not happen. GP 21

For tanker spills only, the cumulative case predicts 15 spill of greater than 1000 bbls. The consistent use of greater than 1000 barrels is misleading for transportation and production scenarios, since in the case of tanker spills, the 15 spills consist of 7 spills of 5000 bbls, 1 of 15,000 bbls, 3 of 110,000 bbl spills, 3 of 260,000 bbls, and 1 of 520,000 bbls! That scenario predicts 3 spills of comparable size to the Exxon Valdez spill and 1 spill twice the size of the Exxon Valdez. To take

GP 21

those kinds of risks in developing the Alaskan Arctic OCS is wholly unacceptable.

GP 22

5. Developing Chukchi Sea and other Arctic OCS energy resources will not contribute to U.S. energy security.

The DEIS reiterates that one of the goals of the leasing program is to reduce dependency on foreign oil. This is short-sighted in light of the fact that we have the capability to implement conservation programs and alternative technologies that would preclude our crippling and environmentally devastating dependence on fossil fuels. The DEIS admits that "major dependence on a non-renewable resource-based economy could cause long-term social costs at the time of resource depletion."

According to the DEIS, the base case resource estimate for Lease Sale 126 is 1,160 million bbl. This translates into about 95 days worth of oil at the current rate of consumption in the U.S. Even the high case estimate is the equivelent of only 208 days, or about six months, of oil. It is understood that this oil would be produced over a longer periods of time, but it is essential for the federal government to recognize that the OCS resources means far more in terms of industry profits than it does for energy for the nation.

The current Middle East situation is a signal for the U.S. to establish an aggressive energy conservation program which would replace foreign imports and OCS oil and gas many times over. Since the conservation programs created in response to the oil embargoes of the 1970's, the U.S. has saved $150 billion every year and 14 million bbl of oil every day. The U.S. is still twice as energy inefficient as many other industrialized countries.

Further dependence on both foreign and domestic oil will only contribute more to the greehouse effect and acid rain. According to World Watch Institute, as much energy leaks through American windows every year as flows through the Alaska pipeline. It is unconscionable that the federal government, via MMS, would permit putting the entire Alaskan Arctic coast at risk through more development before exploiting the renewable energy resources available to us at a fraction of the cost to society and to the great benefit of the environment.

6. Potential cumulative, long-term, chronic and interregional impacts of oil and gas development in the Arctic and North Pacific have been vastly understated in this DEIS.

As stated in Boesch and Rabalais' Long Term Effects of Offshore Oil and Gas Development, "the most significant unanswered questions for offshore oil and gas development are those

regarding the effects on ecosystems of long-term, chronic low-level exposures resulting from discharges, spills, leaks and disruptions caused by development activities...the cases of habitat disruptions or chronic petroleum contamination, either as a result of continuous or intermittent discharges or from repetitive accidental spills during the life of a field (13)." This is especially true of poorly understood Arctic ecosystems.

Oil and gas development planned for other areas of the Arctic have the potential for devastating impacts on the entire arctic ecosystem and circumpolar populations such as the polar bear, in particular. Development of offshore oil and gas planned or being developed in the Soviet Arctic, Greenland, Svalbard, the Canadian High Arctic Islands and Hudson Bay, as well as the Canadian Beaufort and U.S. The polar bear is protected under the International Agreement on the Conservation of Polar Bears and Their Habitat, signed by Canada, Denmark, Norway, U.S.S.R., and the U.S.

Potential global climate changes may be set in motion from a large spill in the Arctic as would result from a large uncontrolled blowout. Large quantities of oil could greatly accelerate melting of polar ice. Reduction of the reflective properties of oil-contaminated ice could accentuate melting and prevent refreezing. With exposure of the polar sea, meteorological conditions over the northern hemisphere would drastically change (14).

Lease Sale 126 will place the Arctic marine, coastal and terrestrial ecosystem at great risk to long-term, chronic and acute damage from large scale oil development. It is incumbent upon the Department of the Interior to exercise reasonable caution by adopting the NO ACTION alternative.

Thank you for your careful consideration of these comments.

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7) Personal communication, Fred Rhoades, Botanist, Western Washington University, 8 September 1990.

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11) Stirling, I. 1988. Attraction of Polar Bears to Offshore Drilling Sites in the Eastern Beaufort Sea. Polar Record 24(148):1-8.

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13) Boesch, D. and N. Rabalais. 1987. Long-term Environmental Effects of Offshore Oil and Gas Development. Elsevier Applied Science, London.

14) Personal Communication, Dr. Charles Jonkel, Polar Bear Biologist and Arctic Ecologist with the University of Montana, September 8, 1990.

Greenpeace USA

Response GP-A1

The DOI is charged by law (OCSLA) to develop the resources of the OCS. Highly vulnerable and critical resources and habitats are considered in this EIS, but the information contained in the EIS is only part of the information used by the Secretary to make an informed decision about whether or not to hold the sale and, if so, what conditions of block configuration and/or forms of mitigation will be imposed. The Secretary's decision must also take into account other national-interest and economic information as well as the environmental information contained in the EIS.

Response GP-A2

The MMS considers the information currently available to be adequate for a basic understanding of the potential environmental effects of Sale 126 in and adjacent to the sale area. In addition, MMS has successfully evaluated the potential environmental effects of two other lease sales in the Chukchi Sea Planning Area. The first sale, Sale 85, scheduled for February 1985, was not held. The second sale, Sale 109, was held in May 1988; but the task of analyzing the effects of the sale had to begin long before the sale date. Since work began on the first sale, the amount of information available to analyze the effects of petroleum exploitation in the Chukchi Sea has been increasing.

The MMS Environmental Studies Program has helped to increase the information base. As a measure of this contribution, MMS has expended over $120 million on environmental studies in the Chukchi and Beaufort Seas during the period 1975 to March 1988. The studies conducted have investigated major disciplines including geology, oceanography, sea ice, pollutant transport, living resources, endangered species, ecosystems, oil-spill effects, noise effects, sociocultural systems, socioeconomic systems, and transportation; and a considerable effort has been made to integrate and synthesize available information. Monitoring programs have been developed to study specific effects on resources of concern.

Response GP-1

The information used and cited in this EIS represents the best scientific data available for environmental description and analysis purposes. The MMS makes every effort to use reports and publications that are available for public review, including reports of the MMS Environmental Studies Program. The use of peer review is encouraged by MMS, but it is not always possible to accomplish this. The practice of incorporating material by reference is used as a means of reducing the bulk of the document, in accordance with CEQ regulations.

Response GP-2

Federal-agency biological opinions were not reproduced in the DEIS because they were not available when the DEIS was published; they are now included in Appendix D of this FEIS.

Response GP-3

The environmental-assessment process is an ongoing learning process that makes use of the best scientific data available at the time. This underscores the need to monitor environmental effects, as more becomes known over time, so as to better evaluate changing cumulative, long-term, and synergistic effects.

With regard to the overland pipeline used in the developmental scenario for this EIS, no attempt was made to trivialize its potential effects, as was shown, for example, with the VERY-HIGH effects level assessed for fishes occupying freshwater habitats. This effects level was the direct result of potential spills (the number of which were predicted for the scenario) from the overland pipeline affecting freshwater streams and deltas.

Response GP-4

Lease Sale 85 was deleted from the 5-Year Oil and Gas Leasing Program to address the concerns of the State of Alaska and the Alaska Congressional delegation. The following sentences regarding those concerns are excerpted from a January 10, 1984, letter from the Honorable Bill Sheffield, Governor of Alaska, to William Clark, Secretary of the Interior: "The primary concern of the state was the pace of the Department of Interior's current five-year oil and gas leasing program. Due to internal budget constraints, the MMS personnel assigned to Alaska's OCS appear to be insufficient for their greatly expanded responsibilities under the accelerated program. A two year delay would enable valuable scientific data interpretation and synthesis effort of available information to continue." The assessment of working in heavy ice conditions was completed in the Sale 109 FEIS (USDOI, MMS, 1987b). Exploration is likely to continue in open-water conditions. It is estimated that development drilling will begin in 2000. This allows 9 years for the oil industry to study conditions. Drilling will be allowed when the oil industry demonstrates to MMS that they can operate safely in the ice conditions of the Chukchi Sea.

Response GP-5

The ice-strengthened drillships and the CDU have shown that they can be used to safely and successfully drill exploration wells. Prior to operating in Alaskan waters, these units have been used since 1976 to drill exploration wells in the Canadian Beaufort Sea; also, they were inspected by MMS and the USCG to ensure compliance with applicable MMS and USCG regulations.

Before an exploration well can be drilled on an OCS lease, the lessee must submit an exploration plan in accordance with 30 CFR 250.33 for approval by MMS. Information in the plan includes (1) a description of the type of drilling unit to be used and important safety and pollution-prevention features and (2) an oil-spill-contingency plan.

After it has been deemed submitted, the exploration plan is transmitted to the governor and the CZM agency of each affected state. Comments from the governor are considered in the evaluation of environmental impacts of the activities described in the plan. The exploration plan may be (1) approved; (2) modified if it is inconsistent with the provisions of the lease, OCSLA, or regulations prescribed under the OCSLA including air quality, environmental safety, and health requirement; or (3) disapproved if it is determined that a proposed activity probably would cause serious harm or damage to life, property, offshore natural resources, the national security or defense, or the marine, coastal, or human environment, and that the proposed activity cannot be modified to avoid the condition(s).

Prior to the initial drilling of a well under an approved exploration plan, the lessee shall submit to MMS an APD for approval (30 CFR 250.64). The APD's for wells to be drilled from mobile drilling units shall include (1) an identification of the maximum environmental and operational conditions the rig is designed to withstand; (2) documentation of operational limitations imposed by the American Bureau of Shipping classification or other appropriate classification society, and either a USCG Certificate of Inspection or Letter of Compliance; and (3) for frontier areas, the design and operation limitations beyond which suspension, curtailment, or modification of drilling or rig operations are required (e.g., vessel motion, offset, riser angle, anchor tensions, wind speed, wave height, currents, icing or ice loading, settling, tilt, or later movement) and contingency plans that identify actions to be taken prior to exceeding the design or operating limitations of the rig.

The MMS considers that the operating experiences, inspections, and information submitted in the exploration plans and the APD's ensure that exploration wells can be drilled safely from floating units and in a manner that minimizes potential environmental effects and pollution risks.

Response GP-6

The system used to transport any commercial oil discoveries will depend on where the oil is discovered and the environmental features at and near the discovery site: the amount and characteristics of the oil; the relative costs of constructing, operating, and maintaining various systems that might be used; regulatory requirements; and the possible use of existing transportation systems.

The Sale 126 pipeline scenario is a hypothetical case to equally distribute hypothetical pipeline-spill points throughout the Sale 126 area. The commenter's interpretation on the distribution of permafrost is in agreement with the analysis in Section III.A.1(c)(2). Permafrost-behavior references have been added to Section III.A.1(c)(2). Extensive work on ice gouging has occurred on the Canadian Beaufort Shelf. The technical considerations for Beaufort Sea pipelines are discussed in Weidler et al. (1985). Row et al. (1987) looked at the overall feasibility for design of offshore arctic pipelines and concluded that current technology and design procedures allow technically feasible designs of arctic offshore pipelines to be developed.

Response GP-7

The MMS is familiar with the referenced report and its findings that over 16,000 violations have been found and that no civil penalties have been issued. The lack of civil penalties was a result of a U.S. District Court ruling that MMS had no authority to impose civil penalties for violations without first providing the company the opportunity to correct the violation. The MMS subsequently sought legislative changes to the OCSLA that would allow civil penalties to be imposed for violations, regardless of corrective action taken. Legislative amendments were passed in the Oil Pollution Act of 1990 (Title 8, Section 8201), and MMS is currently pursuing promulgation of regulations to implement the changes to the law.

Even without legislative authority to impose civil penalties, MMS has effective enforcement authorities. The MMS has the authority, and has required companies, to shutin a platform or specific component if operations are not in compliance with regulatory requirements. Operations are required to remain shutin while the violation is corrected. Most violations are minor and corrected immediately.

The Alaska OCS Region inspection strategy is to maintain at least a near-continuous presence at the location during exploratory-drilling activities to ensure compliance with all applicable regulations, lease terms, and specific conditions of approval. This strategy has been adopted, in part, due to the nature of drilling activities, the special operating stipulations, the public concerns for maintaining a safe and pollution-free environment, and the remoteness of the Alaskan OCS.

Inspections consist of witnessing critical operations and tests, records checks for proper worker qualifications and training, and checks for proper maintenance, testing, and testing frequency of safety, pollution-prevention and pollution-cleanup equipment at the drilling location, and for safe and workman-like operations.

We believe that MMS has a credible and effective inspection and enforcement program that is further strengthened by the new legislative authority to impose civil penalties.

Response GP-8

The joint cooperation and funding of oil and gas-related studies is common to several countries, e.g., Canada. The proprietary nature of the studies extends only to those studies funded jointly by MMS and industry; these studies are proprietary for a limited time and are then available to the public. Wholly MMS-funded Technology Assessment and Research Program (TA&RP) studies are not proprietary and are available to the public. The MMS participates in joint technical projects with other governments and industry due, in part, to the tremendous costs associated with technical research, particularly large-scale field studies. The results of this research are available to MMS and industry in evaluating the technical aspects of oil and gas operations. These research efforts are not related to specific industry activities under consideration for approval by MMS. The MMS does not consider joint research an "unholy union" but rather appropriate and necessary for MMS to remain abreast of technological advances.

Response GP-9

While there is the desire to have more information about any ecosystem, MMS considers that there is sufficient information concerning the distribution and abundance of organisms inhabiting the Chukchi region, when combined with the OSRA and other environmental information, to forecast significant effects of oil and gas development in the sale area. According to the results of the OSRA, MMS has not underestimated the probability of oil contact in coastal areas. Given the relatively small numbers of individual birds and mammals likely to be contacted by oil, or the relatively small areas occupied by prey organisms likely to be affected, MMS feels that the concluded effect levels are realistic. The MMS would be receptive to any additional specific information pertinent to a discussion of potential effects that could result from this sale. Essentially all of the potential adverse effects discussed in references cited by the commenter are discussed in the introductory sections of these analyses, in referenced EIS's, or other documents. To clarify your concerns, an analysis or discussion based on the specific evidence contained in the cited publications would be most useful.

Response GP-10

The Western Arctic caribou herd depends on lichens and mosses for winter forage. A number of factors should be considered in evaluating whether the Western Arctic caribou winter-forage area could be affected by soot from burning spilled oil. The forage area is more than 80 km (50 mi) from the nearest part of the sale area. Northwest winds that could carry soot in the direction of the wintering area occur only 1 to 2 percent of the time. Ocean currents would carry spilled oil away from the wintering area. Soot deposited from a burn during the open-water season would likely be dispersed over a large area but could be concentrated in a small area. Summer and fall rains would remove some soot from lichens and mosses. Any winter burns would be from many small sources as oil surfaced in leads and ignited. Oil burned in the winter would have traveled with winds and currents farther from the winter-forage area. Only a spill of ≥ 10,000 bbl close to shore could noticeably contaminate land. Given the distance from shore, the low likelihood of a spill of sufficient size to generate sufficient soot to travel to the winter-foraging area, and the potential mitigating effect of summer and fall rains, it is not likely that soot would affect the Western Arctic caribou winter-foraging area.

All cases consider transport of winter and spring pollutants from industrialized Europe and Asia. Modeled emissions and emissions from other known sources are considered in determining compliance with Prevention of Significant Deterioration and National standards.

Offshore Soviet arctic oil and gas development is not considered a reasonably foreseeable event for the cumulative case.

Response GP-11

Since substrate changes associated with offshore oil and gas drilling/development are accumulative rather than subtractive, it follows that the miniscule increased substrate and subsequent similar change in benthic topography would increase the area available for colonization. Whether the colonizing species would be alien to that ecosystem is doubtful. At any rate, whether the colonizers are opportunistic or undesirable is a matter of judgment.

Results of numerous studies to date have shown only very localized, short-term adverse effects on the biota from the discharge of drilling muds and fluids. Section IV discusses these discharges and their effects in some detail.

Response GP-12

Based on the OSRA, there is a low probability that the two shallow-water kelp beds located to date would be contacted by an oil spill. The location of these kelp beds is described in Section III.B.1.c., where it is also stated that their area varies to the extent that this measurement is indeterminate. Based on surveys to date, kelp beds are uncommon in the Chukchi Sea.

Response GP-13

The assessment of low effect is based on the low number of oil spills projected to occur, their low volume, their infrequency as compared with the length of the proposed project, and the wide distribution of marine fish populations in the Chukchi Sea in comparison to the limited distribution of the projected small number/volume of oil spills. There is, we believe, sufficient information on the effects of discharges on fisheries habitats to justify the low-effect conclusion. Seismic surveys have been found to have virtually no effect on fishes.

Response GP-14

The potential effects of onshore spills are considered in Sections IV.C.5 and IV.C.9. The relatively small areas of tundra and wetland affected by small onshore oil spills are likely to result in minor effects on bird and mammal populations. A spill in a major river also is unlikely to result in high mortality, since a spill would be greatly diluted if allowed to run the full length of the river; and most tundra-breeding waterbirds spend most of the breeding period on or near tundra ponds or in coastal areas rather than on major rivers. Development of the magnitude of Prudhoe Bay (FWS assessment cited by commenter) is not likely to be associated with construction and operation of the onshore pipeline.

Response GP-15

The Point Belcher landfall is included in the scenario for analysis purposes only. Effects on land use plans and coastal management programs are discussed in Section IV.C.14 for the base case (Alternative I) and in Section IV.D.14 for the Point Lay Deferral Alternative (Alternative IV).

Response GP-16

Every effort is made in this EIS to address pertinent issues identified in the scoping process. Contrary to the suggestion of the commenter, this EIS has addressed the environmental effects caused by the pipeline landfall at Point Belcher and the potential effects on the barrier islands. The effects of utility corridors within units of the Alaska Maritime National Wildlife Refuge were not addressed because the proposed lease sale is well northward of the northernmost segment of this refuge. "The combined effects of OCS activities and other onshore and offshore oil and gas developments--existing and potential" are discussed in Section IV.H.

Response GP-17

The MMS takes exception to the statement that recovery rates for birds affected by oil spills are underestimated; we can find no substantiation for this statement by the commenter. Recovery rates, which were determined from Ford et al. (1982) (added to the FEIS bibliography), depend on percent mortality of a given population; these determinations incorporate species' sensitivity and reproductive rates. The probabilities of oil-spill occurrence and contact are taken directly from Tables C-13 through C-16 of Appendix C. We find no example to substantiate the claim that the values used are underestimated; perhaps the commenter is confusing conditional probabilities, which assume that oil has been spilled, with combined probabilities, which incorporate the probability of spill occurrence and thus are lower. Certainly a large spill entering a coastal lagoon or lead during a period of heavy use by waterbirds could result in substantial mortality; but in concluding a level of effect, the likelihood of this occurring and the likely proportion of the regional population involved also must be considered. A large proportion of relatively few species populations concentrates where there is a high probability of occurrence and contact by a spill associated with this sale. No examples offered by the commenter substantiate the claim that activities of supply and support vessels, and potential disturbance arising therefrom, are underestimated. In fact, rather low numbers of vessels are contemplated; and since there is no evidence of significant disturbance of marine birds by vessels, the expected level of potential disturbance from this source is likely to be low.

Regarding the numbered statements in this comment:

(1) Although admittedly not well studied, there is little evidence to suggest that large numbers of birds overwinter in the flaw-zone lead or polynya that may extend from Point Hope to Barrow in late winter and spring. During the winter, this lead could often be less than 1 km wide and open only 50 percent of the time--not favorable statistics for an overwintering population. Effects from oil spilled in winter and released at breakup probably are more correctly termed "delayed" rather than "new" effects, since oil poses little danger to birds while it is encapsulated in the ice.

(2) At each colony there exists a reservoir of nonbreeding murres from which individuals occupying any newly vacated breeding sites will come. This subpopulation includes young birds that have not yet bred, birds that have bred in the past but do not presently occupy a site, and failed breeders from the current season. This group may comprise a substantial proportion (e.g., 50%) of the birds present at the colony. In the sense that they are contributing nothing to the current reproductive effort of the population, they are "surplus," although this should not be interpreted as meaning expendable since they represent the replacements for any birds lost during the year. It is reasonable to suppose that species with a large population (e.g., murres) are likely to recover rather quickly from even a substantial incidence of mortality. The MMS disagrees with the statement that "wildlife does not occur in surplus"; there are numerous studies showing that when breeding birds are removed from a population, their vacant breeding site is soon reoccupied by individuals from a nonbreeding, "floater" subpopulation. Also, it would be difficult to explain population cycles if there were not, at times, a surplus of individuals beyond what a given habitat could support. MMS personnel are as concerned over the presumably painful death of individual birds in an oil spill as the general public is; however, the more important aspect, and the one that necessarily commands our attention because of the particular phrasing of the effect definitions used in this EIS, is the potential effect on regional populations and species. That is, we are not insensitive to the plight of individuals or individual colonies; but mortality is appropriately considered at the population level and related to the survival of the species.

(3) The EIS states that the Ross' gull could be at considerable risk. Other factors, such as the amount of time they are likely to be in the area of higher risk and their foraging method, were considered in concluding an overall low effect.

(4) The cited statement actually reads ". . .represents no measurable effect on the availability of wetland- and tundra-bird habitats due to the abundance of uncontaminated habitats." The implication here is that the area of these habitats likely to be contaminated represents a very small proportion of that available in northern Alaska. The text of Section IV.C.5 has been revised to clarify this interpretation.

(5) The statement suggesting that cleanup activities could drive birds away from an onshore-spill site, thereby making it less likely that they would be affected by oil, is presented as a possibility--not a fact. It also is noted that the reproductive effort of these individuals probably would be lost.

(6) The best available information concerning pelagic-bird densities is found in Fadely et al. (1989); this citation has been added to the FEIS text.

(7) Murres accounted for 74 percent of approximately 30,000 birds examined following the Exxon Valdez oil spill; the proportion of this number that was already dead and then oiled is unknown, as is the accuracy of the estimated 100,000 to 300,000 total mortality based on the 30,000 figure, since it is founded on very little

rigorous experimentation and mathematical modeling. If the figures are correct, the loss of 30,000 murres from an estimated population of 10 million (Sowls, Hatch, and Lensink, 1978) is not likely to threaten the species.

Response GP-18

Fewer whales were observed in the industrial zone near the Mackenzie River Delta during the 1980-1984 period. The statement by Richardson et al. (1985) says that bowhead distribution may or may not be influenced by industrial activities, that bowhead distribution probably depends strongly on prey distribution, and that until prey/bowhead dynamics were understood it would be difficult to attribute changes in bowhead distribution to industrial activities. Since prey/bowhead dynamics are not yet understood, it remains unknown whether industrial activities have or have not affected bowhead distribution in the Mackenzie Delta area. The findings from a later distributional study (Harwood and Davis, 1985) add support to the hypothesis that prey distribution is responsible for bowhead distribution.

Industrial noise has only a local, short-term effect on those whales that respond to it. It is not known if there are significant effects in the long term. Since potential long-term effects are unknown, they were not factored into the analysis. When and if production and development activities are contemplated, consultation will be renitiated with NMFS.

Regarding the EIS assumptions that industrial noise in or near the spring lead is likely to be similar to that anywhere else, and that bowheads and gray whales can be discussed together, these assumptions are well-supported (e.g., Richardson et al., 1984, 1985; Malme et al., 1983; 1984, 1985, 1986; Ljungblad et al., 1985; Wartzok et al., 1989). In every geographic area examined, and for every whale species observed, whales have been observed to respond to similar industrial stimuli in a similar fashion. This includes bowhead whales that were responding to industrial noise in the spring lead system (see Richardson et al., 1990).

Industrial operations are not likely to affect gray whales on their summer feeding grounds, since these grounds are located largely outside of the sale area. Further, all authoritative studies to date (e.g., Richardson et al., 1984, 1985, 1990; Malme et al., 1983, 1984, 1985, 1986; Ljungblad et al., 1985; Wartzok et al., 1989; Geraci and St. Aubin, 1980, 1982, 1985; Fishman et al., 1985) have shown that industrial noise and crude oil are likely to have only local, short-term effects on some whales. Consequently, industrial operations associated with Sale 126 are likely to have a very low effect on bowhead and gray whale populations, although some whales could be affected. Lastly, the EIS concludes nothing concerning "risk," but discusses what could occur.

Response GP-19

The text of Section IV.C.6 has been revised to address the concern for potential effects on polar bears.

Response GP-20

The MMS planning guidelines provide that, if local conditions or geography permit, the target for initiating recovery operations with pre-staged equipment (i.e., the response time) should be 6 to 12 hours. If the risk analysis included in the OSCP indicated that an oil spill from the proposed activity would contact a shoreline or biological community in sooner than 6 to 12 hours, the response time would be reduced accordingly in order to protect the environmental resource. The MMS does not believe that it is appropriate to mandate a specific response criterion, such as time, without consideration of location, timing, potential spill size, trajectory, and risk.

The MMS requires annual drills to test the lessee's response capabilities under realistic environmental conditions. The MMS/USCG planning guidelines require additional drills for different environmental conditions. The MMS reviews proposed scenarios for response drills in cooperation with the USCG. Drills are witnessed by the MMS and the USCG to ensure that personnel are capable of properly deploying response equipment. The MMS can require additional drills if the initial drill is unsatisfactory. The MMS routinely invites individuals from State, local governments, and community organizations to attend the oil-spill drills.

Lessees are required to inspect response equipment, train personnel in response techniques, and maintain records of the inspections and training. The MMS also has a rigorous inspection program that ensures that response equipment is available and maintained in workable condition and that all personnel receive training.

The MMS believes that the adequacy of spill response can be determined through reviewing the OSCP and viewing oil-spill-response drills in accordance with current MMS rules and guidelines.

Response GP-21

Arctic tankering is not considered in the Sale 126 scenario since it is not anticipated that crude oil tankers would be used for oil shipment in the Chukchi Sea Planning Area. Tankering from the Valdez terminal since 1976 has provided an adequate regional database for North Pacific tankering. However, the exposure variable for the oil-spill rate is not the type of environment; the exposure variable is the amount of oil transported. Studies to elucidate spills by cause have been unsuccessful (The Futures Group, 1982). Spill rates for production in Cook Inlet and Endicott (State) have not indicated higher spill rates in ice-infested areas. A large-spill scenario is addressed in Section IV.J. The use of ≥ 1,000 bbl is not intended to be misleading; it is the statistically correct method for writing about a database with spills as small as 1,000 bbl and greater. The tanker spill size distribution in the cumulative case is a statistical distribution based on the volume of oil transported through the Valdez terminal for the cumulative case (Table IV-A-1) including all OCS, State, and North Slope oil (Table IV-A-1). The tanker-spill-size distribution is derived from all the anticipated oil transported through the TAP and the Valdez terminal. Since fifteen tanker spills are estimated to occur in PWS/GOA, this is multiplied by the average tanker-spill size, 100,000 bbl, to derive the 1.65-MMbbl estimated spillage. The 1.65 MMbbl is then used to calculate the statistical distribution of spill sizes. For analysis purposes, this EIS assumes that this statistical distribution of spills would occur.

Response GP-22

The commenter is referred to EIS Appendix I, Alternative Energy Sources. Appendix I summarizes and incorporates by reference Appendix C, Alternative Energy Sources, of the Final EIS for the Proposed 5-Year OCS Oil and Gas Leasing Program, 1987-1992 (USDOI, MMS, 1989c).

September 10, 1990

Paul Dubsky, Regional Director
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue, Room 110
Anchorage, AK 99508-4302

Dear Mr. Dubsky:

The Northern Alaska Environmental Center (NAEC) is a non-profit conservation group with 600 members and a student chapter at the University of Alaska in Fairbanks. For nineteen years we have been concerned with the impacts of resource development on the sensitive Alaskan environment. NAEC appreciates your invitation to review and comment on the proposed Outer Continental Shelf (OCS) Lease Sale 126 in the Chukchi Sea.

We are concerned that the Environmental Impact Study (EIS) process utilized by the Mineral Management Service (MMS) for Lease Sale 126 is flawed. The EIS's conclusions are based upon inadequate scientific information and deficient, undertested oil industry technology. In light of these unsupported conclusions, we are forced to question MMS's "unbiased" position and believe MMS's apparent pro-drilling bias discredits the recommendation to hold Lease Sale 126. Additionally, the proposed lease sale directly contradicts long-term national interest by speeding domestic petroleum resource depletion which is expected to become essential in the future.

Without full scientific information, improved oil industry cleanup technology and a clear need to develop limited domestic petroleum resources, oil leasing, drilling and production perilously jeopardize the Chukchi marine environment. Therefore, NAEC cannot support Sale 126 or drilling on previously leased tracts in the Chukchi Sea. Instead, we recommend Alternative II, that the entire area proposed for lease under Sale 126 be eliminated from further OCS Oil and Gas Leasing Program consideration.

I. THE LACK OF INADEQUATE SCIENTIFIC DESCRIPTION OF THE CHUKCHI AND THE QUESTIONABLE USE OF AVAILABLE INFORMATION INVALIDATES THE PROPOSED ACTION.

A. General Comments

Of all OCS regions, the Chukchi Sea is probably the least popularly known and least scientifically understood. The remote geographic location and harsh arctic climate make scientific research difficult and sometimes life-threatening. However, in order to fully assess the potential impacts of oil drilling activities on the massive scale proposed by Alternative I, extensive knowledge of the coastal environment is required. Data gathering alone is not sufficient. The scientific community must be willing and able to submit ideas to the lengthy process of peer review, particularly necessary to sort out complex ecological relationships. In order to provide adequate protection for marine life cycles, endangered species populations and communities of species within the Chukchi, MMS must abandon Sale 126.

B. Heavy Ice Conditions

Insufficient research on ice conditions has been reason enough to jeopardize previous lease sales in the Chukchi. In 1985 Lease Sale 85 was deleted from the 5-year schedule "to provide for assessment of operations in heavy ice conditions." Disregarding the need for adequate data and analysis on Chukchi ice conditions, 350 leases were issued (Sale 109 conducted in 1988). Now, again without a thorough understanding of the unique ice conditions on the Chukchi, another lease sale is being proposed by MMS.

NAEC 1

C. Marine Ecology

The impacts of potentially harmful oil industry activities on the Chukchi flora and fauna must be understood before the sale of leases. Yet, the current EIS descriptions of the arctic waters of the Chukchi and the marine life that thrive there inadequately explain the diverse, fragile relationships within the ecosystem. The EIS neglects to include consideration of the concepts of toxic bioaccumulation and synergistic effects.

NAEC 2

NAEC found no mention of the ecological concepts of toxics bioaccumulation and synergistic effects. These concepts contraindicate the MMS assumption that because the concentration of fish, marine mammals, etc. is low in any given area, releases of petroleum or other toxic chemicals such as those contained in drilling muds (lead, mercury, zinc, cadmium) would have a correspondingly low, or even no, effect on marine life (EIS 126,

II-29). The "low bio-concentration equals low/no biological impact" theory does not account for the fact that sediments and organisms, including plants, invertebrates, fish, birds, seals, whales, polar bears and humans will store some toxics associated with oil drilling. The stored toxics become concentrated, particularly higher in the food chain.

Synergistic effects of discharged pollutants is also ignored in the EIS. Although the concentrations may be sublethal initially or independently, complicated synergistic reactions may create chronic poisoning problems, perhaps even affecting subsistence hunters. Drawing conclusions based wholly on the chemical effects on a single trophic level is an inappropriate use of available ecological knowledge.

NAEC 2

In the EIS for Sale 126, MMS must evaluate the chronic and acute effects of synergistic combinations and bioaccumulation on the marine ecology. Until these data have been gathered and submitted to peer review, the lease sale should be indefinitely postponed.

D. Endangered Species and Marine Mammals

The effects of oil industry activities on the habits and population stability of marine life endemic to the proposed lease area, particularly on endangered species are currently not well understood. Two species of endangered whales (bowhead, gray) summer in the Chukchi. Under the Endangered Species Act, MMS must ensure that the proposed action is not likely to jeopardize the continued existence of a threatened or endangered species and/or to result in adverse modification or destruction of their

NAEC 3

critical habitat. Inadequate data has been gathered on the effects of drilling activities on these endangered whales to comply with the Act. Despite an absence of baseline data, MMS makes assumptions describing the impact of oil industry activities on whales. For example, vessel avoidance behavior and startle responses demonstrated by bowhead whales are not evaluated for their biological cost, although it is assumed to be negligible (EIS 126, IV-B-15). Also, MMS neglects analysis of the effects of bioaccumulation and synergistic combinations of chemicals released by the oil industry. Therefore, MMS's proposed alternative is in violation of the federal Endangered Species Act. NAEC 3

The high value placed on the protection of endangered species and marine mammals reinforces the need for complete data before allowing the oil industry open access to the Chukchi. In fact, under the Marine Mammal Protection Act, walrus, cetacean, pinniped and polar bear populations and habitats must not be diminished beyond the point at which they cease to be a significant functioning element in the ecosystem, or to diminish such species below their optimum sustainable population. Are we ready to calculate the effect of hundreds of wells and support vessels on critical breeding and feeding habitat? Can MMS point to the expected consequences of the discharge of thousands of tons of drilling muds and cuttings and the cumulative impact of large and small oil spills and chemical leaks? How will stable population thresholds for each marine mammal be known and maintained? Rich with arctic marine life, the Chukchi Sea and NAEC 4

its associated polynya are without parallel. Proposing drilling activities without complete knowledge of the effects on unique and irreplaceable protected species is plainly irresponsible. To protect endangered populations and their habitat and to abide by the Endangered Species Act and the Marine Mammal Protection Act, MMS must incorporate thorough analysis including disturbance caused by industrial activity and the cumulative and synergistic impacts of unavoidable chemical releases. NAEC 4

II. THE PROPOSED ACTION WILL RESULT IN CONTAMINATION OF THE CHUKCHI DUE TO TECHNOLOGICAL CONSTRAINTS ON OIL SPILL CLEANUP AND UNAVOIDABLE RELEASES OF TOXIC CHEMICALS.

A. General Comments

Although no one, including the oil industry, wants oil spills, spills occur and cleanup is imperfect. On this point, NAEC is in agreement with MMS. Unfortunately, oil industry drilling and cleanup technology is both deficient and undertested. Also, the crushing Chukchi ice and harsh, highly erratic weather conditions increase both spill probability and cleanup difficulty. Undesirable chemical releases, whether routine or accidental, must be considered an inherent part of oil development. For these reasons, we believe that a moratorium should be placed on drilling until the behavior and effects of the chemical discharges is known and spill response technology has been developed and tested in hazardous arctic conditions similar to the Chukchi.

B. Unavoidable Adverse Effects

1. Oil Spill Risks

NAEC 5

MMS underestimates the overall oil spill risks for Lease Sale 126. The formula used to estimate these risks incorporates historical oil spill rates which are derived from the US and worldwide spill rate data (EIS 126, IV-A-4). Although the formula may predict spill risks accurately in average conditions, no one can reasonably argue that the Chukchi is average. The exceptionally hazardous arctic conditions make the derivation of MMS's spill risk formula unreliable when applied to the Chukchi. Therefore, NAEC views with skepticism the estimate that only two spills of 1,000 barrels or greater are likely to occur over the life of the field (base case scenario). Lessons learned in other seas cannot necessarily be applied to the Chukchi.

2. Oil Spill Behavior and Effects

NAEC 6

Winter spill modeling and tracking may not be possible with the variable behavior of oil under ice. The oil "may freeze onto sea ice and move with the ice throughout the winter" or it may not adhere to the ice undersurface as with smooth, first-year ice (EIS 126, IV-A-5 and C-2). Oil will flow under landfast ice until it freezes onto the undersurface in hours or days (EIS 126, IV-A-5). Given this type of information provided in the EIS, predicting oil spill behavior and tracking it through the dark winter months until spring breakup would complicate the already overwhelming task of oil spill recovery at sea.

3. Muds, Cuttings and Formation Waters

NAEC 7

Drilling muds, cuttings and formation waters are routine, unavoidable elements of oil exploration and production. Tens of thousands of tons of muds and cuttings would be discharged into the Chukchi during the exploration phase under the MMS base case. During production, the projected amounts of muds and cuttings discharged climbs into the hundreds of thousand of tons, although recycling of drilling muds can reduce these amounts somewhat (EIS 126, II-10 and II-13). Six platforms would be used for 214 production and service wells under the base case estimate. Therefore, the combined volume of muds and cuttings (depending on mud quantities recycled) released would be approximately 37,000 to 58,000 short tons per platform (EIS 126, II-13). On top of the estimated quantities of toxics and sedimentation released during oil exploration and production, non-estimated quantities of formation waters (drawn from wells along with oil) containing hydrocarbons and metals (EIS 126, IV-C-19) are discharged at the drilling site, increasing stress on the ecosystem. MMS's Alternative I base case analysis barely touches on the impact these unavoidable discharges have coming from six platforms, acting as concentrated pollution point sources.

The use and discharge of phenomenal volumes of muds, cuttings, and formation waters is an inherent part of oil exploration and production. As mentioned on page three of this document, the fluids euphemistically called by the oil industry drilling "muds" are actually a mixture of highly toxic chemicals. We are gravely concerned with MMS's dubious estimate of the contaminating effects such quantities of routinely discharged toxics will have on marine life cycles, endangered species populations and communities of species within the Chukchi environment.

C. Spill Cleanup

Oil spill drills and real-life cleanup attempts suggest that there are technical limits on current cleanup abilities. New cleanup technologies and strategies developed for the complicating weather and ice conditions in the Chukchi have not yet been proven capable. In fact, cleanup is an attempted process, not a result. MMS acknowledges that "cleanup at sea is only marginally effective. Using mechanical equipment, spilled-oil recovery generally ranges between 10 and 15 percent" (EIS 126, IV-A-13 re: US Congress, OTA, 1990). Without solid examples of successful cleanup in waters analogous to the Chukchi, no drilling activities should commence.

NAEC 8

1. Preparedness and Spill Drills

Although MMS requires spill drills, these drills are intended to test personnel familiarity with the equipment, not to demonstrate response capability in any particular weather condition or combination of weather and ice conditions. For example, the Shell Western Exploration and Production Inc. spill drill on 12 July 1989 was preformed in the protected waters of Kotzebue Sound. Inside the sound waves were only three feet, but just the previous day at Shell's exploratory drilling site in the Chukchi seas reached 16 feet. In a different spill drill held in the relatively calm Beaufort Sea, recovery of oranges (used to

model oil) was hampered by three foot swells and widely scattered icebergs (perhaps 5% ice cover). As a result, many of the oranges escaped under or around the boom before a skimmer could be deployed. These tests were hardly realistic representations of what weather or ice conditions would be likely to occur in the Chukchi.

2. Small Spill in Winter

Actual oil response efforts show the difficulty of dealing with the sub-zero temperatures found in the nine month Chukchi winter. During efforts to cleanup a small spill in the lower Cook Inlet, booms broke and igniters would not light the spill at negative 20 degrees Fahrenheit. Also, the ability to burn oil decreases rapidly with increasing sea roughness (EIS 126, IV-A-13).

3. Very Large Spill (Exxon Valdez)

Lessons learned from the 11 million gallon Exxon Valdez tanker spill in March 1989 should be difficult to forget. Initial problems deploying the cleanup equipment and logistical snags hampered quick action, and the spill spread outside the confines of Prince William Sound. The oil emulsified, making chemical dispersants ineffective. During stormy seas (4-8 foot waves), mechanical cleanup became nonfunctional (EIS 126, IV-A-13). Winter shut down cleanup entirely.

4. Multi-year Blowout

The worse possible scenario would be a massive blowout that cannot be controlled during the first summer. The flow would have to continue unchecked through the winter and efforts to drill a relief well would have to begin the following summer. Movement of the spilled oil through the winter and the corresponding difficulties of tracking it would hamper oil recovery efforts during the second summer.

5. Complicating Circumstances

Circumstances which complicate oil recovery under any size spill scenario are adverse weather or ice conditions, combinations of adverse weather and ice conditions, equipment failure, inadequacy or absence and human error. The EIS neglects to consider, for example, the problem of spill response in fog and broken ice or in 16 foot seas and scattered ice. It is not sufficient for oil companies to be required to demonstrate response capability only in solid-ice, open-water and broken-ice conditions before being granted the right to explore or drill for oil. The combined weather and ice conditions, known to be so hazardous in the Chukchi, deserve more stringent spill drill demonstrations.

NAEC
9

III. THE PROPOSED ACTION WILL NOT BENEFIT THE LONG-TERM INTERESTS OF THE US.

The base case scenario for Lease Sale 126 estimates that 1,610 million barrels of oil may be recovered. Using the current US rate of petroleum consumption, only about 95 days worth of oil would be gained. Instead of burning up this 95 day supply of oil (over the next 15 or 20 years), it would be contribute more to US national interest if that oil were added to domestic oil

resources in the future when tighter supplies make small quantities more valuable. Drilling now permanently revokes the possibility of having the oil later when we will need it more.

A more reliable and safer alternative to Lease Sale 126 is to develop alternative energy sources and energy conservation and efficiency. Besides being sustainable, energy conservation and efficiency do not contribute to acid precipitation and climate change.

Global economic relationships can best be described as interdependent. Oil deposits, in particular, require that policymakers realize that US petroleum demands will increasingly have to be met by Middle Eastern oil. Congress must face up to the reality of US dependence on Saudi Arabian oil reserves and work through diplomatic (or other) channels to maintain the oil supply. However, even global oil deposits are limited; long-term energy stability must include a greater emphasis on efficiency and conservation.

IV. ALTERNATIVE II IS THE ONLY RESPONSIBLE, SAFE AND LEGAL OPTION.

Lease Sale 126 jeopardizes the delicate Chukchi marine environment. Inadequate scientific data on the effects of oil spills and unavoidable chemical releases in the rich Chukchi environment along with pathetic oil industry cleanup records and spill drills which do not apply to Chukchi weather and ice conditions indicate that MMS's proposed Alternative I should not go forward. Additionally, federal laws concerning marine mammals and endangered species have not been followed in the development of Alternative I.

Deferring Sale 126 will allow the scientific community time to develop more complete environmental data for the Chukchi and to improve oil industry technology necessary to cope with the hazardous weather and ice conditions. Historic data show that the spill rate declined between 1964 and 1987 (EIS 126, IV-A-4). As global petroleum resources are being depleted, domestic supplies are likely to become more valuable later. Therefore, it is within our long-term national interest to delete Lease Sale 126. NAEC cannot support Sale 126 or drilling on previously leased tracts in the Chukchi Sea. Instead, we recommend Alternative II, that the entire area proposed for lease under Sale 126 be eliminated from further OCS Oil and Gas Leasing Program consideration.

Thank you for considering these comments.

Sincerely,

Sylvia J. Ward

Sylvia J. Ward
Northern Alaska Environmental Center
218 Driveway
Fairbanks, AK 99701

Northern Alaska Environmental Center

Response NAEC-1

Lease Sale 85 was deleted from the 5-Year Oil and Gas Leasing Program to address the concerns of the State of Alaska and the Alaska Congressional delegation. The following sentences regarding those concerns are excerpted from a January 10, 1984, letter from the Honorable Bill Sheffield, Governor of Alaska, to William Clark, Secretary of the Interior: "The primary concern of the state was the pace of the Department of Interior's current five-year oil and gas leasing program. Due to internal budget constraints, the MMS personnel assigned to Alaska's OCS appear to be insufficient for their greatly expanded responsibilities under the accelerated program. A two year delay would enable valuable scientific data interpretation and synthesis effort of available information to continue." The assessment of working in heavy ice conditions was completed in the Sale 109 FEIS (USDOI, MMS, 1987b). Exploration is likely to continue in open-water conditions. It is estimated that development drilling will begin in 2000. This allows 9 years for the oil industry to study conditions. Drilling will be allowed when the oil industry demonstrates to MMS that they can operate safely in the ice conditions of the Chukchi Sea.

The MMS agrees that ice conditions are a significant consideration for exploratory and development and production operations in the Chukchi Sea. While exploratory-drilling activities generally are conducted in the open-water season, ice-reinforced drillships and a specifically designed ice-class drilling unit with icebreaker support can operate in limited ice conditions. Over 10 wells in the U.S. and Canadian Beaufort Sea and 4 wells in the Chukchi Sea have been drilled using this technology.

In the event of a major commercial discovery, detailed DPP's would have to be submitted, including the technical specifications for platform design. Considerable research has already been conducted on ice and ice forces on offshore structures, and additional research is ongoing. Offshore production platforms would be subject to technical review by MMS; and MMS requires that the design, construction, and installation of bottom-founded structures be reviewed by MMS-certified third parties. The design of offshore platforms and multilevel technical review will consider all potential hazards, including ice.

Response NAEC-2

The MMS finds no citations to support the many statements concerning bioaccumulation, synergism, etc., made by the commenter. The NEPA requires that EIS's include adequate documentation of factors causing the effects concluded from the analysis, not all information used in an analysis. Drilling muds containing trace metals and other additives, as well as cuttings resulting from well drilling, generally have been shown to have low toxicity to marine organisms at the dilutions that are attained within a few hundred meters of a drilling platform. While there is little doubt that these materials accumulate in sediments and some organisms, and may reach higher concentrations at higher levels in a food chain, only a limited area downstream of a platform is likely to be affected. For example, if we conservatively assume that dilutions greater than values for all effects reported are achieved within a 1,000-m radius of a platform, only slightly more than 3 km^2 would be affected. Even assuming considerable accumulation in the food chain and possible synergistic effects with other compounds present, no animals concentrate to such an extent in the sale area that significant effects on their populations would result from the numbers of individuals likely to be affected in such a small area.

Response NAEC-3

While more data are needed to fill certain information gaps, the current database is more than adequate to determine the likely effect of industrial noise and crude oil on whales; and it has been adequate for some time. Every authoritative study pertaining to the effect of these two agents on cetaceans has consistently shown that these agents have only a minor, short-term effect on some whales and no effect on the others. Because of the volume of data available, it was unnecessary to make assumptions for the larger part of the assessment on endangered species. Assumptions were made in the encounter scenarios due to uncertainties associated with where, when, and how much industrial activity would actually take place and how many whales would actually be present during such times.

While it is true that a low number of whales are likely to avoid about one exploratory operation per year (or may be startled by the same), it is also true that such responses would have only a minor, short-term effect. Further, most whales avoid naturally occurring obstacles on a daily basis during their migrations. There is no information available concerning "synergistic combinations of chemicals released by the oil industry." Further, due to the number of unknowns and variables associated with synergistic investigations, and the low probability of obtaining definitive results from studies of this type, relevant information is not likely to become available. The effects of contamination and bioaccumulation are discussed in Section IV.C.7.a(3)(d) of the EIS, which indicates that petroleum-based compounds are not likely to accumulate in marine mammals and would be likely to result in only localized effects on prey species.

The EIS makes assumptions on the type and scope, level of oil and gas activities, and analyzes the potential effects of these activities on resources in accordance with the NEPA. This process includes consultation with NMFS and FWS under the Endangered Species Act (ESA) and adoption of mitigating measures based on reasonable and prudent alternatives and conservation recommendations. The EIS does not authorize activities that would violate the ESA. Specific lease activities, such as those described in the EIS, must be conducted under an approved EP/DPP that is subject to public review including NMFS and FWS. Activities taht could result in incidental taking of marine mammals are subject to the provisions of the incidental taking regulations and LOA, as provided by the Marine Mammal Protection Act, as amended.

Response NAEC-4

The likely effect of Sale 126 on bowhead and gray whales has already been "calculated" and is discussed at length in Section IV of the EIS. The procurement of "complete knowledge" is unrealistic and does not exist for any field of endeavor. Because of this, a NEPA analysis does not require complete knowledge; rather, it requires that the EIS analysis be focused on what is likely to occur based on the best available scientific information. The commenter does not raise any specific effect that was overlooked. The analysis in the EIS placed in temporal and spatial perspective the relationships among resources and the various causal agents. The synergistic effects of noise on whales are discussed in Section IV.B.7.a(1)(e). However, the implication that the DEIS analysis should have discussed all synergistic effects is beyond the scope of the EIS.

Response NAEC-5

Ice conditions in Cook Inlet and the Endicott Field have not resulted in a major platform or pipeline spill in State waters. The scientific method used by MMS in estimating the risk of oil spillage and a discussion of the causes of spillage are included in Section IV.A.1.a(2), Appendix C, and the references contained therein. The statistical exposure variable used by MMS is not the environmental condition but the volume of oil transported. A study by the Futures Group and Environmental Research and Technology, Inc. (1982) was unsuccessful in deriving any valid statistical relationships for predicting the occurrence of major spills from specific causes. Other estimation procedures, such as fault-tree analysis, have been considered by MMS but have been found to be less reliable than the method now in use. In addition, the commenter is referred to Figure IV-A-3 for an explanation of the most likely number and the distribution of spills. The most likely number of spills is two in the base case because two spills has the highest probability of occurring (27.06%). As many as six spills may occur but with a 1.28-percent probability of occurring. More than six may occur but with a <0.5-percent chance. The MMS does not estimate that only two spills would occur; the MMS estimates that two spills is the most likely number that would occur.

Response NAEC-6

The interpretation of the commenter is in agreement with the analysis in Section IV.A.2.e(3) and

Appendix L. Furthermore, a winter spill would most likely move into U.S.S.R. waters prior to spring/summer breakup, resulting in additional complications.

Response NAEC-7

Formation waters, including estimates of the amount produced and their composition, are discussed in Sections IV.C.2 and IV.D.2. Formation waters may be reinjected rather than discharged and, if discharged, would be subject to NPDES requirements.

Response NAEC-8

Oil-spill-contingency measures are discussed in Section IV.A.2.e(3) and Appendix L. Figure IV-A-12 shows the applicability of oil-spill-response techniques in the proposed sale area. There have been spill responses in seasonal ice fields off the U.S. and Canadian East Coasts and in the Baltic Sea. Small, stand-alone response tests have been conducted with some degree of success.

The MMS requires lessees to conduct oil-spill-response drills to demonstrate their capability to deploy and utilize oil-spill equipment. Several exercises have been conducted in the Beaufort and Chukchi Seas. Several offshore and tank tests have been conducted to evaluate major response equipment, in some cases with spilled oil or simulants. In situ burning remains one of the primary response strategies for oil-spill response in broken-ice conditions, which would limit or prohibit mechanical response. In situ-burn technology is well documented and has been demonstrated in several offshore trials and field and tank tests. Additional field trials of in situ burning, are currently being planned through an interagency and industry working group, are tentatively scheduled for 1991 and 1992.

Response NAEC-9

This EIS indicates in Section IV.A.2.e(5) and Appendix L that weather and sea conditions become critical factors during oil-spill-response operations . The oil industry is regulated by 30 CFR 250.42 for oil-spill-contingency planning and spill drills. The MMS requires operators to conduct an oil-spill-response drill to demonstrate their capability to deploy and utilize oil-spill-response equipment at least annually. The MMS can require lessees to conduct additional drills if the first drill indicates that personnel are unprepared or the equipment does not function properly. In addition, MMS requires that operators train personnel in oil-spill-response and inspect and maintain equipment on a scheduled basis to ensure that the equipment is operational and functional. The MMS also inspects equipment both on and off the drill site.

Due to the limited scope and timing of exploratory-drilling activities (60-90 days) and requirements for inspecting and maintaining equipment, MMS believes that oil-spill-response drills are being conducted as appropriate. In the event of development and production, the type, frequency, and scope of oil-spill-resonse drills will be modified commensurate with the level of development and production activity.

Trustees for ALASKA

A Non-Profit, Public Interest, Environmental Law Firm

September 12, 1990

Minerals Management Service
Alaska OCS Region, Room 110
949 East 36th Avenue
Anchorage, AK 99508-4302

Dear Sir or Madam:

I enclose a "hard" copy of Trustees for Alaska's Draft Environmental Impact Statement, Lease Sale 126 which was sent to your office via fax transmission on September 11, 1990. Minor typographical changes have been made to the comments I sent to you yesterday as well as some minor word changes. Please note that Trustees for Alaska expressly incorporates its prior comments to the Draft Environmental Impact Statement, Lease Sale 109 into the enclosed Lease Sale 126 comments. TFA 1

Thank you for the opportunity to comment.

Sincerely,

Nitza Delgado

725 Christensen Drive, Suite 4 Anchorage, Alaska 99501 (907) 276-4244

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Comments of Trustees for Alaska
on the
Draft Environmental Impact Statement

OCS Lease Sale No. 126

Chukchi Sea, Alaska

Prepared By:
Nitza Delgado
Law Clerk

September 11, 1990

**Chukchi Sea Oil and Gas Lease Sale 126
Comments to Draft EIS**

Trustees for Alaska is a non-profit public interest environmental law firm dedicated to the wise management of Alaska's natural resources, consistent with the protection of Alaska's environment. Trustees welcomes the opportunity to comment on the Draft Environmental Impact Statement (DEIS) for the proposed Outer Continental Shelf (OCS) Lease Sale of 126 in the Chukchi Sea.[1] Trustees proposes the adoption of the no sale alternative (Alternative II) for a number of reasons, including the inadequacy of scientific information concerning the effects of oil and gas exploration and production on the delicate balance of the arctic ecosystem, and the lack of oil spill cleanup technology given the environmental conditions in the Chukchi Sea, i.e., extremes in temperature, broken sea ice conditions, high wave conditions and high velocity sub surface water currants. Moreover, the Trustees believe this sale would only discourage the inevitable -- the need for an aggressive energy conservation campaign and development of alternative energy sources.

GENERAL COMMENTS

Trustees opposes Lease Sale 126 for numerous reasons. The foremost one being that there is insufficient information available TFA A1

[1] Trustees incorporates by reference NRDC's and Trustees' comments to the Lease Sale 109 DEIS for the Chukchi Sea herein. TFA 1

TFA A1

to make OCS decisions.[2] Moreover, in the DEIS, present data has been selectively gathered and used so as to encourage drilling in these waters at the cost of proper environmental safeguards. This problem is ever-present in the DEIS for Lease Sale 126. TFA 2

The most glaring example is the DEIS selective "mis-reference" to the Gerasi study which exposed crude oil to the skin of a living sperm whale.(DEIS IV-C-49). The DEIS cites this study to support the conclusion that the exposed skin of a living whale is only mildly affected after 17 hours exposure to crude oil. (DEIS IV-C-49). However, the EIS fails to mention that the study was done on a beached whale which died before the experiment was concluded. (Gerasi Report pp. 154-154). In other words, although the DEIS cites the study to support the position that, crude oil has no adverse effects on living whales, the whale was alive for only approximately half of the 17 hour experiment. This problem of "selective citation" of the Gerasi study is further exacerbated by logical gaps in the presentation of the data. Specifically, although the crude oil experiment lasted for 17 hours, the DEIS implies that the gasoline experiment was only conducted for two TFA 3

[2] This problem has been highlighted by the Improvements to the Scientific Content of the Environment Impact Statement Process. The most glaring problem has been the lack of peer review in study design and in the review of results. The magnitude of this problem was touched upon in The Adequacy of Environmental Information for Outer Continental Shelf Oil and Gas Decision: Florida and California
y, National Research Council, 1989 (NAS Report). The Conclusions in the NAS Report that there was insufficient data upon which to make OCS Lease Sale determinations for Florida and California and this applies to Alaska as well.

hours. Later however, we discovered that the DEIS failed to mention that the Gerasi study reported "dramatic changes" after 17 hours of gasoline exposure. "[T]he original skin surface could not be defined and the upper 1/2 to 1/3 of the epidermis was pale gray and had the consistency of thick paste." (Gerasi Report p. 157). These gaps of logic in the presentation of information lead Trustees to conclude that no real evaluations of the underlying studies have ben performed as the DEIS cites portions of studies, including quotations out of context to achieve the end MMS desires. TFA 3

Another egregious example of "selective citation" is in the DEIS citation to the Gerasi study regarding the dolphin study.(DEIS IV-C-49). The DEIS states that after 75 minutes of exposure to gasoline, the dolphin skin was unharmed. However, the DEIS fails to mention that there were four dolphins in the study and two of the four dolphins blistered after 30 minutes of exposure and the third blistered after 45 minutes of gasoline exposure. (Gerasi Report p. 153). This selective use of scientific data or "miscitation" is replete throughout the DEIS and belies the notion that OCS decisions are made after a careful weighing of existing scientific information. TFA 4

Moreover, the DEIS fails to present new information regarding the industry's ability to safely operate in the heavy sea ice conditions of the arctic environment. The DEIS itself admits that in February of 1985 a proposed Lease Sale in the Chukchi Sea, Lease Sale 85, was postponed in order to provide for "further assessment of operations in heavy ice conditions." Regardless this fact, in TFA 5

1987 Lease Sale 109 in Chukchi Sea went forward. It is our position that a decision to proceed with Lease Sale 126 blatantly disregards the need for more information assessing the industry's ability to safely operate in arctic conditions. TFA 5

Trustees also oppose the sale because to date, there is no indication that the industry has the cleanup technology necessary to clean up an oil spill of any size in the arctic. Rather, history indicates the opposite - that the industry will not be able to clean up any sized spill in the ice-laden waters of the Chukchi Sea. History shows that oil spills are highly probable but cleanups are not possible. The following two spills highlight this point.

The July 1987 S.S. Glacier Bay spill shows us that oil spill cleanups are simply not possible even under the best environmental conditions. Specifically, the S.S. Glacier Bay spill occurred in summer, in waters milder than the Chukchi Sea. Despite these facts, it was not possible to clean up more than 10 - 20 % of the S.S. Glacier Bay spill. Mechanical cleanup proved to be inadequate despite the fact that there were 20 vessels on site to perform the cleanup. TFA 6

On January 31, 1989 a second oil spill took place in Cook Inlet and history repeated itself. In relatively mild environmental conditions, when compared with conditions present in the Chukchi Sea, mechanical clean up was not attempted because of the cold weather and icy conditions. Moreover, oil burning techniques were not employed because responders determined that the propane ignition system on the Heliotorch would probably not operate in -20 to -25 degree temperatures. That spill was only 520 barrels of an oil/water mixture containing a mere 110 barrels of oil. Query, if a small spill cannot be adequately cleaned up in Cook Inlet, where the logistical problems are not a fraction as severe as in Chukchi Sea, how can the industry represent that it can respond to any sized oil spill in the Chukchi Sea, an area characterized as a frontier area with extreme wind, temperature and ice conditions? The DEIS avoids addressing these real issues (as the treatment of the Cook Inlet spills are not addressed in the DEIS) and does little more than parrot statements from previous environmental impact statements. TFA 6

The DEIS suggests the use of chemical dispersants as an appropriate method to clean up a spill; however, it fails to mention the types of chemicals that would be used, their toxicity, and their decay rate in the cold saline waters of the Chukchi Sea. Chemical dispersants are problematic because, like oil, they too may be toxic. Dispersants, by definition, do not change the toxic nature of oil, but merely cleave long hydrocarbon chains into smaller ones. Therefore, the true danger of an oil spill remains and, in fact, may be further exacerbated by the addition of new toxins into the water. TFA 7

Perhaps most troubling to Trustees (and a major reason for Trustees' opposition to the sale) is that the DEIS does not evaluate the alternative of developing an aggressive energy conservation campaign as well as the development of alternative TFA 8

energy sources as viable alternatives to the exploitation of oil reserves on the OCS. In a simplistic fashion, the DEIS justifies Lease Sale 126 on the ground that the OCS is necessary to meet the nation's energy needs and aid in the reduction of dependency on foreign oil. However, the DEIS does not seriously address the possibility of an aggressive energy conservation campaign or the development of other energy sources to meet these goals. It simply proposes maintaining the status quo of consuming finite fossil fuel. The status quo is consumption at the alarming rate of 26.0% per year of the total world oil production. (British Petroleum Statistical Review of World Energy p.8).

SPECIFIC COMMENTS TFA 8

I. No Lease Sale (ALTERNATIVE II)

The DEIS claims that the importation of oil and gas would increase and as a possible alternative to this increase, lists the energy sources which may be developed as substitutes. (DEIS IV-E-1). However, the DEIS fails to address any of these substitutes as serious, viable alternatives. The DEIS fails to propose that an aggressive energy conservation campaign be employed to encourage Americans to decrease fuel consumption and incorporate alternative energy sources-the technology for which has already been developed. For example, even though the technology for reducing automobile energy use exists today, it is not employed. The DEIS ignores the fact that this nation could save the equivalent amount of oil produced by Iraq and Kuwait through a 1.5 mile per gallon per year fuel economy increase over seven years. (NRDC News Release August 8, 1990). The DEIS' failure to discuss these realistic alternatives typifies the main problem facing American today - its inefficient and myopic dependency on fossil fuel. TFA 8

II. Delay Lease Sale (ALTERNATIVE III)

If the no lease alternative is not adopted, Trustees proposes that the Department of the Interior delay Lease Sale 126 until adequate environmental information is available upon which to make OCS decisions. At a minimum, the Sale should be delayed until the industry has conclusively demonstrated that it has the necessary technology to clean up oil spills in the arctic environment. In making this proposal, Trustees urges MMS to treat the delay alternative as a true alternative. Past experience shows that lease sale delays do little to encourage industry to develop reliable cleanup technology. (Lease Sale 85 at EIS I-5). TFA 9 The DEIS does not highlight any new developments in the area of oil spill cleanup technology, perhaps because there have not been any significant developments since 1985; the recent Valdez spill is testimony of the ineffectness of today's available technology. Any delay type of alternative to Lease Sale 126 must be accompanied by a mandate to improve cleanup technology. TFA 10

III. Point Lay Deferral Alternative (ALTERNATIVE III)

The Point Lay Deferral alternative should be a deletion rather than merely a deferral. Moreover, the deferred area should be TFA 11

expanded to coincide with the areas of critical biological importance represented in Graphic No. 2. (DEIS opposite III- 28). Trustees notes that the areas represented in Graphic 2 extend well beyond the areas presented in the Point Lay Deferral Alternative. (DEIS Figure I-3 opposite I-18).

In addition, as in the delay alternative, Trustees questions whether this is truly an alternative. Specifically, Trustees is concerned that deferral consideration in this instance would receive the same treatment as the deferral in Lease Sale 109. The area in question is the same which was analyzed in Lease Sale 109. In Lease Sale 109, despite comments in support of the Point Lay Deferral Alternative from the state of Alaska, North Slope Burough, NOAA, and the EPA, this area was leased and the rest of the area is included in proposed Lease Sale 126. (DEIS II-39). For this reason, Trustees urges MMS to expand the Point Lay area to include those areas in Graphic 2 and to delete the entire area from proposed Lease Sale 126 and future sales. TFA 11

IV. Proposed Action (Alternative I)

Trustees adamantly opposes this proposal for the reasons discussed in its general comments above, and based on the specific comments it presents below.

A. <u>Low/Base Case Effects</u>

1. Air Quality

DEIS admits that the USDOI regulating exemptions levels would be exceeded for nitrous oxides (NOx) but that air pollution TFA 12 concentration permitted by air quality standards would be attained. However, regardless of air quality attained, the DEIS fails to discuss the actual effects of air pollution on the fragile vegetation of the arctic ecosystem. The DEIS relies on information found for Lease Sale 87 to support its position that the effect of air pollution on the arctic vegetation would be low. (DEIS IV-C-3). Once again the use of information is selective. The DEIS estimates that sulfur deposit of 0.1 kg/km2/year would occur as the result of development and juxtaposes it with the lethal amounts of sulfur deposit cited at 670 kg/km2/year which causes fish kills and the destruction of plant species. It then cites that 12.0ug/m3 for short periods can depress photosynthesis with damage occurring at 60 ug/m3 but the DEIS does not reveal how many ug/m3 would be deposited at any given point. (DEIS IV-C-2). In other words, once again the logic is skewed in that data is provided for lichen damage in terms of short period exposure yet it is juxtaposed with data corresponding to fish kills and die-out of plant species resulting from yearly sulfur deposits. The DEIS then fails to give us the data for lichen tolerance of yearly sulfuric deposits.

TFA 12

The DEIS also fails to provide information on the importance of this vegetation to the wildlife of the Chukchi area. The schematic diagram of the food chain in the arctic only addresses the aquatic food chain, neglecting the effect of air pollution on the terrestrial food chain. (DEIS Figure III-B-3 opposite p. III-20).

TFA 13

2. Effect on Marine Mammals

The DEIS alludes to the effects that oil development will have on marine mammals but it fails to seriously account for the effects that vessel traffic, air traffic, and oil spills will have on marine mammals.

a. Vessel Traffic and Drilling Noise

The DEIS acknowledges that sound travels at a greater velocity in water and that it may alarm marine mammals and interfere with communication. (DEIS IV-C-42). This fact cannot be disregarded because underwater communication is important for whale migration. Whales depend on call reflection in order to determine ice thickness. By determining the thickness of the ice they can detect whether they can break out small breathing holes. (see Trustees comments to Beaufort Sea Planning Oil and Gas Lease Sale 124 p.7). In addition bowhead whales have exhibited strong reactions to vessel traffic from afar. They commence swimming rapidly from boats at distance of one to four kilometers away. (Id at p.8). Regardless, the DEIS treats the effect of industrial noise as insignificant in comparison to natural variation in habitat use migratory path selection, and whale behavior and as a short term problem since the whale are migrating. (DEIS IV-C-48). However, whales need to use underwater communication in order to maneuver through the arctic ice and find possible breathing holes.

TFA 14

b. Air Traffic

The DEIS notes that the walrus population is declining, yet, regardless of this fact, the DEIS disregards the Johnson and Salter studies which show that low flying aircraft panic both seals and

TFA 15

walrus causing them to trample over calves and pups. (DEIS IV-C-42). These studies can not be viewed as unimportant because, as the DEIS states, the North Pacific walrus population represents 80% of the total world population with roughly 40% inhabiting the Chukchi Sea and presently they exhibit population decline. (DEIS III-30). The DEIS response is that the mammals will be displaced and adjust at another site. However, is it truly possible for an animal to switch habitats and adjust to new predators in a new location without negatively impacting the species? TFA 15

c. Oil Spills

Both seals and walrus risk oil contamination from spills, even if the spill took place in the winter when the mammals are not in the area in abundant numbers. It is possible to suffer population loss due to oil contamination from a winter spill during the months of March through May. Seals and walrus give birth on the ice between the months of March and May. This is important to note as the report leads one to think that we only need to worry about summer spills when the animals are present in abundant numbers and that winter time spills do not affect the animals. Oil spilled during the cold weather may freeze in the ice or get trapped under the ice within a few days after the spill. Should this occur the toxicity of the oil will remain until it is released once again in during a thaw. This presents two problems which are not accounted for in the DEIS. TFA 16

The first problem is tracking. Assuming that contaminated floes can be identified, it would not be possible to track them

throughout the winter, given the harsh conditions of the Chukchi Sea, ice movements, ocean currents, and limited daylight. Once these floes begin to melt, the result will have effects similar to a new oil spill in a new location. Then, a new generation of marine mammals face the probability of oil contamination. Young pups and calves face oil contamination which is as toxic as it was when it became frozen into the ice. This is especially problematic for the young ones as they are particularly vulnerable to oil. TFA 16

The second problem, of course, is that even if the oil could be tracked, history indicates it cannot be efficiently cleaned up. TFA 17

B. <u>Subsistence Lifestyles</u>

In deciding whether to go through with Lease Sale 126 the effect of oil development on marine life should be analyzed as it interrelates to Native subsistence. Sale 126 would exacerbate the walrus population decline, and whales may alter there course which will make them more difficult to hunt. (DEIS IV-C-42). The DEIS is also somewhat callous in its disregard of the anticipated increase of alcoholism and domestic violence which may result. (DEIS III.C.3.d) The DEIS fails to analyze how these tangible problems affecting people, created by those who do not have to deal with the problems on a long term basis, would be addressed. TFA 18

III. CONCLUSION

In summary, Trustees opposes Sale 126 on the grounds that there is insufficient information upon which to make an informed decision regarding oil development in the Arctic waters of the TFA 19

Chukchi sea and the information which does existed is manipulated so as to encourage the desired outcome of further drilling in the arctic. Our opposition is based on the fact that present technology is incapable of coping with oil spills in the Arctic, and the DEIS does not fully explore the possibility of developing new energy resources or launching an aggressive energy conservation campaign, or even employing the energy efficient technology available today. Given the present situation in the Middle East and given the knowledge that oil reserves are finite we should strive to reduce American dependency on fossil fuel and develop new energy sources. TFA 19

Trustees For Alaska

Response TFA-A1

The MMS considers the information currently available to be adequate for a basic understanding of the potential environmental effects of Sale 126 in and adjacent to the sale area. In addition, MMS has successfully evaluated the potential environmental effects of two other lease sales in the Chukchi Sea Planning Area. The first sale, Sale 85, scheduled for February 1985, was not held. The second sale, Sale 109, was held in May 1988; but the task of analyzing the effects of the sale had to begin long before the sale date. Since work began on the first sale, the amount of information available to analyze the effects of petroleum exploitation in the Chukchi Sea has been increasing.

The MMS Environmental Studies Program has helped to increase the information base. As a measure of this contribution, MMS has expended over $120 million on environmental studies in the Chukchi and Beaufort Seas during the period 1975 to March 1988. The studies conducted have investigated major disciplines including geology, oceanography, sea ice, pollutant transport, living resources, endangered species, ecosystems, oil-spill effects, noise effects, sociocultural systems, socioeconomic systems, and transportation; and a considerable effort has been made to integrate and synthesize available information. Monitoring programs have been developed to study specific effects on resources of concern.

Response TFA-1

The responses prepared by the MMS to the comments made by the Natural Resources Defense Council and Trustees for Alaska regarding Chukchi Sea OCS Lease Sale 109 are herein incorporated by reference.

Response TFA-2

The commenter's claim of insufficient information is not focused and does not offer any significant new relationships to the decision of what they claim is missing. The references cited in the EIS represent the best scientific information available for environmental description and analysis purposes. Additional references introduced in the FEIS, as a result of comments on the DEIS, improve the quality of the analysis (as shown, for example, by the analysis of polar bear in Sec. IV.C.6).

Response TFA-3

The fact that the sperm whale being experimented upon was stranded and had been dead for 5 to 10 hours before the experiment was concluded had nothing to do with the experimental results. This reality is borne out on Page 160 of the 1982 Geraci and St. Aubin report, where it states that "The whale died during the course of the contact study. Yet the histological changes noted in the epidermis exposed to gasoline are noteworthy in that they are indicative of damage to living cells, and not postmortem autolysis." Consequently, according to the report, the death of the sperm whale had no bearing on the outcome of the experiments. This represents a demonstration of effects on living tissue.

Regarding the "dramatic changes" after 17 hours of exposure to gasoline, the subject of the EIS analysis concerns the effect of crude oil on cetaceans, not the effect of gasoline on cetaceans. In the few places where the effects of gasoline are mentioned, they are mentioned for comparative purposes only, in the more realistic scenario of 75 minutes of exposure. The idea that free-ranging whales would somehow be exposed to gasoline for 17 hours due to activities associated with Sale 126 is clearly unrealistic. In all likelihood they would not be exposed to gasoline at all. In addition, gasoline is many times more damaging to tissues than crude oil and does not accurately reflect effects that would be expected from contact with crude oil. This, of course, is why the EIS does not elaborate on gasoline experiments. No attempt was made to imply that gasoline experiments were only 2 hours long. Regarding the actual damage caused by 17 hours of exposure to gasoline, the report also indicates that damage occurred only to the medial and superficial layers of the epidermis and states that "even this degree of damage seems to be reversible."

Response TFA-4

See Response TFA-2. Regarding the blisters observed on two of the four dolphins tested, this is indicated on the chart on Page 90 of the 1982 Geraci and St. Aubin report. The chart shows (among other things) the effects of gasoline on the skin of four dolphins after 15, 30, 45, 60, and 75 minutes of exposure. However, the report also indicates that the blisters on the two dolphins at 30 and 45 minutes of exposure were small and that the same animals showed no visible reaction after 75 minutes. That is why the report stated on Page 89, concerning the chart on Page 90, that "In some cases, the exposed skin had a faint hobnail texture that disappeared within 5 minutes. Normal color was always restored within 2 hours. At no time was there any swelling, hemorrhage, or break in the continuity of the skin associated with exposure." The report concluded that "We found that dolphin skin exposed to gasoline and crude oil turned pale gray, and otherwise showed no evidence of damage or loss of integrity."

Response TFA-5

Lease Sale 85 was deleted from the 5-Year Oil and Gas Leasing Program to address the concerns of the State of Alaska and the Alaska Congressional delegation. The following sentences regarding those concerns are excerpted from a January 10, 1984, letter from the Honorable Bill Sheffield, Governor of Alaska, to William Clark, Secretary of the Interior: "The primary concern of the state was the pace of the Department of Interior's current five-year oil and gas leasing program. Due to internal budget constraints, the MMS personnel assigned to Alaska's OCS appear to be insufficient for their greatly expanded responsibilities under the accelerated program. A two year delay would enable valuable scientific data interpretation and synthesis effort of available information to continue." The assessment of working in heavy ice conditions was completed in the Sale 109 FEIS (USDOI, MMS, 1987b). Exploration is likely to continue in open-water conditions. It is estimated that development drilling will begin in 2000. This allows 9 years for the oil industry to study conditions. Drilling will be allowed when the oil industry demonstrates to MMS that they can operate safely in the ice conditions of the Chukchi Sea.

Engineering studies indicate that a key consideration in the design of buried offshore pipelines in an arctic environment is to determine the optimum burial depths that (1) maximize the pipeline's safety from rupture by ice gouging and (2) minimize costs. Prior to construction of subsea pipelines, operators would be required to conduct geological and geophysical surveys to determine potential hazards, including ice scouring, to the pipeline. The density, age, depth, and reoccurrence rate of ice gouging must be fully evaluated and considered in the design, construction, and placement of a pipeline. Any pipeline design must include devices to monitor damage or leaks, and redundant automatic and manual shutdown valves to shut off the pipeline and stop a continuous leak if a break in the pipeline occurred. Continuous monitoring techniques will enable the operators of such pipelines to be forewarned of potential scour problems and to take corrective actions.

Response TFA-6

Cleaning up an oil-spill is a major and difficult task regardless of the location and type of environment. The reference to Cook Inlet provides an excellent example; although the commenter suggests environmental conditions are milder, Cook Inlet has the second-highest tides in North America. These high tides create extremely fast tidal currents that complicate oil-spill cleanup. A review of historical spills indicates that mechanical cleanup averages 10 to 15 percent recovery (U. S. Congress, OTA, 1990). Response planning for short response times (6-12 hr and 48 hr for additional equipment) is required for drilling operations on the Alaska OCS. Prior to the Oil Pollution Act of 1990, similar requirements were not previously in place for general ship traffic in Cook Inlet. Oil-spill cleanup and response is discussed in Section IV.A.2 and Appendix L. OCS exploration and development and production activities require approved oil-spill-contingency plans, which establish and commit equipment, manpower, logistical support, and communications resources to a specific activity. The MMS believes this will ensure greater response than in previous transportation or other non-OCS spills.

Response TFA-7

Appendix L, Tables L-5 and L-6, contain a listing of dispersants aboard SWEPI's oil-spill-response barge in the Chukchi Sea and the ACS warehouse at Deadhorse. Chapter 3, Toxicological Testing of Dispersant and Dispersed Oil, and Chapter 4, Intermediate-Scale experiments and Field Studies of Dispersant Applied to Oil Spills in Using Oil Spill Dispersant on the Sea, have been referenced and included in the discussion on dispersants.

Response TFA-8

The DOI is charged by law (OCSLA) to develop the resources of the OCS. Energy conservation programs are the responsibility of DOE. The commenter is referred to Appendix I, Alternative Energy Sources. This information summarizes and incorporates by reference Appendix C, Alternative Energy Sources, of the Final EIS for the Proposed 5-Year OCS Oil and Gas Leasing Program, 1987-1992 (USDOI, MMS, in Press).

Response TFA-9

The MMS believes there is adequate information available to prepare an EIS on a proposed OCS Chukchi Sea lease sale and to reach a reasoned decision on a proposed course of action. By means of an Exploration Plan, lessees must demonstrate to the MMS prior to exploratory drilling their ability to clean up oil spills and operate safely in the ice conditions of the Chukchi Sea. Should commercially marketable quantities of hydrocarbons be discovered in the Chukchi Sea, a developmental EIS would be required based on the plans for development, production, and transportation of such oil to market. At that time, more specific additional data should be available to plan for arctic-oil-spill cleanup.

Response TFA-10

During the Exxon Valdez Cleanup Technology Workshop (1989), Jim O'Brien concluded from a detailed literature search and interviews that no technology, other that what has already been considered, is available to facilitate mechanical recovery and cleanup of oiled shorelines. During the 1980's the major emphasis was on refining existing technology rather than major technology development. The MMS is in the process of developing minimum performance standards for response equipment once standard test protocols are established. This will be a milestone in developing effective containment and cleanup equipment for the Arctic. Since the Exxon Valdez spill, oil-spill research and development has been in the spotlight. The Oil Pollution Act of 1990, Public Law 101-380, establishes an interagency coordinating committee on oil-pollution research. Membership of the Committee includes representatives of NOAA, DOE, DOI (includes MMS and FWS), DOT, DOD, EPA, National Aeronautics and Space Administration, and the United States Fire Administration in the Federal Emergency Management Agency, and other Federal Agencies that may be designated by the President. In addition to Federal research, Marine Spill Response Corporation (MSRC), a consortium of oil companies and shippers, will administer a comprehensive research and development program to improve the knowledge and technology used to respond to and clean up spills. This program will complement programs in government, academia, and industry.

Response TFA 11

Chukchi Sea Lease Sale 109 presented a proposal that included the entire Chukchi Sea Planning Area. Largely for this reason, three deferral alternatives were examined in the Sale 109 EIS. In the case of Sale 126, however, the existence of one deferral alternative is the result of having excluded from leasing--during the Area Identification phase of the lease-sale process--a large number of blocks on the southeastern (nearshore) boundary of the planning area. The MMS made a reasoned attempt, prior to defining any deferral alternatives, to protect the habitat represented by the nearshore blocks that were deleted from the proposed Sale 126 area. The southeasterly boundary of the proposed Point Lay Deferral Alternative in Sale 126 coincides with the same boundary for what was known as the Sale 109 Coastal Deferral Alternative.

Numerous factors entered into the decision process by which the boundary of the deferral alternative was drawn--not the least of which were critical habitats and the flaw zone of the Chukchi Sea. The northwestern boundary of the flaw zone shown on Graphic 2, however, is only indicative of possible annual and seasonal boundary locations and cannot be used with precision to describe a lease-sale boundary. This is why a cautionary note to readers is provided on Graphic 2 to underscore the imprecision of the data described.

Response TFA-12

The DEIS discusses, directly and by reference, potential effects of emissions from OCS operations on tundra. For comparison, three levels of effects are given. The first level, with an extraordinarily high level of pollutants, results in the death of plants. The second level, with about 10 times fewer pollutants, results in damage to plants. A third level, five times lower than the second, can depress photosynthesis. The maximum modeled concentration of sulfur, at the shoreline, is about 100 times less than the level that would cause damage to plants. While not modeled, further dispersion of pollutants would reduce concentrations to near ambient levels affecting only a local area. To some limited degree, tundra would be affected by the addition of pollutants to existing air. However, even the greatest effects from potential emissions would be localized and not measurable and would occur during the summer during the 10-year exploration period.

Response TFA-13

Given that effects on tundra would not be measurable and localized, no effects on wildlife due to OCS emissions are anticipated.

Response TFA-14

Since few exploratory operations are proposed, the likely rate of bowheads encountering industrial noise is very low to start with. In addition, whales that did encounter industrial noise would do so for only the brief period of time it takes them to swim past the operation. This period represents only a small fragment of the total time needed for migration. During the remaining portion of their migration, all bowheads are subject to naturally occurring noise (from ice, wind, waves, seismic events, and animals) and diversions around areas of thick or extensive ice cover on a daily basis. They are also subject to death during both migrations, due to the spring and fall subsistence hunts. For these reasons, it is clear that industrial noise is likely to result in only insignificant effects on bowheads, in comparison to effects due to other events. Hence, the commenter's statements (which are based on speculation) regarding how whales use the reflection of their own calls to determine ice thickness, and thereby locate places where they can break out of the ice, are irrelevant, since only a small number of bowheads would be exposed to the minor, short-term effects of industrial noise for a small fraction of their total migration time. Consequently, even if whales did depend on the reflection of their own calls to navigate or communicate, it is unlikely that industrial operations associated with Sale 126 would affect them in any significant way.

Response TFA-15

The analysis does not state that results of disturbance studies are unimportant for interpreting potential effects. However, available evidence suggests that the numbers of walrus and seals that might be affected are likely to be small and the effects mainly localized and short-term; thus, a conclusion of effect greater than low resulting from disturbance alone would be difficult to substantiate.

Response TFA-16

In terms of adversely affecting substantial numbers of walrus or seals, an oil spill occurring or released from ice from late May through the open-water period is likely to be the most severe. It is not clear from this comment why the commenter feels it is important to track a winter oil spill trapped in the ice if, as is asserted, it cannot be cleaned up. We find no new evidence in the comment or elsewhere that would suggest that spills in winter or spring are likely to contact significant numbers of walrus or seals or result in greater-than-low effects.

Response TFA-17

The commenter's interpretations are consistent with the analysis in Section IV.A.2(e)(5) and Appendix L. The MMS OCS Oil Spill Task Force report to the Secretary of the Interior (1989) considered Orion tracking buoys, ice-marking dye, and the ACS trajectory model sufficient for detection and monitoring during SWEPI's exploration drilling in the Chukchi Sea.

Response TFA-18

The concepts of "sharing networks" and interrelationship of Inupiat family values/culture and their dependence on subsistence resources are discussed in Section III.C.3. The effects of the lease sale on walrus and bowhead are expected to be low and very low, respectively; thus, the overall effect of the sale on the harvest of these subsistence resources (and subsequent effects on sociocultural systems) may be similar. Section III.C.3 discusses life in North Slope communities and the various prevalent social pathologies as well as the North Slope Borough's efforts to deal with them. It is unfortunate that the commenter finds the text's impartial analysis "callous;" alcohol is currently the primary threat to public health and Inupiat family values on the North Slope and has been for decades. Long before the advent of the oil ang gas industry on the North Slope, whalers and traders introduced alcohol (and the means to make alcohol) into the Inupiat culture.

Response TFA-19

See Responses TFA-A1 on sufficiency of information, TFA-2 through TFA-4 on the use of information in the EIS, TFA-5 through TFA-7 on oil-spill cleanup, and TFA-8 on energy alternatives and conservation.

Bering Sea
Fishermen's Association
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September 11, 1990

George H. Allen
EIS Coordinator
U.S. Department of the Interior
Minerals Management Service, Alaska OCS region
949 East 36th Ave
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Re: Chukchi Sea Oil & Gas Lease Sale 126
Draft Environmental Impact Statement

Dear Mr. Allen,

Thank you for this opportunity to comment on the Draft Environmental Impact Statement (DEIS) for Lease Sale 126. In general, we find the DEIS for Chukchi Sea Lease Sale 126 to be fairly rigorous in its analysis and a useful and informative document. The errors we find in the document, for the most part, are not errors in analysis but generally errors of omission.

The Bering Sea Fishermen's Association represents commercial and subsistence fishermen from western Alaska. Amongst this constituency are the Inupiat villagers of the NANA region. The DEIS does a good job of describing the subsistence activities, fisheries resources and areas of North Slope Borough (NSB) villages near and immediately adjacent to Sale Area 126. In assessing potential effects of oil development activities, the DEIS focuses on the impacts to these communities and resources.

BSFA
1

However, this is not the case for non-NSB villages that use resources that may be affected by OCS development in the Chukchi Sea. The DEIS does not take note of nor analyze potential impacts to resources that migrate through either the Sale Area or the area suggested for the Pt. Belcher/NPR-A pipeline are utilized by residents from outside the North Slope Borough. There is absolutely no mention of the commercial fisheries located in these areas and potential impacts from oil development and possible spills. These omissions are the basis for most of our comments. As well, we wish to comment on other areas of the text, where we feel further analysis is necessary.

Section III C.2. Subsistence Harvest Patterns

This section fails to describe the resource harvesting patterns of non-NSB communities that utilize resources which could be affected by Chukchi Sea development. It would not be necessary to do as exhaustive an analysis for non-NSB communities but we feel that the following issues should be addressed with regards to the following resources utilized by non-NSB communities.

Caribou: The Western Arctic Caribou Herd forms a vital component of the subsistence economy of NANA region residents. For example, it is the single most important resource for Kotzebue and Kivalina residents, contributing roughly 24 percent and 26 percent, respectively, of the total subsistence harvest by edible weight. NANA region residents travel more than 100 miles to harvest caribou. The northern limit of their hunting range extends from Cape Thompson in the west then follows the Colville River drainage until it turns south at 151 50'. The proposed pipeline across the NPR will pass across the caribou hunting territory of NANA residents as it passes along the Colville River.

BSFA
1

Small Game (ptarmigan, grouse, hare, etc.) and Furbearers: NANA region residents also hunt small game and trap various furbearers hundreds of miles from their home villages. The northern boundary of their hunting range for small game extends from a point 30 miles north of Cape Beaufort, to the headwaters of the Meade River, then follows the Colville River drainage to a easternmost point at roughly 69 N, 153 W. The proposed pipeline across the NPR will also pass close to or within the small game and furbearer harvesting territory of NANA villagers.

Although it is a matter of debate as to the degree of impact to terrestrial mammals from a pipeline, the DEIS does acknowledge that short-term disruptions to caribou migration will occur especially during the two years of pipeline and road construction. The DEIS states that "possible short-term reductions of the season's harvest" of caribou (p. IV-C-75) may occur due to these disruptions. Since non-NSB communities utilize the Western Arctic Caribou Herd as well, the DEIS should state the possible impacts to NANA region residents' use of caribou. As well, the DEIS should acknowledge that NANA residents harvest small game and furbearers in areas close to the proposed NPR / Pt. Belcher pipeline.

Marine Mammals: The DEIS also fails to note that non-NSB residents harvest marine mammals that migrate through the Sale 126 area. The marine mammal hunting territory of NANA residents extends up to Point Hope. Marine mammals are a major portion of the subsistence harvest by NANA residents. Walrus, bowhead whale, belukha, and bearded seal that NANA residents harvest migrate from the Bering Sea up to the Chukchi Lease Sale Area. Harvests of these four species make up over 50 percent (by weight) of the total subsistence harvest by Kivalina residents, for example. The DEIS projects in Figure IV-C-1 that if an offshore oil spill occurred, there would be a high probability that migration corridors north of Pt. Hope would be contacted by oil. Therefore, the DEIS should state that any impacts to marine mammals that migrate through Sale Area 126 could have repercussions on the marine mammal subsistence harvest of NANA residents. BSFA 1

Additional subsistence comments:

Throughout the discussion of impacts to subsistence harvesting from development of Lease Sale 126, the DEIS makes repeated statements to the effect that though disruptions to harvests of particular species or harvesting activities within specific locales may occur, residents of villages will easily be able to make up "lost" harvests, by harvesting other resources or obtaining them from other locales (see especially section IV.C.11.b). While these statements are not false, they fail to appreciate the significant traits of a subsistence strategy. BSFA 2

The subsistence harvesting cycles and resource use areas of Alaska Natives have evolved over several generations. Efficiency and high productivity characterize harvesting activities. People use areas that are easy to access and which will provide them a good and rapid return for their investment of time, money, and skill. Villagers affected by short-term disruptions to their harvesting will probably be able to make up the deficit in their harvests; indeed they will seek to do so since they know how much food they usually need. However, disruptions to their regular harvesting patterns could have significant repercussions. Villagers would have to travel longer or over more difficult terrain or sea conditions to harvest the amounts they need.

One issue not addressed at all is the effect the presence a pipeline road will have in terms of increasing non-subsistence hunter access to game and fish populations of the northwest Arctic. The DEIS states that the NPR pipeline road would be private. However, would the owner of the pipeline BSFA 3

be allowed to issue use-permits for hunters or guiding operations? Would the owner be able to monitor activity on the road should hunters trespass on it? Would employees working on construction of the pipeline and road be permitted to hunt and fish in the region? BSFA 3

The North Slope haul road has allowed increased urban hunter access to such areas as the upper Koyokuk drainage near Bettles and the upper Yukon River near Stevens Village. Given the proposed NPR pipeline through what is now an area isolated from urban Alaska, the DEIS should explore likely scenarios or regulatory options with regards to increased access to the region by non-local residents, discuss further the impacts the NPR pipeline road.

The primary response to an oil spill or blowout would be to physically capture and retrieve the oil using oil spill response barges. Under icing conditions it would not be possible to use barges and booms; burning and dispersants would be the only options. Under rough seas and poor weather, none of these response options would be viable. What would you do if a blowout or oil leak occurred under these conditions over a prolonged period of time? BSFA 4

In closing on our comments, the Bering Sea Fishermen's Association supports delaying Lease Sale 126 (Alternative III). This would provide time to further develop oil spill prevention and cleanup technology for the arctic and to conduct additional research on impacts to marine mammals and fisheries resources.

Sincerely,

Gordon Ito

Gordon Ito
Member, BSFA Board of Directors

Bering Sea Fishermen's Association

Response BSFA-1

While hunters from some NANA communities probably use the Colville River area, the pipeline route lies nearly 245 km north of interior communities such as Ambler and Kobuk. If it is conceded that these communities' subsistence range includes the hypothetical pipeline route, then it must also be noted that such a range represents the limit of subsistence activities and not the core area of the communities' harvest. This extent of activity would equate to similar maximum subsistence ranges of 245 to 320 km for the North Slope communities of Barrow and Wainwright. The core-area boundaries of community subsistence activity generally coincide with a day's snowmachine ride (out and back) from the community (approximately 97 km).

The effects of the pipeline on the subsistence harvest of migrating caribou would be moderate for Atqasuk. Atqasuk's harvest zone would be substantially more affected by the proposal than the harvest area of NANA communities due to its proximity to the hypothetical pipeline corridor. Therefore, any effect on the NANA communities' harvest of subsistence resources would be substantially less than on Atqasuk's due to the extensive travel required to harvest resources near the pipeline. Regarding the potential disruption of the marine mammal harvest of NANA communities by the proposed action, the same argument is advanced as for caribou (Fig. IV-C-4 shows caribou range). The area immediately affected by the proposal lies outside the core subsistence area of the NANA communities, and effects of the proposal on NANA harvests are expected to be negligible. The development scenario of the proposed action includes those communities that MMS believes would be obviously and measurably affected by the proposal. This EIS is a prelease document; should recoverable quantities of hydrocarbons be discovered in the Chukchi Sea, at least one developmental EIS would be prepared by the MMS to evaluate in detail a greater number of issues than are covered in this EIS.

Response BSFA-2

Disruptions to community harvest patterns may require hunters to travel longer distances or over more difficult terrain and thus may be a factor in the reduction of the subsistence harvest; however, due to the distribution of the resources available to North Slope communities (see Figs. III-C-6 through III-C-11 and IV-C-4), it is unlikely that long-term disruptions of subsistence resources would occur as a result of the proposal. An exception would be the potential high effect of the proposal on the Wainwright bowhead harvest, which would occur only if there were an oil spill. For all other North Slope communities, subsistence effects are expected to be low to moderate. It is unlikely that any effects would occur on NANA communities as a result of the proposal.

Response To BSFA-3

Effects assessment of the use or nonuse of the Chukchi Pipeline Road by hunters are not within the purview of this document and is purely speculative at this point. We recognize that the renewable resources of the area could be affected if the pipeline road were used by hunters. However, road use and hunting regulations for the pipeline area will become a matter of public policy--a matter no doubt resolved only after extensive public debate. In general, effects of the pipeline on the resources of the interior would be addressed in a developmental EIS if recoverable quantities of hydrocarbons were found and one of the transportation options were a feeder pipeline to the TAP.

Response BSFA-4

An under-ice, long-term-spill scenario is addressed in Section IV.J. Oil-spill response is addressed in Section IV.A.2 and Appendix L. Mechanical recovery, dispersants, burning, and natural dispersion are the general options for responding to oil spills. The best combination of these options would be used under the conditions at the time of a spill, providing that safety was the first consideration.

SEACO, A Division of SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
2845 NIMITZ BOULEVARD, SUITE D • SAN DIEGO, CALIFORNIA 92106 • (619) 225-8631

6 September 1990

Mr. George Allen
EIS Coordinator
MMS, Alaska OCS Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Dear Mr. Allen,

In response to your request for written comments on the sections of the Draft Environmental Impact Statement (DEIS) for Chukchi Sea Oil and Gas Lease Sale 126 during our phone conversation today, I enclose three pages of the DEIS concerning bowhead and gray whales marked to indicate where information should be updated. The numbers marked on the draft text refer to numbered references (attached), all of which should be available through Dr. Jerome Montague, MMS, Alaska OCS Region. SEA 1

Most important of the changes, I think, is that Figure III B-5 indicates that the fall bowhead whale migration across the Chukchi Sea has a broad and well-defined component north of 72° N latitude. This is not supported by recent sighting data. Although a few bowheads have been seen north of 72° N, most whales appear to disperse southwest from Point Barrow. Also, bowhead feeding has been described for various areas across the Alaskan Beaufort Sea and in one case in the northeastern Chukchi Sea in fall, not just "in areas to the east of Barter Island" and "near the Plover Islands". Finally, Wursig et al. (1985) and Nerini et al. (1984) should be cited when discussing feeding and likely bowhead mating and calving periods, respectively [found in ref # 5 LIT CIT]. Similarly, the information for gray whales is somewhat outdated and sketchy. I have marked suggested references to update the material, as for bowhead whales. SEA 2

I hope you find this submission helpful. Please call if there are any questions.

Sincerely,

Sue E. Moore

Sue E. Moore
Program Manager
MMS Contract No. 14-35-0001-30468

encl.
cc. P. Dubsky
J. Montague

Comments on MMS DEIS for Chukchi Sea Oil and Gas Lease Sale 126

MARKED TEXT

Endangered Species Act also are protected under the International Convention for the Regulation of Whaling (1946) and the Marine Mammal Protection Act of 1976. Endangered species likely to occur in or adjacent to the proposed Sale 126 area include bowhead and gray whales and the threatened arctic peregrine falcon. The biology of these species was described in Section III.B.5 of the Sale 97 FEIS (USDOI, MMS, 1987a), which is hereby summarized and incorporated by reference. Endangered fin and humpback whales rarely occur in the sale area and thus would experience no significant effect from the proposal. There are no listed endangered plant species in areas adjacent to the sale area.

a. Bowhead Whale: The bowhead is an ice-associated whale. The western arctic stock of bowhead whales, estimated to number about 7,800 (Zeh, Reilly, and Sonntag, 1988), passes through the proposed sale area semiannually as they migrate between summering grounds in the Canadian Beaufort Sea and wintering areas in the Bering Sea. There are no reliable data on whether the western arctic bowhead population is increasing, stable, or decreasing. However, the bowhead population is believed by some to have increased dramatically in recent years (the scientific basis for these beliefs is unclear). Assuming the current population estimate (7,800) and the estimated historic population (prior to commercial whaling) cited by Braham (1984), to be accurate, the bowhead population is currently about 40 percent of the historic population level. If these assumptions are valid, bowheads are more abundant now than at the close of the commercial whaling period, when they were estimated at about 1,000 animals.

After summering in the Canadian Beaufort Sea, bowheads begin moving westward in August into Alaskan waters. Generally, few bowheads are seen in Alaskan waters until the major portion of the migration occurs, typically between mid-September and mid-October. The extent of ice cover can influence the timing and duration of the fall migration. The primary migration corridor appears to be the area between the depth contours of 10 and 50 m.

Data on the bowhead fall migration through the Chukchi Sea is limited; however, it appears that before they move south into the Bering Sea, most bowheads cross the Chukchi Sea in a broad front from Point Barrow to the northern coast of the Chukotsk Peninsula (see Fig. III-B-5). The bowheads' northward spring migration appears to be timed with the ice breakup, usually beginning in April. In the Chukchi Sea, they follow leads in the flaw zone from outer Kotzebue Sound to Barrow. After passing Barrow from April through mid-June, they move through offshore leads in an easterly direction. East of Point Barrow, the lead systems divide into numerous branches that vary in location and extent from year to year. Bowheads arrive on their summering grounds in the vicinity of Banks Island/Amundsen Gulf in about late May to June (Fraker, 1979).

Bowheads feed throughout the water column. Food items most commonly found in the stomachs of bowheads killed by Eskimos include euphausiids, mysids, copepods, and amphipods. Most feeding has been observed to occur in the Canadian Beaufort Sea; however, bowheads are opportunistic feeders and may feed anywhere within their range where feeding conditions are favorable. For example, feeding has been observed off Wainwright and Point Barrow during the spring migration (Carroll and George, 1985) and in areas to the east of Barter Island during the fall migration as bowheads migrate westward across the

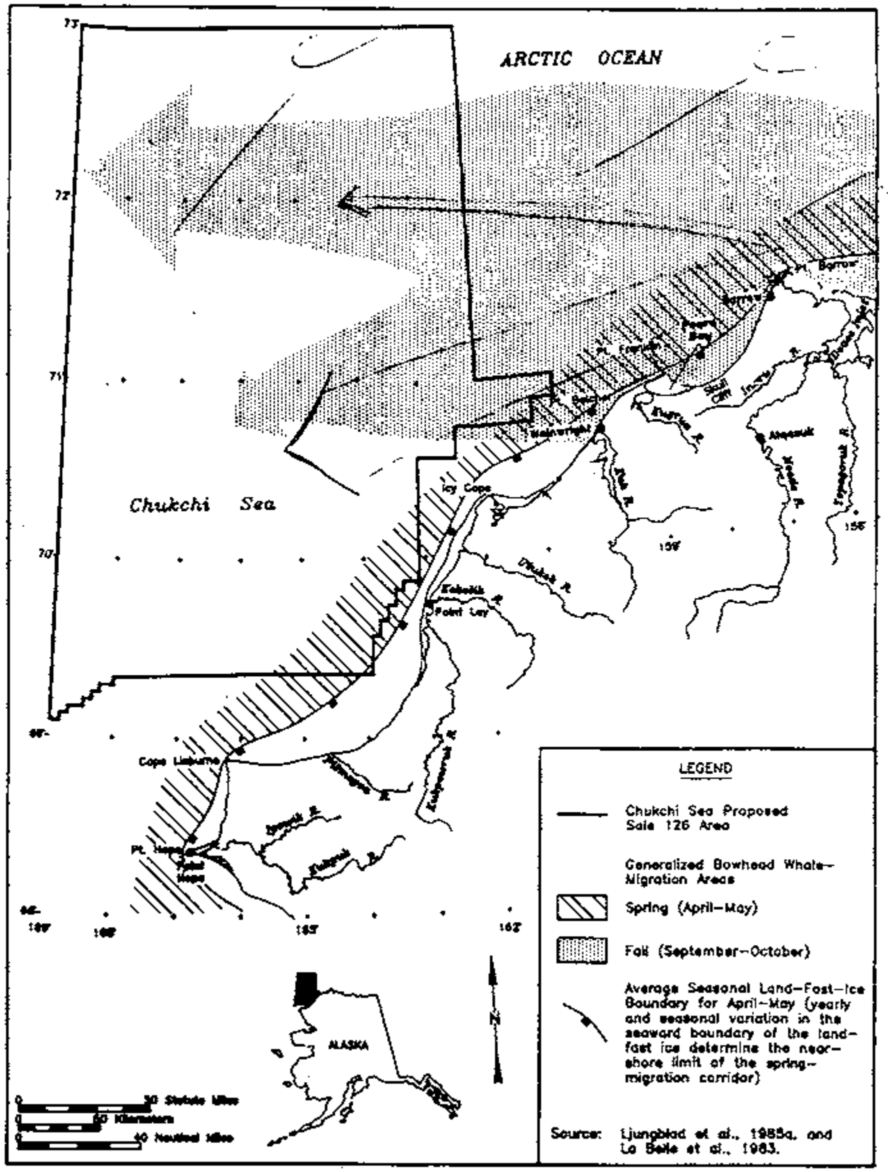

Figure III-B-5. Bowhead Whale-Migration Areas

Alaskan Beaufort Sea (Thomson and Richardson, 1987). Bowheads also have been seen feeding in areas east of Point Barrow near the Plover Islands. Carbon isotope analysis of bowhead baleen indicates that a significant amount of feeding also may occur in wintering areas in the Bering Sea (Schell, Saupe, and Haubenstock, 1987).

Bowhead mating and calving appear to occur during the spring migration. Late winter is the most probable mating season, at the time when most of the population is located in the Bering Sea. However, mating behavior also has been reported north of Point Barrow. The peak of calving probably occurs in May, although the calving season can extend from late March until early August. Although some mating, calving, and feeding occurs within the sale area, these activities generally occur elsewhere (due in part to the relatively short time during which the whales are actually in the sale area).

b. Gray Whale: The eastern Pacific gray whale stock is estimated to number 21,000 individuals (Breiwick et al., In Press). The eastern Pacific gray whale stock has recovered to, or now exceeds, its size prior to commercial whaling (Rice, Wolman, and Braham, 1984). In recent years, the population has grown by an estimated 2.5 percent per year.

Gray whales spend the summer-through-fall months feeding, calf rearing, and resting in the northern Bering and Chukchi Seas (see Fig. III-B-6). Their northern range generally extends to Point Barrow, but they have been sighted up to 445 km northwest of Point Barrow (Ljungblad et al., 1986) and occasionally to the east of Point Barrow. However, for the most part, grays tend to be more concentrated in nearshore waters (often within 15 km of shore) between Point Hope and Point Barrow. Although these nearshore areas are essentially outside the sale area, some grays are likely to feed and move about within the sale area. From 1982 to 1984 (July through October), Moore, Clarke, and Ljungblad (1986) reported 323 gray whales sighted between Point Hope and Point Barrow. Most whales were feeding within 14.5 km of shore. All cow/calf pairs were seen in July between Wainwright and Point Barrow and Cape Lisburne and Point Lay, within 4 km of shore. Ljungblad et al. (1988) reported that 394 gray whales have been sighted in the nearshore area between Point Hope and Point Barrow since 1982 (September-October), that 85 percent were feeding in open water or light ice cover, and that they were also seen feeding 160 km northwest of Point Barrow. The southbound migration generally begins in mid-October (Johnson et al., 1981).

Gray whales are predominantly suction-bottom feeders, but in some areas they have been observed feeding on dense swarms of pelagic euphausiids (Guerrero, 1985). Most feeding activities are believed to take place on the northern feeding grounds (Oliver et al., 1983); however, feeding during the spring migration has been documented to begin as early as March (Braham, 1984; Folkens, 1985). Feeding occurred most often in the Point Belcher area but was also observed between Point Hope and Point Barrow (Ljungblad et al., 1985a). On the summer feeding grounds of the Chukchi and Bering Seas, gray whales feed primarily on benthic gammaridean amphipods; however, approximately 100 different prey species have been identified from stomach analysis.

c. Arctic Peregrine Falcon: Threatened arctic peregrine falcons occasionally enter the coastal area adjacent to the eastern boundary

Comments on MMS DEIS for Chukchi Sea Oil and Gas Lease Sale 126

NUMBERED REFERENCES

1 - Moore, S.E., J.T. Clarke and D.K. Ljungblad. 1989. Bowhead whale (Balaena mysticetus) spatial and temporal distribution in the central Beaufort Sea during late summer and early fall 1979-86. Rep. int. Whal. Commn. 39: 283-290.

2 - Ljungblad, D.K., S.E. Moore and D.R. Van Schoik. 1986. Seasonal patterns of distribution, abundance, migration and behavior of the western Arctic stock of bowhead whales, Balaena mysticetus in Alaskan Seas. Rep. int. Whal.Commn. Spec. Iss. 8: 177-205.

3 - Moore, S.E., J.T. Clarke and D.K. Ljungblad. 1986. A comparison of gray whale (Eschrichtius robustus) and bowhead whale (Balaena mysticetus distribution, abundance, habitat preference and behavior in the northeastern Chukchi Sea, 1982-84. Rep. int. Whal. Commn. 36: 273-279.

4 - Ljungblad, D.K., S.E. Moore, J.T. Clarke and J.C. Bennett. 1988. Distribution, abundance, behavior and bioacoustics of endangered whales in the western Beaufort and northeastern Chukchi Seas, 1979-87. NOSC TR 1232, prepared for MMS, Alaska OCS Region, 231 p.

5 - Moore, S.E. and Clarke, J.T. 1990. Distribution, Abundance and Behavior of Endangered Whales in the Alaska Chukchi Sea. Final Report prepared for U.S. Minerals Management Service, prepared by SEACO, a Division of SAIC, 240 p.

6 - Ljungblad, D.K., S.E. Moore and J.T. Clarke. 1986. Assessment of bowhead whale (Balaena mysticetus) feeding patterns in the Alaskan Beaufort and northeastern Chukchi Seas via aerial surveys, fall 1979-84. Rep. int. Whal.Commn. 36: 265-272.

7 - Clarke, J.T., S.E. Moore, and D.K. Ljungblad. 1989. Observations on gray whale (Eschrichtius robustus) utilization patterns in the northeastern Chukchi Sea, July-October, 1982-87. Can. J. Zool. 67: 2646-2654.

8 - Moore, S.E., D.K. Ljungblad and D.R. Van Schoik. 1986. Annual patterns of gray whale (Eschrichtius robustus) distribution, abundance and behavior in the northern Bering and eastern Chukchi Seas, July 1980-83. Rep. int. Whal. Commn. Spec. Iss. 8: 231-242.

SEACO

Response SEACO-1

The suggested changes have been made to the text, as appropriate.

Response SEACO-2

Figure III-B-5 is a generalized illustration of the fall bowhead migration areas and, hence, is not intended to define the area in a specific way. The area north of 72°N. is included in the diagram because a few bowheads have been sighted there, and it is likely that if aerial coverage were greater in that area, more bowheads would be sighted. Regarding bowhead feeding areas, those mentioned in the EIS are only examples that are not intended to be all-inclusive (Wainwright and Point Barrow were also mentioned). Additional citations have been added to the text, as appropriate.

TESTIMONY OF JOASH TUKLE
ON LEASE SALE 126
Sept. 5, 1990

I had given my testimony the last you were here, but since you had also stated that written testimonies would also be accepted until a certain time as at the time you were here I felt I was taking too long.

It has always been said by all oil companies that an oil spill would be taken care of right away. I always believed that, should a spill occur, it would be cleaned up right away. As has been said at all Public Hearings that all the technology is available for clean-up purposes. But all this talk has become questionable in my mind since I have viewed the Exxon/Valdez spill, there were efforts to clean-up the oil on the water.

As I viewed this mishap it looked like that nothing was available at the moment to clean up the spill. For I have learned from experience that when your emergency equipment is available you take it with you at all times and at the first sign of trouble you have it with you to use for emergency purposes. Some time later efforts were made to clean-up the spill after it had spread, come to think of it, it was only a barge load. Therefore we all have to have better communications and prepare for the worst better yet to have all the modern technology available here in Alaska, in fact by the shores of the Arctic ocean. So with everything available on hand we can be assured that should a blowout occur it wouldn't spread. JT 1

Another thing too should a blowout occur during a westwind storm the oil could easily spread on top our ocean then onto the lagoons then unto the rivers as I know for a fact that during a storm that salt water goes up river, so therefore oil can go with the current upriver. Another thing too that we use outboard motors on our boats when we are out hunting and should the ocean water be mixed with oil from the blowout it is a fact the outboard won't last long when both our ocean and the lagoons are filled with oil from the blowout for we depend on our livelihood from the rivers and oceans. For all the fish and the fowl depend on the small fish for food, not only that but it will include the seals, and every living thing we depend on for food.

We have seen it takes a long, long time to clean up a spill, and since you wanted the peoples comments. We give our testimonies to at least let the oil companies know our viewpoints and comments. Like for instance should a fire brake out in our shores then we will be in a hazardous situation. So therefore we should have a permanent road to take us to safety further away from what Barrow already have so we can be able to escape. JT 2

When all the sea mammals have died we want a positive road to take us to safety far away, where we can be able to do subsistence hunting. We need roads where we can get as far away as we can no

matter how far away one gets. Each of the villages should decide where abouts would be the best place for subsistence hunting, when a blowout occurs when we can no longer travel by boats like we once did. In the winter time it could be different when we would be able to use our snowmachines, but in the summer time when we travel by boats to get to the rivers, therefore should a blowout occur it is a fact we will no longer be able to travel by boat. Where we know game is available up in the rivers, so therefore we might have a better chance if we had a road we might be able to get to where game is plentiful.

Take Barrow for instance, it may take years should a blowout occur, only if we had roads we would be able to go where hunting is available, there may come a time we are offered money but that won't replace what we got from subsistence hunting we will go hungry, and too the money will not be sufficient to take care of all our needs, but if we had roads it might be different, where we will be able to get what the land has to offer. JT 2

If there was a road to Collville area it wouldn't be so bad, where game is plentiful including moose, white fish, and lots of other game. It really would benefit Barrow.

So it will have to depend on each village to say where they would like to go should a blowout occur in our waters. Kaktovik has it's own choice, so does Nuiqsut. But me, I'm from the North Slope and therefore I'm talking for it. Like I said it's up to each village to get together and find out where would be the best place for survival. I repeat, that our only chance of survival will be to have a road so we can be able to go where we want should a blowout occur. It is up to Wainwright to decide where they would like to be as we know should a blowout occur it will not be anything small.

Since it was requested of us as citizens of the North Slope I am giving my comments so therefore I would request that roads be built so we would not be stranded here so to speak should a blowout occur in our oceans.

Take for instance the Dalton Highway, I had the privilege to drive a vehicle from Anchorage to Prudhue and I had a chance to see first hand that a road is very convienent for hunting, as more than one vehicle bypassed me that were towing ATV, etc., behind them and were able to catch big game like moose, etc., So therefore I say a road would really benefit us.

Therefore, I say we who live here and you live there there ought to be better communications between us so we all can better understand ourselves.

Mr. Joash Tukle

Response JT-1

Historically, including the Exxon Valdez, using mechanical equipment, spilled-oil recovery generally ranges between 10 and 15 percent (U.S. Congress, OTA, 1990). Locally available spill-cleanup equipment is addressed in Section IV.A.2(e) and Appendix L. Exploration wells drilled to date in the Chukchi Sea kept oil-spill-response equipment on a drillship, on a large icebreaker/support ship, and on an oil-spill-response barge. Having the oil-spill-response-barge on or near the drilling site is the option of the oil company and is not required by 30 CFR 250.42. Oil-spill-contingency plans approved to date for the Chukchi Sea (Spiltec, 1989, 1990) indicate that an oil-spill-response barge would be shared between companies drilling in the Chukchi Sea.

Response JT-2

The MMS understands your concern; however, there is little that the MMS can do in the matter of road construction. The construction of roads for local use is a matter of State and local government priorities regarding how State/local revenues should be spent. The Federal Government provides some funds for road construction; however, the State determines how and where those funds will be spent. Whether roads are constructed to serve North Slope communities is currently dependent on the State legislature's desire to appropriate funds for this purpose.

J. L. MOHR
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7 September 1990

Regional Director
Minerals Management Service, Alaska OCS Region
949 East 36th Avenue, Room 110
Anchorage, Alaska 99504-4302
Attn: Paul Dubsky

COMMENTS ON OCS LEASE SALE 126 CHUKCHI SEA DEIS
(OCS EIS/EA MMS 90-0035)

John Luther Mohr

included by reference:
Comment on DEIS proposed sale 109 Chukchi Sea
Comments on DEIS proposed sale 107 Navarin Basin
Commenta on DEIS sale 124 Beaufort Sea
which include background material on commenter, and much other material relevant to Sale 126.

POSITION: ALTERNATIVE II NO SALE should be elected; the Draft Environmental Impact Statement omits too many significant matters, ignores too many essential facts, misuses much material.

It is useful to address first the inevitable pressure to proceed with more oil activities in the Chukchi Sea and other outer continental shelf areas because of reduction of supplies from "the Middle East". This is largely from the subliterates who wiped out Near East (Middle is now the west side of the East) and the oil industry, the automotive industry and co-conspirators who sabotaged the energy programs of the 1970's. MMS or its predescessor did not lack participants in that.

Pushing OCS activity is not a reasonable answer. It would not provide petroleum quickly whereas conservation measures and alternative energy programs could make virtually immediate improvement.

Recommended reading for EIS preparers:
Carter, Jimmy *America still needs a policy to cut our oil habit.* Washington Post National Weekly Edition, Aug. 20-26, 1990.

U. S. Department of Energy *Programs in Renewable Energy: Fiscal Year 1990.*

Experience with the Arctic research drifting station program operating under Office of Naval Research and through Naval Arctic

Research Laboratory (NARL), Pt. Barrow (I was involved from 1959 through 1971 -and earlier with the Air Force from 1952 to 1957, including field work 1952 t0 1954) provides insights into the special difficulties and stresses of operations at Arctic posts and especially at Arctic offshore posts generally.

One vivid experience was my having to phone the parents of one of our field biologists, Donald Robinson, that the plane on which he was returning from an ice island station had disappeared. I would keep them posted.

As the account became more complete, I learned that that the NARL, Point Barrow, supply plane, the radio of which was mal- or non-functioning, carrying both the NARL director and assistant director (contrary to policy), had been refueled in the dark at the ice island station. Fuel containers were snow- or frost-coated, obscuring labels. In the confusion wrong fuel was loaded into one of the plane's tanks. Men at the ice island station discovered the error shortly after the plane took off for return to NARL, but because the plane's radio was not working, they could not warn the pilot. It appeared certain that the plane would draw on the wrong fuel. Much of the way to NARL was over ice, but there was a stretch of open water. If the plane went down in the water, all would be lost. If it came down on pack ice, the question was whether even an exceedingly skilled bush pilot could land without disaster in the dark on a largely very irregular surface. Fortunately indications of motor trouble came over ice and the pilot did bring down the plane without loss of life.

However, 1) the plane should not have been flown without its radio functioning.
2) Either the director or his assistant should have remained on duty at NARL, Pt. Barrow.
3) Fueling should never be done without a double-check on kind being poured.

Our big concern, of course, was that all were rescued, *but*(a big one) 1) our scientific collections and records for a third of a year were lost;
2) personnel effects, including Robinson's working library, were all lost;
3) the plane was lost.

Because one of the preparers of DEIS 126, John F. Schindler, was a NARLer concerned with this episode, there should have been (should be) total awareness that stress and irrational acts are usual in the Arctic to a degree that they are not at lower latitudes and that the statistics on which Alaskan Region has relied, with most data from other latitudes and other light regimes, are NOT meaningful for this area.

A further look at the drifting station experience! In my Arctic projects from 1952 to 1971 more than 45 men, mostly, but not all, university students went into the field(s). In the several years I directed the University of Southern California Antarctic ship program a considerable group went to far southern latitudes. No advice on or provision for psychological testing (screening) was given, and in both sets we were rebuked, at least by implication, for sending men not suitable for such stress situations. However, the episode that was most telling was not the fault of any of our men. In brief, two ice island workers got into a fight over who was getting an unfair share of some locally fermented material (home brew) and one of them, possibly scolded by the station leader, killed him. This episode should have been kept in mind by the DEIS 126 preparer. Behavior on Arctic rigs, drilling islands and drilling platforms is stressful for kindred reasons: lack of psychological screening, confinement in close quarters with other people, darkness, and work that is dangerous even under more ordinary circumstances.

The tolls in *Ocean Ranger, Java Sea, Piper Alpha,* and numerous Gulf of Mexico accidents, to mention only ones that involve U. S. firms, can be constantly in the workers' thinking and alcoholism (as was mentioned in *ONR: European Scientific Notes* for North Sea operations out of Scotland) is a very real problem in the North. Again, the NARLer could not have been ignorant of this menace of aloholism in the special situations.

It is almost impossible to accept the notion that the preparers of DEIS 126 and previous northern DEISs really believe that the statistical bases for their projections have reliability for this document:

they work in Anchorage the scene of the impressive seismic liquifaction of substrate of 1964;

they are not so far away from Prince William Sound as to have been unaware of the mishap involving an Exxon T/V of exquisitely local name.

Presumably they should have heard that drinking was thought to have been. a factor;

that the U. S. C. G. was understaffed;

that the U. S. C. G. was not sufficiently "on its toes",

that industry assurances on lack of danger and of response capabilities, which MMS along with other agencies had accepted without critical examination, were less than reliable

and so on!

Again, it is obvious, particularly for the Alaskan area, that DOI-statistics-based predictions have not panned out. Under the extra-stressful circumstances of the Chukchi Arctic with the increased likelihood of erratic actions, new disasters are much more likely than indicated in Section IV.

Other stressful episodes involving NARL also within the single decade of the 1960's should be noted. A 1964 storm forced the evacuation of the entire laboratory facility. It did severe physical damage. The brief account in the book, *Arctic Laboratory*, would provide food for thought for the preparers of DEIS 126. At two different times major fires destroyed buildings at NARL and the ice stations had at least one blaze. A watchman at NARL started the engine of a laboratory Cessna and ran into two other Cessnas.

Not involving NARL directly, but close by, an experienced bush pilot of Barrow, one with an excellent reputation, took off with an unbalanced load and a group of Alaskan officials. The plane tipped and all were killed in the crash. And a bit west of the town of Barrow is the monument to Wiley Post and Will Rogers who took off without refueling (and presumably without checking how much fuel they had) and crashed lethally.

To those willing to think it is obvious that extrapolation of lower latitude experience to northern Alaska ignores the hugh latitudinal differences in the prices of misjudgement. Even if the data bases used were wholly respectable, which because much is derived from industry or industry-influenced sources in DEIS 126, is nuts, extrapolation should be avoided. Stuart Chase's estimate is worthy, "A dangerous abuse of mathematics appears in the practice of extrapolation - described earlier as riding a trend curve to Cloudcuckooland" as is his description of a practitioner as "making an extrapolating ass of himself". Dr. Hugh Taylor, Princeton Dean and chemist and editor of the *American Scientist* in the 1960's, said more simply, but firmly, "Extrapolation is not science!" It is super-risky business in the praeter-high difficulties area of Arctic Alaskan O. C. S. activities. The DEIS has departed from reality.

DUBIOUS INFORMATION: The very fragmentary knowledge combined with the apparent astonishing confidence of the preparers of DEIS 126 is disquieting. In DEIS 109 preparers indicated that the shores of the area were uniform over large stretches. I pointed out that G. Dallas Hanna, Norman Wilimovsky and I had collected marine algae from a cobble bed in the area - not conforming to the DEIS description. The DEIS 126 has a somewhat altered picture, but it is essentially as dubious as ever. I point out that Wilimovsky, Fehlman and Horvath during the Cruise of the *Red* took numerous bottom samples between Barter Island and Barrow, presumably getting good representation of what was there. They missed entirely kelp beds in the Beaufort Sea studied more recently. And early *this year* off Huntington Beach in southern California *T/V Pacific Trader* got snagged because the nautical chart used (which may have been accurate earlier) did not indicate correct depth -- this in an area of intense activity.

The fact is that Chukchi Sea studies are preliminary throughout. It is instructive to note in the current issue of *The Journal of the Marine Biological Association of the United Kingdom, Vol. 70, No. 3, August 1990* in that part of the world Continuous

Plankton Recorder studies have been going on since 1931 and Plymouth "serial observations" since 1899 and charts much more precise than those for any part of Alaska have been available for decades. The charts did not prevent the skipper of the *Torrey Canyon* from taking a disruptive shortcut through the Scilly Islands (considerable knowledge of currents did not tell local scientists just where spilled oil would go or what would be hurt most; significant amounts did reach areas under long study by Plymouth M.B.A., U.K. biologists) nor the *Amoco Cadiz* from wrecking on a Brittany reef (its spill smothering the study area of the Roscoff laboratory). The work done over nearly a century at these venerable stations did make it possible to make meaningful calculations of biological changes. [My Oberlin mentor, Prof. Hope Hibbard, *had worked at the Roscoff station and used Roscoff examples in some of her lectures and I spent a sabbatical year at the Plymouth* Laboratory, so I have long followed the work of Mollie Spooner and Alan Southward.]

In contrast with the areas about southwest Britain and the north coast of Brittany - or even with the Santa Barbara Channel area of the Platform A blowout, data, physical and biological, from the Chukchi Sea are negligible. There could be a wipeout even greater than that by *Amoco Cadiz* devastating all of the lower organisms of the local food webs and the agencies concerned would be able to muster only miniscule evidence in court to prove that it was this event that resulted in subsequent losses. It is safe to predict that for every expert ("expert") Alaska or an environmental group mustered to testify that the spill had been the cause, industry would have a counter-"expert" to testify that there was no direct link, and with the current data base, the counter-"experts" could not be disproved. Dealing with them is tough enough in well-studied zones. [Consider tobacco industry scientists holding that cigarette smoking has not been *proved* to be harmful and a National Academy of Sciences panel insisting that it has not been *proved* that cotton linters in the mills caused textile workers brown lung disease and current insistence of Electric power industry "scientists" that acid rain has not been proved to damage forests.] There is need to know in considrable detain at all places that may be exposed to changes by the industry what kinds and how many of the kinds of organisms besides the warm-blooded vertebrates are present during full population cycles. The Chukchi:Arctic is still overwhelmingly a we-don't-know area.

For those involved with the manipulations of facts and figures in the DEIS 126, it would be useful to ponder John Allen Paulos' recent book, *Innumeracy*.

Study of Robert J. Meyers & Associates and Research Planning Institute, Inc. 1989 *Oil Spill Response Guide* derived from *Arctic Oil Spill Response Guide for the Alaskan Beaufort Sea* 1988 prepared for the U. S. Coast Guard Research and Development Center (but, strange to say, copyrighted) made some points clearer than the kindred portions of DEIS 126. Significantly, neither the federal government nor the publisher accepts any liability for its use.

I have not time to go into the detail that is desirable, but focus on a few matters. There is great detail about the booms and skimmers that might be available - how much they can handle, etc. Two things are reasonably clear (as they are also for kindred coverage in DEIS 126): 1) on the basis of abundant experience in gentler latitudes it is extremely unlikely that a considerable response fleet could or would get to a Sale 126 area spill/blowout and 2) even with *American Trader* off southern California, with 22 skimmers reported to be in action in calm waters, oil recovery was minor. To suggest, especially after the *Exxon Valdez* debacle, that there would be a response providing tidiness is absurd.

The report contains such sentences as "However, with respect to the Beaufort Sea, this is much easier said than done". One may correctly replace Beaufort with Chukchi in this and many other sentences of the report. One such, by an EPA staffer at the 1983 Anchorage Dispersant Symposium, refers to the use of dispersants: "there are too many unknowns about the fates and affects (sic) of dispersed oil in the Beaufort Sea". I question the Report's general acceptance of the spill trajectory model: too little micro-scale current data over much too short a time is available for either Beaufort or Chukchi Sea to make these concoctions even probably helpful guesstimates. JLM 1

Seven spill response scenarios are interesting, but where they are optimistic (there are some negatives), they are not convincing. Why, for example, should we think that recovery by skimmer would be effective in water deeper than 7 feet when skimming has had such limited success in Californian waters?

A couple of interesting sections are that on modes of transportation (airports that could be used for a Chukchi Sea response are limited in number and length of runways and other capacities) and on dispersants (29 kinds are identified, but there were only Corexit 9527 -400+ drums- and ARCo D-609 -10 drums- in all of Alaska; there is quite a bit of information on toxicities of various dispersants, including Corexit 9527, but none for ARCo D-609, and it is toxicity for a crustacean, *Mysidopsis bahia*, with nothing about harmfulness for human beings. And nothing about flammability. These are very real matters as made clear by the William Mason case to which I have referred in the earlier Comments.) JLM 2

It also should be recalled that Jack Anderson, long specializing in such work, has raised objections to using ***Mysidopsis bahia***, a warm-water species, to predict effects in cold-water zones.

The ***Oil Spill Response Guide*** obviously provides more to chew on in these matters than does DEIS 126.

JLM 2

SCOPE: AVOIDANCE

A primary concern with the O. C. S. environmental impact documents, and not just those of the Alaskan region, is that they neglect altogether issues after the exploratory drilling. This was true in 1980 with the Lake Buena Vista Symposium, in 1988 with the Calgary Conference and in between with the largely industry-produced National Academy of Sciences/National Research Council 1983 ***Drilling Discharges in the Marine Environment*** and lots more, (even though a public release of your agency in December, 1983 stated, obviously inaccurately, that *Drilling Discharges* showed that later stages of O. C. S. oil field development had been shown to have little adverse environmental effect).

Information on the exploratory phase is muddy in more senses than one, it is seriously incomplete (cf. the effects of withholding proprietary information), and it has been used uncritically, but there is some useful data to work with.

During the 1984 Santa Barbara EPA workshop, a former Gulf of Mexico platform worker spoke of burns from a metallic salt being used. Maurice Jones, earlier of IMCO Division, dismissed this because it was part of the completion process.

JLM 3

J. A. Short's 1983 book, *Drilling*, mentions in Chapter 10: Completions, p. 498 for wellbore cleanup "an acid wash using hydrochloric acid with a small amount of hydrofluoric acid". P. 495 reports that in stimulation by acidization, "The size of the acid jobs ranges from 1000-100,000 gal." (Interestingly, hydrofluoric acid is not mentioned here and it is not listed at all in the index; it is in a University of Texas primer that I found about the use of hydroflouric (sic) acid for siliceous blockages and there the amounts are given as a few to thousands of gallons; HF is listed in API working literature).

The concern here is that none of our steward agencies have informed affected or affectable sections of the public. This is particularly interesting in Los Angeles County because attention had been focused for some time on the Mobil Torrance refinery and several others in the area that use hydrogen fluoride in their processing. No one has pretended that hydrogen fluoride/hydrofluoric acid is not

a killer Why have the agencies involved in the preparation of DEIS 126 ignored the hazards in the completion phase and in stimulation by acidization generally? It would seem to be, at least potentially, criminal neglect as many lives could be lost if outlets of HCL and HF tanks were accidently or deliberately opened or a pilot from the associated airfield took off with an unbalanced load or an empty fuel tank and crashed into an acid tank.

At whatever phase -exploration, development, production or transportation of the petroleum- there are compounds released that the DEISs continue to ignore though concern has been espressed formally.

JLM 3

There is the problem of barium halides in barites. That they are highly poisonous is indicated in *Registry of Toxic Effects of Chemical Substances*. There are biocides (cf. acrolein mentioned in the *Buccaneer Field Report*) there are assorted components of drilling slurries that are simply talked around. NAC/NRC *Drilling Discharges* indicates that biocides are minimally bothersome, mentioning among them carbonates (*carbamates* are used) and none of the steward agencies picks it up, even after that has been pointed out. *Drilling Discharges* (p. 102) quotes amounts of metals in slurries as lower than in the papers it claims to use - steward agencies, including yours, have been informed of this, but they continue to use *Drilling Discharges* as authoritative. *Drilling Discharges* identifies *Eunephthya*, the common soft coral of the Chukchi and Beaufort Seas, as a plant. That also apparently does not suggest to Anchorage preparers (EPA and MMS) that such work is of questionable worth for an impact document. It must be concluded, therefore, that worked based on such, namely DEIS 126 and predecessors, is not trustworthy. More than that, because these have been pointed out in previous comments, one must question whether the preparers are honest.

IN COMMENTS INCLUDED BY REFERNCE I dealt at some length with problems of discharged formation derivatives ("waters"). The Brian Middleditch edited *Buccaneer Oil Field Report, Marine Science 14* is the only substantial source I have found. It has evidences in most of its sections of being a first effort and some of the work is not even passable technology, but it does point up a number of serious problems, among them release of large quantities of particulate sulfur, presence of a large number of aromatic compounds, including some primary pollutants (resulting, among other things, in the presence of ~~benzo~~-alpha-pyrene in every bottom sample examined), modified microbial communities, and so on.

JLM 4

The editor's observation, "It was fully realized at the outset that the findings of such a study might not be legitimately applied by extrapolation to other fields....", should be appreciated.

At the recent MMS Information Transfer Meeting in Santa Barbara, Dr. Russell T. Schmitt, Coastal Research Center, Marine Science Institute, University of California, Santa Barbara, reported that work is under way there on formation discharges in nearshore waters. Results are not ready for publication.

As Middleditch says, results may not be legitimately applied to Chukchi Sea, but the indications are that careful, well-conceived studies on formation derivatives and their effects need to be made in the area - and in other Alaskan fields - and results of those studies need to be released for examination by the interested public before any further leases are offered for sale.

JLM 4

THE WILLIAM MASON CASE

As stated in previous comments, during the *Pacbaroness* sinking and spill off Santa Barbara, California, Mr. Mason, a response-boat first mate, was heavily sprayed with dispersant Corexit 9527 by a dispersant-spraying airplane. It turns out that the response crew had been instructed neither about poisonousness of the dispersant and what one should do if one were exposed by accident nor about its flammability and the need for special care in storage and application. Mr. Mason has not learned the full composition of Corexit-9527, but was informed that it contains 2-butoxy ethanol which is poisonous. That it is poisonous was confirmed by a specialist's examination of Mr. Mason at the Medical School Hospital of the University of California at Los Angeles. Among the serious effects is marked depression of his immune system.

The response-boat company at last report had not accepted any responsibility for Mr. Mason's medical expenses and does not pay wages. Clean Seas, Inc., the clean-up consortium formed by the offshore petroleum industry companies, which uses the response-boat under sub-contract and which ordered dispersant spraying by the airplane crew, has not accepted responsibility. The oil companies that fund Clean Seas, Inc. have not accepted responsibility.

An analysis of the environmental potentialities of Corexit 9527 and of any other dispersant which may be considered for use in the area should be made and published for examination and comment before any further leases are offered for sale.

JLM 5

RESPONSIBLE BEHAVIOR

Corporate behavior in the William Mason case may be an important indicator. It should be noted also that Royal Dutch Shell has decided to rent tankers rather than use its own in United States' waters in order to avoid responsibility under U. S. law for any spills. Shell tankers in Chukchi waters are not an issue, but industry evasion of responsibility in these cases indicates a problem that MMS needs to analyse before proceeding with further leases.

JLM 6

ADEQUATE MANPOWER

Lack of time prevents more thorough examination of DEIS 126, however, one particular concern needs strong emphasis. At the 1984 Denver EPA Workshop, officials from the Gulf of Mexico regions presented, almost desperately one single request: "Give us rules we can live up to; there are more than 2000 wells under our jurisdiction; we are few and our energies are limited!" In the *Exxon Valdez* mess, it is obvious, part of the cause was U. S. Coast Guard understaffing. With the recent sequence of Alaskan O. C. S. environmental impact statements it is similarly obvious that too much work was required (and much could not get done) for both the EPA and the MMS regional groups. *Washington Post* writers in an unrelated matter stated that the normal bureau dictum is the dualistic "Cover your ass and don't rock the boat". The necessary one here, to the contrary, is a frank statement to the Administration, to the Congress and to the public, doing a job that fulfills the requirements of the law will take greater resources especially human.

MMS AND EXXON VALDEZ

As to the DEIS section on MMS and the *Exxon Valdez* events, it is conceded that the spill was not your fault. The point for the DEIS is that *Exxon Valdez* appears not to have changed your use of statistics. In addition to checking Paulos' *Innumeracy*, you may want to consider how readers of Darrell Huff's *How to Lie with Statistics* and Stuart Chase's *Tyranny of Words* will regard your applications.

And a final quote (from Yen, 1986), "Thus the potential target for enhanced oil recovery is greater than the reserves that can be produced by conventional methods."

Submitted

John L. Mohr

John L. Mohr, Ph. D.

Mr. J. L. Mohr

Response JLM-1

Improvements in oil-spill response over the last decade have produced refinements to older techniques rather than development of new techniques. Thus, the effectiveness of response--in terms of percentage recovery--has not increased from the 1979 Ixtoc I spill to the 1989 Exxon Valdez spill. Short response-time planning (6-12 hours and 48 hours for additional equipment) is required for drilling operations on the Alaska OCS. Spill-trajectory considerations in the EIS (see Sec. IV.A.2(c)(3)) are on the mesoscale. On the microscale (<10 km), the commenter's suggestions are most appropriate and accurate. Skimmer recovery is not generally affected by water depth; the critical parameters are wave height and oil viscosity.

Response JLM-2

In SWEPI's 1990 oil-spill-contingency plan the following information on airports is presented: (1) Nome, 6,000-foot asphalt runway; (2) Kotzebue, 5,900-foot asphalt runway; (3) Kivalina, 3,000-foot gravel airstrip; (4) Point Hope, unattended 4,000-foot asphalt runway; (5) Cape Lisburne, military airstrip closed to the public, 24-hour advance permission; (6) Cape Beaufort, unattended 2,800-foot gravel runway at Cape Sabine; (7) Point Lay, 3,500-foot gravel strip with operations only on Tuesday and Friday; (8) Wainwright, unattended 4,700-foot gravel airstrip; (9) Barrow, 6,500-foot asphalt runway; and (10) Deadhorse, 6,500-foot asphalt runway. This was accepted by the MMS as adequate for conducting oil-spill-response measures. Section IV.A.2(e)(5) and Appendix L have been modified to include dispersant toxicity.

Response JLM-3

Hydrofluoric and hydrochloric acids are used only for specific reservoir acidification requirements, and large quantities are not stored on a production platform. Furthermore, it may not be economical to produce petroleum from a reservoir requiring large quantities of either acid. The EPA NPDES permits now prohibit the use of metal-contaminated barite. Barium ions are detoxified in seawater by the immediate precipitation of highly insoluble barium sulfate. If barium halides were exceedingly poisonous, as claimed by the commenter, they would not be used internally as a cardiac stimulant or bone-scanning agent in humans or for treatment of constipation in horses (Windholz et al., 1976).

Response JLM-4

Alaska-specific information on formation waters is provided in Section IV.C.2. Neither the Middleditch volume nor the Santa Barbara study are cited in the discussion on the effects of formation waters on water quality. See also Response NAEC-7.

Response JLM-5

Similar reports of observers rather than the slick being dosed with dispersant were made on the Exxon Valdez spill; however, no significant dispersant injuries were reported. Obviously, getting the dispersant onto the slick can be a problem. In terms of human safety, dispersant application is probably safer than mechanical recovery in many situations. One death did occur during nondispersant response to the Exxon Valdez spill. Dispersant application rather than mechanical response is considered the safer option from mid-September through April in Prince William Sound and other areas affected by the Exxon Valdez spill. Community right-to-know and worker right-to-know laws apply for oil spills. Chapter 3, Toxicological Testing of Dispersant and Dispersed Oil, and Chapter 4, Intermediate-Scale experiments and Field Studies of Dispersant Applied to Oil Spills in Using Oil Spill Dispersant on the Sea, have been referenced and included in the discussion on dispersant.

Response JLM-6

The Oil Pollution Act of 1990 has strengthened oil-spill liability regulations for transportation of oil. Special regulations for Prince William Sound are included in this legislation. In addition, the formation of the Marine Spill Response Corporation indicates a stronger industry approach towards prevention of oil spills and response to oil spills.

FRI 31 AUG 1990
WRITTEN COMMENTS

PUBLIC HEARING OCS SALE 126/CHUKCHI SEA
DRAFT E.I.S.

I HAD PLANNED TO SPEAK AT THE HEARING SO MY WRITTEN COMMENTS ARE ORGANIZED MORE FOR THAT PRESENTATION; LIKE OUTLINE NOTES.

TWO REASONS BROUGHT ME HERE:

(1) THE BAD TASTE OF THE MMS IN LEASING, OR GRANTING DRILLING PERMITS IN THE CHUKCHI JUST ABOUT 30 DAYS AFTER THE EXXON VALDEZ OIL SPILL. I THOUGHT THE GOVERNMENT REPRESENTS US. I'M SURE NO ONE WOULD HAVE SAID YES TO DRILLING IN CHUKCHI – WHERE ALL THE WALRUS PASS BY TWICE A YEAR – RIGHT AFTER THE SPILL. SS 1

(2) THE IMPACTS OF THIS (OCS 126) LEAS.

TWO IMPACTS TO BE ADDRESSED:

(1) WHAT WILL & WHAT IF (WE DRILL).

A. LONG RANGE – ALL ACROSS ARCTIC.

THE LONG RANGE, WE CAN PREDICT A DEGRADATION OF THE WHOLE BIOSPHERE WITH GUNK IN THE WATER, AIR, DEBRIS, AND DISRUPTION.

B. SHORT RANGE – IMMEDIATE AREA IMPACT. NOISE. IF THERE IS A BLOWOUT THERE'D BE NO CAPPING IT IN THOSE DEEP ARCTIC WATERS AND CURRENTS. A MAJOR SPILL WOULD CLOG UP IN THE DIOMEDE NARROWS, MAYBE HITTING THE WALRUS MIGRATION, AND GUSH SOUTH ON CURRENT TO NORTON SOUND, BRISTOL BAY, AND THE CHAIN. SS 2

(2) WHAT DID (HAPPEN BEFORE).

WHAT HAS HAPPENED, THOUGH DEBATABLE AS THROUGH THE EYES OF THE BEHOLDER, IS OBSERVABLE RIGHT N[OW] FROM KUPARUK TO ENDICOTT ON THE N. SLOPE.

(A) THE AIR IS POLLUTED – A YELLOWISH GREEN PALL FOULS THE WHOLE NORTH SLOPE INDUSTRIAL COMPLEX.

(B) THE BREEDING GROUND OF WATERBIRDS HAS BECOME SPARSELY POPULATED – AFTER PRINCE WILLIAM SOUND SPILL, THE BIRDS DIDN'T EVEN MAKE IT BACK. ASK ANYONE WHO HAS WORKED THERE A FEW YEARS, AND HAS SOME PERSONALLY OBSERVED PERSPECTIVE.

THIS MAKES TWO MAIN POINTS HERE:

(1) NO DRILLING IS THE BIG PICTURE.

(2) THE IMPACT STATEMENT IS NOT ENOUGH TRUTH, AND IS TOO BIASED. I SUGGEST, THAT FOR BALANCE, SOMEONE LIKE ALASKA CENTER FOR THE ENVIRONMENT BE FUNDED TO WRITE AN IMPACT STATEMENT AS WELL – THEN YOU WILL BE ABLE TO SEE THE DISPARITY IN TRUTHS AND BIAS. SS 3

(A) MAYBE CONFRONT THE BIG PICTURE, NOT JUST OCS-126 SS 4

AND

(B) STATISTICS AREN'T IMPACT. IMPACT IS BOTH WHAT NORMALLY HAPPENS AND WORST-CASE – THOUGH – IMPROBABLE SCENARIO. WE'VE WITNESSED THE FOUL AIR ON THE N. SLOPE, & THE NON-RETURN OF BIRDS AFTER A MAJOR ACCIDENT. SS 5

THE REAL ENVIRONMENTAL IMPACT STATEMENT IS: DON'T DRILL, DON'T LEASE, DON'T SELL IT OUT.

THANK YOU Scott Simmons

Mr. Scott Sunans (?)

Response SS-1

The Exxon Valdez oil spill was certainly an unfortunate incident, but a single incident such as this is insufficient to halt the continued national search for future oil and gas reserves. Although the timing may also have been unfortunate, the United States has a legal obligation to the successful bidders on Chukchi Sea Sale 109 blocks to allow them to carry out exploratory drilling under the conditions set forth in the leases and Federal law.

Response SS-2

The Sale 126 Chukchi Sea area is shallow, ranging from 6 to 80 m deep. By oil industry-drilling standards these depths are not considered deep. The MMS requires the lessee to include provisions for drilling a relief well in the event of a blowout. The Alaska OCS Region requires that lessees obtain commitment from another rig in the area of operations for the purpose of drilling a relief well. If there are no other rigs operating in the area, the lessee is required to monitor rig availability worldwide and continually update the Alaska OCS Region as to the status of relief-well-rig availability. In 1990, SWEPI indicated that a relief-well rig was available onsite with an additional relief-well rig available in Canada. Surface circulation patterns in the Chukchi Sea generally move north. The Bering Strait provides the only avenue of exchange between the Pacific and Arctic Oceans. The mean flow to the north appears driven by a sea-surface slope downward toward the north of the order of 10^{-6} (Coachman and Aagaard, 1966). There is, however, evidence of atmospherically forced major variability in the flow, including reversals to southward transport (Aagaard, Roach, and Schumacher, 1985). The OSRA sampled the variability and did not indicate a risk to environmental resources south of the Bering Strait.

Response SS-3

The EIS attempts to present a balanced portrayal of potential environmental effects and is not intended to present a biased reporting of such effects. Given that the search for truth and knowledge represents an ongoing learning process, additional facts collected through scientific research and monitoring studies may suggest different possible effects that in turn can be factored into subsequent developmental EIS's should commercially marketable quantities of oil be found and intended for marketing. The MMS does not fund other groups to prepare what might be called "counter-EIS's" to bring to light what the commenter seeks in the search for truth and avoidance of bias.

The EIS is not a justification document. It is as objectively unbiased as an analytical document can be with the type and quantity of information available. The DOI is charged by regulation not to use the EIS to justify the proposal. The decision to lease is not made in or by this EIS. The decision, if made, is made by the Secretary of the Interior only after the environmental effects found in the document are considered and other national-interest and economic information is evaluated.

Response SS-4

The cumulative case in this EIS (Sec. IV.H) attempts to portray the implications of the proposed lease sale beyond the confines of the sale area.

Response SS-5

Major accidents are unfortunate and MMS tries to avoid negative effects from oil and gas operations through enforcing regulations and monitoring operations. Statistics are used in the EIS as a means of predicting possible effects-causing agents. These statistics serve as a basis for analysts to assess the possible effects on the resource under study.

C. Public Hearing Comments and Responses

The Sale 126 DEIS public hearings were held in the following Alaskan communities during the month of August 1990: August 27 in Barrow, August 28 in Wainwright, August 29 in Point Lay, and August 31 in Anchorage. For the hearings in Barrow, Wainwright, and Point Lay, MMS arranged for the services of a professional translator from the NSB Inupiat History, Culture, and Language Commission to translate testimony given in Inupiaq for the hearing record.

Transcripts of the oral testimony are not reproduced in the FEIS because of the volume of material involved. Instead, summaries of significant issues from each speaker's testimony are presented here and marked for response. A copy of the complete transcript of each of the hearings is available at the Alaska OCS Region, Public Information Library, in Anchorage. A copy of the hearing transcript was also mailed to the mayor in each of the NSB communities in which the hearings were held.

During these hearings, many residents of the NSB expressed concerns about how their culture, lifestyle, and subsistence resources and activities might be affected by oil and gas development in the Chukchi Sea. The MMS is making a strong effort to ensure that the government and industry are aware of the importance of the subsistence lifestyle to the Inupiat. The testimony given at the Sale 126 DEIS public hearings will help in understanding the importance of culture, lifestyle, and subsistence resources to the people living along the coast of the Chukchi Sea.

Speakers at the public hearings are listed below in the order of their appearance.

1. Barrow Public Hearing

Forrest Olemann
Don Long, Sr.
Tom Albert
Eugene Brower
Tom Lohman
Warren Matumeak
Alfred Leavitt
Walter Akpik, Sr.
Arnold Brower, Jr.
Raymond Neakok, Sr.
James Neakok
Johnny Brower
Beverly Hugo
Morgan Solomon
Joash Tukle
Patricia Brower

2. Wainwright Public Hearing

No one presented public testimony for the record.

3. Point Lay Public Hearing

Geoff Carroll
Marie Adams
Robert Suydan

4. Anchorage Public Hearing

Robert Haines
Stu Hirsch
Dorothy Smith

SUMMARY OF TESTIMONY AT SALE 126 PUBLIC HEARINGS

Barrow public hearing, August 27, 1990:

Forrest Olemann, NSB:

Oil clean-up demonstrations by industry have not convinced me that they can cleanup an oilspill under real arctic conditions.

Don Long, Sr., Mayor, City of Barrow:

The No Sale or Delay the Sale alternatives are endorsed in order to allow time for communities to develop contingency plans and gain the means to carry them out. These plans would include expanded EMS facilities, airports, and VPSO forces, as well as the ability to handle the influx of workers as happened in Valdez. This aspect should be added to the EIS. PH 1

Tom Albert, NSB:

Analysis of the effects on whales not a fair representation of the references used to justify the conclusions reached. Work of Dr. Gerasi misinterpreted--a misrepresentation of the data in Dr. Gerasi's work in order to support minimal effects on whales. PH 2

Oilspill cleanup in arctic conditions has not been demonstrated by industry, even when they had the chance to do so in winter spills in Cook Inlet.

Eugene Brower, Barrow Whaling Captains Association:

The BWCA consists of 44 active whaling captains, along with roughly 400-plus whaling crew members. In Barrow, the spring whaling season lasts from around mid-April to the first or second week in June, depending on ice conditions. The fall season starts about the end of August and generally extends through October.

Sensible development should be based on proven cleanup capabilities. Oil development should proceed onshore before it extends offshore.

Tom Lohman, NSB:

In review of Chukchi Sea contingency plans, the following should be considered:

o There should be time available to stop and drill a relief well in a late-season spill. How is this possible without a seasonal drilling restriction? PH 3

o There must be the ability to track a winter spill. The DEIS does not address ways of tracking oil multi-year under the ice. The movement of second-year ice should be understood as to its distribution over time. PH 4

o There must be the ability to mitigate noise effects. PH 5

Warren Matumeak, NSB:

Industry may clean up a spill but they do not replace the lost animals.

Can Responder operate in 25-30 knot winds? That's the vessel stationed out there now and we don't think it is capable of cleaning up oil in these conditions, which are common for the area. PH 6

Alfred Leavitt:

Sea mammals come north with their young. Whales may deviate from their historical route with development. Do not say one thing and do the other. The animals know when this happens and things are not in harmony. This hurts our subsistence.

Walter Akpik, Sr.:

Oil has been good for me and for everyone in Barrow. But I fear for the sea mammals. But we need oil and gas for subsistence to run our machines. I fear for the time the oil is depleted.

Arnold Brower, Jr.:

The deception in the whale analysis must be corrected. PH 7

Icebergs can be grounded even in the depths of the Chukchi.

Oilspill cleanup should be localized. Local villages should have cleanup equipment in warehouses and training to use such equipment. MMS should fund this through set asides from lease sales as well as local impacting effects. PL 93-636 (Indian Self-determination Act) should be used to contract for this. PH 8

We need to develop a positive program to replenish the lost subsistence resources.

Raymond Neakok, Sr., President of the Council, Native Village of Barrow Inupiat Traditional Government:

Money is owed to us by the federal government and we have not received anything. We exist on bingo receipts.

James Neakok:

Who is going to clean it (an oilspill)? You guys? Think about it.

Johnny Brower:

What would be the effects of injecting chemicals into wells, as in Prudhoe Bay? PH 9

Anxiety, hatred, and frustration produces long-term sickness among the people.

Beverly Hugo:

We are not expendable--we have the right to cultural privacy--young people are so impacted that they are not rooted--stay out of the Arctic Ocean--what goes on touches our lives.

Morgan Solomon:

Cleanup; what are you going to do?

Joash Tukle:

You need a food-chain analysis for food supplies and chains for fish and mammals. PH 10

Oil drilling should stop in spring and fall whale migrations--bowhead whales are easily disturbed by noise and may take a different migration path. PH 11

The local water table is getting very low due to oil being pumped out of the ground.

There should be an agreement worked out in advance among ADF&G, FWS, and others so that if there is a major oil spill or blowout there would be no restrictions on subsistence hunting so that local residents can maintain their subsistence livelihood. This would allow land animals and fowl to replace sea mammals and fishes and should be in effect until all areas area cleaned up and the mammals and fishes return. PH 12

Patricia Brower:

You need to study the effects on subsistence foods if there were an oil spill. PH 13

Wainwright public hearing, August 28, 1990:

No one wished to testify in Wainwright.

Point Lay public hearing, August 29, 1990:

Geoff Carroll, ADF&G:

Boat and other traffic has diverted belukha whales out of Kotzebue Sound and this could happen in Point Lay. Contact Kathy Frost for ADF&G harvest data. PH 14

Marie Adams:

Need strong local input for oilspill research program. Use local radio stations as means of distributing information locally rather than through formal conferences.

Impacted communities should get impact funds from the Federal government directly rather than through the state.

The Federal government should review its energy policies and develop for oil where there is the lesser change of impacts--and that is onshore.

The International Whaling Commission is now considering the human activities that impact bowhead whales, and I am afraid that increased OCS development offshore could reduce our quotas for bowhead whales. PH 15

Robert Suydan, NSB:

Belukha whales are quite sensitive to noise.

The area has the largest congregation of spotted seals in the world. These can be effected by noise and industrial activity, especially aircraft noise. PH 16

Consider the possibility that the entire population of North Slope eiders could molt at sea off Point Lay and be effected by an oilspill. PH 17

Anchorage public hearing, August 31, 1990:

Robert W. Haines, Mobil Exploration & Producing U.S. Inc.:

Mobil supports the continuation of lease sales in accordance with the 5-year OCS oil and gas lease sale schedule. Mobil supports Alternative I and feels this alternative is supported by the DEIS.

Stu Hirsch, BP Exploration Alaska, Inc., representing the Alaska Oil and Gas Association (AOGA):

AOGA supports the lease sale as part of the OCS 5-year leasing program and supports Alternative I of Sale 126. Failure to proceed on schedule with the evaluation of the hydrocarbon potential of the Chukchi Sea area would be a mistake which could not be reasonably justified or rectified. Industry has spent years of effort and millions of dollars on the development of Arctic technology to explore and develop this area in an environmentally safe and sound manner.

Dorothy Smith, Greenpeace USA:

Greenpeace USA supports the No Action Alternative II for Chukchi Sea Lease Sale 126. It is the position of Greenpeace that further proposed leasing in the Arctic planning areas is being carried out hastily without deserved consideration of the effect accelerated exploration and development will have on wildlife, habitat, and Native cultural values and without a critical eye toward the energy future of the United States.

The DEIS states that the first Chukchi Sea sale was scheduled in 1985 but was deleted from the 5-year schedule to provide for further assessment of operations in heavy ice conditions. The DEIS does not explain what new information is available now regarding operations in heavy ice conditions. PH 18

The DEIS asserts that because of the low density of species in the Arctic, any damage will only affect a small area of habitat and small number of animals. Such sweeping assumptions are used to support conclusions of low effects. For example, the DEIS states that an oil spill could result in high mortality of sea birds, but the impact will be low because of the ability of sea birds to recover. This conclusion is erroneous and appears to be an excuse rather than an acceptable measurement of impact. It is not acceptable for MMS to conclude that because the action is not likely to cause the demise of whole species that the impact on the species will be insignificant. The low density of Arctic animal and plant life, and their slow rate of recovery, makes the species extremely vulnerable and the impacts longer lasting than those in some temperate regions. PH 19

The DEIS does not adequately portray the complexity and delicate nature of the Arctic environment. In the discussion of the short Arctic food chain, the DEIS does not describe the extreme vulnerability of the benthic, eponic, and higher trophic species to industrial intrusion. The DEIS states that Arctic species are subject to extremes in temperature and light, but the document fails to explain how the slightest interruption in that dynamic process has the potential to cause severe damage. A report by the NMFS states that even PH 20 short-term losses of food source due to spilled oil could affect food availability for an entire season causing significant decline in marine mammal populations. The NMFS also states that the tolerance threshold of marine mammals to industrial intrusion is unknown. PH 20

The DEIS estimates that several spills greater than 1,000 barrels will occur in the proposed lease sale area. This is a conservative assessment and does not present the worst case scenario of an uncontrolled blow-out. The impact of a catastrophic event should not be disregarded because of the statistical manipulation that predicts it should not happen. PH 21

The oil spill response described in the DEIS is grossly inadequate. MMS requires that industry respond to a major spill within six to twelve hours, quote, "geography permitting." This qualifier is admission that response is not expected to be possible under common conditions in the Arctic. Regardless of the presence of a response barge with mechanical clean-up or containment equipment on board, current technology will not be effective under common conditions. Oil spill response demonstrations discussed in the DEIS are also not reliable preparation for clean-up. PH 22

The current Middle East situation is a signal for the U.S. to establish an aggressive energy conservation program which would replace foreign imports and OCS oil and gas many times over. It is unconscionable that the federal government, via the Minerals Management Service, would permit putting the entire Alaskan Arctic coast at risk through more development before exploiting renewable energy resources available to us at a fraction of the cost to society and to the great benefit of the environment. PH 23

Summarized by George Allen, Sale 126 EIS coordinator
October 2, 1990

Public Hearings

Response PH-1

The subject of community contingency planning has been added to the discussion in Section IV.F, Alternative III, Delay the Sale.

Response PH-2

The analysis on the effects of industrial noise and crude oil on whales was taken directly from the statements and conclusions of the most authoritative studies available. The work of all investigators was presented in terms of the likely effect of these agents on whales.

Response PH-3

For the Alaska OCS Region, MMS requires lessees to submit, with an exploration plan, their contingency plans for drilling a relief well should a blowout occur. This includes information on the availability of backup equipment, including a relief-well rig and support craft (including icebreakers, when appropriate) and the timing to obtain, initiate, and complete a relief well. The lessee is required to provide the MMS with updated information on the location and availability of drilling rigs capable of operating in the environment where operations are proposed prior to each drilling season and of any changes during the drilling program. The MMS requires mutual assistance/relief-well-drilling-rig agreements between the two operators conducting concurrent operations in the same area to facilitate and expedite relief-well drilling. The adequacy of the relief-well plan is determined based on individual circumstances including the type and location of proposed activities, the type of drilling unit, other operations in the area, and company plans for monitoring environmental conditions and well status and curtailing operations and securing the well prior to the end of the drilling season.

In the Chukchi Sea, floating drilling units will be used for exploratory drilling. Floating drilling units are capable of moving offsite in the event of a blowout and starting a relief well almost immediately. There are currently four drilling units and associated icebreakers and ice-class support vessels that have been successfully used in the U.S. and Canadian Arctic, and which are available in the Arctic and can be mobilized to support a relief-well-drilling program in the Chukchi Sea.

The likelihood of an oil blowout occurring during exploration drilling is extremely low. There has never been an oil spill resulting from an OCS exploratory-well blowout. Blowouts typically are a result of shallow gas without any oil that lasts for short periods of time. Bridging (including depletion) of blowouts (oil and gas) occurs greater than 70 percent of the time, with bridging occurring shortly after the blowout. Relief-well drilling has been attempted for approximately 4 percent of those blowouts that did not naturally bridge (Norwegian Oil Review, 1985).

Prevention is the key to mitigating the risk of an oil spill resulting from a blowout. MMS regulations establish strict requirements in the form of performance standards to ensure that operations will not result in an unsafe condition. Plans, equipment, equipment inspection and maintenance, testing, and training requirements all contribute to the low risk of a blowout on the OCS. Recent technological advances and continuing high levels of research are improving the safety of drilling in the Arctic, thus reducing the already negligible potential for a blowout.

The MMS maintains a near-continuous inspection presence at each exploratory-drilling location and monitors the progress and status of the well and environmental conditions on a daily basis, including well depth, type of operation (drilling, coring, logging), next planned operation, the timing for completing current operations, the next planned operation, downhole conditions, and potential problems in maintaining well control. The MMS has the authority to require that operations be suspended in the event that ongoing operations could increase the risk of well-control problems or, continuing with the next operations following completion of ongoing operations such as drilling to the next casing point following setting and cementing casing, could not be completed before the end of the drilling season.

The costs associated with drilling an exploratory well in the Chukchi Sea are high. Same-season relief-well capability significantly affects an already restrictive and short drilling season in the Sale 126 area, which could require a second season to complete the drilling of a single well or maintain a second drilling unit at the site. The costs associated with such a requirement would be substantial and would not significantly increase safety or reduce risk.

The MMS recognizes the importance of relief-well planning for exploratory-drilling activities in frontier areas such as the Chukchi Sea. The MMS believes that regulatory requirements for documenting relief-well capabilities in conjunction with MMS's inspections and monitoring of well status and environmental conditions on a real-time continuous basis for each site-specific activity, and authority to require operations be suspended, provide an effective and prudent mechanism to ensure that drilling activities are not continued if there is a significant risk of lost well control and remedial action, including drilling a relief well could not be conducted.

Response PH-4

The text in Section IV.A and Appendix L has been amended to address this concern. During the Alaska Arctic Offshore Oil-Spill Response Technology Workshop held in Anchorage, Alaska, on November 29 through December 1, 1988, the mechanical containment panel identified tracking oil spills as a subject area requiring further attention. In the same workshop proceedings the Arctic and Marine Oilspill Program (AMOP) and the Alaskan Clean Seas (ACS) Research and Development Program identified current research in tracking spills in ice. Acoustic studies have produced prototype hardware that has performed well in field tests for detecting oil encapsulated in ice. The ACS, AMOP, and MMS are working on induced florescence for detecting oil under ice. Currently for exploration drilling the MMS OCS Oil-Spill Task Force has accepted the ACS oil-spill-trajectory model, Orion tracking buoys, and ice marking dye as sufficient for tracking oil spills in the Chukchi Sea.

Response PH-5

All authoritative studies to date have shown that industrial noise has only a minor, short-term effect on whales. Stipulation No. 5 and ITL No's. 1 and 6 were evaluated to mitigate the minor, short-term responses of whales that encounter industrial noise. As indicated in the EIS, the number of whales actually encountering industrial noise is expected to be relatively low for bowhead whales and zero to low for gray whales.

Response PH-6

The Responder is a 400-by-105-foot response barge with a 5,000 HP tug that is used to store oil-spill response equipment onsite at SWEPI's exploration sites. Section IV.A.2 and Appendix L address environmental conditions in the Chukchi Sea which may preclude response to an oil spill. The Responder was used in two oil-spill-response drills, one in 1989 and one in 1990. Each spill drill was conducted in seas of a few feet.

Response PH-7

See Response PH-2.

Response PH-8

The MMS agrees that local cleanup efforts and response capabilities are as important as the more centralized capabilities provided by such organizations as the USCG Pacific Strike Team and the oil industry/transportation cleanup group, Clean Seas. The U.S. Congress has recently been considering legislation to direct impact-assistance funds to the local communities that could be directly affected by offshore OCS operations. At this time the exact outcome of such legislation is unclear as is the method by which funds might be directed to local communities.

Response PH-9

The injection of chemicals into the well is regulated by MMS in the APD and the EPA through an NPDES general permit. Test fluids are discharged from the well upon completion of drilling. These may consist of formation water, oil, natural gas, formation sand, any acids or chemicals added downhole or any combination thereof. Test fluids are generally stored and treated for oil removal and pH before being discharged or flared. The permit will require neutralization (pH 6.5 to 8.5) of all spent acidic fluids before discharge.

Response PH-10

The potential effects of major adverse factors on food chains, as well as possible accumulation of toxic materials, were considered in the analysis; specifically, potential effects on lower-trophic level organisms, including those in food chains, and the potentially toxic effects of drilling discharges, are discussed in Section IV.C.3. Inclusion of all information used in the determination of the potential effect of each factor on each species would result in an excessively large EIS in which it would be difficult to find the essential information.

Response PH-11

All authoritative studies to date have shown that industrial noise has only a minor, short-term effect on some whales and no effect on others. Hence, whales are not easily disturbed by industrial noise. Further, indications are that it is the type of noise, and the animal's aversion to that noise, that determines a whale's response, rather than only the quantity of noise involved. This has been most clearly demonstrated in cases where marine mammals learn to associate a particular noise, or combination of noises, with a threatening situation (e.g., when they are hunted).

Response PH-12

The MMS has no authority over the subsistence use of fish and wildlife resources in Alaska. However, the idea presented--substitution of terrestrial-subsistence resources for marine resources during the period of recovery from an oil-spill event--has merit. The commenter might wish to present the idea to the FWS and the Arctic Regional Fish and Game Advisory Council established by the State of Alaska pursuant to the Alaska National Interest Lands Conservation Act.

Response PH-13

The comment is appropriate and will be considered in future studies. There have been some studies of oil-spill effects on subsistence foods conducted by the Alaska Department of Fish and Game in Prince William Sound in the aftermath of the Exxon Valdez spill. The findings of these studies are largely nontransferable due to the incongruency of species in Prince William Sound with those of Chukchi Sea coastal waters.

Response PH-14

It is unlikely that boat traffic generated by the proposed action would divert belukha whales out of Point Lay waters. According to the development scenario on which the analysis is based, Point Lay would not serve as an offshore-support center; thus, there would be little--if any--increase in marine traffic due to the proposed action.

Response to PH-15

Whether increased human activity offshore will decrease the quota of bowheads available for harvest is a question central to the effects of the proposal. Indeed, the question implies that the proposal would reduce the bowhead stock and accordingly reduce the quota and the opportunity to harvest. In the base-case analysis for endangered species (Sec. IV.C.7), the effects of the proposal on the bowhead stock are estimated at very low, while the subsistence-harvest analysis (Sec. IV.C.11) indicates a high effect on the bowhead harvest for only one community--Wainwright. In the latter case, that effect would occur only as the result of an oil spill and the resulting perception by potential harvesters that bowhead flesh was tainted. However, this issue will always be one that demands additional data and further study. Any additional scientific information the IWC may provide on human/bowhead interaction is welcomed.

Response PH-16

The MMS recognizes that large concentrations of spotted seals occur along the Chukchi Sea coast and that they can be adversely affected by activities associated with petroleum development; consideration of disturbance effects is a basic element of this analysis.

Response PH-17

The southward migration of eiders is rather protracted, with males and nonbreeding birds initially proceeding in July, and females with young following later from August to November; hence, it is not likely that the entire North Slope eider population would be simultaneously vulnerable to an oil spill in the sale area.

Response PH-18

Lease Sale 85 was deleted from the 5-Year Oil and Gas Leasing Program to address the concerns of the State of Alaska and the Alaska Congressional delegation. The following sentences regarding those concerns are excerpted from a January 10, 1984, letter from the Honorable Bill Sheffield, Governor of Alaska, to William Clark, Secretary of the Interior: "The primary concern of the state was the pace of the Department of Interior's current five-year oil and gas leasing program. Due to internal budget constraints, the MMS personnel assigned to Alaska's OCS appear to be insufficient for their greatly expanded responsibilities under the accelerated program. A two year delay would enable valuable scientific data interpretation and synthesis effort of available information to continue." The assessment of working in heavy-ice conditions was completed in the Sale 109 FEIS (USDOI, MMS, 1987b). Exploration is likely to continue in open-water conditions. It is estimated that development drilling will begin in 2000. This allows 9 years for the oil industry to study conditions. Drilling will be allowed when the oil industry demonstrates to MMS that they can operate safely in the ice conditions of the Chukchi Sea.

Engineering studies indicate that a key consideration in the design of buried offshore pipelines in an arctic environment is to determine the optimum burial depths that maximize the pipeline's safety from rupture by ice gouging and minimize costs. Prior to construction of subsea pipelines, operators would be required to conduct geological and geophysical surveys to determine potential hazards, including ice gouging, to the pipeline. The density, age, depth, and reoccurrence rate of ice gouging must be fully evaluated and considered in the design, construction, and placement of a pipeline. Any pipeline design must include devices to monitor damage or leaks, and redundant automatic- and manual-shutdown valves to shut off the pipeline and stop a continuous leak if a break in the pipeline occurred. Continuous-monitoring techniques will enable the operators of such pipelines to be forewarned of potential scour problems and to take corrective actions.

Response PH-19

The EIS describes areas where animal populations are at high density as well as low density. Over most of the sale area for most of the year, densities of most species are low; and, together with the generally low probability of oil-spill occurrence and contact over most of the sale area and vicinity, results in the expected effects fall in the low range for most species. Those portions of the analysis stating the potential effects that could occur--if an oil spill contacted an area where, for example, sensitive marine birds were vulnerable--are included to indicate the potential range of effects. They always will conclude a higher level of effect than the final analysis because the probability of a spill occurring and contacting an area is not considered. Nowhere in the analysis is it stated that the effect of high bird mortality would be low because of the ability of seabirds to recover. However, the populations of most seabirds are sufficiently numerous to allow them to recover fairly quickly, even after substantial mortality. Likewise, the analysis does not conclude that, because it is unlikely the sale would cause the demise of an entire species, the effect would be insignificant. Statements such as this confound attempts to convey the expected level of effect through the use of rational analysis.

Response PH-20

Statements are attributed to a NMFS document, but without a citation, it is difficult for us to find it. The potential effects of major adverse factors on food chains and other biotic processes were considered in the analysis. Inclusion of all information used in the determination of the potential effect of each factor on each species is not practical or informative.

Response PH-21

A very large oil-spill event is analyzed in Section IV.J.

Response PH-22

The MMS planning guidelines provide that, if local conditions and geography permit, the target for initiating recovery operations with pre-staged equipment (i.e., the response time) should be 6 to 12 hours. If the risk analysis included in the OSCP indicated that an oil spill from the proposed activity would contact a shoreline or biological community in sooner than 6 to 12 hours, the response time would be reduced accordingly in order to protect the environmental resource. The MMS does not believe that it is appropriate to mandate a specific response criterion, such as time, without consideration of location, timing, potential spill size, trajectory, and risk.

The MMS requires annual drills to test the lessee's response capabilities under realistic environmental conditions. The MMS/USCG planning guidelines require additional drills for different environmental conditions. The MMS reviews proposed scenarios for response drills in cooperation with the USCG. Drills are witnessed by the MMS and the USCG to ensure that personnel are capable of properly deploying response equipment. The MMS can require additional drills if the initial drill is unsatisfactory. The MMS routinely invites individuals from State, local governments, and community organizations to attend the oil-spill drills.

Lessees are required to inspect response equipment, train personnel in response techniques, and maintain records of the inspections and training. The MMS also has a rigorous inspection program that ensures that response equipment is available and maintained in workable condition and that all personnel receive training.

The MMS believes that the adequacy of spill response can be determined through reviewing the OSCP and viewing oil-spill-response drills in accordance with current MMS rules and guidelines.

Response PH-23

The commenter is referred to EIS Appendix I, Alternative Energy Sources. Appendix I summarizes and incorporates by reference Appendix C, Alternative Energy Sources, of the Final EIS for the Proposed 5-Year OCS Oil and Gas Leasing Program, 1987-1992 (USDOI, MMS, 1989c).

VI

CONSULTATION AND COORDINATION

VI

VI. CONSULTATION AND COORDINATION

A. Development of the Proposal

The proposed Chukchi Sea Sale 126 is one of 38 proposed OCS sales included in the 5-Year OCS Oil and Gas Leasing Program. Official coordination with other government agencies, industry, and the public regarding this proposal began on January 12, 1989. At this time, the MMS requested resource reports from all Federal agencies with expertise pertinent to the proposal and the proposed sale area. On January 13, 1989, a Call for Information and Notice of Intent to Prepare an EIS were issued requesting expressions of industry interest in blocks within the Call area and requesting comments on environmental issues related to possible oil and gas leasing in the area. Responses were received from 9 companies, the State of Alaska, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the Environmental Protection Agency, the City of Wainwright, and the North Slope Borough.

Following evaluation of the area nominations and environmental information received in the process described above, the MMS submitted a recommendation for the area selection to the Secretary. On May 9, 1989, the Secretary of the Interior selected 4,319 blocks as the Sale 126 area for further environmental study. (See Sec. I.A for more details.)

B. Development of the EIS

During preparation of this and past EIS's for the Chukchi Sea, Federal, State, and local agencies; industry; and the public were consulted to obtain descriptive information, identify significant effects and issues, and identify effective mitigating measures and reasonable alternatives to the proposed action. All of the information received has been considered in preparing the Sale 126 EIS. In addition, a scoping meeting was held in Barrow, Alaska, with local agencies and the public to more clearly and specifically identify potential issues and alternatives to be studied in the EIS. Scoping information can be found in Section I.D. Departmental agencies with interest and expertise in the OCS were consulted during the development of the potential mitigating measures for this proposed action (see Sec. II.F). Public hearings on the Sale 126 DEIS were held in the NSB communities of Barrow, Wainwright, and Point Lay and in Anchorage during August 27 to 31, 1990.

C. List of Contacts for Review of the EIS

Federal, State, and local government agencies, academic institutions, industry, special-interest groups; other organizations; and private citizens were consulted prior to and during the preparation of this EIS. These agencies, institutions, groups, and individuals are listed below and were sent copies of the DEIS for review and comment.

Federal

- Executive Branch - Departments
  - Department of Commerce
    - National Oceanic and Atmospheric Administration
    - U.S. Army
      - Corps of Engineers
        - Waterways Experiment Station
        - Cold Regions Research and Engineering Laboratory
        - Alaska District
    - Department of Health and Human Services Centers for Disease Control
  - Department of the Interior
    - Bureau of Indian Affairs
    - Bureau of Land Management
    - Bureau of Mines
    - Fish & Wildlife Service
    - Geological Survey
    - National Park Service
    - Office of Environmental Assessment
  - Department of Transportation
    - Commandant, U.S. Coast Guard

- Legislative Branch
  - U.S. House of Representatives

Committee on Interior & Insular Affairs
Committee on Merchant Marine & Fisheries
Subcommittees on Panama Canal & OCS
U.S. Senate
Committee on Energy and Natural Resources
Senator Frank Murkowski
Library of Congress
Congressional Research Services

Administrative Agencies and Other Agencies
Environmental Protection Agency
Marine Mammal Commission
National Science Foundation
Division of Polar Programs
Nuclear Regulatory Commission
Division of Site, Safety, and Environmental Analysis

Other Organizations
Smithsonian Institution

State of Alaska
Alaska State Legislature
Senate Resources Committee
Alaska Oil & Gas Conservation Commission
Alaska State Library
Department of Community & Regional Affairs
Department of Commerce & Economic Development
Department of Environmental Conservation
Department of Fish & Game
Department of Labor
Department of Natural Resources
Department of Health and Social Services
Office of the Governor
Division of Governmental Coordination
University of Alaska
Arctic Environmental Information and Data Center
Elmer E. Rasmuson Library
Fossil Energy Research Council
Geophysical Institute
Institute of Social and Economic Research
Institute of Arctic Biology
Institute of Marine Science
Marine Advisory Program
Petroleum Development Lab
Water Research Center
Department of Civil Engineering

Local Governments, Native Organizations, and Libraries
Alakanuk Public Library
Alaska Eskimo Whaling Commission
Alaska Federation of Natives
Alaska Native Foundation
Aleut Corp.
Arctic Slope Regional Corp.
Brevig Mission Community Library
Bristol Bay Coastal Resource Service Area
Buckland Public Library
City of Atqasuk
City of Barrow
City of Chevak
City of Diomede
City of Kake
City of Kaktovik
Kaveolook School Library
City of Kotzebue
George Francis Memorial Library
City of Nuiqsut
City of Point Hope
City of Point Lay
City of Saint Paul
City of Valdez
City of Wainwright
Cenaliulriit Coastal Management District
Cully Corporation
Davis Menadelook Memorial Library, Diomede
Elim Native Corporation
Elim Community Library
Eskimo Walrus Commission
Eyak Corporation
Gambell Community Library & Learning Center
Golovin Community Library
Halibut Cove Library
Inalik Native Corporation, Little Diomede Island
Kasilog Public Library
Kegoyah Kozga Public Library, Nome
Kenai Community Library
Kiana Elementary School Library
Kingikme Public Library, Wales
Koyuk City Library
Kuukpik Corporation, Nuiqsut
Maniilaq Association, Kotzebue
Martin Monsen Library
Matanuska-Susitna Borough

Municipality of Anchorage
Z.J. Loussac Public Library
NANA Regional Corporation, Inc.
Native Village of Barrow (Inupiat Traditional Government)
Nellie Weyiouanna Ilisaavik Library, Shishmaref
North Slope Borough
Northwest Arctic Borough
Olgoonik Corporation
Point Lay IRA Council
Quinhagak Public Library
Savoonga Public Library
Shishmaref Native Corporation
Sitnasuak Native Corp
Soldotna Public Library
Stebbins Community Library
Ticasuk Library, Unalakleet
Tikigaq Library, Point Hope
Wainwright Tribal Council
Whittier Public Library

Canada
Canadian Wildlife Service, National Wildlife Research Centre
Circumpolar Affairs, Government of the NWT
Department of Fisheries & Oceans
Department of Indian & Northern Affairs
Geological Survey of Canada
Institute of Ocean Sciences, Dept. of Fisheries & Oceans, Sidney, BC
Joint Secretariat, Fisheries Joint Mgt. Com., Inuvikon, NWT

Special-Interest Groups
Friends of The Earth
Greenpeace
National Audubon Society
National Wildlife Federation
Natural Resources Defense Council
Northern Alaska Environmental Center
Sierra Club
Trustees for Alaska

Petroleum Industry
A Ruddy Petina Company
Alaska Clean Seas
Alaska Oil and Gas Association
Alaska Support Industry Alliance
Amerada Hess Corporation
American Petroleum Institute
AMOCO Canada Petroleum Co., Ltd.
AMOCO Production Company
ARCO Alaska, Inc.
Baroid Drilling Fluids
BP Exploration
Chevron USA Inc.
Columbia Gas Devel. Corp.
Conoco Inc.
ELF Aquitaine Petroleum
Enserch Exploration Inc.
Exxon Company, USA
Global Marine
Halliburton Geophysical Services, Inc.
Home Oil Company, Ltd.
Hunt Oil Company
Kerr-McGee Corporation
M-I Drilling Fluids
Marathon Oil Company
Murphy Oil USA, Inc.
Mobil Oil Corporation
ODECO Oil & Gas Company
Pennwell Publishing Co.
Pennzoil Exploration & Production Co.
Petro-Canada Inc.
Petroleum Information
Oil & Gas Journal
Shell Western E&P Inc.
Tennessee Gas Pipeline
Texaco Inc.
Tide Petroleum Company
Union Texas Petroleum Corporation
UNOCAL

Regional Technical Working Group
Paul Gronholdt, Sand Point
Perry Adkison, Dillingham
Alaska Draggers Assoc., Executive Director, Kodiak
Bering Sea Fishermen's Assoc., Extension Specialist, Anchorage
Chevron USA, Inc., Exploration Representative, Anchorage
Department of Natural Resources, Petroleum Mgr., Div. Oil & Gas, Anchorage
Environmental Protection Agency, Anchorage
Exxon Company, USA, Alaska Coordinator, Houston, TX
FWS, Chief, Div. Tech. Support, Anchorage
Halliburton Geophysical Services, Inc., Mgr., Alaska Division, Anchorage
National Wildlife Federation, Alaska Resource Center, Director, Anchorage
NOAA, National Marine Fisheries Service, Anchorage

NSB, Planning Director, Barrow
Shell Western E&P Inc., Mgr., Development Engineering, Alaska Division, Houston, TX
U.S. Army Corps of Engineers, Chief, Regulatory Branch, Alaska District
U.S. Coast Guard, Juneau

Individuals, Associations, Companies, and Other Groups

Adriaan Volker Worldwide Dredging BV
Alaska Geographic Society
Alaska Map Service
Alaska Journal of Commerce
Alaska Land Use Council
Alaska Legal Services Corporation
Alaska Oil and Industry News
Alaska Pacific University, Center for Polar Research and Education
Alaska Power Authority
Alaska Public Radio Network
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APPENDIX A

RESOURCE ESTIMATES

Estimates of Quantities of Undiscovered Resources

I. Resource Assessment Methodology

Estimates of potential quantities of undiscovered oil and gas are vital to essential long-range national planning. The Federal Government's offshore oil and gas leasing program depends in part on projections of the potential amounts of undiscovered hydrocarbon resources on the Outer Continental Shelf (OCS) and estimates of those resources which may be technologically and economically recoverable. The pace of discovery and development of these resources affects national security, the economic health of a large sector of the economy, the balance of trade, and many other important national issues.

The Minerals Management Service (MMS) develops estimates of the undiscovered oil and gas resource base and economically recoverable undiscovered hydrocarbons in support of the OCS leasing program. These estimates are used in a number of public and internal documents related to leasing, such as sale-specific Environmental Impact Statements (EIS), Secretarial Issue Documents (SID), the Biennial Report to Congress (Section 606, OCS Lands Act), formulation of the 5-Year Leasing Program, and technical publications.

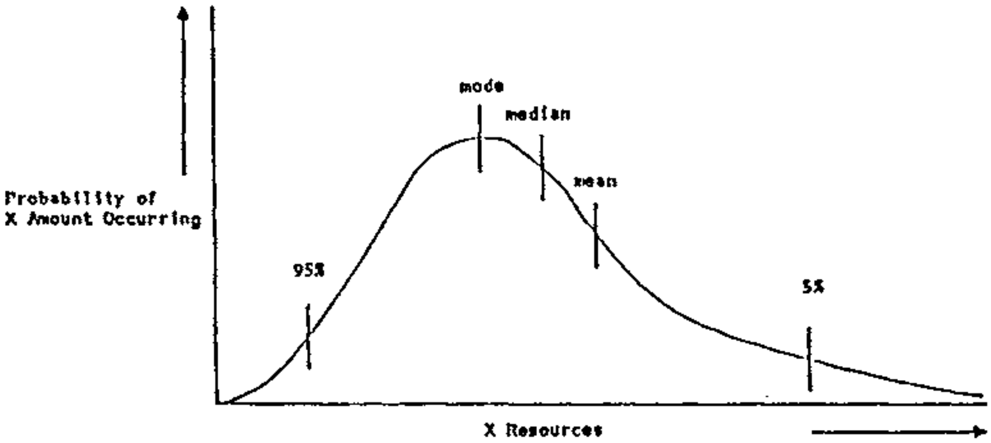
The EIS's for specific lease sales and events such as the development of a 5-Year Leasing Program use the estimates as a basis for analyzing potential environmental impacts of a proposed activity, e.g., oil spill risk analysis, sale alternatives and deferral options, or any other requirement for which the potential resources in specific areas may serve as the basis for evaluating potential actions. In the SID, estimates of the amounts and locations of potential resources are used to assist the Secretary of the Interior in balancing the economic benefits of development against the environmental consequences resulting from the leasing of offshore areas for petroleum exploration and development. Estimates provided in the Biennial Report to Congress may be used by the legislative branch and others for national strategic and economic planning purposes.

Estimating the undiscovered resource base and economically recoverable amounts of oil and gas remaining to be discovered on the OCS is a difficult task because of the uncertainties inherent in the process. The actual existence of hydrocarbon accumulations is not known with certainty prior to exploratory drilling. The only information concerning the existence of a potential producing field is derived from inferences, extrapolations, and subjective judgments. Geophysical data provide clues as to the existence and location of possible traps (prospects) and their general dimensions, but geologic data on the quality of any potential reservoir rocks or source materials are usually absent. Generally, until drilling operations commence, no data will be available on the nature and distribution of included hydrocarbons, or indeed whether hydrocarbons are present at all. Obviously, an exact prediction of resource quantities under such circumstances is impossible because the uncertainties in the input data set translate directly to uncertainties in the estimates.

Two main types of undiscovered resource estimates are commonly used, conditional and risked, each responding to different needs. <u>Conditional</u>, undiscovered resource estimates represent the amount of resources anticipated if a certain condition exists, the condition being that recoverable quantities of oil and/or gas are present in the area of study. In other words, if oil and/or gas are found to exist in an area, the conditional estimates represent the amount of hydrocarbons determined to be ultimately recoverable. These estimates are used, for instance, to assess the full range of potential environmental impacts in an area if leasing, exploration, development, and production were to occur; the condition that hydrocarbons exist must be assumed, otherwise impacts would not be a concern.

However, if the economic value of a resource is being considered, conditional estimates are not the appropriate measure. In these cases, such as the economic analyses prepared for sale-specific SID's, the resource estimates must incorporate the probability (or risk, which is often extremely high in frontier areas) that recoverable hydrocarbons may _not_ be present in the entire area. The conditional estimates are modified by consideration of this probability that recoverable resources do not exist (that is, factoring in the risk) and are then said to be _risked_ resource estimates.

Considering the uncertainty of geologic and engineering variables associated with hydrocarbon traps, resource estimates are usually presented as a range or distribution of values; reporting just one value lends a false sense of precision to the estimate. If a single estimate is required, the mean value of the distribution of possible values is the single best indicator of central tendency, since it reflects both the probability and magnitude of the estimates. The mean, also known as the expected value, is the arithmetic average of all values in the distribution. It is not the "most likely" estimate. The most likely estimate is a probability-weighted average called the mode. Another indicator is the median, which is the value that divides a probability distribution into two equal parts; it corresponds to the 50th percentile on a cumulative frequency distribution. The figure below is a diagram depicting these three measures on a sample probability density curve, which displays the amount of resources versus the relative probability of occurrence. The 95 percent estimate shown on the graph indicates a low estimate having a 19-in-20 chance that the actual amount will be greater. The 5 percent value is a high estimate with a 1-in-20 likelihood that the actual amount will be greater.



The resource estimation process used by the MMS to generate estimates under conditions of uncertainty, incorporates a computer program called PRESTO (Probabilistic Resource ESTimates Offshore). This program provides MMS with a range of estimates, both conditional and risked.

The program is objective and utilizes a large geological and geophysical data base, not only from the offshore areas but also from onshore and offshore State lands. The results produced from the model are reproducible and updatable. This allows new data or new interpretations to have a quantifiable effect on the resource estimates. Results are presented as ranges of values rather than as single-point estimates, so that useful limits can be provided for planning purposes. The program is also functional under a wide range of uncertainty since our knowledge of potential offshore petroleum provinces varies from considerable to general regional knowledge.

The current PRESTO model is in its third generation and incorporates many new, state-of-the-art enhancements. The program uses the types of geologic and geophysical data normally used by the oil industry to locate and define potential hydrocarbon-bearing geologic features. These data are analyzed, interpreted, and eventually refined to a set of input values which numerically model all known potential prospects in the study area.

Since these input values are rarely exactly known, uncertainty is accounted for by range-of-values estimation, i.e., the inputs for variables can be entered as distributions over an appropriate range of possible values with associated probabilities of occurrence. The variables used to define prospects and their resource potential are:

1. areal extent (acres),

2. zone pay thickness (feet),

3. oil recovery factor (stock tank barrels/acre-feet),

4. gas recovery factor (thousand cubic feet/acre-feet),

5. proportion (PROP) of the zone pay thickness consisting of gas,

6. solution gas-to-oil ratio (standard cubic feet/stock tank barrel), and

7. condensate yield (stock tank barrels/million cubic feet of gas).

Dependencies among these input variables can be specified where appropriate. Two other zone properties that may be specified are (1) probability of all oil (OPROB) and (2) probability of all gas (GPROB) for each zone.

Before calculating resources, the model first uses the input geologic risks to determine if hydrocarbons are present in each specific prospect. Next it determines whether a reservoir contains all oil, all gas, or both (by using OPROB, GPROB, PROP). PRESTO then calculates volumes of oil, associated and nonassociated gas, condensate and solution gas, as appropriate, for all hydrocarbon-bearing prospects on each trial by the following equations:

1. volume of oil, barrels = (acres)(thickness)(1-PROP)(oil recovery factor),

2. volume of nonassociated and associated gas, million cubic feet = (acres)(thickness)(PROP)(gas recovery factor)(.001),

3. volume of condensate, barrels = (condensate yield)(nonassociated and associated gas), and

4. volume of solution gas, thousand cubic feet = (gas-to-oil ratio)(oil, barrels)(.001).

Using the above set of inputs as the basis for estimates of resource volumes, the program uses sophisticated statistical sampling techniques to calculate resources. Since each input can be represented by a distribution of values, one point on the distribution for each variable is randomly sampled and the selected values are entered into the volumetric equations to solve for resource amounts. This process is called a "drilling simulation trial" or "pass" and can be repeated as many as 10,000 times. On each of these trials, the model simulates a state of nature by "discovering" which prospects will be hydrocarbon-bearing by using input risks to simulate drilling of each prospect.

To determine the number of trials in which a prospect or zone contributes to the total, the model uses a risk assessment considered at four levels: zone, prospect, basin (or play), and area (or basin). The evaluator must enter risk values which measure the probability that the prospect or zones within a prospect will be dry and the overall probability that the basin (and area) may be dry. Additional estimates of minimum economic field size for each prospect, and minimum economic basin and area reserves (in barrels of oil equivalent (BOE)) are required to determine the portion of the undiscovered resource base that is economically recoverable. Minimum economic field sizes are calculated exogenously through use of a discounted cash flow (DCF) model. They represent the smallest resource amount which would balance development and operating costs (including transportation costs for the gathering system) for a prospect and yield a minimum rate of return. The minimum economic field size is tailored to the prospect, considering factors such as water depth, distance from shore, depth to the potential pay horizon, and current and projected economic conditions.

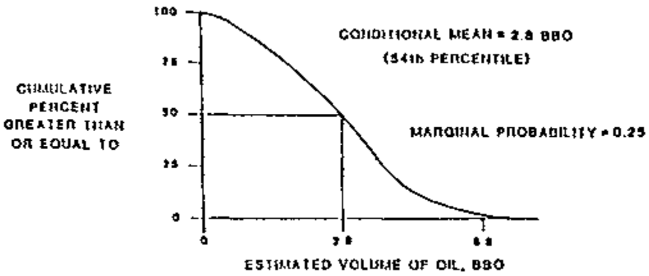
PRESTO develops estimates of economically recoverable resources on a trial by comparing the calculated resource volumes of each successful prospect to the minimum economic field size. The gas volumes calculated for a prospect are converted to a volume of oil equivalent on the basis of energy or economic equivalency and then added to the oil volume to yield a total BOE for the prospect (BOE conversion is described further in Appendix A, Section II, categories of Resource Estimates). If the calculated prospect resource volume in BOE exceeds the minimum economic field size, the prospect is considered to be economically viable and its resources contribute to the total. If the calculated prospect resources are less than the minimum economic field size, then the prospect is considered noncommercial and its resources are set equal to zero for that trial. Resource amounts greater than the minimum economic field size for prospects within a basin are aggregated on each trial and compared to a minimum economic basin reserve. The minimum economic basin reserve, also calculated exogenously, is the minimum amount of resources necessary to justify a regional production infrastructure in a basin. Finally, resource amounts for all basins in an area on a given trial are compared to a minimum economic area reserve to determine whether enough resources are present to justify production facilities for the area. This feature is more appropriate for frontier areas than for mature areas with an existing infrastructure.

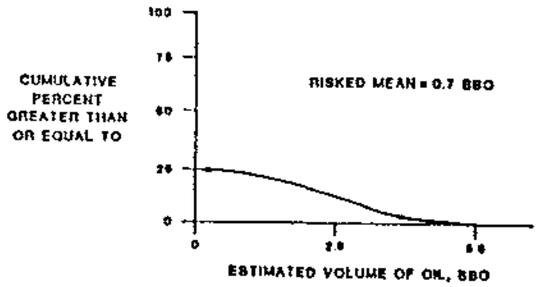
When the specified number of trials is completed for either the undiscovered resource base or economically recoverable estimates, the solutions of each trial are sorted and ranked and the results are defined by distributions of solutions. Thus, the full range of possible volumetric solutions are represented by a single curve with each point on the distribution having an equal probability of occurrence. PRESTO outputs include both conditional and risked distributions. Since the output of PRESTO is a distribution of resource estimates, for convenience, the results are usually reported using only the mean value and the 5th and 95th percentiles. The 5th percentile can be considered a high estimate where there is a 5 percent chance of that amount or more occurring, the 95th as a low estimate where there is a 95 percent chance of that amount or more occurring, and the mean is the average value of all trials.

An important number associated with conditional estimates is the marginal probability. The condition is quantified by assigning it a numerical value (the marginal probability (MP)). The MP is a measure of the probability that hydrocarbons exist in an area and is represented as a decimal fraction. (For economically recoverable resources, the MP is a measure of the probability that <u>commercial</u> hydrocarbons exist in the area.) An MP of 1.00 indicates certainty of hydrocarbon occurrence in the area; an MP of zero indicates no chance whatsoever. The MP applies to the entire conditional distribution. As an example, consider an area having an MP equal to 0.25. This means that the area has a 25 percent chance of containing a hydrocarbon accumulation. If hydrocarbons do exist, then the conditional distribution represents the range of possible values. By removing the condition and incorporating the risk that the entire area may be barren of hydrocarbons, the estimates are said to be risked.

The following graphs illustrate conditional and risked resource distributions. Cumulative percentages are given on the vertical axis and oil volumes on the horizontal axis. The conditional curve has a corresponding MP of 0.25 and if hydrocarbons do exist, the conditional curve displays the calculated range of values. It can be seen on the conditional curve that the 50th percentile corresponds to 2.9 billion barrels of oil, i.e., there is a 50 percent probability that <u>at least</u> 2.9 BBO will be found <u>if</u> there are accumulations of oil present in the area (the mean or average value is 2.8 BBO which corresponds to the 54th percentile in this case).

The graph on the right shows the risked distribution of estimates. Note that the risked mean estimate is only .7 BBO (.25 x 2.8), reflecting the low probability of success in this hypothetical area. The risked curve also shows the chance of resource amounts being greater than or equal to zero is 25 percent (corresponding to the MP); there is a 75 percent chance the area is dry.





Conditional resource estimates are constrained by a number of statistical caveats which are not intuitive. PRESTO calculates planning area resource estimates (or any subset such as an alternative sale configuration) by statistically aggregating the estimates of resources in each individual prospect. It does not follow, however, that the total planning area estimate is the arithmetic sum of the prospect estimates. This is because each prospect has a different condition (i.e., the chance that hydrocarbons occur in the prospect). Prospect resources can be aggregated to planning area totals only by rerunning the program using all prospect data and making any required risk adjustments.

The conditional mean multiplied by the MP yields the risked mean, i.e., the average value factoring in the potential risk of no hydrocarbons existing in the area. However, this is statistically valid only for the mean value; the 5th and 95th percentiles cannot be multiplied by the MP for risked 5th and 95th percentiles. (The 5th and 95th percentiles on the conditional distribution, when multiplied by the marginal probability, will correspond to different percentiles on the risked distribution.)

The <u>risked mean</u> values can be added or subtracted. However, conditional means are not additive; conditional or risked percentile estimates (such as the 5th and 95th percentile estimates) cannot be added or subtracted, but must be aggregated statistically. Risked mean resource values are most useful in comparing different areas for ranking purposes. However, as mentioned earlier, it is the conditional and not the risked mean that is the amount anticipated if recoverable (or commercial) quantities of oil and gas occur in nature. The following example illustrates the essential difference between the two types of estimates and the need to consider both in making informed judgments and decisions. Two areas have been assessed, resulting in very different conditional mean resource levels and marginal probabilities.

	Conditional Mean (Million BBLS)	MP	Risked Mean (Million BBLS)
Area A	1,000	.10	100
Area B	125	.80	100

The risked mean values calculated for both areas are the same. However, Area A has a larger potential (eight times larger than Area B), with only a small chance (10 percent) of hydrocarbons existing in the area. If Area B contains hydrocarbons, the average amount anticipated is much smaller, but the chance of hydrocarbons existing in the area is greater (80 percent).

The distinction between conditional and risked results is further illustrated by the following example. The undiscovered resource base for a fictitious OCS basin is estimated to be between 1 and 7 billion barrels of oil with an average of 3 billion barrels <u>if oil is present in the basin</u>. However, it is estimated that there is only a 25 percent chance that this condition will be met (oil present in the basin). In other words, if there were 100 basins in the world similar to this fictitious basin, 75 would be dry and 25 would contain oil. The 25 basins containing oil would each have between 1 and 7 billion barrels with the average size being 3 billion barrels. The average amount found in the 100 basins would be reported as 750 million barrels. This is the "risked mean" estimate. Therefore, based on current geologic, engineering, and economic knowledge, if this one fictitious basin is fully explored and oil is found, the amount found will be between 1 and 7 billion barrels with an average value of 3 billion barrels. There is, however, only a 25 percent chance of oil being present, so the risked mean estimate is reported at 750 million barrels. In actuality, the amount found would be either zero or between 1 and 7 billion barrels and not the risked mean estimate of 750 million barrels.

II. Categories of Resource Estimates

Various categories of undiscovered resource estimates, each responding to a different question or need, can be developed using the models and methodologies described above. These estimates can be derived from a baseline data set comprised of all prospects in the area. These resource estimates form a nested hierarchy, where each estimate is a subset of previous estimates.

Planning Area Estimate
(Undiscovered Resource Base)

Planning Area Estimate
(Economically Recoverable)

Sale Area Estimate
(Economically Recoverable)

Economically Recoverable
Resources Estimated to be
Leased Due to Sale

Resources Estimated to be
Leased Due to Alternative
Sale Configurations
(or Deferral/Deletion Options)

Planning Area Estimates are the top tier of undiscovered resource estimates. These estimates are for policy guidance and as such, they are broad and all encompassing in nature. They are used, for example, to develop the 5-Year Leasing Program and the Biennial Report to Congress (Section 605, OCS Lands Act). These estimates include both prospects identified through interpretation of geologic and geophysical data and prospects postulated by the extrapolation of geologic trends into areas having scant data. They also include adjustments for the fact that current exploration tools and analyses are not perfect in identifying all potential accumulations.

The undiscovered resource base includes estimated quantities of oil and gas resources which can physically be produced at the surface by conventional technological means, without regard to any economic constraints. Planning area estimates that are described as economically recoverable include resources only from those prospects that are of sufficient size to be economically producible and marketable, based on current and projected economic conditions and foreseeable technological trends.

Gas production is presently uneconomic in all cases, assuming it must be marketed on the U.S. West Coast. The cost of platforms, wells, pipeline, liquefaction plant, tankers, and regasification is much higher than any projected return based on current price forecasts for the gas. The market price is not forecast to rise sufficiently during the sale scenario to change this conclusion. Produced gas, not flared or used as fuel, will be reinjected for pressure maintenance. For more information on the economics of gas, see pages B-3 and B-4 in Appendix B.

For the Chukchi Planning Area, the undiscovered economically recoverable estimates (leased and unleased) follow:

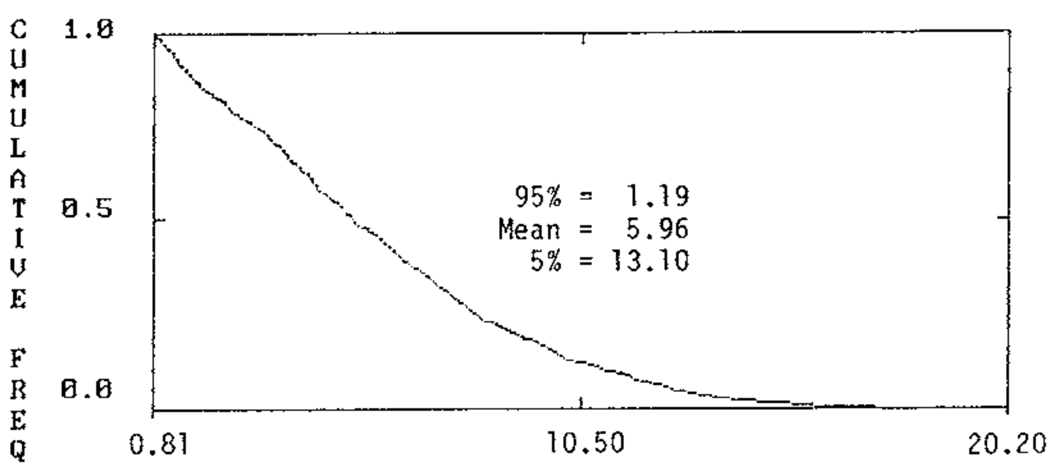
Undiscovered, Economically Recoverable Resource Estimates *
Chukchi Planning Area (leased and unleased)

	Oil (Billion Barrels)	Gas (Trillion Cubic Feet)
Conditional		
95th Percentile	1.19	0.00
Mean	5.96	0.00
5th Percentile	13.10	0.00
Marginal Probability =	0.23	

	Oil (Billion Barrels)	Gas (Trillion Cubic Feet)
Risked		
95th Percentile	0.00	0.00
Mean	1.36	0.00
5th Percentile	8.76	0.00

* The above estimates are an update of the resource estimates developed for the National Resource Assessment (NRA) published in 1989. The updated estimates are higher than those published for the NRA. The increase in the updated estimates is attributed to the identification of many new prospects found in subsequent mapping in preparation for OCS Sale 109 (May 1988). Also, several high quality prospects were found to be larger than originally mapped. A much larger seismic data base was available for the Sale 109 mapping effort.

(Although estimates are shown at the 95th percentile, 5th percentile, and mean cases, these are only three possible numbers from a full and continuous distribution of possible values. The figure below shows a conditional distribution for the economically recoverable resources, in barrels of oil equivalent. Gas volumes are converted to barrels of oil on an energy equivalent basis and then added to the oil volume. One barrel of oil equivalent equals 5.62 Mcf of gas based on 5,800,000 Btu/barrel and 1,032 Btu/cubic feet of gas. Every point on these curves is equally likely to occur. However, the low and high estimates indicate the range of possible values and the conditional mean represents the average amount anticipated, given that recoverable hydrocarbons exist in at least one of the prospects modeled.)



Conditional Results - Chukchi Planning Area

Sale Area Estimates are prepared to comply with sale-specific analytical requirements related to environmental analyses and cost/benefit studies. Oftentimes the area offered for lease is smaller than the entire planning area. Therefore, prospects lying outside of the proposed sale area must be deleted from the assessment. These estimates are undiscovered, economically recoverable resources which are based on current economic and technological conditions and projections. Since these estimates are more area-specific and of nearer term use than planning area estimates, postulated (unmapped) prospects generally are not included, except where justified on a case-by-case basis. Economically recoverable resource estimates for the entire area offered for lease (excludes acreage already leased) in the proposed Chukchi Sale 126 are shown below: *

Undiscovered Economically Recoverable Resource Estimates
Chukchi Sale Area (unleased)

	Oil (Billion Barrels)	Gas (Trillion Cubic Feet)
Conditional		
95th Percentile	1.11	0.00
Mean	4.16	0.00
5th Percentile	9.14	0.00
Marginal Probability =	0.21	
Risked		
95th Percentile	0.00	0.00
Mean	0.88	0.00
5th Percentile	5.72	0.00

* The above estimates differ considerably from the National Resource Assessment (NRA) estimates published in 1989. The NRA was conducted over a period of more than 2 years and reflects data and information available as of January 1, 1987. The updated estimates were developed using additional geophysical data not available for the NRA and also they incorporate the results of the Chukchi Sale 109, held in May 1988.

The sale area estimates represent the amount of undiscovered economically recoverable resources offered for lease. The Resources Estimated to be Leased represent an assessment by MMS of the amount of resources which would be leased, discovered, and produced as a result of the sale and, therefore, the amount upon which the impact analysis is to be based. For proposed Sale 126, MMS considered previous leasing rates, industry interest, prospect distribution, economic and technological considerations, and infrastructure distribution to determine the resources estimated to be leased.

Low, base, and high case estimates are developed to analyze the range of possible outcomes which could result from holding the proposed sale, as explained further in Section III, Rationale for Multiple Scenarios.

To arrive at the base case estimate, a judgment is made as to what percentage of the unleased conditional mean oil resources is expected to be leased and developed. Some of the major considerations in the judgment process include (but are not limited to) the quality and size of the prospects, their locations, reservoir and water depths, and historic patterns from previous sales. For the prospects that are expected to be developed (those that appear to offer the greatest potential for a sizeable discovery), an estimate is made as to what percentage of resources these prospects contribute to the unleased mean resource. However, the resources for each developable prospect are conditional resources with varying marginal probabilities, and therefore cannot be used directly in the process. For this purpose, risked resources can be used because the probabilities that resources do not exist have been factored into each prospect. Therefore, the risked resources are normalized and have the same condition. It follows that by using the risked resources for the prospects, an estimate can be made as to what percentage the developable prospects contribute to the risked mean. This percentage is then applied to the unleased conditional mean to arrive at the base case volume. An estimate was made that the prospects that are expected to be leased and developed represent approximately 39 percent of the risked mean.

This factor was then applied to the unleased conditional mean to arrive at the base case estimate (4.16 billion barrels of oil X approximately 0.39 = 1.61 billion barrels of oil. The yield does not equal the product of the components because numbers have been independently rounded).

The 39 percent factor was then applied to other levels of the resource distribution. For the high case estimate, this factor was applied to the unleased conditional 5 percent volume to arrive at the high case estimate (9.14 billion barrels of oil X approximately 0.39 = 3.54 billion barrels of oil. Again, the yield does not equal the product of the components because numbers have been independently rounded).

This factor was also applied to the unleased conditional 95 percent volume to arrive at the low case estimate (1.11 billion barrels of oil X approximately 0.39 = 0.43 billion barrels of oil). For the low case, leased acreage will be drilled, but no development will occur. The low case estimate is uneconomic because it is below the estimated minimum economic basin resources of .810 billion barrels of oil needed for development.

Undiscovered, Economically Recoverable
Resources Estimated to be Leased
Due to Sale 126

	Oil (Billion Barrels)	Gas (Trillion Cubic feet)
Base Case	1.61	0.00
High Case	3.54	0.00
Marginal Probability =	0.21	

Resource estimates are also developed for Alternative Sale Configurations (or Deferral/Deletion Options). These estimates allow comparison of the Proposal and the various sale alternatives, using procedures developed to estimate the relative resource contribution of each alternative. To make this comparison, the analysis of the sale area alternatives is based on the same condition as the Proposal, that is, that economically recoverable resources exist in the sale area. Therefore, each alternative has the same marginal probability as the sale area. The alternative estimates are based on the prospect data set used for the resources estimated to be leased at the base case. Risked resource estimates are developed for each prospect and used to compute the relative contribution of the prospects for each alternative. Risked resources for prospects located in deferred areas, outside of the alternative, are deleted from the base case estimate. The resultant total risked estimate for the alternative is then divided by the marginal probability to obtain the conditional amount shown below. This amount can then be compared to the amount estimated to be leased for the Proposal to determine the relative effects of the Alternative.

The following resource estimates have been prepared for Sale 126 Alternatives:

Undiscovered, Economically Recoverable Resources
Estimated to be Leased as a Result of
Alternative Sale Configurations

Alternative	Oil (Billion Barrels)	Gas (Trillion Cubic Feet)
Point Lay Base Case	1.61	0.00
Marginal probability for all alternatives =	0.21	

Our current interpretation of available data suggests a negligible difference in resources expected to be developed and produced for Sale 126 between this alternative and the base case. The reason for this negligible difference is that the highest potential prospects capable of supporting and creating an infrastructure lie north of the Point Lay Deferral, and were the only prospects included in the base case. The prospects that fall within the Point Lay Deferral have lower potential and are not large enough to create an infrastructure based on our interpretation of data. Therefore, none of the deferral prospects are included in the base case. However, this does not indicate a total lack of potential in the deferral. In fact, we would expect some blocks in the deferral to be leased and possibly drilled, and perhaps sub-economic volumes of hydrocarbons discovered. This would significantly contribute to area delineation of geology. Also, if an infrastructure is created for a major discovery in the alternative, any sub-economic discoveries in the deferral could become economic in the future by linking into the infrastructure. Furthermore, although our current interpretation of data does not provide any evidence to support a major discovery in the deferral, it is certainly possible. Therefore, the blocks within the deferral are important for the upcoming sale.

The procedures used to determine these different categories of resource estimates are similar in all cases. While subjectivity exists in determining inputs and which prospects are likely to be leased, judgments are consistently applied by specialists in each discipline. For example, inputs such as acreage and net pay are provided by geologists, reservoir engineering parameters are estimated by petroleum engineers, and so forth. The advantages of the model are that subjective judgments of subject matter experts are handled in an objective manner and written documentation of the various judgments is provided so that the estimates can be readily updated in the future as new information and interpretations become available.

III. Rationale for Multiple Scenarios in Environmental Impact Statements (EIS's)

Estimates of remaining undiscovered, economically recoverable oil and gas in a proposed sale area are reported in EIS's to provide the basis for an assessment of the environmental, social, and economic impacts which might realistically be assumed to result from a specific sale. Resource estimates serve as the focus of the assumed exploration and development activities that are fundamental to a rigorous assessment of the potential effects of a proposed sale.

Formerly, the impact analyses for sales were conducted on the conditional mean sale area resource (except in the Gulf of Mexico) with a much abridged high (5th percentile) and low (95th percentile) case analysis separated from the primary analysis. The assumption that the total resources estimated to be present in the sale area would be leased, developed, and produced as a result of the sale overstated the level of activity that would result. Since the bulk of the analysis involved the mean resource, a perception developed among some readers that this amount of resource would, in fact, be discovered and produced. This and the resulting estimates of subsequent exploration and development activities acquired a validity among some readers that generally could not be supported by the available leasing data. The uncertainty inherent in the estimates and by inference in the complex series of environmental, economic, and social effects predicated on them needed to be emphasized.

Recognizing the inherent uncertainty associated with resource estimates, the EIS includes an analysis of a range of potential outcomes as represented by three distinct scenarios. This procedure acknowledges the uncertainties associated with estimating the amounts of resources which will be leased and emphasizes that the resource estimates reflect a range of possibilities. The limits of the range of resources are constrained by a low case and a high case, both of which represent realistic levels of exploration and development activity. Within the range is a base case estimate of resources which are believed likely to be leased, developed, and produced as a result of the sale. The low, base, and high cases and their attendant impacts are presented in the EIS for the proposed action.

The low case presented in EIS's is used in frontier planning areas where there is a high probability that commercially exploitable resources do not exist and development activities may not occur as a consequence of leasing. Therefore, for most frontier planning areas, the low case analysis considers impacts associated with industry efforts related only to exploratory activities because the resource estimated is usually below that which would be economic to produce. However, in the event that resource estimates for the low case justify commercial development, then development and production will be included in the low case scenario and analyzed. The low case is used in all areas except the Gulf of Mexico and Southern California which have established production or significant discoveries which may lead to production.

The base case includes undiscovered resources estimated to be leased, developed, and produced, assuming that hydrocarbons exist in the area (i.e., a conditional estimate), and an estimate of the exploration, development, production, and transportation activities appropriate to that level of resources. The base case estimate is presumed to be the likely result if hydrocarbons are present in the sale area in commercial quantities and if the sale occurs as proposed. Most of the analytical effort is focused on the base case because it represents the resource quantity that is expected to be found and developed as a result of the sale if hydrocarbons are present in economic volumes in the sale area. Post-exploration National Environmental Policy Act analysis is obviously pointless if commercial oil and/or gas does not exist; therefore, the base and high case resources are reported as conditional estimates because these estimates assume that economically recoverable hydrocarbons exist and will be discovered, developed, produced, and transported to the market. The base case estimate reflects the following: successes or failures since the previous sales in a planning area; previous leasing rates; perceived industry interest; costs associated with exploration and development; existing infrastructure to transport oil or gas to market; and so forth.

The high case is an estimate of a significantly higher level of resource recovery and attendant exploration and development activity which could result from leasing more acreage than may occur in the base case, or which could result from the discoveries of larger oil and gas accumulations than estimated under the base case assumptions. The high case estimate is a larger but still reasonable quantity of resources which very likely produce distinctly different impacts. Ordinarily, the effects of this scenario would be higher than those of the base case because they are predicated on more and larger discoveries. It represents a more optimistic scenario and assumes higher than expected leasing rates, favorable geologic conditions, or improved economics.

An examination of these three levels of resources and subsequent development will cover the range of probable outcomes and impacts which could be anticipated to occur as a result of a sale.

The object of the three-case analysis (base and high cases only in mature, producing planning areas) is to scrutinize a spectrum of activity levels, rather than to assess a single scenario which can change because specific estimates change during the 2- to 3-year prelease process. Representing resource estimates as a range recognizes the uncertainties associated with the estimation methodologies and allows some flexibility if the estimates should change.

Regional offices develop base case resource estimates consistent with the data available to them. The Gulf of Mexico Region uses a historical approach which derives the base case from a rigorous analysis of past leasing rates. The result is a time-dependent decline in resource volume for a succession of sales, wherein each sale is assumed to contribute a percentage of the total planning area resource. Other Regions use (with variations) a methodology which extracts and aggregates the resource volumes of those prospects considered most attractive from the PRESTO data base. These prospects usually have high industry interest and are the most likely to yield the highest rate of financial return by reason of size, distance from shore, proximity to transportation infrastructure, water depth, etc., and are thus the most likely to be leased as a result of the sale.

IV. Exploration and Development Scenarios

Infrastructure for each Environmental Impact Statement (EIS) scenario (low, base, and high cases) is estimated for the Exploration and Development (E&D) Report based on the amounts of conditional resources estimated to be leased and subsequently discovered and developed. An exploration-only scenario results when there is an insufficient quantity of resources in the low case to justify development but only an exploration effort is carried out. The E&D Report is composed of timetables with the yearly numbers of successful and unsuccessful exploration, delineation, and production wells for oil and gas, the number of platforms, oil and gas pipeline miles and production schedules. The E&D infrastructure is estimated using methodologies which are specific to each Minerals Management Service Region and which are based on the amount of historical information available, evaluator's professional judgment, and the geologic, engineering, and economic uncertainties associated with each sale area. An EIS impact analysis based on these three distinct scenarios that are derived from a range of resource estimates, provides decisionmakers with a realistic assessment of the consequences of leasing.

V. Resource Estimates for Cumulative Analysis*

In August 1989, the U.S. Geological Survey and the Minerals Management Service published the National Oil and Gas Resource Assessment (NOGRA) of the undiscovered conventionally recoverable oil and natural gas resources of the United States (Mast, et al., 1989). It considered new geological, technological, and economic information and uses more definitive methods of resource appraisal than previous assessments. The assessment was conducted over a period of more than 2 years and reflects data and information available as of January 1, 1987. The resource estimates for Chukchi,

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*This discussion is limited to the methodology used to determine the resource estimates for the OCS in the Arctic Subregion.

Beaufort, and Hope Planning Areas included in the NOGRA were updated as of January 1, 1990, to include use of geological and geophysical data in these planning areas purchased and available through January 1, 1989.

The updated NOGRA is the basis for the generation of both the sale area resource estimates and the cumulative case resource estimate. The cumulative case number will be arrived at by use of a probabilistic method (known as the USGS Crovelli model) which will yield a range of values. The methodology aggregates distributions (not single point estimates) while honoring the marginal probabilities for each of those distributions.

Conditional resource estimates are not directly comparable between planning areas since they are generally based on different marginal probabilities. A regional or subregional resource estimate derived from the NOGRA will be provided for the cumulative case analysis for individual lease sale EIS's. This resource estimate takes into consideration the different marginal probabilities of each planning area. It provides a resource estimate that gives a better indication of the likelihood of oil and gas activities occurring within the region or subregion over the life of the proposal, and provides consistency in the cumulative analysis from one EIS to the next in the region or subregion. Therefore, the life of the proposal considers past and future sales as well as the current sale, and includes both leased and unleased resources.

For the purposes of EIS analysis, conditional mean resource estimates derived for any subregion assume that the sales on the 5-Year Schedule in that subregion will result in exploration, development, and production. Although a precise schedule will not be developed for when that activity will occur, it is logical to assume that some exploration and/or development could occur from more than one sale in the subregion at the same time, and this could continue throughout the life of those sales.

The cumulative number will remain the same until the NOGRA is changed. Consequently, the analysis of the cumulative case for a sale in a given region or subregion will be similar for all other sales in that region or subregion, provided the NOGRA does not change. There will likely be some differences in the discussion of the contribution of the proposal to cumulative impacts from EIS-to-EIS. This will provide a consistent analysis of the cumulative case for all sales on the 5-Year Schedule in a given region or subregion. This avoids the problem of using a different basis for the cumulative analysis in a given area from one EIS to the next, which would result in inconsistent, conflicting analyses in the EIS's.

For Sale 126 the updated NOGRA resource estimates for the Chukchi, Beaufort, and Hope basins were aggregated using the USGS Crovelli model to develop a cumulative Arctic Subregion resource estimate. For the cumulative estimate the marginal probability increases as we would expect to 0.32 with an associated conditional mean estimate of 5.48 billion barrels of oil. The cumulative resources for the Arctic Subregion are as follows:

Undiscovered, Economically Recoverable
Resources for the Arctic Sea Subregion
(leased and unleased)

	Oil (Billion Barrels)	Gas (Trillion Cubic Feet)
Conditional		
95th Percentile	4.29	0.00
Mean	5.48	0.00
5th Percentile	6.87	0.00
Marginal Probability =	0.32	
Risked		
95th Percentile	0.00	0.00
Mean	1.74	0.00
5th Percentile	6.27	0.00

For a full analysis of the cumulative case impact, please see the section of the EIS addressing the analysis of the cumulative case. That discussion contains analyses of cumulative considerations that go beyond just the cumulative resources described above.

APPENDIX B

EXPLORATION AND DEVELOPMENT REPORT

SALE 126 CHUKCHI SEA

Exploration and Development

1. Scenarios

Three scenario schedules for the Sale Area Proposal of figure 1 are attached. The first schedule shows a low case, the second a base case, and the third a high case. The base case is designed for oil discoveries totaling 1,610 million barrels (1.61 BBO) and the high case for 3,540 million barrels (3.54 BBO). Also discussed is the mean cumulative case and the Point Lay Deferral Alternative case.

The mean cumulative case will combine exploration and development efforts from each of three planning areas, including the Chukchi Sea, the Beaufort Sea, and the Hope Basin. The table below outlines the principal locations for shorebase facilities as well as the principal transportation mechanisms. Alternative scenarios are provided for the Beaufort Sea and Hope Basin Planning Areas, but are economically less attractive than the primary scenario. Two scenarios are provided for the Chukchi Sea Planning Area, their relative economic attractiveness varying according to specific development assumptions.

PLANNING AREA	SHOREBASE FACILITY	TRANSPORTATION MECHANISM
Chukchi Sea	Nome	Pipeline south across Lisburne and Seward Peninsula to tanker terminal at Nome
Chukchi Sea	Pt. (PT.) Belcher	Pipeline tie-in to Trans-Alaska Pipeline System (TAPS)
Beaufort Sea	West Dock or Oliktok Pt.	Offshore Gathering System tied into TAPS
Beaufort Sea (ALT)	Barrow area, Pitt Pt., Oliktok Pt., and Pt. Thomson	Onshore Gathering System tied into TAPS
Hope Basin	Nome	Offshore pipeline via Bering Channel to tanker terminal at Nome or pipeline across Seward Peninsula to Nome terminal
Hope Basin (ALT)	Kivalina	Pipeline tie-in to the Trans-Alaska Pipeline System (TAPS)

The mean cumulative case, with 5,480 million barrels (5.48 BBO) of oil resource, is programmed for 48 exploratory wells, 20 delineation wells, 11 production platforms, and 685 development wells, one-fourth of which are assumed to be service wells.

The most likely choice for exploratory drilling vessels for Sale 126 will be drillships with icebreaker support or arctic-class semisubmersibles. Drilling rate would be 1.5-2 wells per year per exploratory rig. Production platforms would be inverted cone shaped, gravity based concrete structures suitable for extreme ice conditions. Each platform will use two rigs to maximize well drilling rates. At least one rig will remain on each platform for remedial workovers.

For the base case, produced oil may be transported to domestic markets under two scenarios. The first scenario employs an offshore trunk and lateral gathering system (200 miles) with landfall at or near Cape Lisburne. Oil would be transported south across the Lisburne and Seward Peninsulas (310 miles) and the Kotzebue Sound (40 miles) via elevated and trenched pipelines, respectively. Oil would be loaded into Class 3 tankers at a Nome shorebase facility and transported to market.

The second scenario employs a similar offshore gathering system with landfall at or near Point Belcher, where oil would be transported via a 400-mile elevated pipeline across the National Petroleum Reserve-Alaska and tied into the Trans-Alaska Pipeline System (TAPS) at Pump Station No. 2 or Pump Station No. 3. Oil would be pumped to Valdez and loaded into conventional tankers destined for the U.S. West Coast.

Under exiting TAPS tariffs, the first and second scenarios are economically equivalent. However, any future increase in the TAPS tariff suggests an economic advantage to the first scenario.

Under the high case, the first scenario has a 5 to 10 percent economic advantage over the TAPS tie-in scenario.

If non-domestic markets become available, the first scenario has a 20 percent economic advantage in the base case and a 35 percent economic advantage in the high resource case. This advantage is largely due to the use of non-Jones Act Vessels.

Gas production is presently uneconomic in all cases, assuming it must be marketed on the U.S. West Coast. The cost of platforms, wells, pipeline, liquefaction plant, tankers, and regasification is much higher than any projected return based on current price forecasts for the gas. The market price is not forecast to rise sufficiently during the sale scenario to change this conclusion. Produced gas, not flared or used as fuel, will be reinjected for pressure maintenance.

Also, no economically recoverable natural gas is indicated in a recently released Department of Interior document entitled <u>Estimates of Undiscovered Conventional Oil and Gas Resources in the United States - A</u>

Part of the Nation's Energy Endowment (Mast etal, 1989). This NOGRA document received considerable review within the Department as well as peer review from outside agencies and organizations. It relates the Los Angeles future market price of natural gas to the Los Angeles future market price of oil, on a heat energy basis, with gas at an indicated discount.

Oil must be priced at about $30 per barrel in that market, in 1987 money, for Alaska's lowest cost gas to be marketed there, and at about $100 per barrel for Alaska's highest cost gas to be marketed there. Potential gas from Chukchi would fall near the $100 per barrel price extreme. When using current price forecasts, Chukchi gas would clearly be even less economic, for a Los Angeles or West Coast market, throughout this lease sale scenario.

Additional insight into the economics of Alaska's natural gas may be gained by considering the status of known very large reserves of gas at Prudhoe Bay. The Yukon Pacific Corporation has endeavored to promote a complete pipeline, LNG plant, and tanker system for marketing about 2 billion cubic feet per day in the Orient. On December 3, 1987, an "Application of Yukon Pacific Corporation for Authorization to Export Liquefied Natural Gas from the United States" was placed before the Economic Regulatory Administration. This included a study paid for by ARCO, one of the Prudhoe gas owners, which concluded that the project was not economically feasible. Its scenario included favorable foreign flag vessels to a Japanese market, and its unfavorable heavy up-front cost was the pipeline at $6.8 million per mile.

Exploration and delineation wells will average 10,400 feet measured depth, ranging to nearly 14,000 feet. Production and service wells would be 11,000 feet average direcionally drilled total depth.

Leases are assumed to be for 10 years. Note that the schedules assume no litigation or regulatory delays. Platform years shown on the schedules are the years of final placement of platforms on location and hooked up for commencement of production drilling. Offshore loading facilities, if used, are constructed at the same time as the platforms.

2. Muds and Cuttings for Base Case

The average exploration well will dispose 660 short tons of dry mud and produce 850 short tons of dry rock cuttings.

The average delineation well will dispose 660 short tons of dry mud and produce 850 short tons of dry rock cuttings.

The average development well will dispose from 110 to 700 dry net short tons of mud and produce 925 short tons of dry rock cuttings.

The mud discharged will have this typical composition:

Component	Weight %
Barite	63.0
Clay	24.0
Lignosulfonate	2.0
Lignite	1.5
Sodium hydroxide	1.5
Other	8.0
Total	100.0

Source: Petrazzuolo, 1983.

3. Change in the Level of Activity from the Base Case to the Deferral Alternatives

The estimated volume of hydrocarbon that is expected to be discovered in the Point Lay Deferral Alternative shown in figure 1 is 1610 million barrels of oil. An exploration and development schedule for this alternative is shown in table 4.

Our current interpretation of available data suggests a negligible difference in resources expected to be developed and produced for Sale 126 between this alternative and the base case. However, this does not indicate a total lack of potential in the deferral. In fact, we would expect some blocks in the deferral to be leased and possibly drilled, and perhaps sub-economic volumes of hydrocarbons discovered. This would significantly contribute to area delineation of geology. Also, if an infrastructure is created for a major discovery in the alternative, any sub-economic discoveries in the deferral could become economic in the future by linking into the infrastructure. Furthermore, although our current interpretation of data does not provide any evidence to support a major discovery in the deferral, it is certainly possible. Therefore, the blocks within the deferral are important for the upcoming sale.

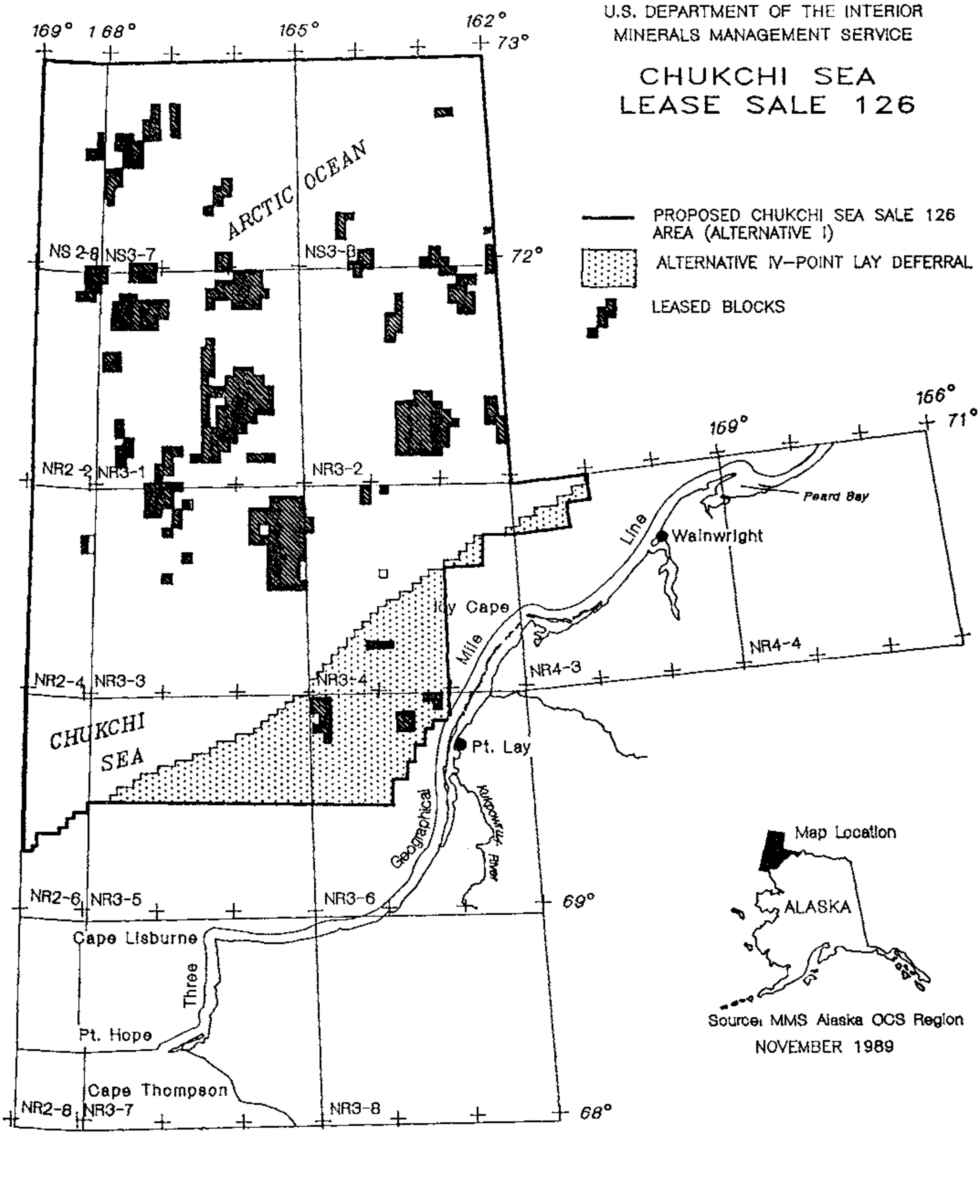
U.S. DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE
CHUKCHI SEA
LEASE SALE 126
PROPOSED CHUKCHI SEA SALE 126 AREA (ALTERNATIVE I)
ALTERNATIVE IV–POINT LAY DEFERRAL
LEASED BLOCKS
ARCTIC OCEAN
CHUKCHI SEA
Peard Bay
Wainwright
Icy Cape
Pt. Lay
Kukpowruk River
Three Mile Geographical Line
Cape Lisburne
Pt. Hope
Cape Thompson
Map Location
ALASKA
Source: MMS Alaska OCS Region
NOVEMBER 1989

Figure 1

1. EXPLORATION AND DEVELOPMENT SCHEDULE

SALE 126 LOW CASE

Sale Year	Exploration Wells	Delineation Wells		Explor/Delin Rigs	Production Platform		Prod/Service Wells		Production Rigs	Number of Shorebases	Production MMB	Production BCF	Pipeline Miles	
		Oil	Gas		Oil	Gas	Oil	Gas			Oil	Gas	Oil	Gas
1*														
2	2			2										
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
TOTALS	2	0	0	-	0	0	0	0	-	0**	430**	0	0	0

* Sale Year 1 = Calendar Year 1991

** This resource is below the minimum economic resource required for development.

2. EXPLORATION AND DEVELOPMENT SCHEDULE

SALE 126 BASE CASE

Sale Year	Exploration Wells	Delineation Wells Oil	Delineation Wells Gas	Explor/Delin Rigs	Production Platform Oil	Production Platform Gas	Prod/Service Wells Oil	Prod/Service Wells Gas	Production Rigs	Number of Shorebases	Production MMB Oil	Production BCF Gas	Pipeline Miles Oil	Pipeline Miles Gas
1*														
2	4			4										
3	6	4		5						.2				
4	6	3		5						.4				
5	4	3		4						.4				
6	3	1		3										
7	3			3										
8	2			2										
9													200	
10					2		8		4				200	
11					2		40		8				150-200**	
12					2		60		12		101			
13							80		12		135			
14							26		12		135			
15											135			
16											135			
17											135			
18											119			
19											103			
20											92			
21											82			
22											73			
23											64			
24											58			
25											52			
26											47			
27											42			
28											37			
29											34			
30											31			
TOTALS	28	11	0	-	6	0	214	0	-	1.0	1610	0	550-600**	0

* Sale Year 1 = Calendar Year 1991
** Pipelay schedule is ranged to encompass two development scenarios (see text).

3. EXPLORATION AND DEVELOPMENT SCHEDULE

SALE 126 HIGH CASE

Sale Year	Exploration Wells	Delineation Wells Oil	Delineation Wells Gas	Explor/Delin Rigs	Production Platform Oil	Production Platform Gas	Prod/Service Wells Oil	Prod/Service Wells Gas	Production Rigs	Number of Shorebases	Production MMB Oil	Production BCF Gas	Pipeline Miles Oil	Pipeline Miles Gas
1*														
2	4			4										
3	6	4		6						.2				
4	6	3		5						.4				
5	5	3		5						.4				
6	4	2		4										
7	4	2		4										
8	3	1		3										
9	2	1		2										
10	2			2	2								200	
11	1			1	6		40		8				200	
12					4		80		16				150-200**	
13							140		24		223			
14							140		24		297			
15							72		24		297			
16											297			
17											297			
18											297			
19											262			
20											227			
21											202			
22											181			
23											159			
24											142			
25											128			
26											113			
27											103			
28											92			
29											82			
30											74			
31											67			
TOTALS	37	16	0	-	12	0	472	0	-	0	3540	0	550-600**	0

* Sale Year 1 = Calendar Year 1991

** Pipelay schedule is ranged to encompass two development scenarios (see text).

4. EXPLORATION AND DEVELOPMENT SCHEDULE

SALE 126 POINT LAY DEFERRAL ALTERNATIVE

Sale Year	Exploration Wells	Delineation Wells Oil	Delineation Wells Gas	Explor/Delin Rigs	Production Platform Oil	Production Platform Gas	Prod/Service Wells Oil	Prod/Service Wells Gas	Production Rigs	Number of Shorebases	Production MMB Oil	Production BCF Gas	Pipeline Miles Oil	Pipeline Miles Gas
1*														
2	4			4										
3	6	4		5						.2				
4	6	3		5						.4				
5	4	3		4						.4				
6	3	1		3										
7	3			3										
8	2			2										
9													200	
10					2		8		4				200	
11					2		40		8				150-200**	
12					2		60		12		101			
13							80		12		135			
14							26		12		135			
15											135			
16											135			
17											135			
18											119			
19											103			
20											92			
21											82			
22											73			
23											64			
24											58			
25											52			
26											47			
27											42			
28											37			
29											34			
30											31			
TOTALS	28	11	0	-	6	0	214	0	-	1.0	1610	0	550-600**	0

* Sale Year 1 = Calendar Year 1991
** Pipelay schedule is ranged to encompass two development scenarios (see text).

APPENDIX C

OIL-SPILL-RISK ANALYSIS

OIL-SPILL-RISK ANALYSIS

I. OIL-SPILL-TRAJECTORY SIMULATIONS

For the Sale 126 base and high cases and the Point Lay Deferral Alternative, oil-spill trajectories were simulated by the Rand Corporation in Santa Monica, California, using Rand's three-dimensional circulation, weather, and spill-trajectory models (Liu and Leendertse, 1987). The Rand Corportation model description and documentation as contained in Liu and Leendertse (1987) is incorporated by reference; a summary of this description, as augmented by additional material, as cited, follows.

A three-dimensional hydrodynamic model is coupled to a two-dimensional stochastic weather model and an oil-spill-trajectory model. The three dimensional hydrodynamic model is formulated according to the equations of motion for water and ice, continuity, state; the balance of mass, heat, salt, pollutant; and turbulent energy densities, on a three-dimensional finite grid (Liu and Leendertse, 1987). The vertical momentum, mass, heat, and turbulent energy exchange coefficients are computed from the turbulent energy; thus, the model contains a turbulence closure (Liu and Leendertse, 1987). The basic equations are derived in Liu and Leendertse (1978).

Local wind stress was modeled using a method called the unit-response function. Response functions are generated by the differences in the currents in the three-dimensional field with and without the wind stress under identical tidal conditions. Under ice-free conditions, the response function (coupled with the stochastic weather model) together with the local residual current was used to compute the movement of oil. The stochastic weather model periodically interrupts to enter a storm track model.

Oil movement underneath the ice is more complicated. When the relative speed between the ice and water is below a critical threshold value, the oil will be contained by the underside roughness of the ice. The threshold value is a function of the density of oil and water, the surface tension between oil and water, the underside roughness of the ice, and the thickness of the oil. When the threshold value is exceeded, the oil begins to move at a speed proportional to the speed of the water. The details of these computations can be found in Liu and Leendertse (1981a,b).

Essential model components and their interrelationships are shown in Figure C-1. Weathering, toxicity, and oil dispersion are considered and taken into account in this EIS, but are not part of the trajectory analysis; see Section IV.A.2. The actual modeled trajectories are center-of-mass trajectories. Rand Corporation transmitted 12-hour-trajectory positions to Minerals Management Service (MMS), Branch of Environmental Modeling (BEM). The BEM applied trajectories to land/boundary segments and to environmental-resource areas identified by MMS, Alaska OCS Region, to determine the environmentalrisk factors.

A. Winter Trajectories: The modeled winter is 227 days from November 1 to June 15. For winter, the Rand Corporation simulated 45 trajectories from each of 26 hypothetical spill sites (J3-J13, J18-J25, and J30-J37; Fig. IV-A-2 of this EIS) totaling 1,170 winter trajectories. Oil spills are staggered, representing an equally likely occurrence chance throughout the entire 7.5-month winter season. Winter trajectories were simulated for the entire winter period to account for oil frozen into winter ice (see Sec. IV.A.3 of this EIS) until breakup. Thus, some winter trajectories were modeled for up to 7.5 months.

In the modeled winter, oil moves with ice or water depending on the differential velocity of ice and underlying water. The oil-spill-trajectory model does not include the time-dependent oil freezing into ice. For smooth first-year ice, the differential velocity of the water has to be greater than about 15 cm per second to strip oil from the underside of the ice. Rough first-year ice or multiyear ice requires greater velocities to strip oil. Because ice and underlying water are being moved by the same forces, the necessary differential velocity is seldom reached; and oil almost always moves or stays with the ice, regardless of whether the oil was spilled onto, into, or underneath the ice (see Sec. IV.A.3). Simulated winter-spill trajectories were stopped when (1) the oil contacted land, (2) the oil moved beyond the boundaries of the model, or (3) breakup occurred.

B. Summer Trajectories: The modeled summer is 138 days from June 16 through October 31. In June, the average ice concentration near the 70th parallel is approximately 4 oktas and the water column is strongly stratified. Trajectories are computed using the ice-concentration data and a three-dimensional model reflecting the stratified water column. Summer trajectories were computed from the 26 hypothetical spill sites (J3-J13, J18-J25, and J30-J37). Under equally likely probability, oil is spilled every 5 days from the 26 hypothetical spill sites, providing 30 trajectories per launch point, totaling 780 summer trajectories. Simulated summer-spill trajectories were stopped when (1) oil contacted land, (2) the oil moved beyond the boundary of the model, or (3) the trajectory simulations reached 31 days.

The MMS emphasizes that the simulated trajectories represent hypothetical oil-slick pathways. The simulated trajectories do not account for cleanup, dispersion, or weathering processes that could determine the quantity or quality of oil that might eventually come in contact with environmental resource.

C. Conditional Probabilities: Trajectory-simulation results are presented as conditional and combined probabilities. The probability that if an oil spill occurred at a specific spill site, it would contact either a land/boundary segment or an environmental-resource area is termed a conditional probability. Conditional probabilities assume that a spill occurs; they do not consider the likelihood of a spill occurring--a function of the presence and amount of oil and transportation assumptions. The conditional probabilities give the percentage chance of oil from that hypothetical spill site contacting specific land/boundary segments and environmentalresource areas. The conditional probabilities are useful in identifying areas that pose the highest chance of contact to specific environmental-resource areas and land/boundary segments, should spills occur.

Two sets of conditional probabilities are used in this EIS: (1) contacts with summer spills during open water (this appendix, Tables C-1 through C-6) and (2) contacts with winter spills during winter (this appendix, Tables C-7 through C-12).

II. ESTIMATED OIL-RESOURCE AND RESERVE VOLUME

Uncertainties exist in estimating the oil-resource volume that may be discovered and produced as a result of an OCS lease sale. The Sale 126 analysis uses three oil-resource levels to represent the amount of oil that could be found if economic oil quantities are discovered (Sec. II.A).

There is a 21-percent chance that commercial hydrocarbon quantities may be found as a result of the Sale 126 base and high cases and the Point Lay Deferral Alternative. For the low case, the estimated oil-resource volume is considered uneconomic, and only exploration is assumed. For the base and high cases and the Point Lay Deferral Alternative, the estimated oil-resource volume is assumed to be leased, found, and produced. The estimated mean number of ≥ 1,000-bbl spills and, accordingly, the OSRA results reflect the estimated oil-spill risk based on the oil-resource-volume estimates for the base and high cases and the Point Lay Deferral Alternative.

The entire oil-resource volume is used in simulating OSRA combined-probability results for both the summer and winter simulations. Seasonal production is not accounted for in the OSRA.

The cumulative case OSRA includes only the estimated mean number of ≥ 1,000- bbl spills and the probabilities of one or more ≥ 1,000 bbl-spills; no trajectory simulations and, therefore, no conditional or combined probabilities are calculated. The cumulative-case mean-spill number is based on oil-resource and oil-reserve volume estimates for the U.S. Arctic OCS, ANWR, NPR-A, State of Alaska leases, other leases, and Canadian Beaufort Sea (Table IV-A-1 of this EIS). Oil resources are undiscovered resources. Oil reserves are discovered resources. Where oil-reserve estimates are not available--for example, OCS discoveries at Tern, Sandpiper, and Hammerhead Prospects--these discoveries are not included in the estimated mean-spill number. Additional offshore lease sales have been held or are planned by the State of Alaska; but no reserves or resources have been reported for these State sales, and these sales are not included in the mean-spill number for the cumulative case. The Geological Survey of Canada estimates Canadian Beaufort Sea reserves at 1.74 Bbbl and (undiscovered) resources at 3 Bbbl (Dixon et al., 1988). The Sale 126 cumulative-case OSRA includes the discovered 1.74 Bbbl; the additional 3 Bbbl of resources are not included in the cumulative-case estimated-mean-spill calculations.

III. TRANSPORTATION ASSUMPTIONS

In the analysis of the Sale 126 base and high cases and the Point Lay Deferral Alternative, a transportation scenario is assumed: oil is transported from offshore drilling units by offshore pipeline (Fig. IV-A-2 of this EIS). For the base and high cases, J4-J8, J11-J13, J20-J25, and J30-J37 are considered hypothetical platform and pipeline spill sites; and J3, J9, J10, and J18 are considered hypothetical pipeline spill sites. In the Point Lay Deferral Alternative, J4-J8, J11, J20, J22-J25, J30-J32, J35, and J37 are considered hypothetical platform- and pipeline-spill sites; and J3, J9, J10, J12, J13, J21, J33, J34, and J36 are considered hypothetical pipeline-spill sites. The Point Lay Deferral Alternative removes hypothetical platform-spill sites J12, J13, J21, J33, J34, and J36 but retains them as hypothetical pipeline-spill sites.

The offshore pipeline landfalls at Point Belcher. The onshore pipeline traverses NPR-A to a connection with the Trans-Alaska Pipeline (TAP). From there, it is transported south by TAP to Valdez and then shipped to the continental U.S., Panama, Hawaii, or the U.S. Virgin Islands by tankers.

Although cumulative-case trajectory simulations are not included in this EIS, an assumed transportation scenario is necessary to calculate a cumulative-case estimated-mean-spill number. The transportation scenario used for the base and high cases is assumed for the cumulative case with the addition of tankering along the TAP route.

Note that these transportation scenarios are hypothetical and are put forth only to aid in analyzing possible effects. Use of any transportation route would depend on finding commercial quantities of oil, where that oil is found, and subsequent environmental and economic analyses of transportation modes and routes.

IV. PROBABILITY OF OIL SPILLS OCCURRING

The procedures and statistics MMS uses to calculate frequencies and probabilities of ≥ 1000-bbl spills are described and discussed in detail in Nakissis (1982), Lanfear and Amstutz (1983), Amstutz and Samuels (1984), and Anderson and LaBelle (1990). This information is incorporated by reference; a summary of this information, as augmented by additional material, as cited, follows.

A. Projected Spillage: The expected number of ≥ 1,000-bbl spills is calculated as proportionate to the volume of oil produced and transported. The spill-rate constant is based on historical accidents, expressed in terms of the number of spills per 10^9 bbl of oil produced or transported (Table C-12a). The spill-rate constant is multiplied by the estimated oil-resource volume to derive an estimated-mean-spill number.

Spill Rates: Oil spills ≥ 1000 bbl from tankers, platforms, and pipelines were analyzed (Anderson and LaBelle, 1990). Platform- and pipeline-spill rates were derived from U.S. OCS-spill data from 1964 to 1987. For U.S. OCS platforms and pipelines, nonparametric tests indicated that the spill rate, based on volume of oil handled, had declined over time (Anderson and LaBelle, 1990). For worldwide tankers, the spill rate, based on volume of oil handled, had remained constant. U.S. OCS-platform- and pipeline-spill-rates are 0.60 and 0.67, respectively, per 10^9 bbl (Anderson and LaBelle, 1990). Worldwide tanker-spill rates are 0.90 at sea and 0.40 in part per 10^9 bbl (Anderson and LaBelle, 1990).

Table IV-A-1 of this EIS shows the statistically estimated mean number of spills ≥ 1,000 bbl that could occur as a result of the base and high cases, the Point Lay Deferral Alternative, and the cumulative case. Sale 126 estimated-mean-spill numbers are derived using the platform-, tanker-, or pipeline-spill rate according to the assumed transportation scenario. For example, the base-case oil-resource estimate is multiplied by the pipeline-spill rate (1,610 MMbbl x 0.67 spills/Bbbl = 1.08 pipeline spills) and the platform-spill rate (1,610 MMbbl x 0.69 spills/Bbbl = 0.97 platform spills). Combining platform and pipeline spills for the base case, the total estimated-mean-spill number is 2.05 (1.08 + 0.97 = 2.05; Table IV-A-1).

B. Most Likely Number of Spills: In this EIS, analysts use the "probability of one or more spills" occurring or contacting a resource. For situations where the probability of two or more spills becomes greater than the probability of one spill, the analysts also refer to and use the "most likely number of spills."

Poisson Distributions: Devanney and Stewart (1974) showed that the probability of oil-spill contacts can be described by a negative binomial distribution. Smith et al. (1982) noted that when the actual exposure is much less than the historical exposure, as is the case for most oil-spill-risk analysis, the negative binomial distribution can be approximated by a Poisson distribution. The probabilities of ≥ 1,000-bbl spills occurring are calculated from the estimated-mean-spill number through use of standard (Poisson) statistical distributions governing the occurrences of rare, random events (Smith et al., 1982).

The relationship between the most likely number of spills (mode), the estimated-mean-spill number, and the probability distribution for various numbers of spills is shown in Figure IV-A-3 of this EIS for the base and high cases, the Point Lay Deferral Alternative, and the cumulative case for the Arctic. For the base case and the Point Lay Deferral Alternative, the most likely number of spills ≥ 1,000 bbl is two. For the high case, the most likely number of spills ≥ 1,000 bbl is four. For the cumulative case, the most likely number of spills ≥ 1,000 bbl is 10 for the Arctic Ocean, 15 for PWS/GOA, and 26 total.

C. Probability That Spills of at Least 1,000 bbl Would Occur: The likelihood of one or more spills ≥ 1,000 bbl occurring under the base and high cases and the Point Lay Deferral Alternative is high due to the high estimated-oil-resource volume. For the base case and the Point Lay Deferral Alternative, MMS estimates an 87-percent chance that one or more oil spills ≥ 1,000 bbl would occur in the Chukchi Sea over the life of the field (Table IV-A-1) and a 99-percent chance that one or more spills would occur for the high case. For the cumulative case, there is a >99- percent chance that one or more oil spills ≥ 1,000 bbl would occur in the Chukchi Sea over the life of the field (Table IV-A-1).

D. Probability that Spills ≥ 1,000 bbl Would Occur and Would Contact Shoreline or Environmental-Resource Areas: As part of the OSRA, the conditional probabilities (probabilities that if a spill occurred, it would contact shoreline or environmental-resource areas) are combined with the spill rates, transportation scenarios, and the unrisked base-case and high-case oil-resource estimates to yield overall, combined probabilities for contact with spills ≥ 1,000 bbl. Thus, these probabilities include both the likelihood that a spill would occur and whether the spill would contact shoreline or environmental-resource areas. The associated Monte Carlo error for combined probabilities--because all trajectories and spill information for all spill sites are incorporated--is much lower than that for conditional probabilities, ranging from ±1 to ±2 percent.

Combined probabilities for the base and high cases and the Point Lay Deferral Alternative are introduced in Section IV.A.1 and are used by EIS analysts to evaluate the likelihood of effects throughout Section IV. Combined- probability tables are provided for the base and high cases and the Point Lay Deferral Alternative in Tables C-13 through C-20 of this appendix. Land/ boundary segments are identified in Figure IV-A-1 and environmental-resource areas in Figures IV-C-1, IV-C-2, IV-C-3, and IV-C-7.

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Oil-Spill-Risk Analysis
List of Tables

Table C-1. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 3 days

Environmental Resource	Hypothetical Spill Sites																								
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Land	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	**	n	n	n	n
Sea Segment 5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n	n	n	n	n	n
Sea Segment 6	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	10	n	n	n	n	n
Sea Segment 7	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40	n	n	n	n	n	n
Sea Segment 8	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor A	n	n	n	n	n	n	**	**	n	n	n	70	n	n	n	n	n	n	n	n	n	**	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	n	**	**	n	n	n	**	n	n	n	n	n	n	n	n	**	n	**
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	n	n	**	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n
P.Hope Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: ** = >99.5 percent; n = <0.5 percent.

Table C-2. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 10 days

Environmental Resource	Hypothetical Spill Sites																								
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Land	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 4	n	n	n	n	13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	**	n	n	n	n	n
Sea Segment 5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	23	n	n	n	n	n	n	n	n	n	n
Sea Segment 6	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	77	n	n	n	n	n	n
Sea Segment 7	n	**	n	7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40	n	n	n	n	n	n	n
Sea Segment 8	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor A	n	n	n	n	n	n	**	**	n	n	n	93	n	n	n	n	n	n	n	n	n	**	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	n	**	**	23	n	**	n	n	n	n	n	n	n	13	**	n	**	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Table C-2. (Continued) -- Conditional probabilities (expressed as percent chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 10 days

Environmental Resource	Hypothetical Spill Sites																								
	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37	
Whale Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	3	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n
P.Hope Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: ** = >99.5 percent; n = <0.5 percent.

Table C-3. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 30 days

Environmental Resource	Hypothetical Spill Sites																								
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Land	n	n	n	n	n	n	n	3	n	n	7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n
Sea Segment 4	n	n	n	n	70	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	**	n	n	n	n	n
Sea Segment 5	n	n	n	n	13	63	n	n	n	n	n	n	n	n	7	23	n	n	n	n	n	n	n	n	n	n
Sea Segment 6	7	n	**	3	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	97	n	n	n	n	n	n
Sea Segment 7	7	**	n	97	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40	3	n	n	n	n	n	n
Sea Segment 8	13	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	3	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor A	n	n	n	n	n	n	**	**	n	3	n	97	n	n	n	n	n	n	n	n	n	**	3	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	23	17	n	**	**	87	n	**	n	n	n	n	n	n	n	63	**	n	**	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	n	n	n	**	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	3	33	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n
P.Hope Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	**	n	n	n	n	n	n	n	n	n	7	n	n	n	n

Note: ** = >99.5 percent; n = <0.5 percent.

Table C-4. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain land segment within 3 days

Land Segment	Hypothetical Spill Sites																								
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37

Notes: Land segments having rows with all values <0.5 percent are not shown. For Table C-4 all land/boundary segments have conditional probabilities <0.5 percent.

Table C-5. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain land segment within 10 days

Land Segment	Hypothetical Spill Sites																								
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37

Notes: Land segments having rows with all values <0.5 percent are not shown. For Table C-5 all land/boundary segments have conditional probabilities <0.5 percent.

Table C-6. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a hypothetical spill site will contact a certain land segment within 30 days

Land Segment	Hypothetical Spill Sites																								
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
16	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Notes: n = <0.5 percent. Land segments having rows with all values <0.5 percent are not shown.

Table C-7. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 3 days

Environmental Resource	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Land	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 4	n	n	n	n	16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	**	n	n	n	n	n
Sea Segment 5	n	n	n	n	n	13	n	n	n	n	n	n	n	n	n	40	n	n	n	4	n	n	n	n	n	n
Sea Segment 6	n	n	**	16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40	n	n	n	n	n	n
Sea Segment 7	n	**	n	9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	27	n	n	n	n	n	n	n
Sea Segment 8	4	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor A	2	n	n	n	n	n	13	13	n	n	n	11	n	n	n	n	n	n	n	n	n	13	2	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	n	13	13	n	n	13	n	n	n	n	n	n	n	7	13	n	13	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n	n	n	n	n	n	n	9	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	22	n	7	n	**	n	n	n	n	n	n	n	n	n	4	n	n	n	n
P.Hope Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	n	n	n	n	n	**	**	n	7	n	**	n	n	n	n	n	n	n	n	n	9	n	n	n	n

Notes: ** = >99.5 percent; n = <0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is an environmental resource between April 15 and June 15. Whale Migration Corridors B and C are environmental resources between April 1 and June 15.

Table C-8. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 10 days

Environmental Resource	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Land	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 1	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 2	n	n	n	n	n	n	n	n	2	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	2
Sea Segment 3	n	n	n	n	20	7	n	n	11	n	n	n	2	n	n	n	n	n	n	n	11	n	n	7	n	n
Sea Segment 4	n	n	n	n	58	33	n	n	n	n	n	n	n	n	7	2	n	n	n	7	**	n	n	4	n	n
Sea Segment 5	2	n	7	9	n	36	n	n	n	n	n	n	n	n	22	40	n	n	n	27	n	2	2	n	n	n
Sea Segment 6	11	7	**	62	n	n	2	n	n	n	n	n	n	n	7	n	n	n	2	82	n	2	n	n	n	n
Sea Segment 7	2	**	n	24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	27	n	n	n	n	n	n	n
Sea Segment 8	4	n	n	2	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	20	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor A	2	n	n	n	n	n	18	22	n	n	n	16	n	n	n	n	n	n	n	n	n	16	2	n	n	n

Table C-8. (Continued) -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain environmental resource within 10 days

Environmental Resource	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Migrat. Corridor B	n	n	n	n	n	n	4	2	n	20	24	9	n	13	n	n	n	n	n	n	n	13	16	n	13	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n	n	n	n	n	n	n	11	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	40	n	9	n	**	n	n	n	n	n	n	n	n	n	4	n	n	n	n
P.Hope Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	n	n	n	n	n	**	**	n	9	n	**	n	n	n	n	n	n	n	n	n	11	n	n	n	n

Notes: ** = >99.5 percent; n = <0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is an environmental resource between April 15 and June 15. Whale Migration Corridors B and C are environmental resources between April 1 and June 15.

Table C-9. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain environmental resource over the entire winter season

Environmental Resource	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
Land	13	5	9	7	29	16	7	20	31	20	11	18	24	22	18	9	7	3	7	13	22	16	18	24	20	16
Sea Segment 1	n	n	n	n	7	4	n	n	9	2	13	n	18	n	2	n	n	n	n	n	2	4	4	4	9	22
Sea Segment 2	4	n	n	n	13	2	4	2	36	7	13	4	27	7	7	n	n	n	n	2	n	2	4	13	18	11
Sea Segment 3	2	n	n	2	40	18	2	4	27	22	9	11	11	31	4	n	n	n	n	2	11	7	11	40	13	n
Sea Segment 4	16	n	n	4	62	47	13	11	2	16	n	20	n	16	27	2	n	n	n	16	**	22	29	18	n	n
Sea Segment 5	27	n	7	18	n	38	27	13	n	n	n	7	n	n	38	40	n	n	n	38	n	18	11	n	n	n
Sea Segment 6	33	7	**	71	n	n	13	n	n	n	n	n	n	n	9	n	n	n	2	82	n	7	n	n	n	n
Sea Segment 7	4	**	n	24	n	n	2	n	n	n	n	n	n	n	n	n	n	n	27	n	n	n	n	n	n	n
Sea Segment 8	4	n	n	2	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	33	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor A	2	n	n	n	n	n	18	27	n	n	n	22	n	n	n	n	n	n	n	n	n	16	2	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	7	13	n	20	27	29	n	13	n	n	n	n	n	n	n	13	16	n	13	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area A	n	n	n	n	2	n	n	n	7	2	2	n	9	2	n	n	n	n	n	n	n	n	2	2	7	9
Whale Area B	n	n	n	n	n	n	n	n	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n	n	n	n	n	n	n	11	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	51	n	9	n	**	n	n	n	n	n	n	n	n	n	4	n	n	n	n
P.Hope Subsis. Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	n	n	n	n	n	**	**	n	9	n	**	n	n	n	n	n	n	n	n	n	11	n	n	n	n

Notes: ** = >99.5 percent; n = <0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is an environmental resource between April 15 and June 15. Whale Migration Corridors B and C are environmental resources between April 1 and June 15.

Table C-10. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain land segment within 3 days

Land Segment	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J19	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37

Notes: Land segments having rows with all values <0.5 percent are not shown. For Table C-10 all land/boundary segments have conditional probabilities <0.5 percent.

Table C-11. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain land segment within 10 days

Land Segment	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37

Notes: Land segments having rows with all values <0.5 percent are not shown. For Table C-11 all land segments have conditional probabilities <0.5 percent.

Table C-12. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a hypothetical spill site will contact a certain land segment over the entire winter season

Land Segment	Hypothetical Spill Sites																									
	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J18	J20	J21	J22	J23	J24	J25	J30	J31	J32	J33	J34	J35	J36	J37
21	n	n	n	n	n	n	n	11	n	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n	n	n
27	9	2	7	2	13	4	4	7	22	11	7	7	9	16	9	2	2	n	2	9	11	7	13	20	9	2
28	4	2	2	4	13	9	2	n	n	4	n	4	2	2	7	4	4	2	4	4	9	7	4	2	2	n
30	n	n	n	n	n	2	n	n	4	2	2	n	2	2	2	2	n	n	n	n	n	2	n	n	n	n
39	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n	n	n	n	n	n	n	n	n	n	7	2
40	n	n	n	n	2	n	n	n	2	n	n	n	2	n	n	n	n	n	n	n	2	n	n	n	n	4
41	n	n	n	n	n	n	n	n	n	2	n	n	2	2	n	n	n	n	n	n	n	n	n	2	n	n
42	n	n	n	n	n	n	n	n	2	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	7
44	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n
46	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
59	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n	n	n	n	n
60	n	2	n	2	n	n	n	n	n	n	n	n	n	n	n	n	2	11	4	n	n	n	n	n	n	n
61	n	9	2	n	n	n	n	n	n	n	n	n	n	n	n	2	7	4	4	n	n	n	n	n	n	n
62	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	2	4	n	n	n	n	n	n	n

Notes: n = <0.5 percent. Land segments having rows with all values <0.5 percent are not shown.

Table C-12a
Spill Rates per Billion Barrels of Oil Produced
or Transported for Platforms, Pipelines, and
Tankers, Based on Historical Trends

Source	Rate
	≥1,000 bbl
Platforms	0.60
Pipelines	0.67
Tankers, Total	1.30
At Sea	0.90
Per Port Call	0.20

Source: Anderson and LaBelle, 1990.

Table C-13. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting environmental resources over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, base and high cases, based on summer trajectories only

Environmental Resource	--- WITHIN 3 DAYS ---				--- WITHIN 10 DAYS ---				--- WITHIN 30 DAYS ---			
	BASE CASE		HIGH CASE		BASE CASE		HIGH CASE		BASE CASE		HIGH CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0
Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 4	4	0.0	8	0.1	5	0.1	11	0.1	10	0.1	21	0.2
Sea Segment 5	1	0.0	2	0.0	4	0.0	8	0.1	15	0.2	30	0.3
Sea Segment 6	39	0.5	66	1.1	50	0.7	79	1.5	54	0.8	82	1.7
Sea Segment 7	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	2	0.0
Sea Segment 8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Seabird Concentration I	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Seabird Concentration II	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bering Strait Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Migration Corridor A	44	0.6	72	1.3	44	0.6	72	1.3	44	0.6	72	1.3
Whale Migration Corridor B	n	0.0	n	0.0	3	0.0	6	0.1	18	0.2	36	0.4
Whale Migration Corridor C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Area B	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Area C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Peard Bay Area	18	0.2	35	0.4	18	0.2	35	0.4	18	0.2	35	0.4
Barrow Subsistence Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Wainwright Subsistence Area	32	0.4	57	0.9	33	0.4	58	0.9	33	0.4	58	0.9
Pt. Lay Subsistence Area	n	0.0	n	0.0	1	0.0	1	0.0	7	0.1	14	0.2
Pt. Hope Subsistence Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Any Subsistence Area	32	0.4	57	0.9	33	0.4	58	0.9	33	0.4	58	0.9

Note: n = <0.5 percent

Table C-14. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting land/boundary over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, base and high cases, based on summer trajectories only

Land/Sea Segment	---WITHIN 3 DAYS ---				--- WITHIN 10 DAYS ---				--- WITHIN 30 DAYS ---			
	BASE CASE		HIGH CASE		BASE CASE		HIGH CASE		BASE CASE		HIGH CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
21	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0

Notes: n = <0.5 percent. Land segments having rows with all values <0.5 percent probability of one or more contacts within 3,10, and 30 days are not shown.

Table C-15. Combined Probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting land/boundary segments over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, base and high cases, based on winter trajectories only

Land/Sea Segment	--- WITHIN 3 DAYS ---				--- WITHIN 10 DAYS ---				--- ENTIRE WINTER ---			
	BASE CASE		HIGH CASE		BASE CASE		HIGH CASE		BASE CASE		HIGH CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
21	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	5	0.0
27	n	0.0	n	0.0	n	0.0	n	0.0	13	0.1	27	0.3
28	n	0.0	n	0.0	n	0.0	n	0.0	9	0.1	19	0.2
30	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	4	0.0
40	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
46	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
61	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	3	0.0

Notes: n = <0.5 percent. Land segments having rows with all values <0.5 percent probability of one or more contacts within 3 and 10 days, and entire winter are not shown.

Table C-16. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting environmental resources over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, base and high cases, based on winter trajectories only

Environmental Resource	--- WITHIN 3 DAYS ---				--- WITHIN 10 DAYS ---				--- ENTIRE WINTER ---			
	BASE CASE		HIGH CASE		BASE CASE		HIGH CASE		BASE CASE		HIGH CASE	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
Land	n	0.0	n	0.0	n	0.0	n	0.0	25	0.3	46	0.6
Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	6	0.1
Sea Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	5	0.1	12	0.1
Sea Segment 3	n	0.0	n	0.0	3	0.0	7	0.1	11	0.1	22	0.2
Sea Segment 4	5	0.1	11	0.1	17	0.2	33	0.4	31	0.4	56	0.8
Sea Segment 5	10	0.1	20	0.0	23	0.3	47	0.6	38	0.5	65	1.0
Sea Segment 6	44	0.6	72	0.5	53	0.7	81	1.6	54	0.8	82	1.7
Sea Segment 7	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Sea Segment 8	n	0.0	n	0.0	1	0.0	2	0.0	1	0.0	2	0.0
Sea Segment 9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Seabird Concentration I	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Seabird Concentration II	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Bering Strait Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Migration Corridor A	7	0.1	16	0.1	10	0.1	21	0.2	11	0.1	23	0.3
Whale Migration Corridor B	1	0.0	3	0.0	4	0.0	8	0.1	6	0.1	13	0.1
Whale Migration Corridor C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Area B	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Whale Area C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Peard Bay Area	18	0.2	35	0.2	18	0.2	35	0.4	18	0.2	35	0.4
Barrow Subsistence Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Wainwright Subsistence Area	33	0.4	59	0.4	34	0.4	59	0.9	34	0.4	59	0.9
Pt. Lay Subsistence Area	5	0.1	11	0.1	8	0.1	17	0.2	10	0.1	21	0.2
Pt. Hope Subsistence Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Any Subsistence Area	33	0.4	59	0.5	34	0.4	59	0.9	34	0.4	59	0.9

Notes: n = <0.5 percent.

Table C-17. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting environmental resources over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, Point Lay Deferral Alternative (Alternative IV), based on summer trajectories only

Environmental Resource	--- WITHIN 3 DAYS --- POINT LAY DEFERRAL ALTERNATIVE		--- WITHIN 10 DAYS --- POINT LAY DEFERRAL ALTERNATIVE		--- WITHIN 30 DAYS --- POINT LAY DEFERRAL ALTERNATIVE	
	Prob	Mean	Prob	Mean	Prob	Mean
Land	n	0.0	n	0.0	1	0.0
Sea Segment 1	n	0.0	n	0.0	n	0.0
Sea Segment 2	n	0.0	n	0.0	n	0.0
Sea Segment 3	n	0.0	n	0.1	n	0.0
Sea Segment 4	4	0.0	5	0.0	10	0.1
Sea Segment 5	1	0.0	4	0.0	15	0.2
Sea Segment 6	39	0.5	50	0.7	54	0.8
Sea Segment 7	n	0.0	n	0.0	1	0.0
Sea Segment 8	n	0.0	n	0.0	n	0.0
Sea Segment 9	n	0.0	n	0.0	n	0.0
Sea Segment 10	n	0.0	n	0.0	n	0.0
Seabird Concentration I	n	0.0	n	0.0	n	0.0
Seabird Concentration II	n	0.0	n	0.0	n	0.0
Bering Strait Area	n	0.0	n	0.0	n	0.0
Whale Migration Corridor A	44	0.6	44	0.6	44	0.6
Whale Migration Corridor B	n	0.0	3	0.0	18	0.2
Whale Migration Corridor C	n	0.0	n	0.0	n	0.0
Whale Area A	n	0.0	n	0.0	n	0.0
Whale Area B	n	0.0	n	0.0	n	0.0
Whale Area C	n	0.0	n	0.0	n	0.0
Peard Bay Area	18	0.2	18	0.2	18	0.2
Barrow Subsistence Area	n	0.0	n	0.0	n	0.0
Wainwright Subsistence Area	32	0.4	33	0.4	33	0.4
Pt. Lay Subsistence Area	n	0.0	1	0.0	7	0.1
Pt. Hope Subsistence Arean	n	0.0	n	0.0	n	0.0
Any Subsistence Area	32	0.4	33	0.4	33	0.4

Notes: n = <0.5 percent.

Table C-18. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting land/boundary over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, Point Lay Deferral Alternative (Alternative IV), based on summer trajectories only

Land/Sea Segment	---Within 3 days --- POINT LAY DEFERRAL ALTERNATIVE		--- Within 10 days --- POINT LAY DEFERRAL ALTERNATIVE		--- Within 30 days --- POINT LAY DEFERRAL ALTERNATIVE	
	Prob	Mean	Prob	Mean	Prob	Mean
21	n	0.0	1	0.0	1	0.0

Notes: n = <0.5 percent. Land segments having rows with all values <0.5 percent probability of one or more contacts within 3, 10, and 30 days are not shown.

Table C-19. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean occurring and contacting land/sea segments over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, Point Lay Deferral Alternative (Alternative IV), based on winter trajectories only

Land/Sea Segment	--- Within 3 days --- POINT LAY DEFERRAL ALTERNATIVE		--- Within 10 days --- POINT LAY DEFERRAL ALTERNATIVE		--- Entire Winter --- POINT LAY DEFERRAL ALTERNATIVE	
	Prob	Mean	Prob	Mean	Prob	Mean
21	n	0.0	n	0.0	2	0.0
27	n	0.0	n	0.0	13	0.3
28	n	0.0	n	0.0	9	0.1
30	n	0.0	n	0.0	2	0.0
61	n	0.0	n	0.0	1	0.0

Notes: n = <0.5 percent. Land segments having rows with all values <0.5 percent probability of one or more contacts within 3 and 10 days, and entire winter are not shown.

Table C-20. Combined probabilities (expressed as percent chance) of one or more spills ≥1,000 bbl, and the estimated number of spills (mean) occurring and contacting environmental resources over the assumed production life of the lease area, Chukchi Sea OCS Lease Sale 126, Point Lay Deferral Alternative (Alternative IV), based on winter trajectories only

Environmental Resource	--- Within 3 days --- POINT LAY DEFERRAL ALTERNATIVE		--- Within 10 days --- POINT LAY DEFERRAL ALTERNATIVE		--- Entire Winter --- POINT LAY DEFERRAL ALTERNATIVE	
	Prob	Mean	Prob	Mean	Prob	Mean
Land	n	0.0	n	0.0	25	0.3
Sea Segment 1	n	0.0	n	0.0	3	0.0
Sea Segment 2	n	0.0	n	0.0	5	0.1
Sea Segment 3	n	0.0	3	0.0	11	0.1
Sea Segment 4	5	0.1	17	0.2	31	0.4
Sea Segment 5	10	0.1	23	0.3	38	0.5
Sea Segment 6	44	0.6	53	0.7	54	0.8
Sea Segment 7	n	0.0	n	0.0	n	0.0
Sea Segment 8	n	0.0	1	0.0	1	0.0
Sea Segment 9	n	0.0	n	0.0	n	0.0
Sea Segment 10	n	0.0	n	0.0	n	0.0
Seabird Concentration I	n	0.0	n	0.0	n	0.0
Seabird Concentration II	n	0.0	n	0.0	n	0.0
Bering Strait Area	n	0.0	n	0.0	n	0.0
Whale Migration Corridor A	7	0.1	10	0.1	11	0.1
Whale Migration Corridor B	1	0.0	4	0.0	6	0.1
Whale Migration Corridor C	n	0.0	n	0.0	n	0.0
Whale Area A	n	0.0	n	0.0	n	0.0
Whale Area B	n	0.0	n	0.0	n	0.0
Whale Area C	n	0.0	n	0.0	n	0.0
Peard Bay Area	18	0.2	18	0.2	18	0.2
Barrow Subsistence Area	n	0.0	n	0.0	n	0.0
Wainwright Subsistence Area	33	0.4	34	0.4	34	0.4
Pt. Lay Subsistence Area	5	0.1	8	0.1	10	0.1
Pt. Hope Subsistence Area	n	0.0	n	0.0	n	0.0
Any Subsistence Area	33	0.4	34	0.4	34	0.4

Notes: n = <0.5 percent.

APPENDIX D

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION AND DOCUMENTATION

OCT 1 9 1989

Mr. Steve Pennoyer
Director, Alaska Region
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

Dear Mr. Pennoyer:

The Minerals Management Service has initiated the planning process for the leasing and exploration associated with the proposed Outer Continental Shelf Oil and Gas Lease Sale 126. This lease sale is proposed for July 1991 in the Chukchi Sea Planning Area (map enclosed).

In accordance with the Endangered Species Act section 7 regulations governing interagency cooperation, we are providing a notification of the listed and proposed species and critical habitat that will be included in our biological evaluation.

It is our understanding that there are no designated or proposed critical habitats for any listed species in Alaska. In our biological evaluation, we will review the following listed species that may be present in the proposed lease area for Sale 126:

Common Name	Scientific Name	Status
Gray whale	Eschrichtius robustus	Endangered
Bowhead whale	Balaena mysticetus	Endangered

Please review our list, and notify us of your concurrence or revisions and any new information concerning the species occurrence in relation to the proposed project area. To facilitate the review, we have provided a copy of this letter to your Anchorage field office. Upon receipt of your letter, we will begin the preparation of the biological evaluation to review the potential effects of the proposed action.

We look forward to working with you and your staff in protecting and conserving endangered and threatened species. If you have any questions concerning this proposed action, please contact Ken Holland at (907) 261-4684.

Sincerely,

(sgnd) Irven F. Palmer, Jr.

Acting Regional Director

Enclosure

cc: Anchorage Field Office, NMFS, NOAA

OCT 19 1989

Memorandum

To: Regional Director, U.S. Fish and Wildlife Service

From: Acting Regional Director, Alaska OCS Region, Minerals Management Service

Subject: Endangered Species - Proposed Oil and Gas Lease Sale 126 (Chukchi Sea)

The Minerals Management Service has initiated the planning process for the leasing and exploration associated with the proposed Outer Continental Shelf Oil and Gas Lease Sale 126. This lease sale is proposed for July 1991 in the Chukchi Sea Planning Area (map attached).

In accordance with the Endangered Species Act section 7 regulations governing interagency cooperation, we are providing a notification of the listed and proposed species and critical habitat that will be included in our biological evaluation.

It is our understanding that there are no designated or proposed critical habitats for any listed species in Alaska. Our biological evaluation will evaluate the effects of proposed Sale 126 on the threatened arctic peregrine falcon (Falco peregrinus tundrius) that may be present near the proposed lease area.

Please notify us of your concurrence with or revisions to our species list and any new information concerning the species' occurrence in relation to the proposed project area. To facilitate the review, we have provided a copy of this letter to your Anchorage field office. Upon receipt of your response, we will begin preparation of the biological evaluation that will review the potential effects of the proposed action.

We look forward to working with you and your staff in protecting and conserving endangered and threatened species. If you have any questions concerning this proposed action, please contact Ken Holland at (907) 261-4684.

(sgnd) Irven F. Palmer, Jr.

Attachment

cc: Anchorage Field Office, USFWS

UNITED STATES DEP 'TMENT OF COMMERCE
National Oceanic and ...mospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

November 27, 1989

Irven F. Palmer, Jr.
Acting Regional Director
Minerals Management Service
949 E. 36th Avenue, Room 110
Anchorage, AK 99508-4302

Dear Mr. Palmer:

Your letter of March 3, 1989, requested information on endangered species that may be present in the proposed Outer Continental Shelf Oil and Gas Lease Sale 126 in the Chukchi Sea. In your letter you identified two endangered species of whales that may be present in the lease area - the bowhead whale and the gray whale. You also state that there is no designated critical habitat for these species. This letter is to notify you that we concur with your evaluation. There are no additional endangered species to be included, and no critical habitat listed.

Sincerely,

Steve Pennoyer

Steve Pennoyer,
Director Alaska Region

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

IN REPLY REFER TO:
DOS/NAES

NOV 27 1989

Memorandum

To: Regional Director
Minerals Management Service
Anchorage, Alaska

From: Acting Regional Director
Region 7

Subject: Endangered Species - Proposed Oil and Gas Lease Sale 126 (Chukchi Sea)

This responds to your subject memorandum of October 19, 1989. We concur with your finding that one listed species is present in the proposed sale area, the threatened Arctic peregrine falcon (Falco peregrinus tundrius). There is no designated or proposed critical habitat in Alaska.

Thank you for your concern for endangered species. If you have questions or comments, please contact Ronald L. Garrett, Endangered Species Coordinator at (907) 786-3505.

John G. Rogers

RECEIVED
NOV 30 1989
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

P 7/20

United States Department of the Interior

TAKE PRIDE IN AMERICA

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

JUL 12 1990

RECEIVED
JUL 19 1990
REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Dr. William W. Fox, Jr.
Assistant Administrator for Fisheries
National Marine Fisheries Service
1335 East-West Highway
Silver Spring, Maryland 20910

Dear Dr. Fox:

The Minerals Management Service (MMS) is preparing a draft Environmental Impact Statement (EIS) on proposed oil and gas lease Sale 126 and associated exploration in the Chukchi Sea Planning Area offshore northern Alaska. This is the third sale proposed for this planning area and is tentatively scheduled for August 1991. The first sale (Sale 85) was dropped from the leasing schedule in July 1984. The second (Sale 109) was held in May 1988.

The enclosed biological evaluation describes the specifics of Sale 126, as well as potential effects of postlease activities on endangered species. (The information in the appendices is from the preliminary draft EIS and may be modified for the final EIS.) These details and effects are similar to those projected for Sale 109, which the National Marine Fisheries Service (NMFS) examined thoroughly before issuing its Endangered Species Act (ESA) section 7 biological opinion for that sale (September 1, 1987) and its revised opinion for the entire arctic region (November 23, 1988). Because these data still represent the best scientific and commercial information available, we believe the Sale 109 and revised arcticwide opinions apply equally well to proposed Sale 126. Because Sale 126 is a separate action and "may affect" listed species, we hereby request, under ESA section 7 (a)(2), formal consultation on the leasing and any exploration that may occur as a result of this sale. To facilitate a timely start of consultation, we are sending a copy of this letter and the enclosed evaluation to the NMFS field office in Anchorage.

We believe there is no need for lengthy formal consultation for Sale 126 as the Sale 109 data are still current. After reviewing the evaluation, NMFS may wish to affirm in writing the applicability of the Sale 109 and revised arcticwide opinions to Sale 126. Such an action would avoid unnecessary paperwork and time delays and is consistent with the statement in the arcticwide opinion that "Opinions on future lease sales should incorporate by reference this Opinion if it contains the best information available."

This approach will result in a speedy conclusion of consultation. It is similar to confirming an early consultation's preliminary biological opinion as a final opinion (as described in 50 CFR 402.11(f)). We hope that NMFS would issue the affirmation within the 45 days noted for confirming a preliminary opinion.

While we believe the affirmation approach has compelling merit, we recognize that NMFS may prefer to conduct a full-scale formal consultation for proposed Sale 126 that might require the entire 135-day period allowed by ESA section 7 for consultation and delivery of a biological opinion. If, during such a prolonged consultation, NMFS considers a potential finding of "jeopardy," new conservation recommendations, or new incidental take measures, terms, and conditions, we request that our respective staffs discuss these aspects as early as possible in the consultation. Such discussions would be essential to ensure that the alternatives, recommendations, and/or measures are within our authority to control or implement and that they would be feasible, appropriate, and effective. Through these discussions, if they should be needed, MMS believes it would be possible to minimize or prevent later problems or misunderstandings and greatly expedite timely and effective conclusion of the formal consultation.

It is understood that by extending existing biological opinions to proposed Sale 126, or by providing us with an entirely new opinion for this sale, NMFS will not be foreclosing on opportunities to reconsider that opinion as new sales are proposed for this area.

If you have any questions regarding this matter, please contact Mr. Jackson E. Lewis, Minerals Management Service, Mail Stop 4330, Parkway Atrium Building, 381 Elden Street, Herndon, Virginia 22070-4817 (commercial telephone: 703-787-1742; FTS 393-1742), or Mr. Ken Holland, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (commercial and FTS telephone: 907-261-4684).

Sincerely,

/s/ Ed Cassidy

Ed Cassidy
Deputy Director

Enclosure

cc: Mr. Ron Morris
National Marine Fisheries Service
701 C Street, Box 43
Anchorage, Alaska 99513

bcc: (all copies without enclosure)
Official File (BEO) (Sale 126; ENV 7-1d)
AD/OMM
Deputy Director
DAD/Leasing
DAD/Operations
RD, Alaska Region
RS/LE, Alaska Region
Ken Holland, Alaska Region
Chief, OLMD
Chief, ORED
OEAD RF
Chief, BEO
Lewis/Turner/Sun
BEE/BEM/BES
Offshore Chron (1)/(2)
BEO RF
LMS:MS644:OEAD:Lewis:lm:6/26/90:9-787-1728:Lewis:NMFS126.mem
Retyped:lm:7/6/90

United States Department of the Interior

TAKE PRIDE IN AMERICA

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

RECEIVED
JUL 19 1990
REGIONAL DIRECTOR, ALASKA O
Minerals Management Service
ANCHORAGE, ALASKA

JUL 12 1990

Memorandum

To: Director, U.S. Fish and Wildlife Service

From: Deputy Director, Minerals Management Service /s/ Ed Cassidy

Subject: Endangered Species Act Section 7 Formal Consultation for Leasing and Exploration Attendant Proposed Chukchi Sea Oil and Gas Lease Sale 126

The Minerals Management Service (MMS) is preparing a draft Environmental Impact Statement (EIS) on proposed oil and gas lease Sale 126 and associated exploration in the Chukchi Sea Planning Area offshore northern Alaska. This is the third sale proposed for this planning area and is tentatively scheduled for August 1991. The first sale (Sale 85) was dropped from the leasing schedule in July 1984. The second (Sale 109) was held in May 1988.

The attached biological evaluation describes the specifics of proposed Sale 126, as well as potential effects of postlease activities on endangered species. (The information in the appendices is from the preliminary draft EIS and may be modified for the final EIS.) These details and effects are similar to those projected for Sale 109, which the U.S. Fish and Wildlife Service (FWS) examined thoroughly before issuing its Endangered Species Act (ESA) section 7 biological opinion for that sale (June 24, 1986). Because these data still represent the best scientific and commercial information available, we believe the Sale 109 opinions apply equally well to proposed Sale 126. Because Sale 126 is a separate action and "may affect" listed species, we hereby request, under ESA section 7 (a)(2), formal consultation on the leasing and any exploration that may occur as a result of this sale.

To facilitate the earliest possible start of this consultation, we are sending a copy of this memorandum and the attached evaluation to the FWS Regional Director in Anchorage. In this way, we expect the consultation to officially start on the date he receives his copy of this request.

We believe there is no need for lengthy formal consultation for Sale 126 as the Sale 109 data are still current. After reviewing the evaluation, FWS may wish to affirm in writing the applicability of the Sale 109 to Sale 126. Such an action is consistent with the conclusion in the Sale 109 opinion that FWS opinions for earlier Chukchi Sea Sales remain valid. It would also avoid unnecessary paperwork and time delays.

This approach will result in speedy conclusion of consultation. It is similar to confirming an early consultation's preliminary biological opinion as a final opinion (as described in 50 CFR 402.11(f)). We hope that FWS would issue the affirmation within the 45 days noted for confirming a preliminary opinion.

While we believe the affirmation approach has compelling merit, we recognize that FWS may prefer to conduct a full-scale formal consultation for proposed Sale 126 that might require the entire 135-day period allowed by ESA section 7 for consultation and delivery of a biological opinion. If, during such a prolonged consultation, FWS considers a potential finding of "jeopardy," new conservation recommendations, or new incidental take measures, terms, and conditions, we request that our respective staffs discuss these aspects as early as possible in the consultation. Such discussions would be essential to ensure that the alternatives, recommendations, and/or measures are within our authority to control or implement and that they would be feasible, appropriate, and effective. Through these discussions, if they should be needed, MMS believes it would be possible to minimize or prevent later problems or misunderstandings and greatly expedite timely and effective conclusion of the formal consultation.

It is understood that by extending existing biological opinions to proposed Sale 126, or by providing us with an entirely new opinion for this sale, FWS will not be foreclosing on opportunities to reconsider that opinion as new sales are proposed for this area.

If you have any questions regarding this matter, please contact Mr. Jackson E. Lewis, Minerals Management Service, Mail Stop 4330, Parkway Atrium Building, 381 Elden Street, Herndon, Virginia 22070-4817 (commercial telephone: 703-787-1742; FTS 393-1742), or Mr. Ken Holland, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (commercial and FTS telephone: 907-261-4684)

Attachment

cc: Regional Director
U.S. Fish and Wildlife Service
1011 East Tudor Road
Anchorage, Alaska 99503

bcc: (all copies without attachment)
Official File (BEO) (Sale 126; ENV 7-1d)
AD/OMM
Deputy Director
DAD/Leasing
DAD/Operations
RD, Alaska Region
RS/LE, Alaska Region
Ken Holland, Alaska Region
Chief, OLMD
Chief, ORED
OEAD RF
Chief, BEO
Lewis/Turner/Sun
BEE/BEM/BES
Offshore Chron (1)/(2)
BEO RF
LMS:MS644:OEAD:Lewis:lm:6/25/90:9-787-1728:Lewis:FWS126.mem

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1335 East-West Highway
Silver Spring, MD 20910
THE DIRECTOR

AUG 28 1990

Mr. Ed Cassidy
Deputy Director
Minerals Management Service
Department of the Interior
Washington, D.C. 20240

Dear Mr. Cassidy:

Thank you for the opportunity to comment on the biological evaluation for threatened and endangered species prepared by Minerals Management Service (MMS) relative to proposed Outer Continental Shelf Lease Sale 126.

After reviewing the evaluation, we believe it is not necessary to reinitiate consultation under Section 7 of the Endangered Species Act for Lease Sale 126 because the Arctic Region Biological Opinion issued to MMS in November 1988 continues to reflect the most current scientific knowledge regarding potential effects on marine mammals. The Arctic Opinion concludes that leasing and exploration activities are not likely to jeopardize the continued existence of any endangered or threatened species. However, we believe that development and production activities within the spring lead system of the bowhead whale would be likely to jeopardize the population of that species, and reinitiation of consultation will be necessary regarding these activities.

Also, the Incidental Take Statement recently issued to MMS for the Arctic Region Biological Opinion requires compliance with 50 CFR Part 228 - Subpart D - Taking of Marine Mammals Incidental to Oil and Gas Exploration in Alaska. These regulations prohibit the take of any marine mammal in the spring lead system used by bowhead whales in the Chukchi Sea and Beaufort Sea. The regulations apply to any exploration activities associated with Lease Sale 126.

If you have any questions, please contact Dr. Nancy Foster, Director, Office of Protected Resources, at (301) 427-2322.

Sincerely,

Michael F. Tillman

for William W. Fox, Jr.

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

United States Department of the Interior

TAKE PRIDE IN AMERICA

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

Dr. William W. Fox, Jr.
Assistant Administrator for Fisheries
National Marine Fisheries Service
1335 East-West Highway
Silver Spring, Maryland 20910

JUL 26 1990

Dear Dr. Fox:

On April 5, 1990, the National Marine Fisheries Service (NMFS) issued an emergency interim rule listing the Steller (northern) sea lion as threatened under the Endangered Species Act (ESA). As required when a species is newly listed, the Minerals Management Service (MMS) has reviewed its proposed oil and gas and other lease sales in Alaska to determine whether any sale and/or associated exploration might affect sea lions.

Specifically, MMS has reviewed its proposed oil and gas lease Sales 107 (Navarin Basin), 124 (Beaufort Sea), and 126 (Chukchi Sea), as well as the proposed Norton Sound Mining Program Lease Sale. The areas proposed for oil and gas leasing in the Beaufort and Chukchi Seas are far from Steller sea lion habitat. We have therefore determined that no "may affect" situation exists for any exploration or subsequent activities that might result from Sales 124 and 126. Neither is it likely that activities associated with proposed mining in northern Norton Sound would affect the one or two individuals that reportedly may use the area from time to time (Frost, Lowry, and Burns (1982)). Accordingly, MMS has determined that reinitiation of ESA section 7 formal consultation for the sales proposed for the Beaufort and Chukchi Seas and Norton Sound is not justified or necessary.

Our review of proposed oil and gas lease Sale 107 has, however, caused us to recognize that exploration and subsequent activities (particularly aircraft and vessel support traffic to, from, or near St. Matthew, Hall, St. Lawrence, and the Pribilof Islands) might affect locally present sea lions. In light of this "may affect" situation, and because NMFS's existing ESA section 7 biological opinion for Sale 107 did not address Steller sea lions, MMS hereby requests, under ESA section 7(a)(2), reinitiation of formal consultation for Sale 107 and amendment or revision (as appropriate) of the existing opinion for the sale. (The existing opinion was issued on June 1, 1989.) To facilitate start of consultation, we are sending a copy of this request directly to the NMFS Anchorage Field Office.

The draft Environmental Impact Statement (EIS) for proposed Navarin Sale 107, issued in May 1990, contains information on the distribution of sea lions and on the types and levels of effect that might result from Sale 107. (We enclose a copy for your information and understand that NMFS Anchorage Office staff are reviewing a separate copy.) You will note that the draft EIS lacks the detailed population data used by NMFS in its rule listing Steller sea lions as threatened. Presumably, all this information will be considered and summarized in the amended or revised opinion for Sale 107. The MMS plans to describe the status and specifics about Steller sea lions in the endangered species section of the final EIS, and to insert the amended or revised opinion into the appropriate final EIS appendix. To be appropriately factored into the final EIS, we request receipt of the amended or revised opinion at MMS headquarters before October 1, 1990.

If during this formal consultation NMFS considers for Steller sea lions a potential finding of "jeopardy," new conservation recommendations, or incidental take measures, terms, and conditions, we request that our respective staffs discuss these aspects as early as possible during the consultation. Such discussions would be essential to ensure that the alternatives, recommendations, and/or measures are within our authority to control or implement and that they would be feasible, appropriate, and effective. Through these discussions, if they should be needed, MMS believes it would be possible to minimize or prevent later problems or misunderstandings and greatly expedite timely and effective conclusion of the formal consultation.

It is understood that by amending or revising the biological opinion for Sale 107, NMFS will not be foreclosing on opportunities to reconsider that opinion as future lease sales are proposed for this area or as significant new information is developed on impacts or changes in the proposed action.

If you have any questions regarding this matter, please contact Mr. Jackson E. Lewis, Minerals Management Service, Mail Stop 4330, Parkway Atrium Building, 381 Elden Street, Herndon, Virginia 22070-4817 (commercial telephone: 703-787-1742; FTS: 393-1742), or Mr. Dan Benfield, Minerals Management Service, Alaska Region, 949 East 36th Avenue, Anchorage, Alaska 99508-4302 (commercial telephone: 907-261-4672; FTS: 907-869-4672).

Sincerely,

/s/ Ed Cassidy

Ed Cassidy
Deputy Director

Enclosure

cc: (without enclosure)
Mr. Ron Morris
National Marine Fisheries Service
701--C Street, Box 43
Anchorage, Alaska 99513

bcc: (all copies without enclosure)
Official File (BEO) (Sale 107; ENV 7-1d)
AD/OMM
Deputy Director
DAD/Leasing
DAD/Operations
RD/Alaska Region
RS/LE/Alaska Region
Dan Benfield/Alaska Region
Chief, OLMD
Chief, ORED
OEAD RF
Chief, BEO
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BEE/BEM/BES
Offshore Chron (1)/(2)
BEO RF
LMS:MS4330:OEAD:Lewis:lm:7/16/90:9-787-1742:Lewis:NMFS107S

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1335 East-West Highway
Silver Spring, MD 20910
OFFICE OF THE DIRECTOR

OCT 25 1990

Mr. Ed Cassidy
Deputy Director
Minerals Management Service
U.S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Cassidy:

Thank you for your letter regarding the reinitiation of Endangered Species Act (ESA) section 7 consultations as a result of the emergency listing of the Steller sea lion.

We concur with your determination that proposed oil and gas lease sales 124 (Beaufort Sea) and 126 (Chukchi Sea) and the proposed Norton Sound mining program are not likely to affect the continued existence of the Steller sea lion.

We also concur with your determination that lease sale 107 (Navarin Basin) may affect the Steller sea lion and reinitiated formal consultation for the lease sale. The enclosed Biological Opinion concludes that the proposed activities are not likely to jeopardize the continued existence of the Steller sea lion. However, we believe these activities will impact Steller sea lions in the lease sale area. We, therefore, are providing Conservation Recommendations to minimize the impacts on sea lions. We also recommend that the appropriate parties apply for incidental take authorization under Section 101(a)(5) of the Marine Mammal Protection Act so the incidental take of Steller sea lions can be considered.

This concludes consultation responsibilities for these actions. However, consultation must, once again, be reinitiated if new information reveals effects of these activities that may affect listed species or their habitat in a manner or to an extent not previously considered, the identified activities are modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinions, or if another species is listed or critical habitat designated that may be affected by the proposed activities.

If there are any questions please contact Steve Zimmerman in Alaska on 907-586-7939 or Robert Ziobro on 427-2323.

Sincerely,

Michael F. Tillman

(for) William W. Fox, Jr.

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

DOS/NAES

OCT 31 1990

Memorandum

To: Regional Director
Minerals Management Service, Alaska

From: Deputy Regional Director
Region 7

Subject: Biological Opinion for Lease Sale 126

This responds to your July 12, 1990, request for formal consultation pursuant to Section 7 of the Endangered Species Act (Act) of 1973, as amended, for Chukchi Sea Oil and Gas Lease Sale 126. Your request was mailed to the Director, Fish and Wildlife Service (Service), who in turn mailed the request to Region 7 in Alaska. The request was received in Region 7 on August 27, 1990, and the consultation period began on that date. The only species considered in this opinion is the threatened Arctic peregrine falcon (*Falco peregrinus tundrius*).

Biological opinions were issued for the Beaufort Sea Region on August 22, 1980, and the Arctic Region on November 9, 1981. Additional opinions were issued for the Navarin Basin (Lease Sale 83) and the Diapir Field (Lease Sale 87) on July 15, 1983, the Beaufort Sea Planning Area (Lease Sale 97) on July 30, 1985, the Chukchi Sea Lease Sale 109 on June 24, 1986, and the Beaufort Sea Lease Sale 124 on May 17, 1990.

This opinion addresses only Lease Sale 126 and those activities associated with leasing and exploration. Since it is impossible to predict with certainty the occurrence or location of commercially significant deposits of oil and gas, this consultation will proceed incrementally. Leasing and exploration are considered the first incremental step in the action; development and production are considered the second incremental step. This biological opinion addresses only leasing and exploration. Any development or production proposals will require separate consultation.

Project Description

Lease Sale 126 is located off the northwestern coast of Alaska from the vicinity of Icy Cape westward to Cape Lisburne. The proposed lease sale encompasses about 23.68 million acres extending from 3.5 to 200 nautical miles offshore in water depths that range from approximately 98 to 164 feet.

The most likely exploration scenarios and facility locations are presented in the "Biological Evaluation for Threatened and Endangered Species with Respect to the Proposed Chukchi Sea Oil and Gas Lease Sale 126" (Minerals Management

Service 1990). A total of 7055 seismic-line kilometers of shallow surveys are expected. Thirty-nine exploration and delineation wells are expected to be drilled during the period 1992 through 1998. Drilled depths of exploration and delineation wells should average 10,000 feet. The most likely choice for drilling vessels would be drillships with icebreaker support. On-shore support would be from existing facilities, such as Barrow and Wainwright. Approximately 2,340 helicopter flights are expected (150 flights per month). Vessel support would be 312 supply trips during open-water season, and two standby vessels for each drilling unit.

Effects on Arctic Peregrine Falcons

The Arctic peregrine falcon is geographically distributed throughout the tundra regions of North America. In Alaska, this includes the area north of the Brooks Range and along the west coast south to and including Norton Sound. The Service estimates that 200 pairs historically occupied Alaska. Beginning in the late 1940s, the use of the pesticide Dichloro diphenyl trichloroethane and its metabolites (hereafter referred to as organochlorine pesticides) greatly affected Arctic peregrine falcons, causing birds to lay thin-shelled eggs which often failed to hatch and consequently lowered reproduction. In Alaska, the population declined to approximately 30 percent of historical levels by 1972, at which time the United States restricted the use of organochlorine pesticides. The population remained stable for the next six years, and in 1978 the population began to increase. In 1984 the Service, prompted by markedly improved numerical levels, changed the status of the Arctic peregrine falcon from endangered to threatened.

Based on 1990 surveys, the Service estimates the population of Arctic peregrine falcons in Alaska to be between 150 and 175 pairs and increasing. Arctic peregrine falcons are present in Alaska from about late April to mid-September. Egg-laying in northern Alaska begins in early May, and young fledge from late July to mid-August. A few nest sites are known to occur along the northwest coast in the area between Cape Krusenstern and Cape Lisburne. No nest sites are known from the coastal bluffs adjacent to the proposed sale area or along the northern coast of Alaska, where all known nest sites occur about 25 miles inland. The most frequent sightings of Arctic peregrine falcons in the vicinity of the proposed sale area occur along the northwest coast and in the uplands south of the proposed sale area. Additional sightings have been made along the northern coast of Alaska east of the Colville River where adults and immature birds stage and hunt prior to and during migration.

Oil spills, noise and disturbance associated with exploration activities are sources of potential impacts to Arctic peregrine falcons. If oil is spilled near migration routes or hunting areas, peregrine falcons could be adversely affected by eating contaminated prey or through reduction of prey availability. The Minerals Management Service concluded that there is less than 0.5 percent probability that one or more oil spills of 1,000 barrels or greater would contact land within 3 or 10 days, or seabird concentrations within 3, 10, or 30 days (based on summer trajectories). The Oil Spill Risk Analysis shows a probability of 1 percent for a spill of 1,000 barrels or greater contacting land within 30 days of the spill. When the probability of oil spills is considered in conjunction with the relatively small amount of time that peregrine falcons spend along the coast, it is not likely that peregrine falcons will be significantly affected by oil spills. If oil spills affected peregrine prey populations, then localized reductions in food availability could occur.

Nesting peregrine falcons could be disturbed by aircraft overflights related to the proposed sale. The extent of such disturbance would depend on locations of support facilities. Barrow and Wainwright are the most likely support facilities and are located on the coast. Aircraft based in Barrow or Wainwright would not typically fly over nesting areas, and thus, significant disturbance of nesting peregrine falcons during the exploration phase is unlikely.

Cumulative Effects

Cumulative effects are those effects of future State or private activities on endangered and threatened species or critical habitat that are reasonably certain to occur within the action area of the Federal action subject to consultation. Future Federal actions will be subject to the consultation requirements established in Section 7 and, therefore, are not considered cumulative in the proposed action. State and private activities reasonably certain to occur include oil and gas near-shore and on-shore leasing, exploration, development and production; gravel mining, support facilities and road construction to support these activities; pipelines and related oil and gas transport facilities, including feeder lines, Trans-Alaska Pipeline operation and maintenance, and oil tanker traffic from the Valdez terminal to points in the lower 48 states; and all associated activities in support of these projects.

Biological Opinion

It is my biological opinion that leasing and exploration activities associated with Lease Sale 126 are not likely to jeopardize the continued existence of the Arctic peregrine falcon. Although this opinion addresses only leasing and exploration, the Service believes there is a reasonable likelihood that the entire action (leasing, exploration, development and production) will not jeopardize the continue existence of the Arctic peregrine falcon. As described in the Biological Evaluation (Minerals Management Service 1990), development and production facilities would be tied closely to existing facilities. New pipelines, if required, would likely be routed along the coast away from nesting areas. Consultation will be required prior to development and production phases.

Incidental Take

Section 9 of the Act, as amended, prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species without a special exemption. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered taking within the bounds of the Act provided that such taking is in compliance with the incidental take statement.

The Service does not anticipate that the proposed Lease Sale 126 (leasing, exploration and associated activities) will result in the incidental take of

Arctic peregrine falcons. No incidental take is anticipated and accordingly no incidental take is authorized. Should any incidental take occur, Minerals Management Service must reinitiate formal consultation with the Service.

This concludes formal consultation on leasing and exploration activities associated with Lease Sale 126. Reinitiation of formal consultation is required if any incidental take occurs; if new information reveals effects of the action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion; if the action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion; or if a new species is listed or critical habitat designated that may be affected by the action.

Thank you for your concern for endangered species.

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

Agency: Minerals Management Service

Activities: Oil and Gas Leasing and Exploration - Arctic Region (Beaufort Sea, Chukchi Sea, and Hope Basin)

Consultation Conducted By: National Marine Fisheries Service (NOAA Fisheries)

Date Issued:

Background:

The Minerals Management Service (MMS) of the Department of the Interior has, to date, offered or proposed five Federal oil and gas lease sales in the Beaufort Sea, three in the Chukchi Sea, and two in the Hope Basin. Chukchi Sea Lease Sale 85 and Hope Basin Lease Sale 86 were cancelled. Since 1980, NOAA Fisheries has conducted Section 7 consultations for Outer Continental Shelf (OCS) lease sales in the Arctic Region and has issued the following Biological Opinions:

Arctic Region
April 1, 1982 - Arctic Region in general

Beaufort Sea
June 24, 1980 - Joint Federal/State Sale BF,
April 1, 1982 - Revised Opinion for Sale BF,
May 19, 1982 - OCS Sale No. 71 (Diapir Field),
December 19, 1983 - OCS Sale No. 87 (Diapir Field),
May 20, 1987 - OCS Sale No. 97 (Beaufort Sea),

Chukchi Sea
September 1, 1987 - OCS Sale 109

The original BF Opinion (1980) found there was insufficient information to determine whether bowhead whales were jeopardized by the lease sale. In 1982 these uncertainties were the basis to find that bowhead whales were likely to be jeopardized by activities associated with the lease sale. Activities associated with Lease Sales 71, 87, and the Arctic Region in general were also found to likely jeopardize bowhead whale populations. Jeopardy findings were based mainly on concerns about the effects of oil spills and of oil exploration-associated noise on the bowhead population. Insufficient data existed to adequately examine these issues, and a conservative approach was taken to protect the population. Subsequent research has been and is being conducted to determine better estimates of population abundance and distribution, investigate the probability of the occurrence and effects of an oil spill when whales are present, and investigate the effects of exploration-associated noise on the whales. After considering results from the most recent research available at that time, NOAA Fisheries issued opinions for Lease Sales 97 and 109 that bowhead whale populations were not likely to be jeopardized by oil exploration activities. Both opinions, however, expressed concerns about oil spill and noise effects and recommended placement of restrictions on drilling associated activities, especially when whales were present in the spring lead systems.

MMS believes the "jeopardy" conclusions in the earlier opinions, based on information then available, are no longer warranted. MMS cites the substantive information investigating oil spill risks and effects to bowhead and other whales of noise from OCS oil- and gas-related operations. On April 9, 1987, MMS requested NOAA Fisheries to re-initiate consultation and amend these opinions where appropriate.

This Opinion is for leasing and exploration activities in the entire Arctic Region (Lease Sales BF, 71, 87, 97, and 109), and replaces the earlier Opinions for Arctic Region sales. Opinions on future lease sales should incorporate by reference this Opinion if it contains the best information currently available.

Proposed Activities:

This is an incremental step consultation covering leasing and exploration activities of OCS lease sales in the Arctic Region (Lease Sales BF, 71, 87, 97, and 109). The activities considered are oil and gas lease sales, and the subsequent exploratory drilling, testing, and surveying. Separate consultations for development and production activities will be conducted if oil is discovered and development plans are proposed. The details for past or potential exploration, development, and production scenarios are contained in each respective Final Environmental Impact Statement for each proposed sale. Details for future lease sales will be provided by MMS.

The expected resource potential for the Arctic Region is 1.74 billion barrels of oil with a marginal probability of discovery of 0.81 (Powers 1987). These estimates apply to all undiscovered economically recoverable resources in the Beaufort Sea, Chukchi Sea, and Hope Basin Planning Areas. The activities associated with lease sales in the Region are foreseen to be similar to the activities associated with past and proposed lease sales, with exploration beginning on newly leased tracts the first year following the sale and continuing for six years. A total of 23 successful exploratory wells are projected for the Beaufort Sea, Chukchi Sea and Hope Basin Planning Areas. Of these, 9 likely will be drilled from artificial islands, 11 from mobile gravity structures and 3 from ice-strengthened drillships.

Drilling from ice-strengthened drill ships or other floating platforms will be conducted in water depths over 25 m, working in the late summer and fall when there is minimal sea ice. For the purposes of this opinion late summer and fall are considered July through mid-November in the southern Chukchi Sea and in the Hope Basin Planning area, August through October in the Beaufort and northern Chukchi Seas. Icebreaker assistance would be necessary to extend the drilling season into freeze-up. In water depths of less than 25 m, gravel and ice islands, single steel drilling caissons, or concrete structures may be used for exploration (MMS 1985). Caisson retained islands may be used in water depths to 30 m. Conical drilling units, or other round drillships or ice-strengthened floating platforms, may be used for exploration in water depths over 30 m. Monocone-type structures (mobile, bottom-founded structures) have been designed but not yet constructed for the 30 to 50 m water depths. Sub-sea well completions are unlikely.

Associated activities include ice-breakers in support of drillships, helicopter flights, supply boat trips, and dredging at some well locations prior to installation of the well-head. In the Chukchi Sea, drillship operations may be supported from barges towed into the area from the west coast. The most practical method of support may be to load all equipment and supplies aboard a large ship and keep it near the drilling site (MMS 1985).

Shallow-hazards seismic surveys are expected to occur on leases in the Beaufort Sea, Chukchi Sea, and Hope Basin Planning Areas. The total shallow-hazards seismic activity is estimated to cover 80,000 line kilometers. Low resolution, deep seismic surveys (air guns) are primarily a pre-lease activity and few, if any, are projected to occur as post-lease activities.

<u>Listed Species and Critical Habitats</u>: There are six species of endangered whales that inhabit Arctic Region waters of Alaska. These are:

Bowhead Whale	<u>*Balaena mysticetus*</u>
Right Whale	<u>*Eubalaena glacialis*</u>
Fin Whale	<u>*Balaenoptera physalus*</u>
Sei Whale	<u>*B. borealis*</u>
Humpback Whale	<u>*Megaptera novaeangliae*</u>
Gray Whale	<u>*Eschrichtius robustus*</u>

No critical habitat has been designated for any endangered whale under Section 4 of the Endangered Species Act (ESA).

The right and sei whales are rare in Arctic waters. They are represented by isolated records in the Chukchi Sea, probably of stray individuals well outside the normal ranges of their populations. The humpback and fin whales are occasional inhabitants of the Chukchi Sea, usually in low numbers. Both are at the northern edge of their summer range when in the Chukchi Sea. The few migrants that reach Arctic waters in the summer are found primarily on the Siberian side of the southern Chukchi Sea and have been only irregularly sighted in the Alaska sector. Only the bowhead and gray whales commonly occur in the Arctic Region with gray whales only occurring infrequently in the Beaufort Sea.

<u>Gray Whale</u>: The northern Bering and Chukchi Seas are the main summer feeding grounds for the gray whale population. Gray whales are regular summer inhabitants of the Chukchi Sea from June through October, although the majority of the population probably summers south of the Bering Strait. The Bering Strait is an important migratory corridor for whales moving north between late May and August and returning to the Bering Sea from September to November on their return to southern waters. From July through mid-October, some gray whales are found regularly as far north as Point Barrow, and a few occasionally travel as far east as the Canadian Beaufort Sea.

Present knowledge of the distribution and abundance of the gray whale is incomplete. Up to one-fourth of the total gray whale population of an estimated 21,113 (IWC In press) may enter the northern Chukchi Sea to feed during the open water season (July-October).

Gray whales have been observed feeding in the Alaskan Chukchi Sea well into October (Ljungblad et al. 1983).. However, it is not known if this is a summer resident feeding population of gray whales. Many gray whales have been observed feeding in coastal waters of northwest Alaska during summer and fall aerial surveys (Ljungblad et al. 1985a, 1987). Most recent sightings of gray whales feeding in the Chukchi Sea are in nearshore waters averaging 20.5 m in depth and within 14.5 km of shore (Moore et al. 1986). They normally avoid heavy ice conditions, remain south of the pack ice edge, and leave northern areas before freeze-up, an exception being the Fall of 1988 when 3 gray whales were trapped by ice off Barrow, Alaska. Other reports of whales feeding farther offshore are known, and feeding appears to be widespread.

<u>Bowhead Whales</u>: The bowhead whale is the northernmost ranging of the great whales. The size of the Western Arctic population of this whale has recently been estimated to be 7,800 animals

(95% confidence level of 5700-10,600) (IWC In press). These whales migrate northward in the spring from their wintering areas in the Bering Sea. They pass through the Bering Strait and eastern Chukchi Sea from late March to mid-June through newly opened leads and polynyas in the shear zone between the shorefast ice and offshore pack ice. Recent acoustic survey data indicate that bowhead whales also swim through the area beneath the ice within several kilometers of the leads. The path followed through the leads along the edge of the shorefast ice varies in distance from shore with water depth and the topography of the coast. At coastal promontories such as Pt. Hope, Cape Lisburne, Icy Cape, and Pt. Barrow the leads are within a few kilometers of the coast. At indentations, the shorefast ice zone is wider and the leads farther from shore. The spring migration of bowhead whales past Cape Lisburne seems to follow two or more corridors, depending on the number of leads, 2-10 km offshore (Braham 1984). This migration essentially spans the period mid-April to early June, with a few whales migrating before and after depending on annual variability in ice conditions.

In the Beaufort Sea, the fast-ice zone is broader and the leads are progressively farther offshore as they extend eastward. The lead system at Pt. Barrow is especially narrow and close to shore, and all whales are believed to funnel through the near-shore leads or under the ice adjacent to the leads. The width of the lead system varies with ice movements and is sometimes less than one km. East of Pt. Barrow, the spring lead system begins to branch offshore. East of 151° W (approximately the longitude of the Colville River), the leads dissipate into numerous branches that vary in location and extent from year to year. Here, the migration corridor widens as multiple leads are used by the whales in their movements to the Canadian Arctic (Ljungblad et al. 1982). The spring migration appears to be contained between 71°20′ N and 71°45′ N to at least as far east as the longitude of Barter Island. Past Barter Island, the path of the eastward migration is less predictable, and complex leads branch north and east towards Banks Island.

In spring, bowhead whales use the Alaskan Beaufort Sea primarily as a migration path. Activities such as calving, socialization, and some opportunistic feeding also occur, but generally the whale movements are purposeful through the area (Braham et al. 1980, Ljungblad et al. 1982, 1985a, 1987). For example, three whales taken by Barrow natives in the spring of 1985 had stomachs full of zooplankton (George and Tarpley 1986), as did 4 of 7 harvested in 1986 (George et al. 1987), indicating that at least in some years feeding does occur along the migration path.

Bowhead whales appear to be scarce in the Alaskan Beaufort Sea during July when the offshore water is usually still heavily ice-bound. Bowhead whales return to the eastern Alaskan Beaufort Sea as early as the beginning of August. Aerial surveys beginning in

August have been conducted in the Beaufort Sea since 1982. During 1982 and 1983, bowhead whales were found in the offshore area east of Barter Island as early as August 2 (Ljungblad et al. 1985a,b). Distributional data for an offshore component does not exist, however, such an offshore component could partially account for the small number of nearshore sightings compared to the estimated size of the population. In addition, they apparently do not commonly occur inside the Beaufort Sea barrier islands. From 1974 to 1988, only one confirmed sighting of a bowhead whale has been made inside the Islands.

In the fall, both feeding and migration activities occur in the Alaskan Beaufort Sea. Certain areas appear to be regularly used for feeding and resting. The best documented feeding area is east of Barter Island including the waters offshore of Demarcation Bay, where bowhead whales repeatedly were observed feeding and resting in the fall (Ljungblad et al. 1982, 1983; McLaren and Richardson 1985, Richardson et al. 1986). Bowhead whales have also been observed feeding north of Flaxman Island (Ljungblad et al. 1982), in outer Harrison Bay north and east of the Colville River plume (Ljungblad et al. 1983), and in the waters offshore of Smith Bay and east of Barrow (Braham et al. 1983, 1984, Ljungblad et al. 1985a).

A two year study (Richardson, 1987) on the importance of the Eastern Alaskan Beaufort Sea to feeding bowhead whales indicates that, for the population as a whole, food resources consumed in the Eastern Alaskan Beaufort Sea do not contribute significantly to the annual energy needs of the Western Arctic bowhead stock. However, it was also noted that in some years those animals that feed in the study area longer than others may acquire a significant fraction of their annual energy needs in the study area.

Bowhead whales tend to congregate at locations with significantly higher concentrations of zooplankton (primarily copepods, mysids, and euphausiids) than are present in surrounding waters (Richardson et al. 1985a). Such feeding in deep water areas has been inferred in the Canadian Beaufort on a regular basis (McLaren and Richardson 1985). Feeding in late summer and autumn may be especially important to bowhead whales as this may be the last major feeding period for several months and the energy content of the zooplankton prey is highest at this time (Lowry and Frost 1984, McLaren and Richardson 1985). In addition, bowhead whales appear to feed while wintering in the Bering Sea (Schell, Saupe and Haubenstock 1987).

Depending on ice conditions and proximity to freeze-up, the bowhead whales appear to alternate feeding and westward migration activities, probably stopping to feed in areas containing suitable prey. In 1985, there was evidence of feeding while whales were traveling slowly westward and at times when they remained in specific areas (Thomson 1986, 1987).

Assessment of Impacts:

NOAA Fisheries believes that oil spills and noise associated with exploration activities in the Alaska OCS Arctic Region have the potential to adversely affect endangered whales. Because of their relatively low population numbers, their habit of frequenting confined coastal waters, and their apparently low reproductive rate, bowhead whales may be particularly vulnerable to impacts from offshore oil and gas activities throughout their range.

Since the issuance of the Arctic Region Biological Opinion in 1982, several studies have been conducted on the possible effects of OCS activities on bowhead and gray whales. Studies on the effects of oil on marine mammals have continued (Geraci and St. Aubin 1986), however, none has been conducted on living baleen whales but only on the baleen from dead specimens. Noise disturbance of bowhead whales related to industrial activities have been studied during a 5-year program in the Canadian Beaufort Sea (Richardson and Green 1983, Richardson et al. 1985a,b, 1986, 1987). Some studies have investigated noise disturbance of bowhead whales in Alaskan waters (LGL et al. 1987, Miles et al. 1987).

Oil Spill Probabilities: Oil spills from OCS drilling are a major concern. Oil spilled in the spring lead systems might be critical to bowhead whales contacting the oil while migrating through the area. Oil spills in the fall might affect bowhead whales in feeding areas or along migration paths either through open water or among multi-year or newly forming sea ice.

Oil spill risks from gravel islands or other bottom-founded structures are perhaps generally less than from drillships. Operations from these structures are generally spread out over a period that does not have to coincide with the bowhead migration because their operation is not constrained by ice conditions. Because bottom-founded structures are used in the shallower waters, the probability of oil from a blowout contacting bowhead whales is partly dependent on whether or not the structure is located in the spring migration path. Although much of the oil may be contained on the structure, any spilled oil that entered the water may be difficult to contain and clean up.

An oil spill or blowout associated with a drillship, on the other hand, is likely to enter the water. Also, drillships, which are more appropriate for use in deeper water, are more likely to drill in or near the migration path. Drillships operating in the fall may also have to suspend operations temporarily and move off the well because of pack-ice encroachment. The risk of well-

control problems may increase because of suspension of operations and subsequent reentry into the well, however, MMS (J. Lewis, MMS, pers. comm.) believes that the increased risk is minimal. Easley (1987) reported that although circulation of heavy mud was the most common method of well control for blowouts of wells drilled from stationary platforms, this method may not work for drillship blowouts. Due to safety requirements, drillships may have to move off location if a blowout occurs. Therefore, it cannot circulate mud for well control but must rely on other remedial actions. In addition if a relief well is required to halt a blowout, it may not be possible to complete it during the normal drilling season. However, MMS believes that the drilling season can be extended into early winter if necessary through the extensive use of ice-management programs.

MMS (Powers 1987) estimates a mean of four spills of 1,000 barrels or greater in size in the Arctic Region over the projected life of all fields discovered and developed in the region. This assumes full development of the resource estimate of 1.74 billion barrels and transportation of that oil to shore. MMS also estimates that most likely zero spills of at least 100,000 barrels will occur.

MMS has concluded that the probability of an oil spill resulting from a blowout during exploratory drilling is extremely low (Martin 1986). In fact, to date, there has been no oil spilled as a result of a blowout during exploratory drilling on the U.S. OCS. They cite several studies of offshore drilling statistics that indicate the probability of a blowout during offshore exploration on the U.S. OCS is around 0.64 percent or about 1 blowout per 156 wells drilled, however, most of the data is from drilling in the Gulf of Mexico.

MMS believes that such a low probability does not pose a threat to bowhead whales as a result of an oil blowout from exploratory drilling. In fact, based on the U. S. record and technically advanced equipment, procedures, and operational training employed in exploratory drilling in the Arctic, MMS expects a substantially lower probability of an oil blowout during exploratory drilling in the Arctic Region.

Easley (1987) reviewed MMS's oil spill probability statistics and suggested that the factors associated with historic data used by MMS to calculate the statistics may be entirely different from those associated with future blowouts. He also suggested oil probabilities should be computed using more systematic techniques (e.g., Fault-Tree Analyses and/or Failure Mode and Effect Analyses) instead of simply dividing the number of blowouts by the number of wells drilled (including Gulf of Mexico wells) as done by MMS.

An oil spill from a blowout has not occurred to date in the Alaska OCS. For this reason it seems reasonable to examine data from the remaining U.S. OCS to get approximate values that may be applicable for the Alaskan OCS. Because the number of blowouts in other U.S. OCS regions is very small compared to the large number of drilled wells, NOAA Fisheries believes the probability of an oil spill resulting from a blowout during exploratory drilling in the Arctic Region is low. However, we recognize that other techniques may be available to calculate oil spill probabilities and we urge MMS to investigate these possibilities.

Finally, MMS cites legal authorities and operational procedures (Murrell et al. 1987) that are in place to ensure safe drilling practices on OCS leases, providing further assurance that an oil spill from exploratory drilling would be unlikely. Such authorities include operational requirements contained in regulations, OCS Operating Orders, lease stipulations, inspection requirements, and conditions of approval of Exploration Plans, Applications for a Permit to Drill, and Critical Operations and Curtailment Plans.

If, however, an oil spill should occur during exploration activities from either a blowout or an operational discharge, the conditional probabilities (expressed as percent chance) that an oil spill will contact a certain bowhead whale habitat (i.e., spring or fall migration corridors, feeding areas) within 3 to 30 days have been calculated to range from nil (less than 0.5 percent) to nearly 100 percent depending on spill location and season (MMS 1985, 1987a,b).

Effects of Oil: Assuming an oil spill were to occur and contact whales, the worst adverse impacts to whales from contact with spilled oil include death or illness caused by ingestion or inhalation of oil, irritation of skin and eyes, fouling of feeding mechanisms, and reduction of food supplies through contamination or losses of food organisms. Although no data exists on effects of oil on bowhead whales in the open ocean, Albert (1981) speculated that the most likely adverse effects of oil contact to bowhead whales would be 1) conjunctivitis and corneal eye inflammation leading to reduced vision and possibly blindness, 2) development of skin ulcerations from existing eroded areas on the skin surface with subsequent possibility of bacteremia, 3) compromising of tactile hairs as sensory structures, and 4) development of bronchitis or pneumonia as the result of inhaled irritants. In a laboratory study using baleen plates from bowhead whale specimens, plates fouled by oil had decreased filtering efficiency for at least 30 days but 85% of the efficiency was restored within eight hours (Braithwaite et al. 1983). This fouling possibly may result in oil ingestion which, theoretically, could lead to blockage of the narrow channel of the stomach (Albert 1981). However, the extent of

oiling that would be necessary to produce these effects is unknown. Neither is it known, however, if oiling would produce such effects. Experiments by Geraci and St. Aubin (1982, 1985, 1986) demonstrated that effects of actual oiling of certain marine mammals (no bowhead whales were tested) are probably short-term, transient, minor, and reversible.

Although direct evidence is lacking, Geraci and St. Aubin (1986) reasoned that bowhead whales have the visual capability to detect spilled oil which sufficiently alters the optical properties of the surface, and may also be able to detect oil by tactile senses. Cetaceans may be initially attracted to an oil slick but may subsequently become conditioned to avoid them. Such behaviors, as displayed in dolphin studies, may help individuals avoid multiple contacts with oil. Geraci and St. Aubin indicated, however, that in heavy ice conditions, the ability of bowhead whales to avoid oil trapped among ice would be limited.

Ahmaogak (1986) suggested that bowhead whales may not detect oil fouled waters and, even if they could, they may not avoid it. Observations from the Regal Sword spill off Cape Cod (Goodale et al. 1982) showed that large whales (i.e., fin, humpback, and probably right whales) did not avoid areas of oil spills and apparently performed normal activities, such as feeding, in and among oil slicks. This may indicate that either the whales were unaware of or unable to detect the oil slicks, or were not bothered by them. Gray whales off Coal Oil Point in California showed mixed reactions to the oil seeps there (Geraci and St. Aubin 1982). Some whales apparently avoided the area, and others modified their behavior while passing through the area. Whether this indicates detection and learned avoidance among individuals, or adverse reaction, is unclear. In any case, these examples indicate that whales may not readily avoid oil spills, and may, therefore, be susceptible to the effects of contact with a spill. However, no ill effects to whales have been observed in these areas.

Geraci and St. Aubin (1986) concluded that the skin of toothed whales and dolphins is at least partially resistant to oil, and subtle effects caused by short-term contact with volatile components are reversible. They believe the structure of the skin of bowhead whales should afford at least equal protection. However, the questions of adhesiveness of oil to the skin and the effects of long-term exposure to persistent oil remain unanswered. Albert (1981) and Ahmaogak (1986) suspect that the skin erosions on bowhead whales will facilitate adherence while Geraci and St. Aubin (1986) believe that unless whales are trapped in a lead and remain in continuous contact with newly spilled oil for a period of hours or days, petroleum hydrocarbons would have little effect on the intact epidermis of whales.

Petroleum vapors, particularly the low molecular weight hydrocarbons, inhaled within a few hours of being spilled can be toxic. Evaporation rapidly removes these components from oil and they are the first to disperse into the air. Evaporation would be slowed in the cold Arctic waters, possibly lessening the spread of harmful concentrations of toxic vapors. Inhaled volatile hydrocarbons may aggravate lung diseases or be absorbed into the circulatory system and liver. Bowhead or gray whales encountering a weathered oil spill in open water would not be exposed to harmful vapors (Geraci and St. Aubin 1986). Although bowhead and gray whales may feed on contaminated prey, it appears to be difficult for them to consume enough oil in this manner to be poisoned by absorbed hydrocarbons. As in humans, cetaceans could develop lung damage from aspirating regurgitated hydrocarbons (Geraci and St. Aubin 1986).

Bowhead whales rely primarily on ice leads, cracks and small pools in ice during their spring migration. Cracks and small pools are likely to concentrate spilled oil entering the water. Bowhead whales, in a lead system, may be unable to avoid encounters with oil in cracks and small pools, and, therefore, would be more susceptible to oil contact than would whales in open water.

Hansen (1985) reviewed the literature on the potential effects of oil spills on whales and other marine mammals, and suggested that the level of effects would be related to the degree of exposure of a cetacean to an oil spill. Baleen whales, such as the bowhead, may be less likely to avoid oil slicks than more mobile small cetaceans, and the bowhead whales' association with sea-ice may also provide less ability or opportunity for avoidance than for subarctic species (Geraci and St. Aubin, 1986).

Other effects of oil spills on whales may include reduction in availability of food within localized areas near the spill site and in areas where the oil slick occurred. However, Richardson (1987) suggests that it is unlikely that accidental oil spills would have a significant or lasting effect on zooplankton in the study area, or on the availability of zooplankton to bowheads. Nonetheless, there may be uncertain long-term effects of oil ingestion and hydrocarbon accumulation.

Noise disturbance: Many of the sounds produced by industrial activities are at low frequencies (below 1000 Hz), which is also the frequency range of most bowhead vocalizations. Such low frequency noises could travel long distances to waters used by bowhead whales for migration and feeding in spring and fall.

Potential impacts to whales that may result from noise disturbance include disruption of feeding activity, short- or long-term displacement or deviations from migratory paths,

interference with socialization, reproductive behavior and communication, physiological stress, and possibly even abandonment of traditional areas. Geophysical seismic noise, drilling, construction, icebreaker activity, and other vessel noise in areas where whales are present, possibly, could cause such impacts. The level of noise required to produce these effects depends on the distance of the noise from the animals, the ambient noise levels, the source level of noise, and the acoustic propagation properties of the environment.

To date, there has been little opportunity to directly assess the impacts of industrial activities on bowhead whales in Alaska waters. This is because of seasonal drilling restrictions imposed for the first three Beaufort Sea Federal oil and gas lease sales and because most prior OCS activities in Arctic Alaska (all of which are still in the exploration phase) have occurred in the Beaufort Sea during the winter when bowhead whales are not present. During the spring, the ice leads used by the migrating whales are offshore and away from any gravel islands where most Beaufort Sea wells have been drilled to date, and exploratory drilling in the spring lead systems has not occurred.

Exploration at a few drilling locations has recently been permitted during the fall migration. Most of these locations have also been shoreward of the main migration corridor. In 1985, Unocal Exploration was allowed, by waiver of MMS' Stipulation #4 for Lease Sale 87, to conduct drilling during the fall whale migration from a drillship operation in the Alaskan Beaufort Sea. However, the drilling was completed before the onset of the fall migration. Drilling of a second nearby well in 1985 by Shell Western was prevented by heavy pack ice. In 1986, Shell Western conducted exploratory drilling during the beginning of the fall migration, and Unocal subsequently drilled an exploratory well, during the migration. The two wells, which were located in the nearshore migration path of the bowhead whales, were drilled using a drillship, an icebreaker and icebreaking support vessels. Drill-associated noises were monitored to determine their effects on the migrating whales (LGL et al. 1987).

Data from these studies suggested that migrating bowhead whales avoided and could have been displaced by the offshore drilling operation. No whales were sighted closer than 9.5 km from the drillship, and few were sighted closer than 15 km (LGL et al. 1987). Significant numbers of bowhead whales passed south of the rig as well as north of it. One whale was tracked for 6.8 hours while it travelled 32 km. The whale moved in an arc around the drilling operation maintaining a distance of about 23-27 km from the drillship. Bowhead whales observed between 15 and 30 km from the drillship apparently did not exhibit "strong" (i.e., definite responses which usually involved major changes in respiration, surfacing, and dive cycles) behavioral responses.

There was no evidence that the drilling operation (including the support vessels) acted as a barrier to migration (LGL et al. 1987). However, during the study period ice conditions were very light and animals could pass north or south of the rig. No evidence exists to determine if whales would or would not approach an operating rig to continue their migration during heavy ice conditions and if the rig was located in the migration path. Although recent research indicates whales travel under the ice near leads, it is not known how far whales travel from the leads.

Disturbance responses to industrial activities of bowhead whales summering in the Canadian Beaufort have been the focus of a 5-year study (Richardson 1981, 1982, 1985; Richardson et al. 1985a,b, 1986, 1987). Sound sources, besides ambient noise, included geophysical seismic exploration, drilling and associated machinery noise, dredging, icebreaker activity, boat and aircraft traffic, and construction of gravel islands or other offshore structures. Behavior near actual and simulated activities associated with offshore oil exploration was compared with presumably undisturbed behavior. In general, bowhead whales showed considerable tolerance of ongoing noise from dredging or drilling, but tended to react more strongly to a moving or rapidly changing noise source such as an approaching boat or aircraft or the startup of noise sources (Richardson et al. 1985a,b, 1986, 1987).

In the Canadian Beaufort studies, behavioral responses of bowhead whales were not apparent beyond 4 km from an active drillship. However, playback experiments showed that some whales reacted, although not strongly, to drillship noises at intensities similar to those 12 km from an active drillship (Richardson et al. 1985a,b, 1986, 1987). Why bowhead whales reacted more strongly to playback noises than to actual noises is not clear. Richardson concluded that sightings near drillships and the limited reactions to playbacks show that at least some bowhead whales summering in the Canadian Beaufort tolerate considerable drillship noise. In fact, comparison of behavior of bowhead whales summering in the Canadian Beaufort with that of migrating whales in the Arctic Region (LGL et al. 1987) indicates that summering whales may be considerably more tolerant of drillship noise than migrating whales.

Playback of dredge noise in Canadian waters produced behavioral responses from some bowhead whales, including avoidance and changes in orientation, out to 2.25 km, although some animals did not respond until they were within 800 meters of the sound source. Around active dredges, apparently undisturbed bowhead whales were observed, within 1 to 5 km, and no disturbance was

observed beyond 2.8 km. However, there are differences in reactions of these whales to dredge noise. The whales seen near actual dredges may have been less sensitive animals; those more sensitive may have moved away earlier or may have avoided the area (Richardson et al. 1985 a,b, 1986, 1987).

The effect of noise associated with a drilling operation on bowhead whales has also been investigated using simulation models. In an MMS-contracted, 2-year study of noise characteristics and propagation, the underwater acoustic environments of five specific drill sites in the Alaskan Beaufort Sea were measured during 1985 and 1986. This information was used to simulate preliminary estimates of zones of responsiveness of bowhead whales to these noise sources. The zones of potential responsiveness (where half of the whales would probably respond at a 30db signal to noise ratio) were estimated for continuous noise sources at 6 drill sites through modeling studies. The radii of responsiveness ranged from 1 to 8 km for a tug underway in open water, 1 to 4 km from an active drillship, 0.02 to 0.2 km from man-made gravel island drilling noise, 2 to 12 km from an icebreaker underway in open water, and 1.6 to 12 km from two tugs forcing a barge against an island (Miles et al. 1987). Because the study by Miles et al. involved no direct observations of whale behavior relative to real or playback sound, they relied on Richardson et al.'s earlier reported observations of whales behavioral responses to comparable sounds in the Canadian Beaufort Sea. Therefore, Miles et al. were able to insert Richardson's observations into a broader framework wherein roughly half of the bowhead whales show avoidance responses (probability of avoidance of about 0.5) to industrial sounds which have a 30 dB S:N (signal-to-noise ratio). A smaller proportion of the bowhead whales observed by Richardson, et al. reacted when the S:N is about 20 dB, which would occur at greater ranges than those estimated above by Miles et al. and a few bowhead whales may react with even lower S:N. However, some bowheads observed by Richardson, et al. apparently tolerated S:N ratios of 40 dB without exhibiting an avoidance reaction.

Marine geophysical sounds from seismic surveys are the loudest industrial sounds emitted into the marine environment. Seismic surveys are of two general types: (1) low-resolution, high-energy, deep-penetration and (2) high-resolution, low-energy, shallow-penetration seismic surveys. Low resolution surveys (airguns) are used to study deep geologic formations. They are, generally, authorized under a geological and geophysical permit to occur prior to a lease sale, and usually are not expected to occur during post-lease sale exploration. Companies most often conduct high-resolution seismic surveys during exploration on leases to evaluate potential shallow hazards to drilling. MMS (Powers 1987) estimated that the total high-resolution seismic activity in the Arctic Region will be 80,000 line km.

In three of six experiments, bowhead whales oriented away from a vessel with a single airgun deployed (high-energy, low-resolution system) at a range of 0.2 to 4.5 km from the sound source (Richardson 1985). There was no reaction to the single airgun vessel at a range of 3 to 5 km in the other three experiments. We believe the effects on bowhead whales from high-resolution seismic disturbances are minor because low-resolution seismic effects disappear (i.e., whales' surface-respiration-dive characteristics return to normal) within 30 to 60 minutes (Ljungblad et al. 1985c).

Heavy boat and aircraft traffic could also affect bowhead whales adversely. In the Canadian Beaufort Sea, responses of whales to moving boats is the most consistent and second-most pronounced of all disturbance factors tested (Montague 1985). In most cases, bowhead whales oriented away from a moving vessel up to 4 km away and actively swam away from vessels 2 km or less away. There was no clear relationship between the size of the vessel and the distance of the response (Richardson 1982, Richardson et al. 1985a). The whales ceased their avoidance when the vessel passed out of range, but may have remained scattered for longer periods. Collisions between vessels and bowhead whales are unlikely if the whales are able to detect and avoid the vessels, or if the vessels take appropriate steps to avoid the whales.

The reaction of bowhead whales to aircraft is more variable than to vessel noise. Most reactions to fixed-wing aircraft occur at altitudes of less than 1,500 feet (Richardson et al. 1985a). Reaction to helicopters may have a similar area of influence (M. Dahlheim, NOAA Fisheries, pers. comm.). Disturbance due to aircraft traffic, unless sustained and intense, is likely to cause only temporary disturbance to these whales. With proper altitude observance, most impacts from aircraft can be avoided.

Noise producing activities, such as drilling and vessel traffic, in the spring lead systems used by bowhead whales have a high potential of significantly affecting the whales. If migrating bowhead whales are concentrated within the lead systems in the spring, the noise could seriously disrupt the migration. However, according to MMS, exploratory activities using floating drill ships within the spring lead systems are not expected during the bowhead migration since the ice at this time of year typically would be too thick for drilling ship and supply vessels operations. Although marine exploration activities generally occur for about 90 days, in August, September and October, exploration in the Chukchi Seas and Hope Basin Planning Areas may also occur in July through mid-November.

<u>Additional Impacts</u>: To date, the exposure of bowhead whales to the effects of OCS activities has largely been confined to the Canadian Beaufort Sea. In Alaska waters, limited drilling during the fall migration of the whales has only recently begun. The

additional effects from planned or future sales will be limited to further exploratory drilling, increases in boat and air traffic in relation to support activities, and the small increased risk of an oil spill occurring prior to or during the migration period.

The ability of the bowhead whale to accommodate increasing industrial disturbance is uncertain. Some accommodation undoubtedly can occur, but the level of stress imposed on the species as a result cannot be predicted. A decreased use by bowhead whales of the Canadian Beaufort Sea industrial areas, as evidenced from aerial surveys during the summer, has been noted (Richardson et al. 1985a,b, 1986, 1987). However, changes in bowhead whale abundance has also occurred outside as well as within the main industrial area. One suggested cause for the decreased use is the effect of increased disturbance from industrial activity that began in the early 1970's and significantly increased since 1980. Variation in food availability (zooplankton concentrations) may also have been involved.

Present and proposed OCS exploratory and development activities in the Arctic Region may eventually adversely affect the successful life cycle of bowhead whales. At present, we are unable to predict what these tolerance thresholds might be, but we do not believe the foreseeable additive effects of previous and planned sales should exceed this level of concern. Continued efforts to monitor distribution patterns and indicators of population health, such as reproductive success, recruitment, growth rates and behavior are important to assure the combined effects from all OCS activities are not likely to jeopardize the continued existence of the bowhead whale population.

<u>Conclusions</u>:

Based on review of the information provided to us by MMS and from information available on endangered whales, NOAA Fisheries has reached the following conclusions on proposed oil and gas leasing and exploration activities in the Arctic Region.

<u>Right, Sei, Fin and Humpback Whales</u>: The proposed activities are not likely to jeopardize the continued existence of the right and sei whales. Right and sei whales rarely occur in Arctic waters, being found there only as isolated, possibly stray, individuals, and are unlikely to be affected adversely by the identified activities. The proposed activities are also not likely to jeopardize the continued existence of humpback and fin whales which inhabit the Chukchi Sea on occasion, but in relatively low numbers.

Gray Whales: We conclude that the proposed activities are not likely to jeopardize the gray whale. In Arctic waters gray whales are most likely to be encountered in the southern Chukchi Sea and the Bering Strait region and would be affected most by oil and gas exploration activities in those areas. Perhaps as much as one-fourth of the gray whale population may enter the northern Chukchi Sea through the Bering Strait. Although some individuals may suffer disturbances or other impacts from the proposed activities, due to the good overall condition of the gray whale population and to its widespread distribution in the Bering and Chukchi Seas, such impacts are not likely to jeopardize the existence of the species.

However, additive impacts that could result from past and future OCS activities in the Arctic Region, the Bering Sea, and in other regions outside Alaska, may have the potential to affect the population adversely. Continued monitoring of the health of the gray whale population and the effects of OCS activities in these areas are important to assess whether the combined impacts are affecting the gray whales adversely.

Bowhead Whales: We conclude that the proposed activities are not likely to jeopardize the continued existence of the bowhead whale. However, the primary concerns of NOAA Fisheries in the Arctic Region focus on the bowhead whale. The entire population of this whale is susceptible to impacts in this area during its spring migration through nearshore leads. In the fall, a large portion of the bowhead whale population may again be exposed to oil spills and disturbance from noise when they migrate through the Arctic Region both nearshore and offshore with the pack ice.

Oil Spill Probabilities: Based on information utilized by MMS (Martin 1986), an uncontrolled oil blowout or a major oil spill in the Arctic Region as a result of exploratory drilling is an unlikely event. Therefore, we conclude that exploratory drilling itself does not constitute a significant level of risk of oil spills.

Noise Disturbance: Large or widespread noise disturbance along the spring or fall migration paths or in feeding areas could affect bowhead whales by interfering with successful feeding, migration, or other behavioral activities. The range or level of noise required to produce these effects depends on the location and source of noise, and on the acoustic propagation properties of the environment. Although some impacts to individuals may occur, we do not believe anticipated proposed exploratory activities will produce noise levels expected to reduce appreciably the likelihood of survival and recovery of the bowhead whales by reducing the reproduction, numbers, or distribution of the species.

However, this conclusion is based on the assumption of MMS that exploratory activities will not occur within the spring lead system during the bowhead migration. If new exploratory activities technology, procedures, etc., are developed that would allow activity in spring leads, MMS should reinitiate consultation with NOAA Fisheries. Our concerns over other activities in the spring lead systems are discussed further under the subsequent section on "Incremental Step Consultation".

Physical Impacts: Although individual impacts may occur, we believe the foreseeable exploratory activities in the Arctic Region are unlikely to produce a level of physical impacts, such as collisions with vessels or structures, that are likely to jeopardize the species.

Based on jeopardy conclusions in previous consultations, exploratory drilling operations in lease areas have been restricted by lease stipulation to avoid or reduce their coinciding with bowhead whale presence during the fall migration. However, new information indicates the probability of an oil spill during oil exploration is very small (Martin 1986) and other recent research suggests that bowhead whales continue their migration while avoiding noise from drilling operations by detouring around the drill site in open water conditions (LGL et al. 1987). Therefore, limiting OCS exploratory drilling to the times of years and portions of the lease area where whales are not present may not be necessary to prevent jeopardizing the population.

Because few bowhead whales have been sighted inside the Beaufort Sea barrier islands, exploratory drilling operations during the bowhead migration should not be restricted inside the barrier islands. However, monitoring OCS exploratory drilling outside the barrier islands especially during heavy ice conditions, when concurrent ice-breaking activity would be greatest, should be conducted to insure that migrations are not blocked or impeded, resulting in whales being trapped in the Beaufort Sea at freeze up. Additionally, several drill sites operating simultaneously, even in open-water years, could form an acoustic barrier to the whale migration. However, present MMS drilling schedules do not include this possibility.

NOAA Fisheries believes that continued monitoring of bowhead whale migrations at industrial sites is necessary to detect any major disturbance. Results from monitoring studies and other additional information will prove valuable for future consultation on OCS activities, particularly those associated with development and production. Conservation Recommendations addressing research needs and additional actions that MMS and/or the oil companies can take to minimize adverse effects to bowhead whales are provided with this opinion.

Reinitiation of Consultation

During the post-lease exploration phase, MMS should provide NOAA Fisheries with all exploration plans and any subsequent revisions of these plans. MMS should review these plans to determine if further Section 7 Consultation is necessary during exploration. Consultation must be reinitiated for the development and production phases in the Arctic Region. Consultation must also be reinitiated if (1) new information reveals impacts from the proposed activities that were not previously considered, (2) the activities are modified in a manner that causes effects that were not previously considered, or (3) a new species is listed or critical habitat is designated that may be affected by the proposed activities.

INCREMENTAL STEP CONSULTATION

The preceding opinion covers the incremental step of leasing and exploration of the Arctic Region. In addition to our opinion on the incremental step (leasing and exploration), NOAA Fisheries is providing its views on the entire action including development and production. For the Federal agency to proceed with the incremental step, there must be a reasonable likelihood that the entire action will not violate Section 7(a)(2) of the ESA (50 CFR 402.14(k)).

Based on currently available information and technology and the absence of effective mitigating measures, NOAA Fisheries believes that development and production activities in the spring lead systems used by bowhead whales have the potential to jeopardize the continued existence of the bowhead whale population. We base this belief on our present knowledge of the confined nature of this pathway and our concerns for the risks of oil spills and noise disturbance. Although recent acoustic studies indicate that bowhead whales swim beneath the ice within several kilometers of the leads, it is not clear how long whales remain under the ice before returning to the leads. In particular, we believe that noise-producing activities in the pathway of the spring migration could block or seriously disrupt the successful movements of the species along the Chukchi Sea coast and into the Beaufort Sea. We believe this potential for jeopardy should be recognized and addressed at the leasing stage. NOAA Fisheries will reconsider this conclusion when new information, technology and/or measures that would effectively eliminate or otherwise mitigate this potential jeopardy situation become available or are proposed.

Therefore, NOAA Fisheries provides the following reasonable and prudent alternatives that MMS can adopt to avoid the likelihood of jeopardy from oil spills and noise. We believe that either (1) the lease blocks within 25 miles of the nearshore lead system should be deferred from the lease sale [for example see the Coastal Deferral Alternative VI (MMS 1987a) for Lease Sale 109 and the Barrow Deferral Area identified by MMS during consultation for Lease Sale 97] or, (2) if these blocks are leased, development and production activities should not be approved unless and until further consultation results in a no jeopardy conclusion or a reasonable and prudent alternative is developed and adopted that would avoid the likelihood of jeopardy. More specific options and alternatives may be developed during further consultation, particularly as new information or technology is developed or specific development plans or specific mitigation measures are proposed. However, we cannot, at this time, identify more specific reasonable and prudent alternatives to avoid this likelihood of jeopardy from production and development activities.

INCIDENTAL TAKE STATEMENT

Section 7(b)(4)(C) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the Marine Mammal Protection Act of 1972 (MMPA). Since no incidental take in the Arctic Region has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered or threatened marine mammals is provided.

CONSERVATION RECOMMENDATIONS

NOAA Fisheries offers MMS the following recommendations to further promote the conservation of endangered whales in the Arctic Region.

1. MMS, with the assistance of NOAA Fisheries, should establish measures to reduce, as far as practicable, possible impacts from noise associated with drilling and other activities. During the spring (April through June) and fall (August through October), drilling, construction, and vessel traffic should not be conducted in a manner that will significantly affect any whales present. Specific measures to reduce impacts of drilling and associated activities at individual well locations cannot be developed until these locations are known and exploration plans are submitted. Case-by-case information on the location, times, and manner of drilling operations, along with planned mitigating measures to protect bowhead whales, should be provided to NOAA Fisheries for review. In addition, MMS should limit the number of active industrial sites to ensure that the potential for adverse effects is low.

2. To minimize potential harassment to bowhead and gray whales from daily activities associated with OCS exploration in the Arctic Region, MMS should advise operators that aircraft should observe a minimum distance of 1,500 feet (approximately 500 m), horizontally or vertically from observed whales, and from areas where whales are believed to be present; and vessels, including seismic geophysical vessels, should avoid concentrations of whales and attempt to keep a distance of at least 1 mile from any observed whales.

3. To avoid adverse effects should a major oil spill occur, MMS should cooperate with appropriate Federal agencies to ensure that areas occupied by either bowhead or gray whales are clear of spilled oil. Special precautions should be taken to ensure that spilled oil does not persist in areas located in or near (a) lead systems used by bowhead whales during their spring migration (April through June), (b) the bowhead whale coastal migratory corridor from the U.S./Canada Border to the Bering Strait in the fall (August through October), and (c) feeding areas used in the fall.

4. Except for exploratory drilling operations inside the Beaufort Sea barrier islands, exploratory operations conducted in the area of and during the fall migration should be monitored using appropriate survey techniques to determine the movement and activity of whales near the drill sites, and whale migration and other habitat use, such as feeding. The behavior of the whales should be monitored by qualified researchers to determine the

behavior of whales present and if they are being affected. Use of feeding areas is particularly important to document. NOAA Fisheries should be involved in monitoring efforts and then kept informed of the status of monitoring efforts and of any potential indications of significant disturbance or displacement of bowhead whales. Each year's research should be conducted so that it is comparable with previous years. At the end of the season all years data should be reviewed and a decision made by MMS in consultation with NOAA Fisheries as to the need and kind of further research.

5. If an unauthorized take of bowhead whales occurs as a result of OCS activities, MMS should halt the activities immediately. It is strongly recommended that NOAA Fisheries conduct or participate in the monitoring efforts to make these determinations.

6. MMS is encouraged to continue to sponsor research needed to improve knowledge of the seasonal movements and habitat utilization of endangered whales in the Arctic Region, and of the effects of oil spills and other OCS activities on these whales. Possible areas of continued research are to (a) identify and characterize feeding areas and habitat use of gray and bowhead whales, and determine their importance to the populations, (b) determine the nature and effects of industrial noise in the Arctic Region on migrating bowhead whales, including geophysical seismic sounds using airguns and drilling noise from both fixed and floating units and their support activities, including icebreakers and dredges, and (c) detect cumulative effects.

7. The location of the spring lead system and distribution of whales in this system should be investigated to determine as precisely as possible the location, extent and yearly variation of this migratory corridor, so that this information can be used in leasing decisions.

8. The results of MMS sponsored research on bowhead and gray whales should be made available to NOAA Fisheries and other parties interested in management of these whales in a timely manner. To provide for greater interdisciplinary coordination among researchers, and between researchers and agencies, the information gained during the research efforts should be made available at meetings such as the Biennial Conference on Marine Mammals, Biennial Bowhead Whale Biology Conference, and MMS Information Transfer Meetings.

9. The Beaufort and Chukchi Biological Task Forces should be utilized by MMS for input for sales in the Arctic Region to ensure that future OCS operations are planned and conducted in a manner consistent with MMS's responsibilities to protect and conserve endangered species and other living marine resources and the habitats upon which these resources depend.

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APPENDIX E

MAJOR PROJECTS CONSIDERED IN CUMULATIVE-EFFECTS ASSESSMENT

Information in this appendix supplements and updates material contained in Appendix B of the Final Environmental Impact Statements (FEIS's) for Sales 71, 87, and 97, which are incorporated by reference (USDOI, MMS, 1982, 1984, and 1987a, respectively). The 18 projects described in this section are depicted on Graphic No. 3 and summarized in Table IV-A-2. Projects in this table are numbered to correspond to the project number in the text. As on the table, projects are segmented under three broad categories: Existing Development (Projects 1 through 8), Exploration and Potential Development (Projects 9 through 16), and Future Lease Sales (Projects 17 and 18).

This appendix also contains a list of projects from the 5-Year Supplemental FEIS (USDOI, MMS, 1990) that are used to assess the effects of projects and activities on migratory species in other parts of their ranges--this includes the Bering Sea, Prince William Sound and the Gulf of Alaska, and the Pacific coastal area of the U.S. and Canada.

EXISTING DEVELOPMENT

1. Trans-Alaska Pipeline (TAP): Approximately 16.3 mi^2 are occupied by the 800-mi pipeline that runs between the Prudhoe Bay Unit and Valdez. Between Prudhoe Bay and Fairbanks, the Dalton Highway (Haul Road) was constructed parallel to the pipeline. Ten pump stations move about 1.7 million barrels of oil per day (MMbpd) through the pipeline. Two additional pump stations could be added and drag-reduction agents introduced that would take capacity past its design capacity of 2 MMbpd to approximately 2.4 MMbpd. The Valdez terminal handles four tankers at once and has an average turnaround time of 24 hours. Approximately 900 tankers visit the Port of Valdez each year. The TAP is presently delivering crude oil from Prudhoe Bay and Kuparuk. The Alyeska Pipeline Service Company designed, constructed, and now operates the TAP (Alyeska Pipeline Service Co., 1984).

2. The North Slope Borough (NSB) Capital Improvements Program (CIP): One of the goals in the formation of the NSB was the improvement of living conditions in North Slope Inupiat villages. With revenues from the Prudhoe Bay field, a network of NSB and construction subcontractor management, and maximum participation of Inupiat men and women in each project, this massive CIP has been used to construct schools and housing in every village, acquire gravel and land, improve airport runways, improve fuel generation and water and sewer systems, acquire maintenance equipment and search-and-rescue helicopters, and initiate areawide communications and solid-waste-disposal improvements for every village of the North Slope during the 1970's and early 1980's. Many of the projects have been completed. The focus of future expenditures emphasizes health and human services, safety, and the maintenance of facilities already built (NSB Ordinance 86-10 et seq.).

Previously, the CIP proposed the development of conceptual master plans for service bases at Bullen Point and Kuparuk (NSB, 1983). Although these areas still may serve as industrial centers for North Slope oil and gas development, the focus of the CIP has been redirected.

3. Prudhoe Bay Unit (PBU): The PBU produces 1.5 MMbpd from the Sadlerochit formation, approximately 17 percent of the total U.S. production. Sixteen companies are included in the unitized field. ARCO Alaska, Inc., operates the east half of the field; and Standard Alaska Production Company operates the west half. Approximately 4,000 persons are employed for this field. Major facilities include base camps for Standard and ARCO personnel, a crude-oil-topping plant, a central gas facility, airstrip, flow stations, gas-injection facilities, two docks, seawater-treatment plant, water-injection plants, and a power system. Additional facilities for support activities have been located at Deadhorse. Approximately 348 km of roadways and 1,160 km of oil and gas pipelines have been constructed within the PBU (this includes 80 km of pipeline constructed for Lisburne production).

Original well spacing was based on 160 acres per well; spacing is being reduced to 80 acres per well. As the field matures and "infill drilling" increases, spacing in some locations may be reduced to 40 acres. Gravel pads, which typically are 46 m by 400 m, accommodate up to 40 wells. Waterflooding, a secondary recovery technique, is expected to increase production by approximately 1 Bbbl. Initially, the waterflood process was accomplished by reinjecting into the reservoir formation waters produced with Prudhoe Bay oil. Subsequently, seawater processed at the treatment plant has been injected. The processed seawater is distributed via 13 mi of 40-in-diameter pipe to the eastern injection plant and 11 mi of 36-in-diameter pipe to the western injection plant. Operating the waterflood system increased employment at Prudhoe Bay by 42 persons per shift. Waterflood equipment, including the world's largest seawater-treatment plant and two injection plants, was shipped by barge in the summer of 1983. The 26,000-ton, 11-story treatment plant is the largest module ever shipped to the PBU. By 1989, water-injection rates had reached 1.2 MMbpd, with 900 MMbbl of this amount composed of source water. Water-injection levels could reach 1.5 MMbpd by 1993 (Weeks, 1989).

In addition to waterflooding and infilling, production was increased further when the world's largest gas-processing plant came on line. During the 12-month period ending June 30, 1989, Prudhoe gas production totaled 1,418 Bcf. Of that figure, 1,133 Bcf were reinjected into the gas cap to maintain formation pressure, while another 125 Bcf were injected into the oil-field rim to further assist resource recovery (Weeks, 1989). As much as 50,000 bpd of liquefied natural gas (LNG) can be commingled with the Prudhoe Bay crude oil and piped through the TAP (Oil and Gas Journal [OGJ], 1987).

In addition to the main Prudhoe Bay field, the PBU also contains smaller satellite fields. Three are worthy of mention here: the West End (Eileen) field, Sag River, and Point McIntire. The West End field, as its name implies, is located to the west of the main Prudhoe field, between it and the Kuparuk field. The Eileen reservoir currently produces 52,000 bpd. By 1990, ARCO expects to have 72 producing wells and 4 gas-injection wells in operation on the West End field. The Sag River formation is located 50 ft above the Sadlerochit formation (the Prudhoe production formation). As of May 1989, the Sag was being serviced by 96 producer wells and 36 injector wells. Production in the Sag field is calculated at 15,000 bpd (Weeks, 1989). The Point McIntire field lies at the northern edge of the PBU about 400 to 500 yd to the west of the West Dock. Discovery of the field was announced in 1989; field reserves are estimated at 300 MMbbl. The McIntire field may be subunitized within the PBU; however, no development plans have been made public.

4. Lisburne Field: The Lisburne field is part of the PBU. ARCO committed $575 million in 1984 to develop the first phase of a commercial field. Permits have been issued for expanding five onshore drill sites, roads, and gathering facilities; plans for an offshore drilling platform have been placed on hold. ARCO has constructed 80 km of pipeline and drilled approximately 80 wells on five pads for an initial production rate of 35,000 bpd in 1988. During the Lisburne production phase, ARCO plans to upgrade and expand housing and support facilities at the ARCO camp to accommodate workers for 60 permanent positions. Filling these positions could require 200 to 250 employees (Maynard and Partch et al., 1985).

5. Kuparuk River Unit: The Kuparuk River oil field lies approximately 30 mi northwest of Prudhoe Bay. ARCO, the major shareholder, operates the unitized field for the eight owner companies. Oil in place is estimated to range from 4 to 5 Bbbl. Total recoverable oil with a successful waterflood is estimated at 1.6 Bbbl; and, in 1983, a water-flood-demonstra-

tion project was begun. During 1989, 337,000 bpd are expected to be processed from the field, making Kuparuk second only to Prudhoe Bay in U.S. daily production. A total of 800 wells (including oil, gas, water, and injection wells) ultimately will be drilled. Almost 500 persons will be employed at full production to operate the field. Facilities include living and dining quarters; a water- and sewage-treatment plant; warehouses; offices; a central processing plant; an operations center; construction camps; and a 1,700-ft gravel airstrip. A bridge across the Kuparuk River connects the 150 km of roads in the Kuparuk Field to those of the PBU. Oil is transported via 668 km of pipeline. Pipeline distance includes a 24-in pipeline running 26 mi to the TAP. In 1984, the 24-in pipeline replaced a 16-in pipeline that had been in operation since 1981 (Snapp, 1984).

6. **West Sak Formation**: The West Sak formation lies within the boundaries of the Kuparuk River Unit. Construction information is included in the totals for the Kuparuk River Unit. ARCO conducted a pilot project in this formation to determine the potential for full-scale production. ARCO used eight wells to produce the oil and five additional wells to inject hot water to drive the production. Through this project, ARCO demonstrated that the oil could be recovered by conventional methods; however, development would not occur until oil prices improved and became more stable (Anchorage Daily News, 1987). If the field is developed fully, wells spaced every 20 acres would produce between 100,000 and 200,000 bpd. Total production could reach 2 Bbbl. ARCO estimates 15 to 25 Bbbl are in place, of which 20 percent ultimately might be recovered (OGJ, 1984).

7. **Duck Island Unit**: Development drilling began on the unit's two causeway-connected islands in 1987. By February of 1989, the unit possessed 51 operational production wells, which produced at a rate of 100,000 bpd. Developmental drilling within the Duck Island Unit will continue into 1989 with only one rig allocated for both islands. Approximately 1.3 percent of Duck Island's production consists of natural gas liquids. With the exception of gas used for fuel and that used to extract LNG, all gas is reinjected into the formation water. In 1988, a waterflood project was begun in the unit, so 35,000 to 40,000 bbl of water per day are injected into the Endicott formation from each of four wells. This extensive waterflood project has repressurized the Endicott, which lost its formation pressure in an unexpectedly rapid manner after production was initiated.

8. **Milne Point Unit**: Conoco operates Milne Point, an (approximate) 21,000-acre field that is located north of the Kuparuk River Unit. The field was identified by Conoco in 1970 but was not considered economic to develop until 1979 when the area was unitized. Housing modules for both the 50-person permanent camp and the 300-person construction camp were delivered in 1984. Development modules were shipped on three barges during the 1985 sealift. During the period of construction, approximately 300 persons resided in camp. The construction camp is located adjacent to the permanent camp and can be opened and closed in segments to facilitate accommodating varying sizes in the work force. About 30 km of roadways were built. Approximately 24 km of oil pipelines were constructed from the drilling sites in the Milne Point field to the West Kuparuk pipeline. Production from 24 wells located on two pads began in November 1985 at approximately 10,000 bpd. Production was suspended in 1986 and reinstituted in 1988. Recoverable resources are estimated at 100 MMbbl (Anchorage Daily News, 1985, and Hastings, 1986, personal commun.).

EXPLORATION AND POTENTIAL DEVELOPMENT

9. **Discovered Resources (Oil Fields, Gas Fields, and Mining)**: Possible new projects that are described in Maynard and Partch et al. (1985) primarily include oil resources too viscous to produce and gas resources. Although these projects are not on the immediate horizon, given appropriate technology, market prices, and infrastructure, they could be processing commercial quantities of oil or gas on short notice.

Oil Fields: Gwydyr Bay oil is thought to be pooled in a very small area between two faults. The 27,160-acre field, located north of the west operating area of the PBU, was unitized in 1979 and is still being evaluated. Conoco, Hamilton Brothers, Cities Service Company, and Mobil/Chevron have drilled approximately nine wells.

Between 6 to 11 Bbbl of oil have been identified in the Ugnu Sands, which lie in the northern part of the Kuparuk River Unit and the Milne Point Unit. Because the oil is extremely viscous, no plans to develop the field have been proposed.

The Simpson Lagoon Field consists of two wells drilled during the late 1960's. Although oil was found, no additional work on the field has been undertaken.

Gas Fields: Several gas fields contain resources that could be recovered should the infrastructure for transporting the gas be constructed. Two fields that fall in this category already are associated with oil production. Estimates for gas from the Prudhoe Bay gas cap indicate 2 Bcf per day could be extracted for 25 years without substantially affecting the production of oil. Proven resources total 28,183 Tcf. Estimates of gas resources at Endicott indicate initial production could reach 250 MMcf per day for 20 to 30 years. Other fields with significant gas potential include Point Thomson and Gubik. The Point Thomson Unit is located between the Canning River and Bullen Point Camp. Exploration began in 1975 and 15 wells have been drilled to date. Although 350 MMbbl of gas condensate have been estimated for the Point Thomson Unit, no announcements of field development have occurred. Production is contingent on a gas-marketing scheme for the North Slope (OGJ, 1985). Gubik is located near the eastern border of the National Petroleum Reserve-Alaska (NPR-A) on land owned by the Arctic Slope Regional Corporation (ASRC). Estimates of gas resources reach 317 Bcf.

The Kemik, Kavik, and East Umiat fields contain lesser accumulations of gas resources. Kemik and Kavik could be commercial only if a gas pipeline were constructed adjacent to them. East Umiat is considered noncommercial.

Mining: The Red Dog Mine, located in the Northwest Arctic Borough, currently is being developed by Cominco Alaska, Inc. The mine is owned by the Northwest Arctic Native Association (NANA) Regional Native Corporation. The port through which the ore will be shipped is south of Kivalina. The NANA shareholders will hold the majority of the jobs for this project.

Coal (and its development) also is a potential source for cumulative effects on the North Slope, especially near Cape Beaufort, along the Chukchi Sea coast from Cape Lisburne to Wainwright. A State-funded study of coal resources during 1984 in the western Arctic was conducted to determine if the resources could be used as an economic replacement for the fuel oil currently being imported into the villages. The coal deposit of the Deadfall Syncline, located 6 mi from the Chukchi Sea and about 40 mi south of Point Lay, was identified as the best source for this use. A detailed feasibility assessment was completed in 1986. Development of this resource has been recommended and awaits further funding (Arctic Slope Consulting Engineers, 1986).

10. **Seal Island**: Seal Island is a gravel island constructed on a lease obtained by Shell during the Joint Federal/State Beaufort Sea Lease Sale held in 1979. Recovery of 300 MMbbl of oil has been estimated from a discovery announced by Shell in January 1984. Shell would like to start producing about 100,000 bpd of oil, possibly by 1992. An oil discovery from the nearby Northstar gravel island was announced in January 1986. This discovery helps to define the Seal Island reservoir (Alaska Report, Jan. 22, 1986). Amerada Hess drilled one well and spudded a second from Northstar during the 1985 to 1986 drilling season (Van Dyke, 1987, personal commun.). In 1989,

a proposal to unitize the Seal Island and Northstar Island fields as the Northstar Unit was submitted to the State of Alaska as well as the U.S. Department of the Interior (USDOI) by Amerada Hess. Upon approval of the unitization plan, a development plan for the Northstar Unit will be forwarded for review and approval.

11. National Petroleum Reserve-Alaska: The NPR-A is administered by the USDOI. Resources are estimated at 6.4 Bbbl of oil and 11 Tcf of gas; recoverable reserves are estimated at 1.85 Bbbl of oil and 3.74 Tcf of gas.

More than 90 wells have been drilled on NPR-A (Schindler, 1983). Although none has proven commercial, the wells that have been drilled in Simpson Field (35 wells with an estimated 12 MMbbl in place) and Umiat (11 wells with an estimated resource of 66 MMbbl) may eventually become commercial (Maynard and Partch et al., 1985). In compliance with the 1981 Department of the Interior Appropriation Act, as amended, the USDOI has undertaken studies and initiated a leasing program in NPR-A. Two lease sales were held in 1982, in which the most promising areas were leased. Plans called for one lease sale a year for 5 years beginning July 20, 1983. However, no acreage was leased in 1984. Due to lack of interest, no sale has been held since then. Two areas have been deleted from lease-sale plans, removing approximately 3 percent of the estimated oil resources. One deletion is the core of the Western Arctic caribou calving area and the other includes approximately 85 percent of the black brant molting area north of Teshekpuk Lake. Leasing on the First Creek Delta saltmarsh waterfowl area has been deferred 5 years. In 1985, drilling began on areas leased under the NPR-A program. The first well, drilled on the Brontosauris Prospect about 30 mi south of Barrow, was plugged and abandoned.

12. Oil and Gas Leasing in the Arctic National Wildlife Refuge (ANWR): The ANWR is situated in the northeastern part of Alaska. The boundaries of the coastal plains portion of the ANWR facing the Beaufort Sea extend from the Canning River Delta on the west to the Canadian border on the east. Controversy as to whether or not the coastal plain of ANWR should be open for oil and gas exploration and development led Congress to create Section 1002 of the Alaska National Interest Lands Conservation Act (ANILCA). This section laid out guidelines for the Secretary of the Interior to follow prior to reporting to Congress with recommendations for the use of the coastal plain, or 1002 area. The U.S. Fish and Wildlife Service (FWS) released its final legislative FEIS on the potential effects of exploration and development on the coastal plain in April 1987 (USDOI, FWS, 1987). The FEIS analysis was based on a 150-mi pipeline that would extend from the easternmost development hypothesized in ANWR to TAP Pump Station No. 1. The conditional, economically recoverable resource in the base case was estimated at 3.2 Bbbl with a 19-percent probability of oil being present. Approximately 12,650 acres, or 0.8 percent of the 1002 area, would be modified from its initial condition. Approximately 200 to 300 mi of all-season gravel roads within several oil fields and about 110 mi of road between the Canning River and the marine facilities at Pokok Lagoon are assumed.

The Secretary of the Interior recommended to Congress that the entire Arctic Refuge coastal plain (Alternative A) be made available for oil and gas leasing. Other alternatives identified in the ANWR FEIS for consideration by Congress are: (1) limited leasing of the 1002 area (Alternative B)--there would be no leasing or other oil and gas activities in the traditional core-calving area of the Porcupine caribou herd; (2) allow further exploration (Alternative C)--this would include exploratory drilling and allow permits for obtaining additional data by the Government, industry, or both to determine whether or not to authorize leasing of the 1002 area; (3) take no further legislative action (Alternative D)--this would allow the prohibition against oil and gas leasing, exploration, and development to continue; and (4) designate the area as wilderness (Alternative E)--no further study or public-review process would be necessary for this action.

Section 1003 of ANILCA states "production of oil and gas from the Arctic National Wildlife Refuge is prohibited and no leasing or other development leading to production of oil and gas from the range shall be undertaken until authorized by an act of Congress." This prohibition on downhole-hydrocarbon exploration was modified as a result of the land exchange between USDOI, the Kaktovik Inupiat Corporation (KIC), and the ASRC. Through this exchange, the Native corporations received 92,000 acres within the refuge. As a result, the KIC was able to have a well drilled on refuge lands. No hydrocarbon discovery was announced. Up to three exploratory wells may be drilled on this acreage prior to congressional action. As noted above, however, no development can proceed without congressional approval.

Another activity permitted in ANWR is geophysical fieldwork. This work must be conducted consistent with USDOI guidelines developed to protect the renewable resources of the refuge (ANILCA Sec. 1002[d]). Three types of geologic surveys have been permitted--surface geology, gravity-magnetic, and seismic. Between 1983 and 1985, 18 permits were issued to conduct surface-geology studies. Some of these permitted work in multiple years. One permit was issued to conduct a gravity-magnetic and control-net survey. Only 1 of 12 applications for seismic surveys was issued. More than 2,460 km of seismic lines were run over the course of two winters (1984 and 1985). This work provided the FWS with the necessary data for the report on ANWR that was delivered to Congress in April 1987. No future seismic work is anticipated until authorized by Congress.

13. Recent State of Alaska Arctic Lease Sales:

Sale 34: This sale was held in May 1982 for acreage in the Prudhoe Bay uplands. The lease area straddled the Arctic Slope and Northern Foothills petroleum provinces. The northeastern quadrant is adjacent to two significant discoveries at Point Thomson (State of Alaska, Div. of Policy Dev. and Planning [DPDP], 1982b).

The State offered 1.23 million acres in 261 tracts; 119 tracts were leased. Many of the leased tracts were along the Canning River, the western boundary of the ANWR. Two wells were drilled in 1984; both were abandoned. No further drilling has been proposed (Van Dyke, 1985, personal commun.).

Sale 36: This sale was held in September 1982. Acreage offered equalled 56,862 acres--41,500 acres were submerged lands north of Prudhoe Bay near Midway Islands and approximately 15,500 acres included both submerged lands in the Flaxman Island-Canning River area and uplands along the northwest border of the ANWR. Oil potential is considered high for the eastern tracts and low for the Midway Islands tracts. The scenario for this lease sale assumed development from the eastern tracts would begin within 10 years of the sale and that production would join a pipeline previously built to accommodate production from Point Thomson (State of Alaska, DPDP, 1982a). One well was drilled in the spring of 1983.

Sale 39: This sale, held in May 1983, was for 211,956 acres between the Colville River Delta and Gwydyr Bay. Nine tracts totalling 43,000 acres along the delta were eliminated for environmental reasons, and 5,000 acres along the boundary of the territorial sea were deleted because title to them was in dispute. Thirty-nine mitigating measures were stipulated to safeguard against environmental and sociocultural effects. Leases in Sale 39 are eligible for "exploration drilling credits" for the first exploratory well drilled on each tract (State of Alaska, Department of Natural Resources [DNR], 1983).

Sale 43: This sale, held in May 1984, offered tracts immediately west of Sale 9. Tracts extended west from the Colville River Delta to Pitt Point (at the east end of Smith Bay). Sale 43A, offering nine tracts at the mouth of the Colville and six tracts much farther south, was held concurrently. All tracts, except three offshore, received bids. Three stipulations and 41 additional terms of the sale are applied to these leases.

Sale 47: In May 1985, the eastern portion of the Kuparuk Uplands was offered in Sale 47. This area includes approximately 600,000 acres between the Kuparuk and Sagavanirktok Rivers. Petroleum potential is considered moderate to high.

Sale 48: In February 1986, the Kuparuk Uplands south of the Kuparuk oil field was offered for lease in Sale 48. Of 54 tracts offered, 104 received bids; 266,736 acres were leased.

Sale 48A: Eleven tracts totalling 42,053 acres in the Mikkelsen Unit were reoffered in February 1986. All tracts received bids.

Sale 51: The Prudhoe Bay Uplands lease sale was held on January 27, 1987. One hundred and nineteen tracts were offered; 26 were sold. Total acreage sold was 100,632. Petroleum potential in the lease-sale area is thought to be moderate.

Sale 50: The Camden Bay lease sale was held on June 30, 1987. Thirty-five tracts were offered and all were sold. Total acreage sold was 118,147. Petroleum potential in the lease-sale area is thought to be moderate to high.

Sale 54: The Kuparuk Uplands lease sale was held on January 26, 1988. Eighty-nine tracts were offered; 72 were sold. Total acreage sold was 338,687. Petroleum potential in the area is thought to be moderate.

Sale 55: The Demarcation Point lease sale was held on September 28, 1988. Fifty-six tracts were offered; 26 were sold. Total acreage sold was 96,631. Petroleum potential in the lease-sale area is thought to be moderate to high.

Sale 69A: The Kuparuk Uplands lease sale was held on September 28, 1988. One hundred and fifty-five tracts were offered; 75 were sold. Total acreage sold was 368,490. Petroleum potential in the lease-sale area is thought to be low to moderate.

Sale 52: The Beaufort Sea lease sale was held on January 24, 1989. The tracts were located between Pitt Point and Tangent Point and centered on Smith Bay. Forty-three tracts were offered; 15 were sold. Total acreage sold was 52,463.

14. **Postsale Activity on Areas Leased in Previous Outer Continental Shelf (OCS) Sales in the Beaufort and Chukchi Seas**:

Beaufort Sea: Four sales have been held for Beaufort Sea OCS oil and gas leases. The first sale, a joint Federal and State Sale, held in December 1979, offered Federal and State submerged lands and State offshore islands. The second sale, held in October 1982, offered tracts primarily west of Prudhoe Bay and east of Smith Bay. The third sale, Sale 87, offered tracts between Barrow and Canada and generally out to the 200-m isobath. Leases were awarded on 372 tracts totalling 786,617 ha. The fourth and most recent OCS sale, Sale 97, resulted in the sale of 202 tracts totaling 449,551 ha. The mean, conditional, unleased, economically recoverable oil estimated for Sale 97 was 650 MMbbl. The mean, conditional, leased and unleased (cumulative mean) economically recoverable oil for the Arctic Region (Beaufort Sea, Chukchi Sea and Hope Basin Planning Areas) is estimated to be 3.82 Bbbl. Capacity in the TAP should be adequate for all oil coming from the North Slope. Production of natural gas in the Beaufort Sea is considered uneconomic at this time.

Most drilling from leases issued in the joint sale has been done on State tracts; the Duck Island Unit (Project 7) is located on the State tracts. On Federal tracts, two wells drilled at Beechy Point were determined to be producible and were plugged and abandoned. Two wells drilled from Tern Island were determined to be producible and were temporarily abandoned in 1987. Results from a third well drilled into lease OCS-Y-197 are not yet available. In regard to Seal Island, the Amerada Hess Corporation has submitted a proposal to unitize the field as the Northstar Unit (see Project 10).

Seven wells have been drilled on leases issued in Sale 71. Both Mukluk (one well drilled from a gravel island) and the Antares Prospect (two wells drilled from the Concrete Island Drilling System were determined to be nonproducible and were plugged and abandoned.

Drilling from blocks leased in Sale 87 began in the summer of 1985. Including the summer of 1989, six wells have been drilled on the subject leases. The drillship then was moved to the Corona Prospect, located north of Camden Bay. The Corona Prospect was completed in the 1986 drilling season; and the drillship returned to the Hammerhead Prospect, where a second well was drilled. Drilling for each of the three prospects was supported by three ice-class vessels–two smaller vessels were used for supplies and ice management and the third vessel, the Robert Lemeur (an icebreaker-supply boat), was used to open the route to the drill site plus perform tasks similar to the smaller vessels. The Belcher Prospect, located near the Canadian border, was spudded from a drillship in September of 1988 and completed in the summer of 1989. Near Harrison Bay, Exxon has drilled a well on the Orion Prospect. The Prospect lies just north of Cape Halkett. Northwest of Oliktok Point, Tenneco used the Single Steel Drilling Caisson placed on a steel mat during the 1986 to 1987 season to begin a well that was completed in 1988. (See Roberts, 1987, for a more complete description of activities that have occurred on previously leased Federal tracts in the Beaufort Sea.)

Chukchi Sea: Sale 109, the first Federal offshore oil and gas lease sale in the Chukchi Sea, was held in May 1988. Of the tracts offered, bids were accepted on 350. The mean, conditional resource estimates for the sale were estimated at 2.68 Bbbl of oil and 15.1 Tcf of natural gas. To date, four wells have been drilled on Chukchi leases by the Shell Corporation. No report has been issued about either the producibility or existence of hydrocarbons.

15. **ASRC Oil and Gas Leasing**: The ASRC is a for-profit corporation created pursuant to the Alaska Native Claims Settlement Act of 1971. The Corporation has title to 4.9 million acres, both surface and subsurface estate, located in the northern part of the State. The ASRC lands are located principally to the west and to the south of the NPR-A boundaries. The ASRC has leased approximately half its acreage to various oil companies. Several exploratory wells have been drilled on ASRC leases to date; the most notable are the wells drilled in the ANWR and Gubik, east of NPR-A.

16. **Canadian Beaufort Sea**: The following information concerning Canadian Beaufort Sea oil and gas activities is summarized from Campbell (1989). Eighty wells have been drilled to date in the Canadian Beaufort Sea. There have been 26 significant discoveries encompassing an estimated 1.5 Bbbl of oil and 4.5 Tcf of natural gas. The giant Amauligak oil and gas field will likely be the lead offshore oil development project, although plans are on hold at present. Current transportation concepts suggest that oil from Amauligak will be shipped by pipeline from the production islands to shore at Richards Island and then down the Mackenzie Valley to southern markets. The 9 offshore-exploration licenses that are currently in good standing are due to expire in 1990 or 1991.

FUTURE LEASE SALES

17. **Future State of Alaska Leasing Offshore and Onshore**: Seven lease sales in the Beaufort Sea and mid-Beaufort uplands are included in the State of Alaska's 5-year lease-sale schedule (State of Alaska, DNR, 1989). Offerings in the Beaufort Sea coastal area are considered to have moderate to high resource values.

Sale 70A: This sale is scheduled for September of 1990. The sale will include lands between the Colville and Canning Rivers and will reach 532,906 acres in extent. Petroleum potential of this area is thought to be low to moderate.

Sale 64: Proposed Sale 64 consists of approximately 771,840 acres of State acreage lying 30 mi from the coast between the Canning and Sagavanirktok Rivers. Most of the area was offered previously in Prudhoe Bay Uplands Lease Sale 34, held in September 1982. Some of these lands also were offered as part of previously held lease Sale 51. Additional acreage may be added to the sale, which is scheduled for May 1991, if certain active leases expire.

Sale 65: This sale reoffers submerged Beaufort Sea acreage between Pitt Point and Flaxman Island. The sale is scheduled for May 1991 after leases sold in the 1979 Joint Federal/State Beaufort Sea Oil and Gas Lease Sale expire. The acreage offered in Sale 65 is approximately 340,000.

Sale 61: The proposed Sale 61 area consists of about 875,000 acres southwest of the Kuparuk River oil field. The area is situated between the White Hills to the northeast and the Colville River to the northwest. Some of the acreage now included in the proposed sale has yet to be conveyed to the State; however, title to those lands is expected prior to the sale date. The sale is scheduled for January 1992.

Sale 68: The proposed Sale 68 area consists of approximately 393,000 acres of State-owned tide and submerged lands offshore of NPR-A. The seaward boundary of NPR-A is the subject of a dispute between the United States and the State of Alaska. The issue is pending before the U.S. Supreme Court. Should an agreement between the parties be concluded before the sale date, an adjustment in the sale acreage and boundaries may be necessary. The sale is scheduled for May 1992.

Sale 75: The proposed Sale 75 area will consist of approximately 110,080 acres of lands previously leased in State Sales 13, 48, and 54. The sale will include any lands formerly part of the Kuparuk River Unit and other acreage that becomes available as leases expire on the North Slope. The sale is scheduled for September 1992.

Sale 77: The proposed Sale 77 area will include North Slope lands about 70 miles south of the Kuparuk River oil field. The proposed sale area is bordered on the south by the North Slope Foothills Sale 57, on the east by the Trans-Alaskan Pipeline corridor, and on the west by the Chandler River. The proposed sale area consists of approximately 1,030,600 acres. More acreage is optional, depending on the availability of land from expiring or terminating North Slope leases. The proposed sale date is May 1993.

Sale 57: About 1,500,000 acres near the foothills of the Brooks Range between Umiat and Anaktuvuk Pass are to be offered in Sale 57, to be held in September 1993. The petroleum potential in the area is considered low to moderate.

Sale 80: The proposed Sale 80 area consists of approximately 500,000 acres of State-owned upland acreage on the north slope, lying between the Canning and the Sagavanirktok rivers. A major portion of the sale area consists of acreage that was offered but not leased in the previous State Lease Sales 34 and 51. Some of the acreage included in the proposed sale has yet to be conveyed to the State. Any acreage for which the State does not have at least tentative approval before the notice of sale will not be offered for sale. Petroleum potential in the proposed sale area is considered to be low to moderate.

18. **Future Federal OCS Leasing:**

Chukchi Sea: Under the proposed 5-Year OCS Oil and Gas Leasing Schedule for mid-1987 through mid-1992 (USDOI, MMS, 1987c), two lease sales are proposed for the Chukchi Sea--Chukchi Sea Lease Sales 109, held in 1988, and 126, presently scheduled for 1991. Initial descriptions of activities that could ensue from a lease sale in the Chukchi Sea as well the sale's resource potential are provided in the Sale 109, Chukchi Sea FEIS (USDOI, MMS, 1987b).

Beaufort Sea: The proposed 5-year leasing schedule (USDOI, MMS, 1987c) contains one lease sale for the Beaufort Sea, Sale 124, scheduled for 1991. The activities for developing the entire Beaufort Sea that are assumed in Section II.A of this EIS apply also to any future Federal leasing activity.

ADDITIONAL PROJECTS CONSIDERED IN THE MIGRATORY SPECIES' CUMULATIVE-EFFECTS ASSESSMENT

This section describes other OCS projects and proposals and existing oil and gas infrastructures that are part of the existing environment or are reasonably foreseeable future actions. These additional projects are used in assessing effects on migratory species within the range of the respective species.

19. **Dredging and Marine-Disposal Activities:**

Alaska Region: The Snake River, which enters Norton Sound at Nome, is dredged annually. Approximately 13,000 yd^3 of sediment are removed each year and deposited about 1/2 mi east of the mouth of the river. These dredge spoils are contaminated by mercury that was released into the environment during the years that mercury was used for the processing of gold. Data that have been made available recently have led the Environmental Protection Agency (EPA) to review the decision to use this offshore-disposal site. Nome harbor sediments were tested by the Army Corps of Engineers (COE) and the EPA in 1989 and were found to contain measurable levels of a number of chemical constituents. The COE and EPA are reviewing the new information regarding suitability of the material for continued ocean disposal.

Pacific Region: In the Pacific Region, a variety of materials have been and are being dumped offshore: dredge spoils, low-level radioactive wastes, obsolete munitions, and industrial and municipal wastes. Ocean dumping of acceptable waste materials is authorized under Title I of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (33 U.S.C. 1401), and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251). The EPA administers the designation and management of ocean-disposal areas and permits for dumping of all acceptable wastes except dredged materials. The COE administers the permit program for transportation of dredged materials for ocean disposal, with independent review and concurrence by EPA.

20. **Commercial Fisheries:** Waters off the coast of Alaska support some of the most productive fisheries in the world. In 1986, the ex-vessel value of Alaskan commercial fisheries totaled about $955 million. The salmon fishery was valued at $404 million, with a 5-year (1982-1986) average value of $354 million. Fisheries for groundfish (primarily pollock, sablefish, sole, cod, and other flounders) were valued at about $268 million. Although below recent former harvest levels, the shellfish fishery, mainly for crab, has experienced increasing price levels and was valued at $182 million (NPFMC, 1989). The ex-vessel value of the 1986 herring harvest was $39 million (Smith, 1989, oral comm.).

All Alaska OCS Region planning areas support commercial fishing to some degree, although the fisheries in the Beaufort and Chukchi Sea Planning Areas are of relatively minor importance. To some degree, all coastal communities in Alaska derive economic benefit from commercial fishing; however, in landings and value, Dutch Harbor, Kodiak, Naknek, Cordova, Sitka, and Petersburg rank as the major fishing ports in the Region.

Alaskan commercial fisheries employ gillnets, seines, and trolling gear for harvesting salmon; longlines for halibut, sablefish, and rockfish; and trawls for other groundfish. Pots of various types are used in the crab fisheries. The limited spring and summer herring roe/bait fisheries also employ gillnets and purse seines. Commercial-fishing success varies considerably in time according to the species fished and fluctuations in the populations of such species.

Foreign commercial fisheries also may affect Alaskan stocks and recently, concern has been directed toward open-ocean nondiscriminant gear fisheries.

In addition to the commercial fisheries, there are saltwater coastal sport fisheries for salmon, halibut, and other marine fishes. Sport fishermen also harvest shellfish (crab, shrimp, and clams). While of lesser economic value than commercial fisheries, the value of the sport fishery is significant and projected to increase rapidly with the growth in population. For example, a sport-fishing economic study for southcentral Alaska, where most of the State's population is concentrated, showed that angler expenditures associated with all sport fishing in southcentral Alaska were estimated at $127.1 million in 1986 (Jones and Stokes Associates, Inc., 1987).

21. Anadromous Fish—Freshwater Habitat: The freshwater spawning and rearing grounds and riverine migration routes used by anadromous salmonids such as Pacific salmon are especially critical portions of their habitat because the productivity of individual stocks is directly related to the amount and quality of this habitat. In southeastern Alaska, the Tongass National Forest supplies timber for mills at Ketchikan and Sitka and lesser volumes for smaller logging mills at several other locales. Some wood also is used for fuel and local construction. Logging can affect salmon streams and nearshore marine habitat through:

° Siltation that reduces gravel permeability in streams with consequent loss of salmon eggs and pre-emergent fry. This sometimes results from illegally operating logging equipment in streambeds or across streams.

° Stream blockage as a result of buffer-strip blowdowns following cutting.

° Water warming from loss of shade after cutting, with possible adverse effects on adult spawners and rearing fry.

Over 200 watersheds in the southeastern Alaska Tongass National Forest have been affected to some degree (Netboy, 1980). A number of studies have been conducted by the Alaska Department of Fish and Game, the Alaska Department of Environmental Conservation, the U.S. Forest Service, the U.S. Fish and Wildlife Service (FWS), and the National Marine Fisheries Service.

In part, to prevent damage, to mitigate damages, and to perform the necessary research, the above-listed agencies, in cooperation with the timber industry and the Alaska Department of Natural Resources, have organized an interagency group. This Alaska Working Group on Cooperative Forestry and Fisheries Research, has functioned well; however, considerable fisheries-effects studies remain to be done before some definitive conclusions are reached.

The Pacific Fisheries Management Council (PFMC) (1981) reviewed historical problems with, and the status of, freshwater habitat for anadromous salmon stocks in California, Oregon, and Washington. In particular, the PFMC cited the many serious problems associated with hydroelectric dam construction and operation.

For example, construction of hydroelectric projects has flooded or blocked access to productive spawning habitat, while the operation of these facilities has resulted in reduced flows during migration and in spawning areas, increased turbidity and sedimentation of gravel, and temperature modifications. Such changes have completely eliminated many areas from salmon production and have seriously reduced salmon-production potential in other areas.

The PFMC review also cited poor land- and water-use practices such as logging, road building, water diversions, streambed alterations, and pollution as factors responsible for substantially reducing or degrading the critical freshwater-habitat. Based on the freshwater habitat review presented by the PFMC (1981), substantial historical reductions in critical spawning and rearing habitat have occurred for many salmonid stocks in the central valley of California (i.e., the Sacramento and San Joaquin system) and the Columbia River drainage systems. Based on the trend existing at the time of their review (1978), the PFMC (1981) estimated that habitat availability in all major river systems and coastal streams within California, Oregon, and Washington would continue to decrease, or at best remain unchanged, over the next 10 to 20 years. Even with habitat rehabilitation efforts, the PFMC (1981) estimated relatively little improvement in habitat availability would be likely to occur over the next 10 to 20 years.

Although there are no current estimates of habitat availability, many of the same activities (i.e., hydroelectric-plant operation and water diversions) that have resulted in habitat loss or degradation still continue. Efforts to mitigate or rehabilitate degraded freshwater habitat are in progress or planned in some areas (e.g., the Upper Sacramento River), and there is increasing recognition (California Advisory Committee on Salmon and Steelhead Trout, 1988) that substantial action is required to arrest the long-term trend of habitat loss and degradation and also of reduced salmon production.

22. Subsistence Activities: Subsistence hunting and fishing are important from both a cultural aspect and in terms of providing a major source of food for Native and rural Alaskans. The following information is summarized from the Proposed 5-Year Outer Continental Shelf Oil and Gas Leasing Program Mid-1987 to Mid-1992 FEIS (USDOI, MMS, 1987), which is hereby incorporated by reference. The species used vary somewhat in different portions of the State and from community to community; however, in general, marine mammals and fish are important in most coastal areas.

Important subsistence resources for those communities bordering the Gulf of Alaska, Cook Inlet, and Prince William Sound include salmon, halibut, other marine fishes, freshwater fishes, shellfishes, intertidal resources, small marine mammals, waterfowl, and upland game.

Communities along the southern Bering Sea harvest salmon, halibut, shellfishes, intertidal organisms and plants, fur seals, hair seals, sea lions, birds and bird eggs, and caribou. Communities bordering the northern Bering Sea use salmon and other fishes; shellfishes; bearded, ringed, and spotted seals; walruses; bowhead and belukha whales; waterfowl; moose; reindeer; and caribou.

Communities bordering the Chukchi and Beaufort Seas depend heavily upon marine mammals. Resources used include bearded, ringed, and spotted seals; walruses; bowhead and belukha whales; polar bears; freshwater and ocean fishes; waterfowl; birds and bird eggs; caribou; moose; Dall sheep; berries; and vegetation.

23. Municipal Wastes and Other Onshore Effluent: Historically, the Nation's rivers, estuaries, and coastal waters have received municipal-waste discharges since collection and treatment of domestic wastes were initiated. Prior to the 1970's, ocean disposal was largely unregulated, and adverse effects on human health and the environment were observed.

The major point-source discharges of waste materials into nearshore and coastal areas come from sewage-treatment facilities, industrial facilities, and electric-generating facilities. These discharges are regulated by the EPA. The effluent from the industrial and sewage-treatment facilities may contain, even after treatment, substantial quantities of synthetic organics, heavy metals, suspended solids, oxygen-consuming materials, and nutrients. Sewage effluent also may contain fecal coliform and potentially pathogenic microorganisms, and cooling-waste discharges from power plants may be elevated in temperature and have increased chlorine levels.

Contaminants from marine-transportation activities enter the sea intentionally as a result of routine operational discharges and unintentionally as a result of accidental spills. With respect to ships that maintain sizable crews, the pollutants are the large amounts of domestic-waste products such as sewage, food waste, plastic debris, and trash from human activities on board. For recreational vessels, sewage disposal from marine-sanitation devices in highly populated, confined harbors and anchorages is the primary pollution concern.

In contrast to the important progress made during the 1970's in controlling industrial point-source discharges and in upgrading municipal sewage-treatment facilities, progress with nonpoint sources is negligible (CEQ, 1980). Nonpoint-source pollution is primarily the result of precipitation falling and moving over and through land and into surface waters. In some cases, nonpoint-source pollution is the result of human practices such as agriculture and irrigation. All land use activities are potential nonpoint sources of pollution. Such sources are classified as urban and nonurban runoff. Pollution discharges from nonpoint sources greatly exceed the discharge from point sources.

24. Coastal Development in California: California's population is estimated to be 28 million, with a potential 50 percent increase in the State's coastal population (within 50 miles of the coast) between 1980 and 2010. It was estimated that California had 381,000 acres of prime coastal wetlands at the turn of the century. Within 75 years, about two-thirds of this acreage had been lost to a variety of developments along the coast. These developments have caused disturbances that have ranged from large-scale, whole-ecosystem elimination to small-scale, habitat-specific alterations. They include, for example, urban development, harbor construction, dredging, dike and levee development, and marina development (Speth, 1979; Zedler, 1982; Zentner, 1988).

This dramatic loss of habitat is not without corresponding loss in plant and animal species. In fact, the declines of almost all of the species listed as threatened, endangered, or candidate by FWS can be traced to past overhunting or habitat loss by coastal development.

25. Federal and State Oil and Gas Activities:

Postlease-Sale Activities in the Beaufort Sea and Chukchi Sea Planning Areas: See Major Project No. 14 for a summary of postlease-sale activities in the Beaufort Sea and Chukchi Sea Planning Areas.

Oil and Gas Activities in Other Alaska OCS Planning Areas: The following lease sales have occurred in other planning areas of the Alaska OCS Region. Exploration activities have occurred within each of the sale areas except the North Aleutian Basin. Active leases remain within these sale areas, and additional exploration activities could be forthcoming.

Lease Sale BF - Beaufort Sea
Lease Sale 57 - Norton Sound
Lease Sale 70 - St. George Basin
Lease Sale 71 - Diapir Field
Lease Sale 83 - Navarin Basin
Lease Sale 87 - Diapir Field
Lease Sale 92 - North Aleutian Basin
Lease Sale 97 - Beaufort Sea

Exploration activities could include exploratory drilling from a jackup rig, semisubmersible drilling unit, drillship, bottom-founded drilling unit, or artificial island; helicopter-support operations; support-vessel operations, including ice management in the northern sale areas; and high-resolution shallow-hazard seismic surveys.

To date, there have been no proposals for development and production within the Alaska OCS Region. Should oil and/or gas be discovered in commercially producible quantities on leases within one or more of the aforementioned sale areas, development and production activities could occur. Transportation of produced product may occur by pipeline or tanker; the pipeline or tanker routes may pass through several planning areas.

State of Alaska Oil and Gas Activities: See Major Projects No's. 13 and 17 for a summary of activities associated with past and future State of Alaska oil and gas lease sales.

Northern and Central California Federal Oil and Gas Activities: From July 1964, when Exxon drilled the first well off the coast of Humboldt County, through November 1966, a total of seven exploratory wells were drilled in the Northern California Planning Area. Following the 1963 OCS lease sale, Shell drilled three wells in 1965 to 1966 in the Point Arena Basin. In the offshore Eel River Basin, four exploratory wells were drilled between 1964 and 1965. There has been no development or production in the area.

Between September 1963 and September 1967, Shell Oil Company drilled 12 exploratory wells in the Central California Planning Area. Of these, 10 wells were drilled in the Bodega Basin, beginning in 1963, and 2 wells were drilled in the Ano Nuevo Basin, beginning in 1967, on leases issued in the 1963 OCS lease sale. All oil and gas leases in the area have now expired.

Southern California Federal Oil and Gas Activities: While oil production in State waters off southern California commenced in 1896 with the development of the Summerland Field, the first exploratory wells in Federal waters were drilled in the Santa Maria Basin following the first Pacific oil and gas lease sale in May 1963. Chevron Oil Corporation drilled the first well in Federal waters in September 1964, off the coast of San Luis Obispo County. Twelve fields are located in the onshore portion of the basin, with one field on production in the offshore portion. One COST well was completed in 1978. As of September 1988, 296 exploratory wells had been drilled in the Southern California Planning Area.

Following the discovery of the Dos Cuadros oil field by Phillips Petroleum Company in 1967, exploration activities in the Pacific OCS focused on the Southern California Planning Area. A record number of 38 exploratory wells were drilled in the Pacific OCS in 1968. This exploratory activity in 1968 led to the discovery of the Hondo, Government Point, Pescado, and Secate Fields in the Santa Ynez Unit and increased industry's interest in the oil and gas potential of the Pacific OCS Region.

Exploration activities increased from 1974 through 1977, as industry further defined the oil and gas potential of the Southern California Planning Area. After a slight decline, exploration began a steady increase in the early 1980's as lease sales offered new acreage for offshore operators to explore. Since that time, the pace of exploratory drilling in the Pacific OCS has declined, as offshore operators focused their attention on development and production operations.

Twenty-four offshore fields are located in five major areas of the Southern California Planning Area. Among them are: Point Arguello/Gaviota, Santa Ynez/Las Flores Canyon, Point Pedernales/Lompoc, San Miguel/South Nipomo Mesa, and Santa Clara/Ventura. Fourteen fields capable of commercial production have been discovered in Federal waters in the Santa Barbara Channel since the advent of drilling there in 1967. Further fields are currently on production.

Two oil fields have been discovered offshore San Pedro in the inner-banks area of the southern California borderlands. Of the total wells in the planning area, only nine exploratory wells, commencing in 1976, have been drilled in the outer banks area. As of September 1988, 661 development wells have been drilled from 21 permanent production platforms. The cumulative production from this area, from its beginning in 1968 through 1987 has been approximately 403 MMbbl of oil and slightly less than 284 Bcf of natural gas. Annual production is about 33 MMbbl of oil and 45 Bcf of gas.

Development and production plans have been approved or are under consideration for four additional field projects involving six new platforms. In the Santa Ynez Unit, three additional platforms are proposed for installation; i.e., Harmony/60 well slots/in 1992, Heritage/60 well slots/in 1992, and Heather/28 well slots/in 1995. Platform Julius was proposed to be installed with 70 well slots in the San Miguel Field in 1988. However, San Luis Obispo voter initiative disapproved the onshore processing and transportation facilities of Platform Julius. Platform Independence is proposed to be installed in 1992 with 60 well slots in the Point Pedernales Field but may not be needed for development. Platform Hacienda is under consideration for the Rocky Point Field, but no official development and production plan has been received. Shell Western Exploration and Production Inc. is considering a relocation of planned onshore facilities to Santa Barbara County.

Southern California State Oil and Gas Activities: The 51 active leases on State offshore lands cover 161,000 acres. Of these leases, 29 are off Santa Barbara County, 10 are off Orange County, and 12 are off Ventura County. Nine platforms and seven production islands are presently operating on these leases. Four of the manmade islands are inside the Los Angeles/Long Beach Harbor Breakwater. The last State offshore lease sale was held in 1969.

Canadian Beaufort Sea Oil and Gas Activities: See Major Project No. 16 for a summary of Canadian Beaufort Sea oil and gas activities.

26. Transportation of Oil and Gas:

Cook Inlet Tankering: An increase in Cook Inlet-produced oil may be shipped to markets in the Far East if allowed by Congress. Laws currently restrict the export of oil produced from Federal and State leases in Cook Inlet to 3,000 bbl per day (about two tanker trips per year), the current level of export. However, efforts are under way by Alaska's congressional delegation to end these restrictions. If the restrictions are removed, it is estimated that 36 MMbbl of oil may be transported by tankers over the life of the Cook Inlet Field. This could amount to an average of about 14 tanker trips per year. It is believed that the tankers would travel the great circle route from Cook Inlet to Pacific Rim markets, which would result in tankers traveling through Unimak Pass and then westward just north of the Aleutian Islands. Alaska OCS planning areas likely to be affected would include the Gulf of Alaska/Cook Inlet, Kodiak, Shumagin, and St. George Basin.

Trans-Alaska Pipeline: See Major Project No. 1 for information about the Trans-Alaska Pipeline.

Trans-Alaska Gas System: The Yukon Pacific Corporation proposes to construct the Trans-Alaska Gas System (TAGS). This system would transport natural gas from Alaska's North Slope via a 36-inch outside-diameter pipeline to a tidewater facility at Anderson Bay, Port Valdez, Alaska. The proposed TAGS would closely parallel the existing TAP oil pipeline. Up to 2.3 Bcf of conditioned natural gas per day would be moved through TAGS. At Valdez, the natural gas would be converted to liquefied natural gas (LNG) for export by tanker to markets in the Asian Pacific Rim. Approximately 80 to 100 LNG tankers would be expected to visit the Valdez port per year.

27. Nonenergy Minerals:

Federal Offshore Mining Program--Norton Sound Lease Sale: The following information regarding the OCS Mining Program Norton Sound Lease Sale, and offshore mining in State waters was derived from the OCS Mining Program Norton Sound Lease Sale DEIS (USDOI, MMS, 1988), which is hereby summarized and incorporated by reference. The proposed action consists of 40 blocks to be offered for lease in July 1989. The total areal extent of the proposed Norton Sound Lease Sale is about 72,148 ha (approximately 178,282 acres). The blocks that comprise the proposed action are located about 5 to 22 km offshore in water depths that range from about 20 to 30 m. The MMS has estimated that placer deposits of gold in the proposed lease-sale area for a mean case could be 530,000 troy ounces. It is projected under the mean case that one dredge would be used for mining. About 100 acres per year would be dredged for a period of 14 years, with total dredging to include about 1,300 acres.

State Offshore Mining Program: Two areas along the northern shore of Norton Sound have valid mining leases--the area adjacent to the city of Nome and a small area off the coast near Bluff, about 85 km east of Nome. Permits have been applied for along much of the coast within 50 km to the east and west of Nome. These permits have been pending for several years.

From 1986 through 1990 Western Gold Exploration and Mining Co., Limited Partnership (WestGold), mined from leases covering 8,802 hectares (21,750 acres) in State of Alaska waters off the southern coast of the Seward Peninsula for placer gold. WestGold used the bucket-ladder dredge Bima and recovered about 105,000 troy ounces of gold from 1986 through 1989; approximately 277 acres were mined. Mining operations with the Bima were limited to the period from late May/early June to mid-November because of weather and sea-ice conditions.

No chemicals were used in the beneficiation process to recover the gold, but operations appear to have exceeded EPA NPDES limitations for two trace metals (mercury and nickel). Data from the compliance monitoring by WestGold also indicate that NPDES turbidity standards frequently were exceeded at the edge of the 500-m mixing zone.

During the summer of 1989 WestGold conducted test mining operations to evaluate a bucket-wheel-type dredge and suction-type dredge operated from a submersible, remotely operated vehicle (ENSR Consulting and Engineering, 1990). Estimated full-production rates for each of the systems range from 2,700 to 3,000 m^3 per day. However, test-mining-excavation rates averaged only about 120 m^3 per day; the maximum rate was about 1,135 m^3 per day.

In September 1990, WestGold announced that it was suspending mining operations with the Bima at the end of the 1990 season. At the Alaska Miners Convention in Anchorage in November 1990, R. Garnett, a WestGold Vice-President, reported that the Nome Offshore Placer Project was a financial failure and that the Bima had been barged to Seattle, WA, and would be offered for sale. WestGold in Alaska and the continental U.S. was being dissolved, and the leases would be available to others.

WestGold noted that the ore most prospective for gold occurrred in water depths of about 3.7 m; this ore could not be mined by the Bima, which has a draft of 4.4 m and cannot operate in water shallower than 6 m in calm seas and and 7.6 m in rough seas. Also, it was noted that, in the project area, gold occurred to depths of 4.4 m in the sediments but often was concentrated in the top .5 to 1 m. WestGold estimated the potential for gold in the project area to be between .5 and 1 million ounces.

APPENDIX F

MMS ALASKA OCS REGION STUDIES PROGRAMS

INTRODUCTION TO THE ALASKA ENVIRONMENTAL STUDIES PROGRAM

Mandate: The Alaska Environmental Studies Program (ESP) was initiated by the Department of the Interior (USDOI) in 1974 in response to the Federal Government's decision to propose areas of Alaska for offshore oil and gas development. Federal management of the Outer Continental Shelf (OCS) is guided by several legislative acts. Regulations implementing the OCS Lands Act (OCSLA) of 1953, amended in 1978 (OSCLAA), designated the Bureau of Land Management (BLM) as the administrative agency responsible for leasing, and the United States Geological Survey (USGS) as responsible for supervising development and production, of mineral resources on submerged Federal lands. The offices under the BLM and USGS responsible for offshore leasing were reorganized as the Minerals Management Service (MMS) in 1982. One of the goals of OCSLA was to provide for protection of the environment concomitant with mineral-resource development. Also, the Secretary of the Interior is required to conduct environmental studies to obtain information pertinent to sound leasing decisions as well as to monitor human, marine, and coastal environments (OCSLAA, 1978 [P.L. 95-372; Sec. 20]). The National Environmental Policy Act (NEPA) of 1969 requires that all Federal agencies utilize a systematic, interdisciplinary approach that will ensure the integrated use of natural and social sciences in any planning and decision making that may have effects on the environment. Federal laws such as the Coastal Zone Management Act, Federal Water Pollution Control Act Amendments, Marine Mammal Protection Act, Endangered Species Act, Alaska National Interest Lands Conservation Act, and Marine Protection, Research, and Sanctuaries Act impose additional environmental requirements on the offshore-leasing process.

Purpose: The Alaska ESP is unique among the various components of the offshore leasing program. About $219 million have been spent on Alaska-related studies since 1974. It is a part of the largest single-agency, mission-oriented, marine-studies program in the Federal Government. The purpose of the studies program is to establish information needs and implement studies to assist in prediction, assessment, and management of potential effects on the human, marine, and coastal environments of the OCS and nearshore waters by proposed oil and gas leasing and development. Lease-management decisions are enhanced when current, pertinent information is available in a timely manner. To attain the program goals, data on specific environmental, social, and economic concerns arising from offshore leasing are required. The Alaska ESP then monitors selected effects during and after oil exploration and development.

Organization: The Alaska ESP is in the MMS, Alaska OCS Region's, Leasing and Environment Office located in Anchorage, Alaska. It is one of four regional environmental programs responsible for providing information in support of offshore leasing and management processes. Other offices cover the Pacific, Atlantic, and Gulf of Mexico OCS Regions.

When the Alaska ESP began in 1974, BLM requested that the National Oceanic and Atmospheric Administration (NOAA) institute a marine environmental studies program to provide necessary assessment information in the biological and physical sciences. A Basic Agreement between BLM and NOAA provides a framework for administration (by NOAA) of the Outer Continental Shelf Environmental Assessment Program (OCSEAP). The current MMS-funded NOAA OCSEAP Program is located in NOAA's National Ocean Service Office in Anchorage, Alaska.

The Social and Economic Studies Program (SESP), a component of the ESP, was established in 1976 because of the unique characteristics of Alaska's Native population and the relative isolation and nonindustrial nature of the State of Alaska. Initially, Peat, Marwick, Mitchell and Company managed the program under contract. When the Alaska OCS Region took over the management of the SESP in 1979, core studies were conducted for frontier planning areas prior to each lease sale. With the evolution of the program and the increase in our understanding of the social systems in these areas, the studies have become more focused and oriented to specific issues.

As the Alaska Region's ESP has developed, its increased capabilities in information-gathering and marine-resource assessment have led to direct contracting for certain studies. Management and contracting functions for the SESP have been performed in-house since FY 1980. Studies of endangered species and the design and implementation of additional monitoring and some pollutant-transport studies became an MMS contracting responsibility in FY 1984.

Environmental Studies: The initial focus of the ESP was to obtain baseline information on the vast biological resources and physical characteristics of the Alaskan environment for prelease decision making. These studies included biological surveys of marine species, basic oceanography and meteorology, and geologic and sea-ice phenomena. As a broader base of information was established, it became possible to focus on more topical studies in smaller areas to answer specific questions and fill identified information needs. In addition, a number of generic studies were initiated on the potential effects of oil contamination on biological resources, and on the probable transport and dispersion of oil that might be spilled in the marine environment. These latter analyses are used to predict areas likely to be at greatest risk from possible pollution incidents. As more disciplinary data were collected and analyzed, the importance of taking an integrated, interdisciplinary approach by studying complete ecosystems in sensitive areas became apparent.

During this time, the leasing program was maturing. As a number of sales were held and exploration activities began, the need for post-sale studies to monitor the possible effects of oil and gas activities on the environment and resources of these areas was recognized. This has been the most recent change in the focus of the Alaska ESP. The program provides information for the development of the 5-year leasing schedule, continues to provide information for presale and sale-related decisions, and develops monitoring information necessary for post-sale lease management.

As studies efforts have become more complex, involving integrated, interdisciplinary efforts to study ecosystems and monitor the environment, the MMS has initiated planning workshops to gather maximum expertise, assess the status of existing information, identify indicator species and missing information, and plan the best possible approach to a study within the constraints of time and resources.

As more data and information on Alaskan resources and environmental mechanisms are collected by the MMS and other Federal and State agencies, brief studies are funded to search and evaluate existing literature and data prior to initiation of a new site-specific ecosystem study. This prevents duplication of effort, and saves valuable resources by focusing study efforts only on the areas of greatest information need and highest usefulness to MMS decision needs. Such evaluations were conducted as the first phase of recent ecosystem studies.

Computer-modeling techniques are now used to aid in the assessment of potential oil-spill and other pollutant risks to the environment and to key species such as fur seals, sea otters, and endangered whales. Modeling has also been used in the ecosystem studies, especially where extrapolation to other areas seemed warranted. Modeling provides a mechanism for synthesis and integration of theoretical occurrences with actual field observations.

Annual Environmental Studies Planning: From ESP initiation, the Alaska Regional Studies Plan has been prepared annually. The RSP, which will become a 2-year planning document beginning in FY 1991, provides a framework for accomplishing program objectives. Information needs are reviewed by diverse organizations and committees, including the Scientific Committee of the National OCS Advisory Board; the Regional Technical Working Group; the State of Alaska; and several Federal agencies such as the EPA, FWS, NOAA, and MMS. Further critiques result from program reviews and disciplinary workshops. The RSP links the information needs of the decision maker with the environmental studies that are to be conducted. The plan identifies existing and potential offshore management decisions and specifies relevant objectives in the studies to aid in making those decisions. Principal Investigators (PI's), contracted in accordance with the RSP, are drawn from private organizations as well as from universities and State and Federal Government agencies. A core of experienced investigators who are familiar with the task of working under arctic and subarctic conditions is available for the Alaskan program.

Preparation of the RSP is the culmination of a 12-month process carried out in the Alaska OCS Region by the Environmental Studies Section. This plan describes the recommended program for Alaskan environmental and social and economic studies for a given 2-year period. The RSP provides all the information needed by the MMS Branch of Environmental Studies to develop the Alaskan portion of a

National Studies List (NSL) and budget for presentation to the Director of MMS, the Secretary of the Interior, and the Office of Management and Budget.

It is important to note that this FY's 1991-1992 RSP was begun 2 years in advance, during FY 1989. Long-term planning is required because of (1) the scope and significance of the OCS oil and gas leasing process carried out by MMS for the Secretary of the Interior and (2) the time needed for budget planning and completion of studies. Proposed leasing schedules cover a 5-year period but are often adjusted to meet the concerns of affected states and the constraints of available Federal funds. Because of the need for advance planning, the program must try to anticipate all study needs based on the current and projected 5-year schedules; and it must also provide a suggested ranking of studies because the budget is not yet defined at this early stage. The OMB has established national ranking criteria used by all MMS OCS regions to establish study priorities. Primary criteria include legal mandates and timing of the information needs. The national criteria allow MMS to merge regional study needs based on the RSP's into an NSL for funding and procurement.

In addition to justifying Alaskan priorities for the national offshore studies program, the Alaskan RSP provides necessary guidance for conducting the program at the regional level. It assures an integrated framework and establishes priorities for MMS staff who plan, implement, and monitor the individual studies. Finally, at the regional as well as the national level, the RSP provides clear studies descriptions, discussion of regional needs, and ranking priorities that provide the basis for formulating regional and national budget requirements and for adjusting, as necessary, to budget limitations.

The Alaskan RSP introduces the planning process; describes the environmental characteristics of the three major subregions of the Alaskan OCS; provides overviews of the proposed studies to be conducted in these areas, as well as generic studies; charts the relationship of these proposed studies to the sale process; and provides a general picture of the annual budget and suggested ranking for environmental studies.

Environmental Studies Disciplines: From the initiation of the Alaska program, environmental studies have been categorized into several broadly defined subjects. Baseline information on distribution, abundance, and migratory patterns of marine species; potential disturbances to the marine environment; and oceanographic and meteorological conditions was integrated into the design of multidisciplinary studies. Major categories of study have included:

Contaminant Sources and Effects: These studies were designed to determine the predevelopment distribution and concentration in the natural environment of potential contaminants commonly associated with oil and gas development. The nature and magnitude of contaminant inputs and environmental disturbances that may accompany exploration and development, such as spilled oil, are also studied.

Endangered Species: The waters offshore Alaska provide habitat to several endangered species, notably the bowhead whale. In recent years much public and governmental attention in Alaska has been given to the potential effects of oil and gas exploration and production activities on the status and behavior of the bowhead. Studies have concentrated upon observations of bowhead-migration routes, potential feeding areas, and behavior. A unique role of bowhead study components has been to support seasonal drilling and geophysical-survey-monitoring program needs. During fall months, information on the status of the bowhead migration is transmitted from the field directly to MMS regulatory authorities.

Other studies on endangered species include emphasis on surveys of distribution and abundance of endangered whales--especially to document the fall migration routes through the Chukchi Sea, feeding ecology of gray whales, experimental research on the behavioral responses of migrating bowhead and gray whales, and feeding gray and humpback whales to noise sources associated with oil and gas exploration, development, and production. Migrating bowheads have been tracked in the vicinity of offshore drilling operations.

Living Resources: There are large numbers of cetaceans and pinnipeds in Alaskan offshore waters that are not endangered species. These include ringed, bearded, and fur seals; belukha whale; walrus; sea otter; and other species. The studies program has investigated life history, feeding habits, abundance, and distribution of several important species, as well as aspects of their interaction with oil and gas activities. In addition to important studies on marine mammals, studies contracted by MMS or by OCSEAP for MMS have addressed commercial and subsistence fisheries and marine birds. Nearshore-fisheries studies have been conducted in the Beaufort and Chukchi Seas. Seabird studies have been conducted in areas of the Beaufort and Chukchi Seas, and shorebird research has been conducted in the Southern Chukchi. Waterfowl responses to human disturbance and, seabird and ringed seal monitoring are also being investigated.

Oil-Spill Fate and Effects: A vital portion of the studies program is centered on determination of the fate and weathering of spilled oil and the effects that oil spills may have on marine habitats and biota. The MMS and NOAA participated in the Baffin Island Oil-Spill Test Program in the Canadian Arctic and investigated the weathering of spilled oil in open water and in sea ice. Weathering models for spilled oil in arctic waters have been developed and turbulent dispersion of oil droplets investigated.

Pollutant Transport: The possibility of oil spills is one of the principal items evaluated as part of an environmental assessment. The studies program has continued to simulate hypothetical oil-spill transport in open and ice- covered waters by means of circulation models. These simulations are key to sale-specific-EIS preparation. Related physical oceanographic studies have investigated currents, tides, sea-ice motion, and meteorological forcing. The results of these studies are used in computing probabilities of oil-spill contact for different coastal areas. In addition, a coastal- and surf-zone-transport model for prediction of the transport of spilled oil onto and along beaches has been developed.

Environmental Geology: The cold climate of Alaskan offshore waters results in extensive sea ice and permafrost. These conditions pose complications for oil and gas development, which in turn might lead to damage to the habitats of various species. The studies program has investigated shoreline erosion, sand and gravel deposits, shoreline sensitivity to oil, ice-bottom sediment interaction, bottom gouging by ice ridges, ice-ridging processes, and--to a lesser degree--marine permafrost. The information from these studies is used in defining potential areas of exploration difficulty.

Ecosystems: During recent years, two ecosystem studies for areas along the Chukchi Sea coastline have been undertaken. The Peard Bay study was completed in 1986; and at present, Kasegaluk Lagoon ecosystem processes and biota usage are being observed and modeled. Several studies in the northern Bering Sea and the central and northeastern Chukchi Sea have provided pertinent, additional upstream information for the Sale 126 area. These studies are the National Science Foundation-funded Inner Shelf Transfer and Recycling program (ISHTAR), the Chukchi Sea shelf benthic habitat study, and the Bering Strait/Hope Basin habitat characterization study (including Kotzebue Sound).

Environmental Monitoring: Since 1981, the MMS Alaska Region has performed monitoring studies initiated as part of aerial surveys and behavioral studies of bowhead whales. Since 1983, the Alaska Region has developed additional targeted-monitoring programs. The goal of the program is to test hypotheses regarding long-term change in sediments and lower-trophic-level organisms. This and other targeted-study efforts are expected to provide the basic framework by which the Alaska Region will meet monitoring needs under the OCSLAA. In pursuit of this goal, a long-term study was initiated to collect and curate marine mammal tissue for contaminant comparison.

Social and Economic Studies: The Alaska OCS Region SESP is unique among the OCS regions administered by the MMS. This program was begun in 1976 at the urging of the State of Alaska and with recognition by the USDOI that the societies of rural Alaska are especially vulnerable to the influences of western industrial development. Social and economic studies are also mandated by Section 20 of the OCSLAA, which includes monitoring of the human environment. Social and economic studies have now been completed for nearly every coastal region of the state, and the program is turning to more specific studies of topical issues (i.e., subsistence, evaluation of arctic and subarctic offshore technologies, and specific effects of offshore oil and gas activities). The general process followed in all SESP evaluations is based on a comparative analysis of hypothetical changes likely to occur at the State, regional, or local level. As a rule, the methods used to forecast, analyze, and monitor potential changes at the local level vary from those used to evaluate regional and State-level changes. At the local level, offshore activities are most likely to have a physical presence and, therefore, a more direct effect on human activities. In light of these potential effects of offshore activities on infrastructure, community services and facilities, and social stability, the local-level analyses look at the effects on the socioeconomic characteristics of the communities and the sociocultural characteristics of the people likely to be affected. At the regional and State level--where effects are likely to be indirect--cumulative, incremental effects of all prior lease sales form the context for evaluating effects on the subject lease sale.

The analyses of these effects appear in Section IV of this EIS. Social effects that may be attributed to the environmental consequences of OCS development are the subject of several sociocultural studies conducted for this lease sale and for Beaufort Sea Sale 97. Among these studies are the Chukchi Sea Sociocultural Systems Baseline Analysis, the Barrow Arch Socioeconomic and Sociocultural Description, the Description of the Socioeconomics of the North Slope Borough, the Effects of Renewable Harvest Disruption on Socioeconomic/Sociocultural Systems for Wainwright, the Nuiqsut Case Study, the Monitoring Methodology and North Slope Institutional Change Study, the Barrow Case Study, the North Slope Subsistence Study, the Social Indicators Monitoring Study, the Point Lay Case Study, and the Northern Institutional Profile Study.

Past Studies in the Chukchi Sea: Prior to initiation of the ESP, the majority of research in the Chukchi Sea pertained to geodetic and hydrographic surveys. With the exception of Project Chariot, relatively little information was available on the physical and biological processes that sustained arctic habitats and ecosystems or on the biota supported by these areas. In 1959, the Atomic Energy Commission authorized environmental studies in the Cape Thompson area to assess the potential effects of using nuclear-excavation techniques to develop a harbor. Several marine studies were begun to enumerate and depict the physical--chemical-oceanographic environment, coastal and offshore circulation, beach morphology, sedimentary regimes, lagoon biota, marine geology, marine plankton, benthic invertebrate abundance and distribution, climatology, and seabird-colony dynamics. Project Chariot was confined primarily to the southeastern Chukchi Sea (Point Hope-Cape Lisburne to the Bering Strait) and the adjacent landmass.

In the late 1970's, studies were initiated in the Chukchi Sea to collect information prior to Sale 85. Although this sale was subsequently deleted from the 5-year lease-sale schedule, considerable information was obtained. These early Chukchi Sea studies focused on distribution and abundance information on seabirds and bird colonies, marine mammals, fish, benthic organisms, and plankton. Current circulation and annual variation in ice zonations were also studied. Heavy-metal concentrations and ambient-hydrocarbon levels in the bottom sediments and water column were measured. These efforts emphasized the central and southeastern Chukchi Sea environment. Since 1979, several studies have examined the migration, habitat usage, and physiology of endangered whales and their relationship to the ice environment. Studies have been conducted of sound-transmission characteristics and used to predict the ranges at which bowheads and gray whales may react to specific sounds at specific sites. The probability of gray and bowhead whales encountering oil spills has also been studied.

When the Chukchi Sea Planning Area (Sale 109) was included in the current 5-year lease-sale schedule, environmental studies that concentrated on the northeastern Alaska coastline and the northern Chukchi Sea were resumed. Major efforts began on sea-ice transport, ocean-coastal circulation, ecosystem processes centered on Peard Bay, storm-surge effects, nearshore-fish resources, development of a shoreline oil-spill-risk index, oil-spill modeling, ringed seal and seabird-colony monitoring, monitoring bowhead whale migration and habitat usage, investigating Chukchi Sea shelf benthic habitats and processes, and determining regional ocean circulation.

The Alaska Region's ESP also sponsors generic studies that produce results applicable to various planning areas, including laboratory studies on the effects of weathered hydrocarbons on various species and their life-cycle stages, oil weathering in the presence of ice and sediments, developing a coastal-zone-oil-impact/retention model, and the effects of OCS activities on marine mammal and bird behavior. Much of the work on sea-ice morphology and dynamics in the Beaufort Sea can be applied to the northeastern and central Chukchi Sea. As part of the ESP process, small workshops on various topics and Information Transfer Meetings (ITM) focusing on regional study results have been held to assist the lease-sale process and EIS authors, and to inform various government, industry, and interested citizenry on current issues.

During the early years of the ESP, seismicity, volcanic activity, permafrost distribution, and bottom-sediment stability were funded to determine their potential hazard to OCS oil and gas development activities. These studies were gradually phased out due to funding constraints.

Ongoing and Proposed Studies in the Chukchi Sea: The Chukchi Sea Environmental Studies List that follows this discussion shows completed, ongoing, and planned studies as of October 1989. Studies proposed for the near future would provide further information on identified concerns related to the Chukchi Sea area. Recent study efforts from several projects have resulted in the mapping and graphing of statistical data on sea-ice behavior in the Chukchi Sea. Ice frequency, as a function of location, has been displayed for meltback and freezeup periods since the 1970's.

Two studies are underway to define and model Kasegaluk Lagoon ecosystem processes with an emphasis on marine mammal and bird use. Continuing studies also include shoreline sensitivity to oil spills, tracking ocean buoys in the offshore environment, remote imagery from satellites to determine ice-related events, timing and processes, isotope studies related to marine mammal habitat usage, and bowhead whale migration and behavior (both natural and potentially OCS-induced). A present study is comparing cumulative effects of human activities activities on bowhead whale behavior in pristine and industrially active habitats. Continuing studies address the behavioral responses of whales and other marine mammals to OCS activities and the potentially negative effects of these activities on populations, habitat usage, feeding, reproduction, and subsistence harvest.

Proposed studies for the Chukchi Sea will likely include a nearshore-fisheries oceanographic study, seabird-colony monitoring, importance of leads to bowhead whales and other marine mammals, revision of the oil-weathering model used in conjunction with the oil-spill-trajectory modeling, importance of benthic feeding areas for walrus in the northeastern Chukchi Sea and a study relating the potential effects of industrial activity on the subsistence hunting of bowhead whales.

Technology Assessment and Research Program (TA&RP): In addition to the ESP, the MMS has funded or contributed toward approximately 140 studies being conducted under the TA&RP. Many of these studies, which focus on arcticengineering technology, are joint Federal Government/industry efforts. The information obtained by these joint projects is often proprietary, except for that portion of the research that is conducted in Government facilities. Proprietary results from many of these joint studies will be made available to the public 2 to 5 years after completion of a given TA&RP project (see the Chukchi Sea Environmental Studies List that follows this discussion).

Synthesis of Information: Prior to the first lease sale in any OCS area such as the Chukchi Sea, a synthesis meeting is held to integrate multidisciplinary studies results from individual projects into a comprehensive picture of a particular planning area. Synthesis participants include scientists working under ESP contracts; MMS, NOAA, and other Federal-agency staffs; State of Alaska personnel; and representatives from the oil and gas industry, Alaska Native organizations, and other special-interest groups. During the meeting, participants discuss the most current information available and consider the potential effects of oil and gas development upon the human, biological, and physical environments associated with the planning area. Information needs that are identified during these meetings aid in future studies planning. Synthesis meetings provide EIS authors with the opportunity to directly discuss and exchange views with scientists and other participating personnel on pertinent issues and potential effects of leasing decisions.

The Chukchi Sea Synthesis Meeting, held in November 1983, resulted in publication of "The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development" (Truett, 1984).

A meeting to update information on the Chukchi Sea was held on March 27, 1986. ESP contractors presented recent results of their Chukchi Sea work to MMS staff authors of the Sale 109 EIS. A collection of papers that summarize this meeting was published in 1987.

Chukchi Sea Environmental Studies List

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Trace Hydrocarbon Analysis in Previously Studied Matrices and Methods Development for (a) Trace HC Analysis in Sea Ice and at the Sea Ice/Water Interface and (b) Analysis of Individual High Molecular Weight Aromatic HC, National Bureau of Standards, Cheslor, S., Research Unit No. 43, 1980.

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Dynamics of Nearshore Ice, Flow Research Co., Colony, R., Research Unit No. 98, 1979.

The Environmental Geology and Geomorphology of the Coastal Zone of Kotzebue Sound and the Chukchi Sea Forelands from Cape Prince of Wales to Cape Lisburne, University of Alaska, Cannon, J., Research Unit No. 99, 1979.

Delineation and Engineering Characteristics of Permafrost Beneath the Arctic Seas, U.S. Army-CRREL, Sellman, P., and Chamberlain, E., Research Unit No. 105, 1976 to 1983.

Seasonality and Variability of Stream Flow Important to Alaskan Nearshore Coastal Area, University of Alaska, Carlson, R., Research Unit No. 111, 1977.

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Pile-Foundation Design for Ocean Structures, Albertsen, Naval Civil Engineering Laboratory, TA&RP No. 54.

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Ice Stress Measurements, Cox, CRREL, TA&RP No. 77.

Structural Concepts for Lease Sale 87, Birdy, Brian Watt Associates, Inc., TA&RP No. 78.

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Development of a New Philosophy for Effective Underwater Inspection, Negus, Underwater Engineering Group, TA&RP No. 80.

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Numerical Wave Force Simulation, Vandiver, Massachusetts Institute of Technology, TA&RP No. 82.

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ATOS (Antiturbidity Overflow System) Experiment, Cruickshank, USGS, TA&RP No. 86.

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Ocean Wave Simulation Model, Borgman, University of Wyoming, TA&RP No. 103.

Damage Evaluation by System Identification, Yang, Advanced Technology and Research, Inc., TA&RP No. 104.

Chukchi Sea Transportation Cost Comparison Study, McKeehan, Intec Engineering, Inc., TA&RP No. 105.

Development of Inspection and Repair Programs for Fixed Offshore Platforms, Bea, PMB Systems Engineering, Inc., TA&RP No. 106.

Offshore Structural Systems Reliability, Cornell, Stanford University and Amoco Production Company, TA&RP No. 107.

An Investigation of Non-Linear Behavior of Compliant Risers, Chryssostomidis, Massachusetts Institute of Technology, TA&RP No. 108.

Oil Spill Response Equipment Performance Verification, Lichte, Mason, and Hanger-Silas, Mason Company, TA&RP No. 109.

Response of Spray Ice Structures to Ice, St. Lawrence, Atmospheric and Oceangraphic Forces, Polar Alpine, Inc., TA&RP No. 110.

Development of a Method to Evaluate the Tension Capacity of Drilled and Grouted Piles, Briaud, Texas A&M University, TA&RP No. 111.

Platform Removal Experiment, Culver, National Bureau of Standards, TA&RP No. 112 (Cancelled).

Open Ocean Boom Test, Meikle, Conservation and Protection, Canada, TA&RP No. 113.

Field Evaluation of Oil Spill Chemicals Additives, Whittaker, Conservation and Protection, Canada, TA&RP No. 114.

Hydrodynamic Effects on Design of Offshore Platforms, Bea, PMB Systems Engineering, Inc., TA&RP No. 115.

Impact of Annual Ice with a Cable-Moored Platform, Ettema, University of Iowa, TA&RP No. 116.

Performance Evaluation Procedures for Underwater Ultrasonic Inspection Systems, Schmidt, Battelle, TA&RP No. 117.

Blast Effects upon the Environment from the Removal of Platform Legs by Explosives, Connor, Naval Surface Weapons Center, TA&RP No. 118.

Helicopter-Borne Laser Ignition of Oil Spills, Frish, Physical Sciences, Inc., TA&RP No. 119.

Heavy Oil Behavior in the Ocean, Fingas, Environmental Emergencies Technology Division - Environment Canada, TA&RP No. 120.

Waterjet Barrier Containment of Oil in the Presence of Broken Ice, Meikle, Environmental Emergencies Technology Division - Environment Canada, TA&RP No. 121.

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Methodology for Comparison of Alternative Production Systems, Stahl, AMOCO Production Company, TA&RP No. 129.

Interference/Clearance Problem of Risers in Floating Production Systems, Rajabi, Brown and Root Development, Inc., TA&RP No. 130.

Erosional/Corrosional Velocity Criterion for Sizing Multi-Phase Flow Lines, Deffenbaugh, Southwest Research Institute, TA&RP No. 131.

Resistance of TLP Tendon Steel to the Ripple Load Effects of Stress Corrosion Cracking, Pao, Naval Research Laboratory, TA&RP No. 132.

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Shipboard Navigational Radar as an Oil Spill Tracking Tool,Tennyson, MMS, TA&RP No. 136.

NO_x Control Workshop, Philp, Arthur D. Little, Inc., TA&RP No. 137.

NO_x Control Development Program, Philp, Arthur D. Little, Inc.,TA&RP No. 138.

Operation RIGMOOR, Messenger, The Software Guild, TA&RP No. 139.

APPENDIX G

ARCHAEOLOGICAL ANALYSIS PREPARED BY MMS

Prehistoric Resource Analysis
Proposed Sale 126, Chukchi Sea

Purpose

In accordance with the Minerals Management Service (MMS) Handbook for Archaeological Resource Protection (#620.1-H, June 17, 1985), this archaeological analysis was prepared for offshore lease Sale 126 for the Chukchi Sea area. The analysis is intended to identify areas of possible prehistoric archaeological site potential and to aid the MMS in making recommendations to the Secretary on archaeological resource lease stipulation requirements and mitigation.

The MMS archaeological resources protection program is conducted under the authority of the OCS Lands Act, as amended (43 U.S.C. 1331 et seq.); the National Historic Preservation Act (NHPA), as amended (16 U.S.C. 470 et seq.); the National Environmental Policy Act (42 U.S.C. 4332 et seq.); Executive Order 11593; and the Department of the Interior, Solicitor's Opinion M36928, November 24, 1980.

Project Area Description

The area of the proposed lease offering is off the north coast of Alaska in the Arctic Ocean. It is approximately bounded on the north by 73° N. latitude; on the south by 69° 10" N. latitude; on the west by 169° W. longitude; and on the east by 160° 30" W. longitude.

The proposed lease area is approximately 23.68 million acres and contains 4,319 blocks. All blocks are included in this archaeological analysis.

Method

The method used to develop the archaeological analysis was established in the Handbook for Archaeological Resource Protection (MMS 620.1-H, August 11, 1986).

The procedures outlined in Chapter 2, Section D.1-4 of the handbook are:

Integration of the geophysical/geological and archaeological information is the focus of the prehistoric resource analysis. It includes a technical interpretation of existing geophysical/geological data in order to establish sea level changes and to identify relict landforms. This technical interpretation will provide the basis for evaluating the potential for prehistoric resource occurrence (habitability) within the proposed lease sale area. The process of integration begins at the broadest data-base level and proceed toward the specific. Preparation of the analysis is conducted in the following manner:

(1) Review the baseline study. If the regional baseline study indicates that the entire proposed lease sale area lies within an area of low probability for the occurrence of prehistoric resources, and no new data exist which contradict the regional baseline study findings, then no further prelease prehistoric resource analysis or postlease prehistoric resource reports will be required.

(2) Review the sea-level data in the proposed lease sale area to establish the best estimate of paleo-sea level when blocks of medium or high probability occur in the proposed lease sale area. Blocks which a regional baseline study indicates are medium or high probability, but were not above sea level during times of potential human habitation (habitability), will require no further prelease prehistoric resource analysis or postlease prehistoric resource report.

(3) Examine the geophysical/geological literature for information regarding forces or processes that might have destroyed potential prehistoric resources (survivability) or rendered them unrecoverable. Examples of such forces and processes are:

(a) glacial scouring;
(b) sea ice gouging;
(c) subaerial exposure;
(d) inlet migration;
(e) transgressive seas; and
(f) sedimentation.

The block will require no further prelease prehistoric resource analysis or a postlease prehistoric resource report if the block exhibits any of these processes to an extent that it would be expected that prehistoric resources did not survive and/or are not recoverable.

(4) Examine the USGS geology report, existing shallow hazards survey data, etc., for indications of significant landforms. If sufficient data exist to make a determination, those blocks that do not contain significant relict Pleistocene or Holocene landforms will require no further prelease prehistoric resource analysis or postlease prehistoric resource report. Those blocks that are not excluded from further consideration shall require a prehistoric resource report under the archaeological lease stipulation or ROW permit requirements.

Analysis

Step 1 - Review of the Baseline Study

Using the above method, the 4,319 blocks contained in this proposed action were reviewed. No comprehensive baseline study exists for the Alaska Region. Applicable baseline studies which cover portions of the study area include:

- Bering Land Bridge Cultural Resource Study (Dixon et al. 1976);

- Alaska Outer Continental Shelf Cultural Resource Compendium, Technical Report #119 (Dixon et al. March 1986)

These studies developed a general model which delineated areas likely to contain archaeological sites on the Outer Continental Shelf (Dixon et al., 1976). The criteria used for designating probability zones are:

Areas of High Probability

(1) Non-glacial river mouths and constricted marine approaches to these river mouths. Such areas would have concentrated anadromous fish and their predators.

(2) Natural terrestrial conditions, such as passes, which funnel large mammal movements.

(3) Prominent spits, points, rocky capes, headlands, and islands that may have provided habitats for seals and marine birds. Such habitat is only considered high probability of it occurs in conjunction with one or more additional habitat types or if there is a natural constriction which would tend to concentrate these species.

(4) Areas of possibly enhanced marine coastal habitat diversity and availability.

Areas of Medium Probability

(1) Lake margins. Although the presence of fish and waterfowl resources enhances these areas as settlement locales, they are less likely to be as productive (and less likely to foster winter settlements) as those listed above.

(2) North- and south-facing slopes. Guthrie (in Dixon et al., 1976) indicated that south-facing slopes tend to concentrate grazing mammals during early spring plant maturation and that many times north-facing slopes provide wind-blown, snow free winter ranges. However, neither of these habitat types concentrate grazers into specific locations where large aggregates of animals can be harvested. Although these areas are generally more productive, the mammals are scattered over a comparatively large area.

Areas of Low Probability

(1) Any habitat type not listed above.

These previous designations of "high," "medium," and "low" probability for prehistoric resource occurrence are based on paleogeographic reconstructions using only extensions of terrestrial landforms and bathymetric data (Dixon et. al, 1986), not on seismic data which are necessary to delineate buried features. It is the buried features that are protected from the effects of many destructive marine processes, and which, therefore, have the greatest potential for preserved archaeological sites.

Recently, confusion had arisen about use of the term "high probability" to designate archaeological resource potential. The utility of "high," "medium," and "low" designations has also been questioned in the past. Since the decision to be made is whether to invoke the archaeological stipulation or not invoke the stipulation, it may be more useful to refer to areas as either "having potential" for archaeological resources or "not having potential" for resources.

While data exist which document the close association between the campsites of recent native populations and stream channels, the question exists as to whether this association could be projected back through time and used as a predictive model for site occurrence. A study from Banks Island in the Canadian Northwest Territory (Good and Bryant, 1985) suggests that during the last glacial epoch, large relict fluvial channels may have been infilled with aeolian sands, and that only small braided streams flowed intermittently through the valley-fill deposits. If this was the case for formerly exposed areas of the Alaskan shelf as well, it could be argued that archaeological sites, rather than concentrating along the outer banks of stream channels, would occur within the sometimes broad areas of channel fill.

However, regardless of the potential for occurrence of preserved archaeological sites, if specific features, such as braided stream channels, cannot be delineated within the larger areas of channel fill material, there would be no further mitigation required for potential archaeological sites within the fill areas. In such instances only the immediate vicinity (100 to 150 meters) of the channel banks would have potential for the discovery of archaeological sites, and then only if the channel banks appear to be well preserved. These are the areas that would require further mitigation.

One core collected by USGS in the southeastern Chukchi Sea showed a sequence indicative of the Banks Island-type aeolian filled relict valley with braided stream deposits. While this provides some evidence that the Banks Island data may be applicable to the Chukchi Sea, the potential braided stream deposit in the USGS core was less than 0.3 meters thick and would be undetectable with seismic instruments. In such a case, although the channel fill deposits would be seen on the seismic data, the specific braided stream deposit would not, and no avoidance of the general fill material would be required.

Step 2 - Review of Sea Level Curves to Determine Habitability

Published sea level curves for the Alaska Region indicate that sea level was 90 to 100 meters below present during the late Wisconsinan glacial maximum 18,000 to 20,000 years ago. Although the entire Chukchi Sea continental shelf would have been dry land at the glacial maximum, present evidence for the presence of man in the area dates to only about 12,000 B.P.

Sea level curves vary considerably in the estimated position of sea level at 12,000 B.P. The curve by Morner (1969) indicates that eustatic sea level may have been as much as 65 meters below present at 12,000 B.P. A eustatic curve by Godwin, et al. (1958) indicates that sea level was approximately 55 meters below present at 12,000 B.P. A composite curve of sea level indicators from relatively stable areas (such as the Chukchi Sea is believed to be) shows a wide scatter of data points prior to about 7000 B.P., but shows sea level to be on an average about 45 meters below present at 12,000 B.P. (Shepard and Curray, 1967). Finally, a curve derived from indicators in the Kotzebue Sound area, south of the Chukchi Sea Planning Area shows sea level to have been between 32 and 30 meters below present at 12,000 B.P. (McManus, et. al, 1983)

South of the Chukchi Sea Planning Area, sea level data points should become shallower as the influence of isostatic rebound following removal of the late Wisconsinan glacial ice mass caused formerly submerged areas to be uplifted. Therefore, an organic sample giving a date of 12,000 B.P. presently found at -30 meters elevation would have originally been at a lower elevation. For this reason, the McManus, et. al., curve is probably somewhat shallow when being applied to a more stable area such as the Chukchi Sea Planning Area, which is thought to have been relatively unaffected by isostatic rebound.

As more specific sea level data become available from the Chukchi Sea Planning Area, more accurate determinations of the extent of shelf exposed at 12,000 B.P. may be made. In the interim, it is recommended that a very conservative figure of -40 meters be used as an estimate for the 12,000 B.P. shoreline in the Chukchi Sea Planning Area.

Step 3 - Review of the Geological/Geophysical Data to Determine Survivability

For the Chukchi Sea Planning Area, potentially destructive processes include ice gouging, thermokarst erosion, thermal abrasion, winter storms which rework bottom sediments, and marine transgression. Of these factors which may have caused destruction of archaeological sites in the Chukchi Sea Planning Area, only the process of ice gouging has been documented and mapped (Lewbel, 1984). Though other processes are presumed to have occurred, we are not aware of data sufficient to map the areas affected by these processes. Until more data are available, and these processes clearly documented, they cannot be generically invoked as having destroyed all archaeological sites within the planning area.

Phillips of the USGS previously mapped various intensities of ice gouging within the southeastern portion of the Chukchi Sea Planning Area (Lewbel, 1984). Phillip's area of "High Ice-Gouge Intensity" is an area where recent ice gouging can be documented and is of an intensity that archaeological sites occurring within the area may have been completely reworked. This depends on the depth of the ice gouging in relation to the thickness of Holocene sediments which would overlie and protect archaeological sites along the late Pleistocene surface from the destructive effects of ice gouging.

Data on relict shelf processes which would have affected the survival of archaeological sites progressively throughout the Holocene marine transgression are almost entirely absent. Some evidence of buried and infilled gouges has been observed in the seismic data collected in the Chukchi Sea.

Step 4 - Review to Identify Significant Landforms

Landforms are a useful indicator of areas where archaeological sites are likely to concentrate. This is because many landforms are areas where natural resources such as fresh water, and plant and animal resources, necessary for human survival, concentrate. Most archaeological sites cannot be directly detected through remote sensing data; however, the presence of a site can be confirmed through coring of a potential site area (landform).

The MMS Handbook states that "If sufficient data exist to make a determination, those blocks that do not contain significant relict Pleistocene or Holocene landforms will require no further prelease prehistoric resource analysis or postlease prehistoric resource report." In the absence of sufficient data, which is almost always the case prior to the postlease site-specific geohazards survey, blocks cannot be eliminated from the archaeological report requirement based on the lack of known landforms.

Five general areas have been previously identified as possessing landforms with a high or medium probability of archaeological site occurrence. These areas include:

1. A seafloor depression east of Herald Shoal;

2. Various Chukchi Sea nearshore bathymetric depressions;

3. Areas lying offshore of Icy Cape and Point Hope;

4. The Barrow Sea Valley (outside of the sale area); and

5. The buried northwestern delta complex north of Herald Shoal.

In addition to these large landforms, all areas of the Chukchi Shelf were subaerially exposed shallower than 30-32 meters at 12,000-11,800 B.P. and could contain preserved landforms (Bloom, 1983; Dixon et al., 1986; McManus et al., 1983).

Sea-Floor Depression East of Herald Shoal

The large, elongate, closed depression east of Herald Shoal (see Figures 5 and 6) has been proposed by Dixon as an area of high archaeological site potential. This depression can be extrapolated from bathymetry maps as a probable lake or estuary at some time before submergence, which occurred before 15,100 years ago according to the sea level rise curve of McManus et al.or much more rapidly at 12,500 years ago according to Morner's curve (see Figures 1 and 2). Sea-floor sediments within the depression consist of sand and mud (Figure 3). Phillips reported 3 to 4 meters of sediments above folded bedrock at the site (Figure 4). Sediments within the northern part of the depression (as shown on Figure 4) are associated with the deltaic complex northwest of Herald Shoal.

Nearshore Bathymetric Depressions

Several other sites have been proposed by Dixon as paleolakes (see Figures 5 and 6) since today they form closed bathymetric depressions. Five such depressions were located partially or completely within the sale area. These depressions do not have significant topographic relief. The majority of them lie within sand wave fields with closures formed by the sand waves. The sand waves are Holocene features so these areas might not have been depressions during the Pleistocene. Significantly, none of these depressions appear on later, more accurate, bathymetric maps (Hill et al.). These features are probably not paleolakes. One depression, east of Cape Lisburne, was identified by later mapping. Holocene sediments appeared to form closures in this case also.

Offshore Icy Cape and Point Hope

Dixon has reported (Dixon to Miller, personal communication) that archaeological sites at Point Hope and Icy Cape extend virtually to the water's edge. He feels that these areas served as "lookouts" to observe the passage of game. A series of bathymetric rises extend offshore northwest from Icy Cape.

Barrow Sea Valley

The southern head of Barrow Sea Valley reaches but does not impinge on the northeast portion of the sale area. This valley would have been a major region of constricting topographic relief during its subaerial exposure. Phillips reports sand waves and more than 6 meters of sediments cover the site. In this area terrestrial Pleistocene sediments may exist on the sea floor. The down-cutting of modern channels in the sea valley has exposed Quaternary sediments and some of these may be terrestrial Pleistocene deposits.

Northwestern Delta

The buried northwestern delta complex identified by Phillips, et al. could be an area of high archaeological site potential. The major Late Pleistocene drainage patterns were along the ancient Chukchi Valley to the south and along the Barrow Sea Valley to the north. The location of paleochannels is poorly known at present and their individual ages may vary greatly. The large number of channels suggests that they may have been the principle agent of erosion and sedimentation on the Chukchi Plain. These channels may contain terrestrial sediments within the fluvial sequences.

Summary

This analysis concludes that: (1) the various Chukchi Sea nearshore bathymetric depressions do not constitute areas with a significant probability of archaeological site occurrence; and (2) no tracts within either the areas offshore Icy Cape or the Barrow Sea Valley are within the Chukchi Sea Sale 126 area. No specific tracts containing buried channels were identified from available data. Such channels are potentially present on most tracts and could be identified by the shallow hazard surveys conducted prior to drilling.

Step 5 - Prehistoric Site Potential Summary and Recommendations

The 40-meter bathymetric contour provides a rough approximation of where the shoreline would have been in the Chukchi Sea Planning Area at 12,000 B.P., the date at which the evidence for prehistoric man in the Americas is indisputable. More detailed sea level data from the Chukchi Sea may eventually revise this estimate downward to the 45 or 55 meter bathymetric contour, which is more in line with data on eustatic sea level change from other tectonically stable areas of the world.

All blocks in the Chukchi Sea planning area shallower than 40 meters water depth would have been exposed as dry land at 12,000 B.P. Along this portion of the now-submerged shelf, relict terrestrial landforms provide indicators of areas where there is a higher potential for archaeological sites to occur. Prior to the collection of postlease marine geohazards data, insufficient data exist to determine whether landforms which may contain archaeological site deposits are present.

Erosional processes such as ice gouging, thermokarst erosion, thermal abrasion, winter storms, and marine transgression may scatter and destroy archaeological deposits. When sufficient data are available to map the occurrence and extent of these processes, they can be used to eliminate areas from further archaeological consideration. However, until specific data on the effect of these processes are available, only severe ice gouging is sufficiently documented to allow specific lease tracts to be eliminated from further archaeological consideration. Areas mapped by USGS where ice gouging is intense, and extends into the sediments to a depth greater than the thickness of Holocene sediments, can be eliminated from further archaeological requirements.

Figure 7 shows the lease blocks within the Chukchi Sea Planning Area which fall within the 40-meter bathymetric contour and on which the lease stipulation requirement for an archaeological report should be invoked. Those tracts which fall within the area of intense ice gouging as mapped by USGS (Lewbel, 1984) are also shown. These tracts, although they fall within the 40-meter bathymetric contour, would be excluded from the archaeological report requirement due to a low potential for site survivability.

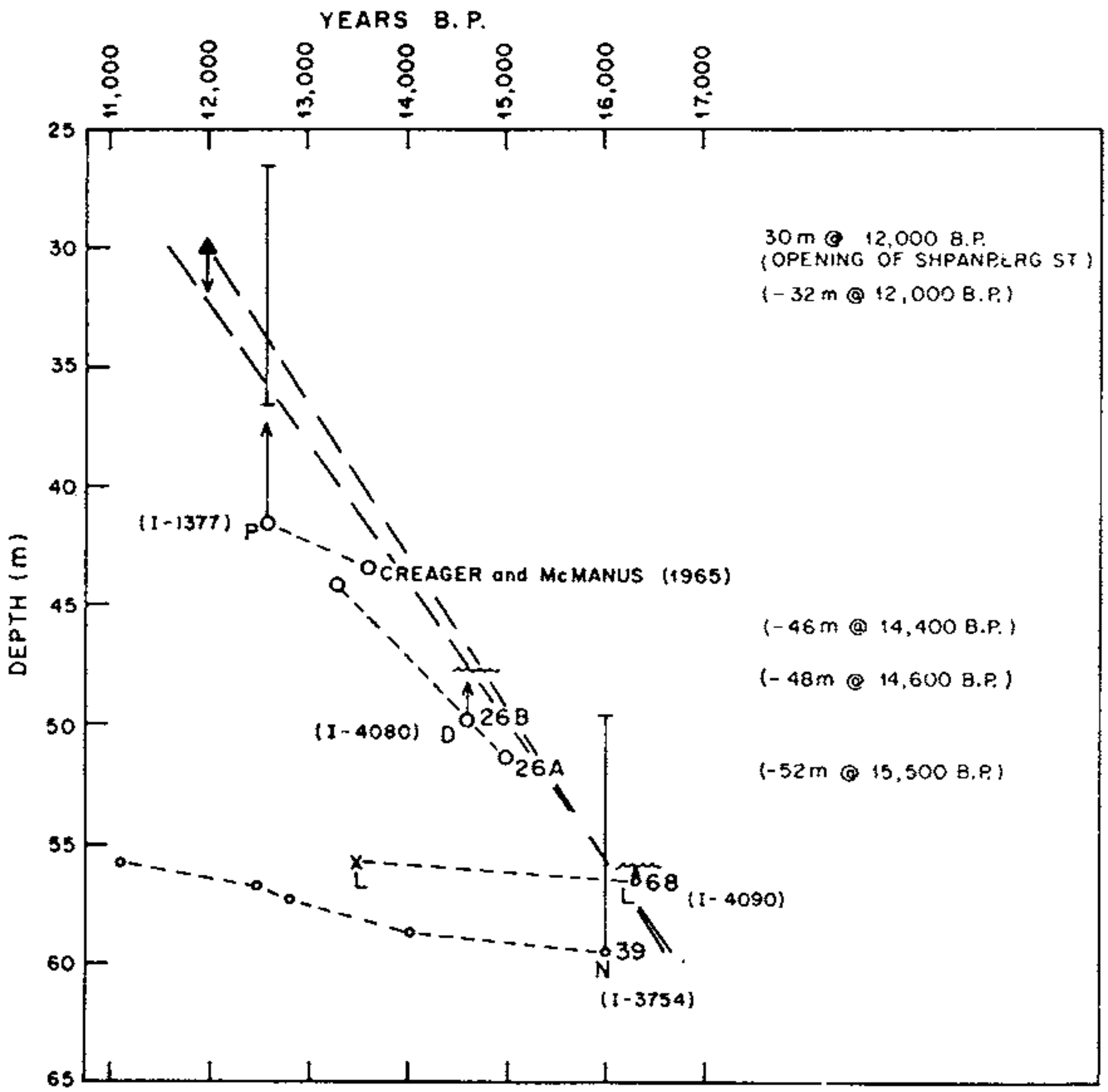
The blocks on which the archaeological resources stipulation are to be invoked are:

OPD	Blocks
NR 2-4	52-55, 96-100, 140-144, 184-187, 228-231, 272-277, 316-321, 360-365, 404-409, 448-453, 492-496, 536-540, 580-583, 624-628, 668-671, 712-715, 756-758, 800-802, 844-846, 889-891, 933-934, 977-978
NR 2-6	17-18, 61-62
NR 3-1	287, 328, 331, 371-372, 418-419, 459-460, 462-463, 503-504, 593-595, 637-639, 681-683, 725-727, 769-770, 947, 990-991

NR 3-2	14-15, 58-60, 139-140, 181-184, 221-227, 265-270, 309-313, 353-356, 397, 573, 661, 726-727, 768-771, 811-815, 837-838, 855-857, 881-882, 899-900, 925-926, 928-929, 940-941, 969-973, 983-985
NR 3-3	23-24, 67-68, 112, 156, 193-194, 200, 234-238, 244, 277-281, 320-324, 367-368, 947-948, 989-992
NR 3-4	1-5, 14-17, 45-49, 57-62, 89-93, 100-106, 110-111, 133-137, 144-151, 153-155, 177-181, 188-189, 193-195, 197-199, 221-224, 231-244, 266-267, 271-284, 314-328, 361-372, 404, 407-416, 447-448, 450-455, 493-499, 537-543, 580-587, 623-631, 666-675, 709-718, 752-761, 795-803, 838-846, 881-889, 925-932, 939, 969-975, 982-983
NR 3-5	22-26, 65-70, 108-114, 153-158, 195-202, 238-246, 282-290, 326-333, 370-377, 413-420, 456-463, 500-506, 543-549, 586-593, 630-636
NR 3-6	1-6, 13-15, 45-49, 56-59, 89-92, 99-103, 133-135, 142-145, 177-178, 185-188, 221, 228-232, 272-275, 315-319, 359-362, 402-406, 445-449, 488-493, 531-537, 575-581, 618-625
NR 4-3	47-48, 52-53, 90-97, 134-140, 178-184, 221-228
NS 3-7	770, 813-814, 855-858, 899-902, 942-946, 986-990
NS 3-8	460-461, 500-506, 541-550, 573-594, 618-638, 662-674, 706-715, 749-757, 793, 795-801, 837, 840-846, 881, 888-891, 925, 934-937, 969-970, 979-981

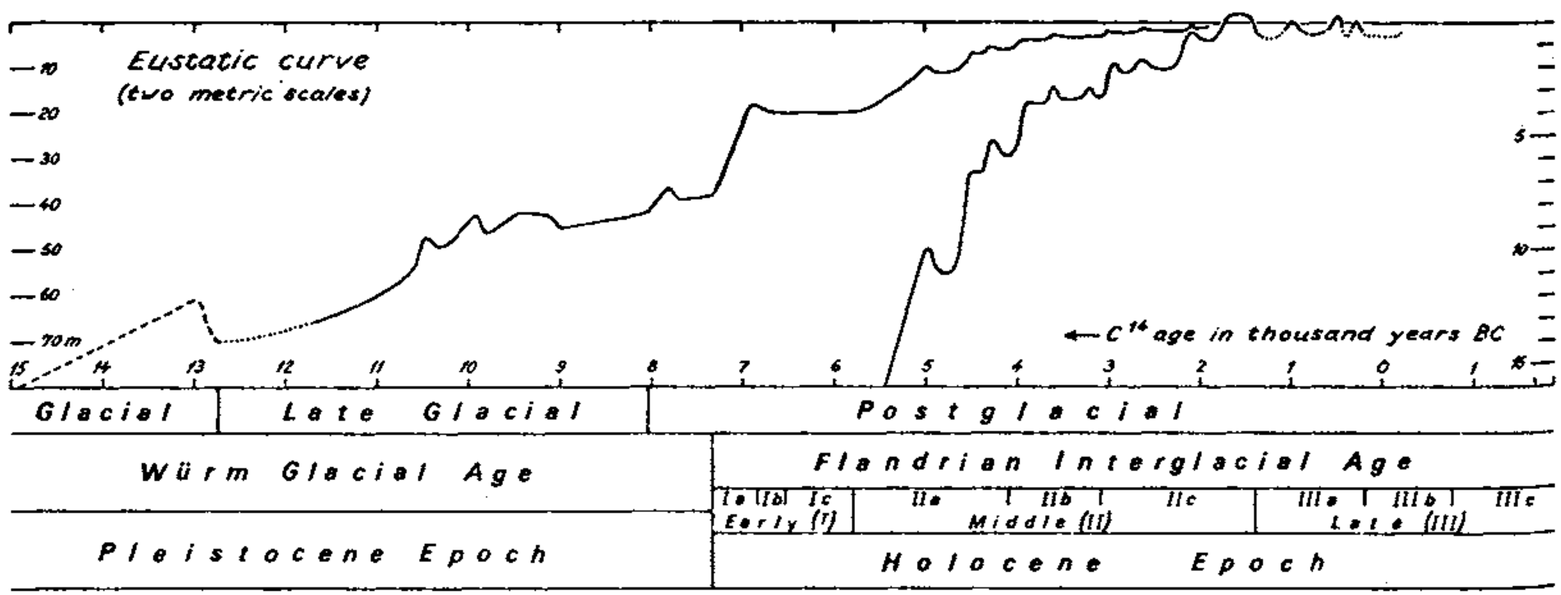
Lessees will be notified, immediately following the lease sale, of the requirements for archaeological reports for those leases which contain blocks on which the archaeological stipulation will be invoked.

Analysis of the geohazards survey data collected on these tracts will provide valuable additional data to address unresolved geologic questions pertinent to archaeological resource potential discussed above. These questions include: 1) what evidence is there for the extent and severity of ice gouging in the Chukchi Sea, and is there seismic evidence of relict infilled gouges at and buried beneath the sea floor; 2) do high frequency seismic signals penetrate areas of sea floor gravels; and 3) do the seismic data provide evidence of the nature of relict fluvial systems on the Chukchi Sea shelf (i.e. is the fill primarily alluvium, or aeolian with braided stream deposits?) By analyzing the geohazards data with such questions in mind, the geohazards data can be used in future MMS Prehistoric Resource Analyses to further refine the area within which there is potential for archaeological sites to occur.



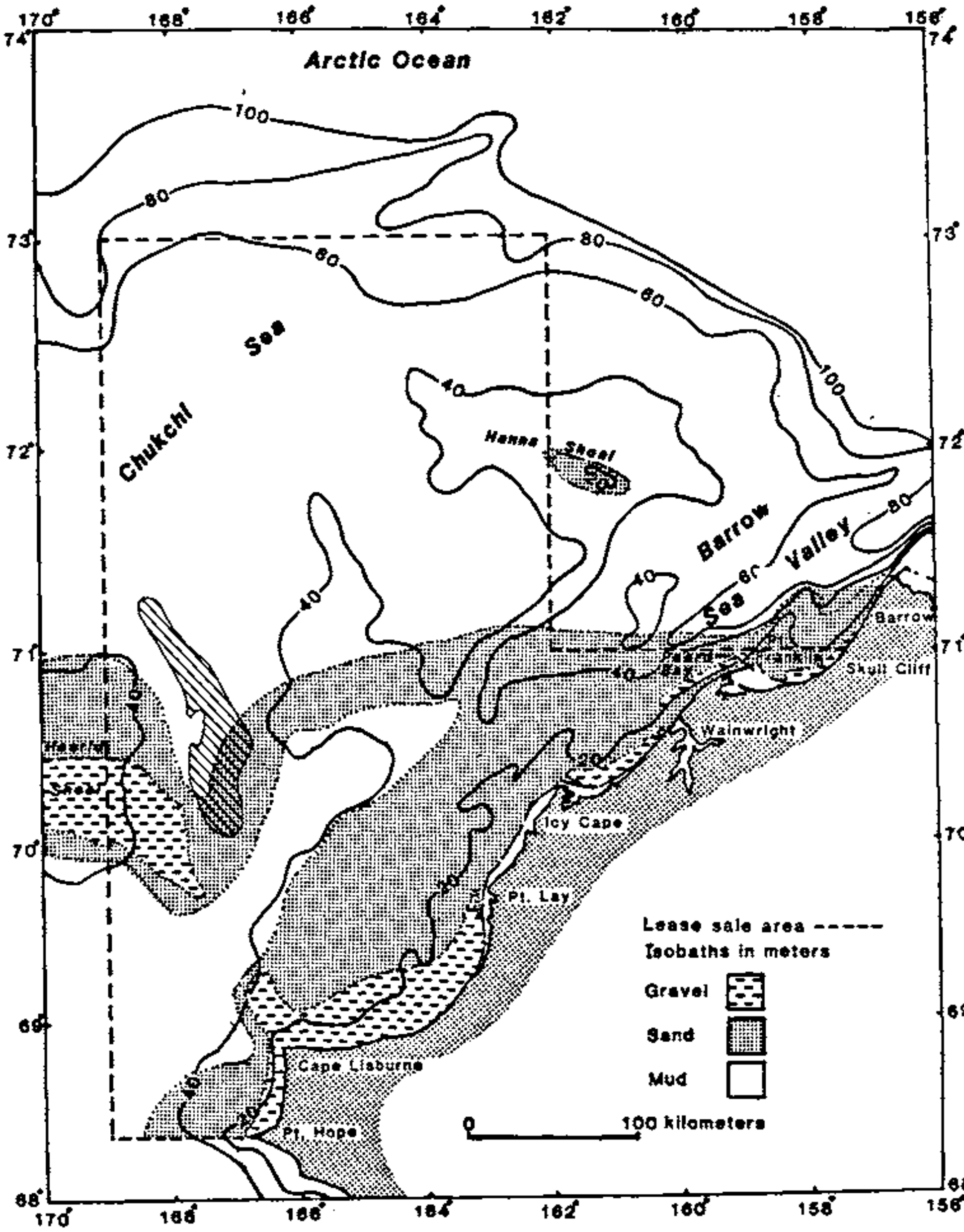
Estimated sea level curve for the Chukchi Sea (16,500 to 12,000 B.P.). Lines of short dashes connect sample data in cores 26 (A and B), 39, and 68 (for locations see Fig. 1) and the core described by Creager and McManus (1965). Circles represent dates and depths below present sea level of samples in these cores. X represents an apparently unreliable date. The types of data used in estimating sea level positions (L, N, D, P, and the triangle) are described in the text. Cores 26A and B are replicate cores at station 26. Laboratory C-14 numbers are as follows: P = I-1377; D = I-4080; L = I-4090; N = I-3754.

FIGURE 1. LATE PLEISTOCENE SEA LEVEL RISE (McManus, et al., op. cit., p. 372)



Eustatic curve for the last 17,000 years. The younger part is enlarged in order to show the fluctuations. The subdivision of the Late Quaternary (three different systems) here proposed is shown below the eustatic curve.

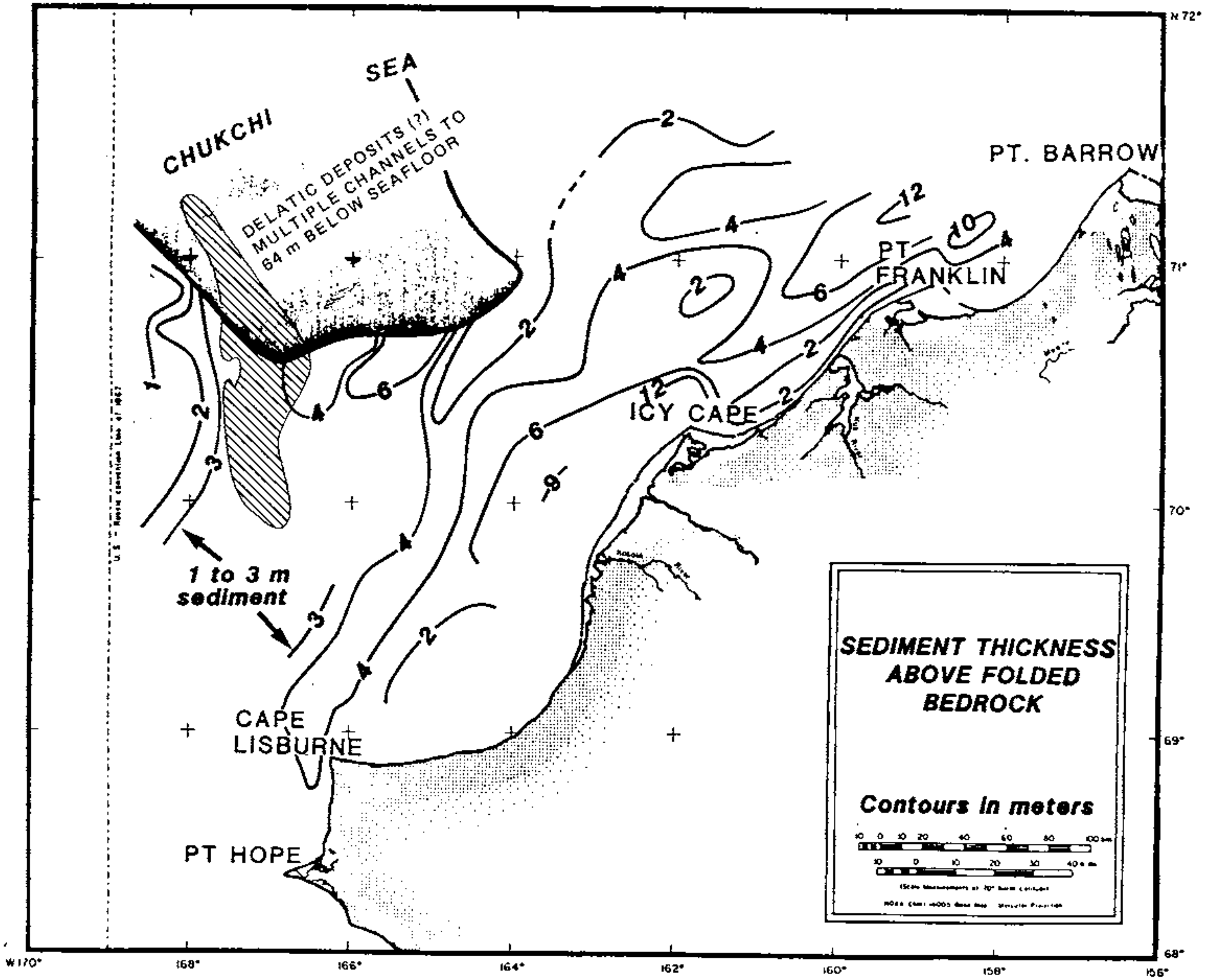
FIGURE 2. LATE PLEISTOCENE SEA LEVEL RISE (Morner, op. cit., p. 396)



Distribution of surficial sediments within the Chukchi Sea. Data from Shumway and Beagles, 1959, Creager and McManus, 1967, Barnes, 1972, Grantz and others, 1982, and Phillips and others, 1982.

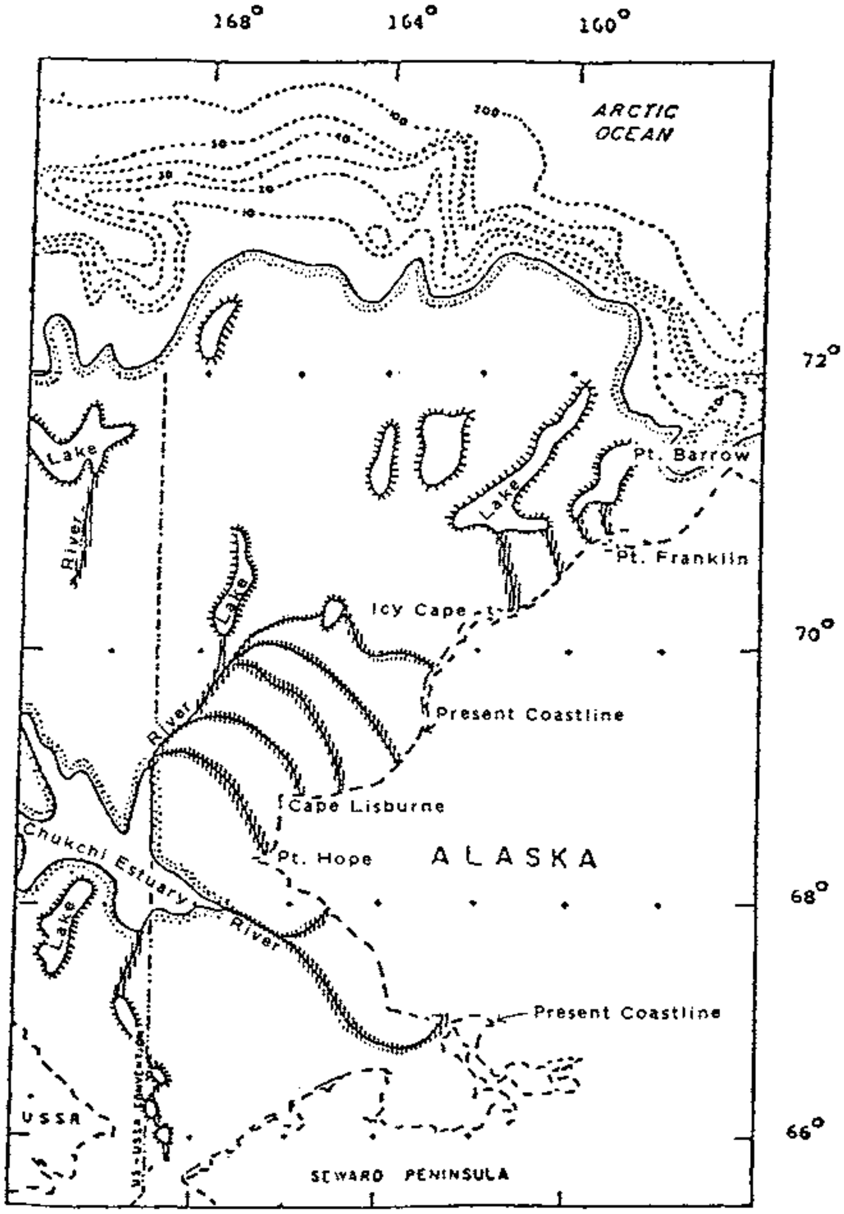
AREA OF HIGH ARCHAEOLOGICAL SITE POTENTIAL

FIGURE 3. SURFICIAL SEDIMENTS IN THE CHUKCHI SEA WITH BATHYMETRIC CONTOURS IN METERS (Phillips, internal memo, MMS)



AREA OF HIGH ARCHAEOLOGICAL SITE POTENTIAL

FIGURE 4. ISOPACH MAP OF SEDIMENT OVERLYING BEDROCK IN THE NORTHEAST CHUKCHI SEA. MULTIPLE CHANNELS, CUTTING DOWN TO AT LEAST 64 m BELOW THE SEA FLOOR, ARE FOUND IN THE NORTHWEST PART OF THE CHUKCHI SEA (Phillips, 1982)



Chukchi/Arctic coast, Standstill II, 16,000 B.P.
Compiled by G.D. Sharma from National Ocean Survey charts 1215 N-10, 1711N-17B, 1711N-18M, 1714-11B, 1714N-12B, 1814-10B and unpublished data of the University of Washington.

River Mouths and Nearshore Upwelling

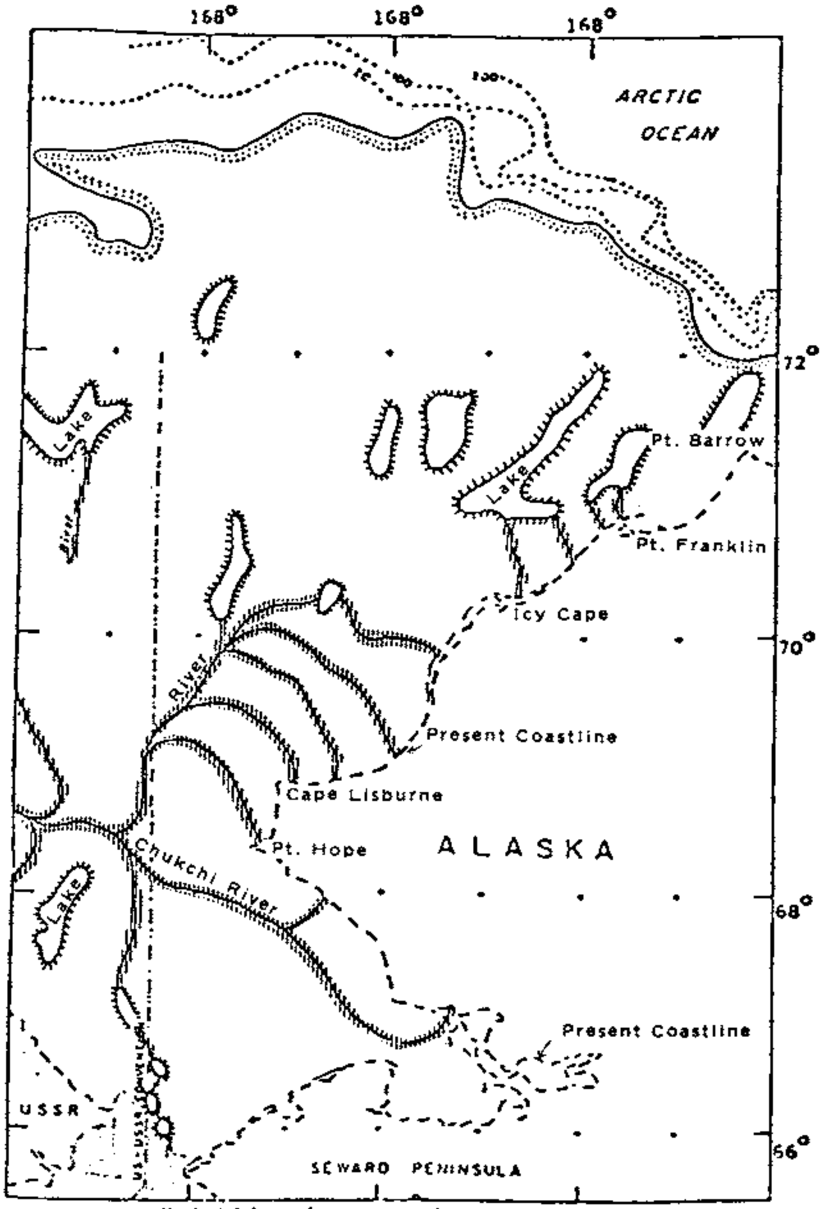
Constricting topography concentrating large mammal movement

Riverine/Tundra-Steppe Ecotone

Freshwater Lake/Tundra-Steppe Ecotone

Chukchi/Arctic coast, Stillstand II, 16,000 B.P. Compiled by G.D. Sharma from National Ocean Survey charts 1215N-10, 1711N-17B, 1711N-18M, 1714-11B, 1714N-12B, 1814-10B and unpublished data of the University of Washington.

FIGURE 5. NORTHERN BERINGIA, BATHYMETRY (m), PALEOLAKES, AND PALEORIVERS AT GLACIAL MAXIMUM (Dixon, op. cit., p. III-53)



Chukchi/Arctic coast, Standstill I, 22,000 B.P.
Compiled by G.D. Sharma from National Ocean Survey charts 1215 N-10, 1711N-17B, 1711N-18M, 1714-11B, 1714N-12B, 1814-10B and unpublished data of the University of Washington.

River Mouths and Nearshore Upwelling

Constricting topography concentrating large mammal movement

Riverine/Tundra-Steppe Ecotone

Freshwater Lake/Tundra-Steppe Ecotone

Chukchi/Arctic coast, Stillstand I, 22,000 B.P. Compiled by G.D. Sharma from National Ocean Survey charts 1215 N-10, 1711N-17B, 1711N-18M, 1714-11B, 1714N-12B, 1814-10B and unpublished data of the University of Washington.

FIGURE 6. NORTHERN BERINGIA, BATHYMETRY (m), PALEOLAKES, AND PALEORIVERS AT GLACIAL MAXIMUM (Dixon, op. cit., p. III–52)

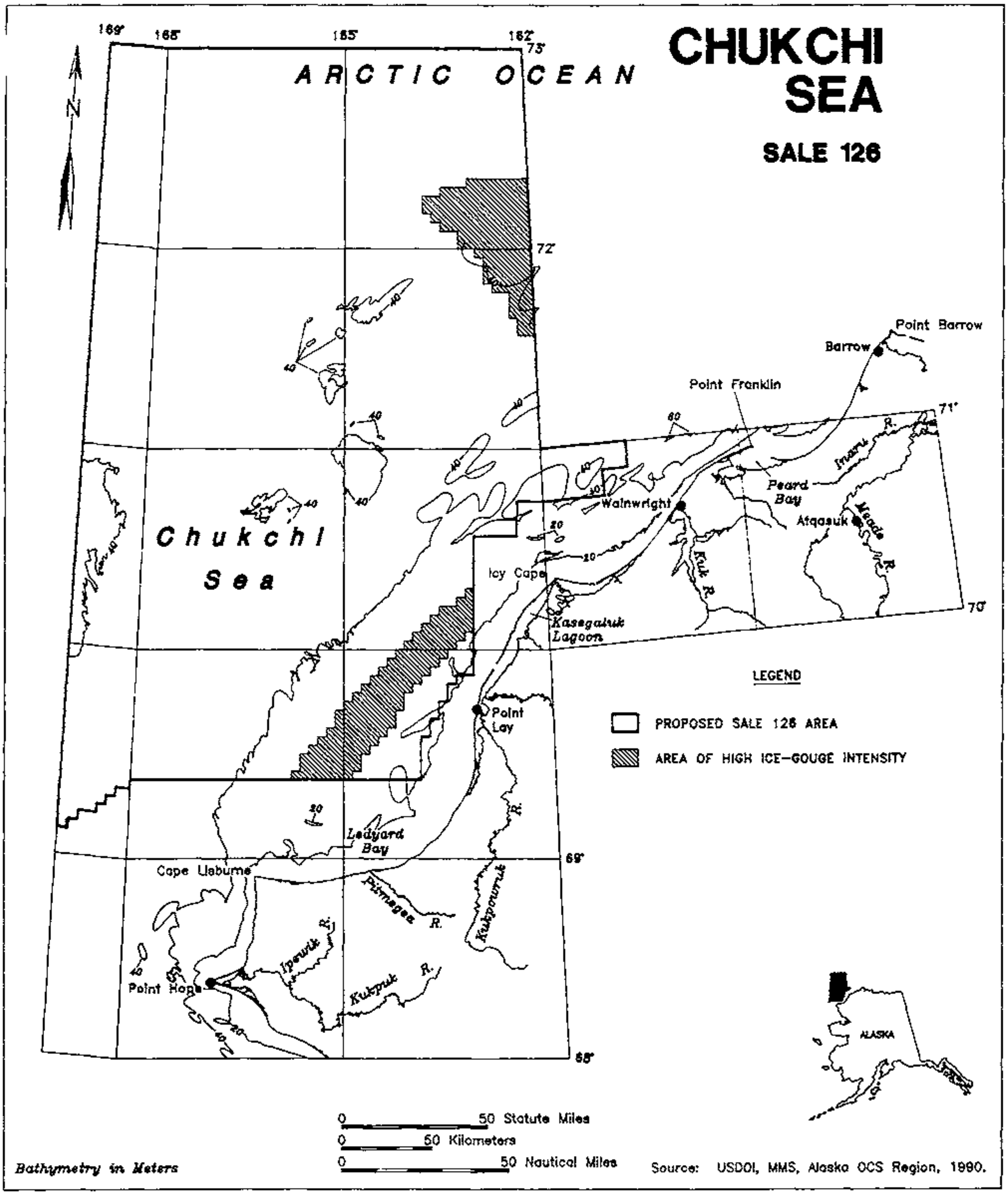


Figure 7. Area of High Ice – Gouge Intensity in the Southeastern Chukchi Sea

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Shipwreck Update Analysis
Proposed Sale 126, Chukchi Sea

In accordance with the MMS Handbook for Archaeological Resource Protection (621. 1-H), the following report was prepared per discussions at the MMS Archaeological Workshop in Anchorage, Alaska, on July 16-18, 1990, and Melanie J. Stright's "Reassessment of Shipwreck Potential and Archaeological Survey Recommendations for Sale 109 Leases, Chukchi Sea, Alaska," 1989. As stated in the MMS handbook, the purpose of the shipwreck update is to provide an assessment of the potential for locating historic resources in a proposed lease-sale area. A regional baseline study or equivalent data were used in the preparation of this document. All new data that may serve to update the regional baseline study are also incorporated in this report.

Known Shipwrecks within the Sale Area

The majority of known shipwrecks within the Chukchi Sea are documented losses of the nineteenth-century arctic whaling fleet (see Tables 1-4). Information that was reviewed to determine the locations of known shipwrecks within the sale area includes the MMS report, "Shipwrecks of the Alaskan Shelf and Shore," (Tornfelt, In Press); "Steam Whaling in the Western Arctic" (Bockstoce, 1977); and "Whales, Ice, and Men: the History of Whaling in the Western Arctic" (Bockstoce, 1986) (Bockstoce is considered by most to be the world authority on whaling in the Arctic). Using these sources, shipwreck locations in the sale area were remapped on a base map showing the OCS lease-block grid and bathymetry at a 1:1,000,000 scale.

There are 46 shipwrecks in the Chukchi Sea Planning Area. The location of the two shipwrecks (Table 1) in the proposed Sale 126 area is uncertain and cannot be assigned to blocks.

Table 1. Shipwrecks That Cannot Be Assigned to Blocks.

Henry Kneeland	Ontario

The probability that these shipwrecks may have survived ice gouging, if they are located within the 30-m isobath, is low. If located beyond the 30-m isobath, ice-gouging frequencies gradually decrease and shipwreck destruction is more speculative (see Reassessment of Shipwreck Potential and Archaeological Survey Requirements for Sale 109 Leases, Chukchi Sea, Alaska, prepared by MMS, and "Summary of Geomorphological Processes Pertaining to Survivability of Archaeological Resources in the Chukchi Sea Sale 109 Area").

The location of 23 shipwrecks (Table 2) is more precise.

Table 2. Shipwrecks That Can Be Assigned to Blocks.

Bowhead	James D. Thompson
Carlotta	Jessie H. Freeman
Caulaincourt	John Howland
Champion	John Wells
Concordia	Navy
Contest	Oliver Crocker
Elizabeth Swift	Paiea
Eugenia	Seneca
Gay Head	Thomas Pope
George	Victoria II
George Howland	
Gratitude	
Henry Taber	

The blocks where these shipwrecks are likely to be located are shown in Table 3.

Table 3. Blocks That Have Shipwreck Potential.

OPD	Block
NR 3-4	596, 639-640.
NR 3-5	1027-1028.
NR 3-7	15-17, 59-61, 103-104, 147, 148, 528-533, 538-540, 582-584, 626-627.
NR 4-3	23, 24, 65-68, 107-110, 111, 150-152, 193-195, 236-238, 279-281, 322-324, 366-367, 410, 573-576, 617, 619, 620.
NR 4-4	1-4, 45, 47, 48, 92.

No ship in the above blocks can be assigned to a particular block since locational data is not that precise for these ships. There are enough ships in the blocks listed in Table 3 that may have survived that invoking the stipulation for these blocks is a prudent action to protect them.There are 25 other ships shown in Table 4 that are all believed to be in State waters and therefore are not within OCS jurisdiction (see Solicitor's Opinion on Onshore Facilities, Memorandum MMS.ER.0227, received August 17, 1987).

Table 4. Shipwrecks That Are in State Waters or Onshore Near the Lease-Sale Area.

Awashonks	Julian
Comet	Kohola
Cyane	Lettie
Eagle	Mabel
Emily Schroeder	Mary
Emily Morgan	Monticello
Fanny	Ohio
Florida	Orca
George and Susan	Reindeer
Hae Hawaii	Roman
Helen Johnston	Thomas Dickason
Hidalgo	Victoria
	William Rotch

Possible Locations of Unreported Shipwrecks within the Sale Area

The most prevalent cause of shipwrecks within the sale area was shipwrecks being caught and crushed by pack ice. As the ships often followed nearshore leads through the pack, they were most often crushed or ran aground when shifting winds caused the pack ice to begin moving shoreward. Once trapped in the ice, strong ocean currents either moved the ships around Point Barrow into the Beaufort Sea or carried them northwestward from Point Barrow into the Arctic.

Nineteenth-century whaling fleets sailed narrow leads up the coast of Alaska from Icy Cape and made their way to Point Barrow by late July or August. Later, particularly after the advent of steam-powered ships, they began making their way into the Beaufort Sea following a route between the coast and the pack ice to the north. In later years, whaling ships began wintering at Hershel Island in the eastern Beaufort. On leaving the Beaufort Sea at the end of the summer season, many of the ships headed westward from Point Barrow, following the southern edge of the pack ice to Herald Island, the autumn feeding grounds of the bowhead whale.

There are only a few reports of ships being wrecked along this western route through the Chukchi Sea. The Henry Kneeland was abandoned somewhere in the Chukchi Sea in 1864, as was the Ontario in 1866. The Mount Wollaston and the Vigilant were caught in the ice and lost in the vicinity of Herald Island in 1879 (Herald Island lies well west of the sale area). The Helen Mar was crushed by ice in 1892 in Russian waters between 71° and 72° N. latitude and just across the U.S./U.S.S.R. border (169° W. long.).

The distribution of known shipwrecks in the sale area indicates that most of the ships were trapped by ice or ran aground within very shallow coastal waters. This observed distribution is due to the fact that ships were generally forced to sail within narrow strips of open water between the pack ice and shore because of the numerous capes and shoals off the coast. Therefore, most unreported shipwrecks within the sale area probably occur close to shore in shallow water.

Preservation Potential of Shipwrecks within the Sale Area

The first consideration in the preservation of shipwrecks in the sale area is the human factor. According to accounts reported in Bockstoce (1986), many ships were extensively salvaged after wrecking. Following the whaling-fleet disaster of 1871, commercial salvagers organized expeditions to the Arctic to remove whatever was of value from the 31 wrecked ships. There are also several accounts of ships having been condemned due to damage from ice, then being towed to shore and auctioned off to raise money for the owners. These salvage actions had the effect of diminishing the apparent shipwreck resource from what otherwise might be expected. These actions have been taken into consideration in Tables 1 through 4.

Geologic and oceanographic factors that may contribute to the preservation or destruction of shipwreck remains in the Chukchi and Beaufort Seas include bottom-sediment type and thickness, water depth, strong currents, and ice-gouge intensity. As the effects of these physical processes on the remains of sunken vessels in the Chukchi and Beaufort Seas have not been directly observed, the following discussion is hypothetical.

Generally, the thicker- and finer-grained bottom sediments are, the more likely that shipwreck remains will be buried and preserved. Sediments in the Chukchi Sea range in thickness from less than 1 m to approximately 12 m, although unconsolidated sediments range only from 1 m to approximately 4.5 m. The thickest sediment cover is found off Cape Lisburne, Icy Cape, and Point Franklin (Phillips, 1986). While the average thickness of sediments in the Chukchi Sea is relatively thin, the thickest accumulations of sediments are around capes and shoals where shipwrecks are known to concentrate. This would be a positive factor for shipwreck preservation.

According to Phillips and Reiss (1984) and Phillips (1986), lag gravels occur at the seafloor just outside the barrier islands between Icy Cape and Wainwright inlet and in a small patch along the coast just north of Peard Bay. Another large gravel deposit, termed the Outer Gravel Facies, lies farther offshore but comes to within a few miles of the coast between Point Belcher and Point Franklin. These coarse-grained gravels probably would not provide as good an environment for shipwreck preservation as would the finer-grained muds and sands outside the gravel deposits.

Ice gouging on the Chukchi Sea shelf is most intense along topographic highs and nearshore slopes, the same areas where shipwrecks tend to concentrate. This is a negative factor for shipwreck preservation. Outside the areas of intense ice gouging, gouges are sparse and gouge depths are shallow (maximum depth of 1.3 m with an average depth of 0.3 m or less [Phillips, 1986]). Ice-gouge intensity decreases rapidly with increasing water depth and is most prevalent in water depths of less than 30 m.

The Alaskan Coastal Current may rework seafloor sediments out to a distance of 70 km from shore in the eastern Chukchi Sea (Phillips, 1986). However, it is storm-generated currents that have the greater effect on bottom sediments, reworking even the seafloor gravel deposits. The periodicity of these storms is unknown.

In summary, the coarse-grained gravels present at the seafloor along much of the coast of the eastern Chukchi Sea, the Alaskan Coastal Current and storm-generated currents that rework the seafloor sediments out to a distance of possibly 70 km offshore, and the intensive ice gouging that occurs in water depths of 30 m or less and concentrates on shoals and nearshore slopes, all are factors that act negatively on the preservation of shipwreck remains in the Chukchi Sea. Areas having the highest preservation potential are those areas that have the thickest accumulations of unconsolidated muds and sands. It is not known to what extent these factors have affected potential shipwreck resources in Table 3. No ships listed in Table 3 fall within the area of intensive ice gouging (Figure 7, Prehistoric Resource Analysis).

Effectiveness of Remote-Sensing-Survey Instruments

In areas having only a thin sequence of unconsolidated sediments at the seafloor, the sidescan sonar should detect evidence of any shipwrecks present within a survey area. Although it was reported by Claussen and Arnold (1975) that the shipwrecks discovered at Padre Island, Texas, were completely buried in only 1.5 m of unconsolidated sediments, these ships were about 300 years older (dating from 1554) and were much smaller than the ships expected to be found in the Chukchi Sea. At 300-m linespacing, the sidescan sonar, operating at a per-channel range of 200 m, has an overlap of 100 m between survey lines and resolves objects on the order of 1 m in size. This should be sufficient to detect any historic-shipwreck remains protruding above the seafloor.

Where surficial unconsolidated sediments are thick enough to have completely buried historic-shipwreck remains, the magnetometer is the primary instrument for shipwreck detection. The survey linespacing required to completely search an area depends on the amount of ferrous material associated with a shipwreck. Closer linespacing would be required to locate a wooden sailing ship having only ferrous fastenings and fittings than would be required to locate a steam whaler with iron pots in the tryworks, and with iron boiler and smokestack. For example, 1 ton of iron would cause a magnetic anomaly of only 5 gammas at a distance of 24 m from the magnetometer sensor (Breiner, 1973). This anomaly intensity is barely above the background-noise level under ideal conditions. At high northern latitudes such as the Chukchi Sea, increased interference from magnetic storms makes detection of such small intensity anomalies problematic. Although permanent magnetic base stations, such as the one operated by the USGS at Point Barrow, Alaska, can provide continuous data on magnetic storm conditions, correlating the data from these base stations to a specific survey data set in order to mathematically factor out noise would be extremely difficult because the two data sets would have to be precisely time-correlated. Of more utility might be the use of a gradiometer that involves towing two magnetometer sensors in a fixed horizontal or vertical configuration. Such a system allows two sets of magnetometer data to be collected simultaneously. The differences between the two data sets then provide real information on magnetic anomalies within the survey area.

The subbottom profiler is of very limited utility in the detection of shipwrecks because it collects only a single line of acoustic information directly under the survey vessel. It would be possible to see evidence of a shipwreck on the subbottom profiler data only if the survey vessel passed directly over the wreck. As a shipwreck may represent a relatively hard object within the seafloor sediments, it might produce a parabolic diffraction on the profiler data similar to those seen when passing over a pipeline or shell bed (Stright, 1990).

In summary, the sidescan sonar is the most practical instrument for shipwreck detection when bottom conditions are such that shipwreck remains would be visible at the seafloor which is most likely the case for the Chukchi Sea. If shipwreck remains are completely buried, a magnetometer is essential for shipwreck detection. While 300-m linespacing is adequate for 100-percent coverage of the seafloor with a sidescan sonar, much closer linespacing (probably a minimum of 50 m) is necessary to ensure detection of buried shipwreck remains with a magnetometer. The effectiveness of the magnetometer at this linespacing is dependent on the amount of ferrous material present on a shipwreck.

Survey Recommendations for the Chukchi Sea

The archaeological report requirement of the lease stipulation will be invoked on the blocks listed in Table 3:

OPD	Block
NR 3-4	596, 639-640.
NR 3-5	1027-1028.
NR 3-7	15-17, 59-61, 103-104, 147, 148, 538-540, 528-533, 582-584, 626-627.
NR 4-3	23-24, 65-68, 107-110, 111, 150-152, 193-195, 236-238, 279-281, 322-324, 366-367, 410, 573-576, 617, 619, 620.
NR 4-4	1-4, 45, 47, 48, 92.

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APPENDIX H

SUPPORTING TABLES FOR THE SECTIONS ON THE ECONOMY OF THE NORTH SLOPE BOROUGH

Table H-1

Direct Employment Assumptions per Unit of Work for Proposed Sale 126--by Work Type

TYPE OF WORK (one unit) AND ASSOCIATED TASKS	CREW SIZE (a)	SHIFT FACTOR (b)	ROTA-TION FACTOR (c)	NUMBER OF AIRCRAFT OR BOATS	TOTAL WORKFORCE (d)	DURATION (MONTHS)	TOTAL WORK-MONTHS	OF OUT-OF-STATE COMMUTERS (percent)
DRILLING AN EXPLORATION OR DELINEATION WELL								
Drilling Crew Activities	50	2	2.0	-	200	3.0	600	79.0
Helicopter Support for Drilling	5	1	2.0	1.5	15	3.0	45	47.5
Supply/Anchor Boats for Drilling Support	12	1	2.0	3.0	72	3.0	216	58.0
Longshoring Support for Drilling	6	1	2.0	-	12	3.0	36	35.0
Other Onshore Work in Support of Drilling	4	1	2.0	-	8	3.0	24	79.0
CONSTRUCTING AN EXPLORATION SHORE BASE	67	1	2.0	-	133	12.0	1600	79.0
OPERATING AN EXPLORATION SHORE BASE (1 YEAR)	10	2	2.0	-	40	6.0	240	79.0
CONDUCTING A GEOLOGICAL-GEOPHYSICAL SURVEY	30	1	2.0	1.0	60	3.0	180	79.0
CONSTRUCTING AN EXPLORATION ISLAND								
Construct Ice Road	6	2	2.0	-	24	2.00	48	70.0
Haul Gravel in Trucks	136	2	2.0	-	544	2.16	1175	70.0
Haul Gravel in Barges	125	2	2.0	-	500	1.33	665	70.0
Construct Island from Barge Mounted Camp	44	2	2.0	-	176	1.33	234	70.0
INSTALLING A PRODUCTION PLATFORM (& EQUIP)								
All Work by Platform Installation Crews	150	2	2.0	-	600	10.0	6000	89.5
Helicopter Support-Platform Installation	5	1	2.0	2.0	20	10.0	200	47.5
Tugboat Support for Platform Installation	10	1	1.5	4.0	60(e)	1.0	60	58.0
Supply/Anchor Boat Support-Platform Inst.	13	1	1.5	3.0	59(e)	10.0	585	58.0
Longshoring for Platform Installation	20	1	1.5	-	30(e)	10.0	300	35.0
Other Onshore Support for Platform Inst.	25	1	1.5	-	38(e)	10.0	375	89.5
INSTALLING AN OFFSHORE LOADING PLATFORM								
All Work by Platform Installation Crews	50	2	2.0	-	200	2.5	500	89.5
Helicopter Support-Platform Installation	5	1	2.0	2.0	20	2.5	50	47.5
Tugboat Support for Platform Installation	12	1	2.0	1.0	24	1.0	24	58.0
Supply/Anchor Boat Support-Platform Inst.	12	1	2.0	2.0	48	2.5	120	58.0
Longshoring for Platform Installation	6	1	2.0	-	12	2.5	30	35.0
Other Onshore Support for Platform Inst.	8	1	2.0	-	16	2.5	40	89.5
CONSTRUCTING A PRODUCTION SHORE BASE	50	2	2.0	-	200	12.0	2400	47.5
DRILLING A PRODUCTION OR SERVICE WELL	28	2	2.0	-	112	3.0	336	79.0
LAYING OFFSHORE OIL PIPE (100 MILES)								
All Work of Laying Barge Crews	175	2	2.0	1.0	700	3.3	2310	89.5
Helicopter Support for Pipe Laying	5	1	2.0	1.0	10	3.3	33	47.5
Tugboat Support for Pipe Laying	10	1	1.5	2.0	30(e)	3.3	99	58.0
Supply/Anchor Boats for Pipe Laying	13	1	1.5	3.0	59(e)	3.3	193	58.0
Longshoring Support for Pipe Laying	20	1	1.5	-	30(e)	3.3	99	35.0
Other Onshore Support for Pipe Laying	35	1	1.5	-	53(e)	3.3	173	89.5
LAYING ONSHORE OIL PIPE (100 MILES)	250	2	2.0	-	1000	6.7	6667	79.0
CONSTRUCTING A MARINE OIL TERMINAL	300	1	2.0	-	600	12.0	7200	47.5
CONSTRUCTING AN ONSHORE PUMP STATION	100	1	2.0	-	200	8.0	1600	47.5
CONSTRUCTING A PRODUCTION ISLAND	225	2	2.0	-	900	3.0	2700	47.5
OPERATING A PRODUCTION PLATFORM (1 YEAR)								
All Work of Platform Operations Crews	40	2	2.0	-	160	12.0	1920	25.0
Helicopter Support-Platform Operations	5	1	2.0	1.0	10	12.0	120	25.0
Supply/Anchor Boats-Platform Operations	12	2	1.5	1.0	36(e)	12.0	432	25.0
Longshoring for Platform Operations	6	1	1.5	-	9(e)	12.0	108	25.0
Other Onshore Work for Platform Operatns	2	1	1.5	-	3(e)	12.0	36	25.0
MAINTENANCE ON ONE MAJOR PLATFORM	10	1	2.0	-	20	4.0	80	25.0
MAINTENANCE ON ONE PRODUCTION ISLAND	28	2	2.0	-	112	3.0	336	25.0
WELL WORKOVERS FOR ONE OIL PLATFORM	10	1	2.0	-	20	6.0	120	25.0
OPERATING A PRODUCTION SHORE BASE (1 YEAR)	40	1	2.0	-	80	12.0	960	25.0
OPERATING A MARINE OIL TERMINAL (1 YEAR)	50	2	2.0	-	200	12.0	2400	25.0

Notes: (a) work-months (180 hours) per shift (b) shifts per rotation
(c) rotations per month: "2.0"--15 days on/15 off schedule, "1.5"--20 days on/10 off schedule
(d) total work-months per month (e) 240 hour work-month

Source: USDOI, MMS, Alaska OCS Region, MMS Employment Model, 1985; Dames and Moore, 1982.

Table H-2

Sale 126 Direct Industry Employment Requirements for the Base Case

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2011	2012	2013
TOTAL DIRECT OCS MANPOWER REQUIREMENTS	0	0	0	0	0	317	837	793	667	457	480	406	1169	2577	2260	3401	2335	1867	1626	1626	1654	1654	1654
ONSHORE JOBS -- TOTAL	0	0	0	0	0	35	112	131	121	55	46	38	811	1037	517	358	212	212	212	212	212	212	212
SHORT-TERM																							
Skilled	0	0	0	0	0	23	70	78	70	33	27	22	620	716	327	96	0	0	0	0	0	0	0
Unskilled	0	0	0	0	0	12	42	53	51	22	19	16	190	240	109	50	0	0	0	0	0	0	0
LONG-TERM																							
Skilled	0	0	0	0	0	0	0	0	0	0	0	0	0	40	40	118	118	118	118	118	118	118	118
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	40	40	94	94	94	94	94	94	94	94
OFFSHORE JOBS -- TOTAL	0	0	0	0	0	272	710	642	506	302	234	166	158	1340	1544	2844	1923	1475	1232	1232	1262	1262	1262
SHORT-TERM																							
Skilled	0	0	0	0	0	272	710	642	506	302	234	166	158	1340	1544	1668	747	243	0	0	0	0	0
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG-TERM																							
Skilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1080	1080	1136	1136	1136	1166	1166	1166
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96	96	96	96	96	96	96	96
EXPLORATION PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	307	822	773	627	357	280	204	0	0	0	0	0	0	0	0	0	0	0
DEVELOPMENT PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	0	0	0	0	0	0	0	1289	2617	1980	1813	747	243	0	0	0	0	0
PRODUCTION PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	0	0	0	0	0	0	0	0	80	80	1388	1388	1444	1444	1444	1474	1474	1474
TOTAL EMPLOYMENT - EXCEPT HQ	0	0	0	0	0	307	822	773	627	357	280	204	1289	2697	2060	3201	2135	1687	1444	1444	1474	1474	1474

Source: USDOI, MMS, Alaska OCS Region, MMS Employment Model, 1990.

Table H-3

Sale 126 Direct Industry Employment Requirements for the Low Case

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2011	2012
TOTAL DIRECT OCS MANPOWER REQUIREMENTS	0	0	0	0	0	204	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ONSHORE JOBS -- TOTAL	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SHORT-TERM																						
Skilled	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unskilled	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG-TERM																						
Skilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFFSHORE JOBS -- TOTAL	0	0	0	0	0	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SHORT-TERM																						
Skilled	0	0	0	0	0	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG-TERM																						
Skilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXPLORATION PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEVELOPMENT PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRODUCTION PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL EMPLOYMENT - EXCEPT HQ	0	0	0	0	0	194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: USDOI, MMS, Alaska OCS Region, MMS Employment Model, 1990.

Table H-4

Sale 126 Direct Industry Employment Requirements for the High Case

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2011	2012	2013
TOTAL DIRECT OCS MANPOWER REQUIREMENTS	0	0	0	0	0	317	537	793	744	611	711	557	1389	2592	4794	3267	3484	3484	3325	2988	2988	3049	3049
ONSHORE JOBS -- TOTAL	0	0	0	0	0	35	112	131	130	73	73	55	797	960	924	458	344	344	344	344	344	344	344
SHORT-TERM																							
Skilled	0	0	0	0	0	23	70	78	76	45	45	33	604	694	578	235	0	0	0	0	0	0	0
Unskilled	0	0	0	0	0	12	42	53	54	28	28	22	166	213	265	143	0	0	0	0	0	0	0
LONG-TERM																							
Skilled	0	0	0	0	0	0	0	0	0	0	0	0	13	26	40	40	196	196	196	196	196	196	196
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	13	26	40	40	148	148	148	148	149	148	148
OFFSHORE JOBS -- TOTAL	0	0	0	0	0	272	710	642	574	438	438	302	392	1432	3670	2588	2940	2940	2781	2464	2464	2524	2524
SHORT-TERM																							
Skilled	0	0	0	0	0	272	710	642	574	438	438	302	392	1432	3670	2588	588	588	317	0	0	0	0
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG-TERM																							
Skilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2160	2160	2272	2272	2272	2332	2332
Unskilled	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	192	192	192	192	192	192	192
EXPLORATION PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	307	822	773	704	511	511	357	280	204	127	0	0	0	0	0	0	0	0
DEVELOPMENT PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	0	0	0	0	0	0	0	1202	2456	4387	2967	588	588	317	0	0	0	0
PRODUCTION PHASE EMPLOYMENT (EXCEPT HQ)	0	0	0	0	0	0	0	0	0	0	0	0	26	33	80	80	2696	2696	2808	2808	2808	2868	2865
TOTAL EMPLOYMENT - EXCEPT HQ	0	0	0	0	0	307	822	773	704	511	511	357	1509	2712	4594	3047	3284	3284	3125	2808	2808	2868	2865

Source: USDOI, MMS, Alaska OCS Region, MMS Employment Model, 1990.

APPENDIX I

ALTERNATIVE ENERGY SOURCES AS AN ALTERNATIVE TO THE OCS PROGRAM

ALTERNATIVE-ENERGY SOURCES

The description of energy alternatives is hereby incorporated by reference from Appendix C, Alternative-Energy Sources, of Volume 3 of the Final EIS for the Proposed 5-Year OCS Oil and Gas Leasing Program, 1987-1992. The following information is a summary of this document.

Energy Conservation: Vigorous energy conservation is an alternative that warrants serious consideration. Several studies have suggested that we could enjoy the same standard of living and yet use 30 to 50 percent less energy than we do now. Aside from these savings, it is not widely recognized that wasteful consumption habits impose social costs that can no longer be afforded, as do pollution and an inequitable distribution of fuel. Existing conservation programs include education, research and development, regulation, and subsidies.

In the residential and commercial sectors of the economy, more efficient energy consumption could be realized by improved insulation, more efficient heating and cooling systems, better designed appliances, and more efficient lighting. Incentives such as standards for improved thermal efficiency in existing homes and offices and minimum thermal standards for new homes and offices also could result in substantial energy savings.

In the industrial sector, more energy-efficient work schedules, better maintained equipment, equipment with better low-heat transfer efficiencies, and recycled heat and waste materials could result in energy savings.

Transportation of people and goods accounts for approximately 25 percent of nationwide energy use. In the transportation sector, short- and mid-term conservation measures, such as consumer education, lower speed limits, and rate and service improvements on public transit and rail-freight transit, could achieve considerable energy savings. Other policies that could encourage fuel conservation in transportation include standards for more efficient new automobiles and incentives to reduce miles traveled.

Significant energy savings are clearly possible through accelerated conservation efforts. In addition, several of the strategies mentioned above have been at least partially implemented by the Energy Policy and Conservation Act of 1975 (P.L. 94-163).

The environmental effects of a vigorous energy conservation program would be primarily beneficial. The exact nature and magnitude of these effects would depend on whether there is a net reduction in energy use or whether the reduction is accomplished through technological change and substitutions. Either case would result in the reduction of pollutants such as CO, hydrocarbons, particulates, NO_x, and SO_x.

Conventional Oil and Gas Supplies: Reserves and undiscovered deposits of oil and gas still exist in the United States. Proven reserves are currently estimated at 31.4 billion bbl of oil and 208.0 Tcf of natural gas, the lowest level since 1951. Since 1970, new oil discoveries have replaced less than one-half of production.

Ultimately recoverable reserves (all deposits known or believed to exist in such forms that economic extraction is currently or potentially feasible), in addition to proven reserves, are estimated to be about 82.6 billion bbl of oil (54.6 onshore/28.0 offshore; 13 years of consumption at current rates), and 593.9 Tcf of natural gas (426.9 onshore/167.0 offshore). This estimate is rising over time, mainly because of higher prices and new discoveries in unexplored areas. Unconventional hydrocarbons and recovery methods, especially enhanced recovery, could more than double these figures. The amount of ultimately recoverable reserves will depend on price, technology, geological information, and public policy such as price controls, access to Federal lands, and environmental standards.

Petroleum production is severely constrained in the short run and greatly affected by world prices in the long run. Although the long-run demand for fuel liquids is not forecast to decline significantly (feasible solid and gaseous substitutes do not appear to exist), consumption of conventional crude oil is expected to decline significantly as synthetic liquids are produced from shale, tar sands, and coal; as biomass sources are utilized; and as industry and utilities reduce oil facilities and shift to coal and possibly nuclear power. Synthetic liquid from coal is expected to be the major source of liquid fuel by 2020, supplying 50 percent of all liquid fuel and 10 percent of all consumed energy.

Conventional natural gas consumption is expected to decline due to depletion, higher prices, and competition with synthetic gas from coal. Enhanced gas recovery from unconventional sources such as tight sands and Devonian shale is expected to make a significant contribution to gaseous fuel production, providing 50 percent of all gaseous fuel and 5 percent of all energy consumption by 2020. Ultimately recoverable reserves from such sources are estimated at 3,000 Tcf.

A detailed description of the crude oil and natural gas systems is found in Chapters 3 and 4 of Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975).

To substitute directly for the proposed action, a combination of onshore and OCS production from other areas and continued foreign imports would be required to make up for the estimated total production of these proposed actions.

This substitution would entail environmental effects such as land subsidence, soil sterilization, and disruption of existing land use patterns. Equipment failure, human error, and blowouts also may impair environmental quality. Moreover, poor well construction, particularly in older wells, and oil spills can result in ground- and surface-water pollution.

The water pollutants from onshore oil production are oil and dissolved solids. The amounts of each vary over a wide range. A summary of onshore oil pollutants is available in Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975).

Air pollutants (particulates, NO_x, hydrocarbons, and CO) result from blowouts and subsequent evaporation and burning. These are generally insignificant, except locally. Onshore or offshore effects are basically the same. Given the fact that onshore supplies are dwindling, users of hydrocarbons from these proposed actions would have to continue their reliance on other regions and foreign imports for needed oil and gas. The decline in these supplies, even with energy conservation, could mean industrial shutdowns, increased unemployment, higher consumer prices, and changes in the standard of living. The lack of natural gas will mean additional use of "dirtier" alternative fuels (oil and coal) with consequent effects on air quality and human health.

Coal: Coal is the most abundant energy resource in the United States. Proven domestic reserves of coal are estimated at 438 billion short tons. This constitutes over one-quarter of the known world supply, 80 percent of proven United States fuel reserves, and 130 times the energy consumed in 1980. Ultimately recoverable reserves are estimated at 3.9 trillion short tons. A detailed discussion of the coal resource system can be found in Chapter I of Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975).

Although domestic coal reserves could easily replace the energy expected to be realized from the proposed actions, serious limitations to coal development exist. In many uses, coal is an imperfect substitute for oil or natural gas. In many other cases, coal use and production is restricted by Government constraints, limited availability of low-sulphur deposits, inadequate mining, conversion and pollution-abatement technology, and the hazardous environmental effects associated with coal extraction and from electricity generation. Coal production also is threatened by a unique set of labor problems associated with mining and new, strict standards for coal-mine safety.

Due to its relative price advantage over other fuels, competitive market structure, and large resource base, coal consumption and production are expected to increase significantly; and coal is expected to become the primary domestic energy source in the future.

Synfuels from coal also will be important. Synthetic oil and gas could contribute substantially to energy supplies by the year 2000. The most important contributions would be high Btu gas from coal, synthetic crude oil from oil shales, and coal liquefaction. The success of these energy sources will depend on developing technology, the cost of the effects, and the cost of conventional oil and gas. Technology for conversion of coal into gaseous and liquid hydrocarbons has been established for several decades, and a number of relatively low-capacity commercial plants exist in various parts of the world. However, few cost-effective, advanced technologies have progressed beyond the pilot-plant stage.

Coal gasification can produce gaseous fuels with low-, intermediate-, or high-energy content. Low and intermediate gases are produced in a two-stage process involving preparation and gasification, and the output is utilized as feedstock for electric generators. A third process, "upgrading," is required to produce high Btu gas, which produces an end-product usable by the consumer. Gasification processes have lower primary efficiency than direct coal combustion; more coal will have to be gasified to reach an equivalent Btu output. However, it is likely that coal gasification will achieve primary efficiencies of 70 percent, which is about twice that of coal to electricity end use.

Liquefied coal has the potential to replace conventional crude oil as the major source of liquid fuel and to provide 10 percent of total domestic-energy consumption by 2020. The available technologies have a recovery rate of 0.53 bbl of oil per ton of coal processed. As with coal gasification, production of liquid fuels from coal requires either the addition of hydrogen or the removal of carbon from the compounds in the coal. Coal liquefaction can be accomplished by hydrogenation, pyrolysis, or catalytic conversion. Only catalytic conversion is in commercial operation.

Although United States' coal resources are very large, as with other extractable mineral fuels, there is some geographic dislocation. Most of our new low-sulphur coal is found west of the Mississippi River or in Alaska, far from industrial areas. Also, much of the western coal is in arid or semiarid areas where scarcity of water could constrain development.

If an alternative to the proposed OCS sale is greater reliance on coal, it may he expected that mining would have to increase in the western states to provide the necessary fuel resources.

Adverse environmental effects from heavier reliance on coal would result from its direct utilization, surface mining, underground mining, transportation, and conversion to liquid or gaseous fuels. Combustion of coal results in various emissions, notably SO_2 and particulates. If the expected production from these proposed actions is replaced by coal, there would be an increase in these pollutants, especially if coal is substituted for the natural gas presently used. Technology to control these emissions is available but has not yet been proven sufficient to be widely applied. Any large-scale shift to coal would require realization of emission regulations or improvement of technologies to convert coal to gaseous or liquid fuels.

The primary effect of surface mining is disruption of the land. This affects all local flora and fauna and water quality and increases landscape problems due to erosion and mine runoff. Reclamation is difficult in the western states due to the lack of water to assist in revegetation. Other problems include acid-mine-water drainage, leaching from spoil piles, processing waste, and disturbances caused by access and transportation. Noise and vibration resulting from operations also can be expected. Finally, surface mining causes conflicts with other resource uses such as agriculture, recreation, water, and wildlife habitat.

The land use of strip mining ranges from 0.8 to 5.9 acres/1,012 Btu extracted, depending on seam thickness and Btu content of the coal.

Underground mining primarily affects land and water quality. The land effects are those that arise from subsidence, waste disposal, access, and transportation. Very little surface is disturbed. Subsidence can destroy structures, cause landslides and earthquakes, and disrupt groundwater-circulation patterns. The amount of subsidence can be controlled by the mining method used and the amount of coal removed. The utilization of certain mining methods and the restriction of the amount of coal extracted can have detrimental effects on the economics of the operation.

Water quality is affected by processing waste and the draining of acid-mine water into surrounding areas. These can be minimized through the proper methods of control both during and after operation. Waste piles can be replaced in the mine and the entrances sealed, which also would help to minimize subsidence. Other pollution problems are those associated with road and coal dust and the like, but these are minimal and easily controlled. Other disturbing aspects of mining have much less of an effect in an underground mine. Working conditions of underground mines have been improved under the Federal Coal Mining Health and Safety Act of 1969, although further efforts are needed to reduce health hazards. This program has resulted in increasing costs of underground mining when compared to surface mining, which has even more severe environmental consequences.

The five major coal transportation systems (road, rail, water, conveyor, and pipeline) all have some adverse environmental effects. These include air and noise pollution, safety hazards, land-use conflicts, trash-disposal problems, and aesthetic damage. However, since spill problems are not associated with coal, most of the effects can be controlled with greater care and consideration. A slurry pipeline also requires large supplies of water and must adequately dispose of this at the other end. Water availability is a problem in many areas of the United States, especially in the west where energy resources requirements will have to compete with existing commercial and private users for a limited and fragile resource.

The environmental effects of coal gasification are those of mining plus those resulting from the production process. Water effects of processing can be minimized by recycling and evaporation. However, large inputs of water are required for some of the technologies, thus creating the potential for conflicts in water-short areas.

Air pollution could include SO_2, particulates, NO_x, hydrocarbons, and CO. Land effects result from solid-waste disposal, as well as land use for the plant, coal storage, cooling sands, etc. Solid wastes include ash, sulphur, and minute quantities of some radioactive isotopes.

Again, the effects of liquefaction will be those of mining and those of the processing plants. Water effluents from liquefaction plants could contain amounts of phenols, solids, oil, ammonia, phosphates, etc. The wastewater could be treated to remove most of these products.

Air pollution could result from particulates, nitrogen, SO_x, and other gases. Pollution-control facilities would be required but would lower the economic attractiveness of the plants. Solid wastes would be mostly ash. If liquefaction plants were sited near mine openings, residue could be buried in the mines with little further environmental effects.

Nuclear Power - Fission: The predominant nuclear system used in the United States is the uranium dioxide-fueled, light-water moderated and cooled nuclear power plant. Research and development are being directed toward other types of reactors, notably the breeder reactor.

Due to environmental concerns, the growth of nuclear energy may be slowing. At the end of 1980, there were 75 reactors in the United States, up from 19 in 1970. Although 4 reactors were licensed in 1980, 14 other planned units were canceled, and the Nuclear Regulatory Commission (NRC) closed 5 for modification to comply with revised seismic requirements and shut down 8 reactors comparable to Three Mile Island to determine the probability for a similar accident and to make required safety modifications. Nuclear energy output was down 16 percent in 1980. There are currently 102 reactors under various stages of construction, construction-permit review, or on order. Nuclear power development has encountered delays in licensing, siting, and environmental constraints as well as manufacturing and technical problems.

Future capacity will be influenced by the availability of plant sites, plant-licensing considerations, environmental factors, nuclear fuel costs, rate of development of the breeder and fusion reactors, and capital costs.

Domestic uranium resources are probably plentiful. Ultimately recoverable reserves are estimated to be 6.876 billion short tons, and large areas are unexplored. Twenty-one million short tons were consumed in 1980 domestic nuclear energy production.

Although fuel-cycle costs of nuclear reactors have increased only slightly in recent years, present trends in reactor capitol costs are significantly narrowing the economic advantage offered by fuel-cycle costs over coal- and oil-fired plants.

Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some airborne and liquid radioactive materials are released to the environment during normal operation. The amounts released are very small, and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity release from accidents is very low.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share a similar problem of heat dissipation from cooling water. However, light-water reactors require larger amounts of cooling water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of thermal discharges may be beneficial in some, though not all, cases. Adverse effects can often be mitigated by use of cooling ponds or cooling towers.

Low-level radioactive waste from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a Federally licensed storage site for burial. High-level wastes created within the fuel elements remain there until the fuel elements are processed. Currently, spent fuel is stored at NRC-licensed facilities. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at a Federal repository.

There also are effects on land, water, and air quality arising from the mining of these uranium ores. Dwindling amounts of high-grade reserves will increase the amount of land mined for lower grade radioactive ores–primarily in the western states. The mining operations will be similar to coal, but the nature and distribution of the deposits mean "lesser" effects, while radioactive tailings cause unusual problems for disposal, the environment, and human health. A more complete discussion of uranium mining and processing and the economics and environmental impacts, as well as nuclear fission and fusion, can be found in Chapters 6 and 7 of Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975).

Nuclear Power - Fusion: The controlled fusing of atoms in a reactor is a long-term alternative-energy source. Scientific feasibility has yet to be proven but looks promising. Technological and commercial feasibility will have to follow, however. The main obstacles are obtaining a high enough temperature and containing the reaction. It is unlikely that fusion will be available to any significant degree before 2025.

Fusion is attractive for two reasons: abundant fuel sources and relative safety. The reaction is fueled by deuterium and tritium. Deuterium exists naturally in seawater and would be nearly cost-free; tritium can be inexpensively produced in a reactor from lithium, which is plentiful.

Because of the small neutron activation involved in fusion reactions, there would be lower radioactive inventories, fewer radioactive wastes, and less serious fuel-handling problems and accident risks.

A proposed hybrid fusion-fission fuel cycle would fuel fission reactors with fusion-produced isotopes and multiply the energy release of fusion tenfold, while demanding less of the fusion core and thus enhancing the safety characteristics of both reactors.

A proposed pure deuterium process, while possessing a lower reaction rate, would have a neutron fuel cycle; thus, all particles and products would be electrically charged and there would, in theory, be no radioactivity.

The environmental risks from fusion energy are probably less than fission, but the degree of reduction and the social acceptability of that degree cannot be determined presently.

Oil Shale: Oil shale is a fine-grained, sedimentary rock that, when heated, releases a heavy oil that can he upgraded to synthetic crude oil. The technology for exploitation currently exists. The resource base for shale is very large, perhaps as much as 360 billion bbl.

Large areas of the United States are known to contain oil-shale deposits, but those in the Green River Formation in Colorado, Wyoming, and Utah have the greatest commercial potential.

Oil-shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities of spent shale, which occupy a larger volume than before the oil is extracted. Inducing revegetation growth in an area of oil shale development is difficult and may take more than 10 years. In-place processing avoids many of these environmental hazards. With underground mining, the spent-shale problem is much less severe.

Air pollutants from the mining will come from dust and vehicular traffic. These will be predominantly particulates, followed by NO_x and CO, with minimal amounts of hydrocarbons, SO_x, and aldehydes.

The mining of oil shale requires little water, both for operations and for reclaiming solid wastes. Water pollutants are considered negligible but may arise if saline water was encountered during the operations and had to be disposed of.

However, the processing (retorting) operations of oil shale consume large quantities of water and generate large amounts of wastewater. The wastewater must be treated and can be reused in the process. Therefore, it has been assumed that water pollution would not be a problem outside the processing complex. However, the limited availability of input water in the development area could lead to resource-use conflicts.

Air pollutants vary with the technology used. Solid waste comprises the greatest problem of oil-shale processing. The volume of the waste is greater than the volume of the input. Therefore, backfilling and the like would not provide a sufficient disposal space. Finally, there are the effects of access and of transporting the products. These are analogous to those of coal mining in the case of access and to petroleum distribution in the case of transporting the product.

A more complete description of this energy source can be found in Chapter 2 of Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975).

Tar Sands: Tar sands are deposits of porous rock or sediments that contain hydrocarbon oils (tar) too viscous to be extracted by conventional petroleum-recovery methods. Large-scale production efforts have been developed in Canada, but ventures in the United States have been minor. United States' resources are concentrated in Utah, with some potentially commercial quantities in California, Kentucky, New Mexico, and Texas.

About 1.5 tons of rich tar sands yield about 1 bbl of tar, or bitumen, the equivalent of about 6.3 x 106 Btu's. Tar can be recovered either from sands mined on the surface or underground or from direct underground extraction of the oil without mining. Recovery is followed by processing, upgrading to synthetic crude, and refining. Ultimately recoverable reserves may be 100 billion bbl, including other heavy oils.

Surface mining produces substantial residuals, including modification of surface topography, disposal of large amounts of overburden, dust and vehicle emissions, and water pollution. Reclamation can minimize these effects. Residuals are similar to those of coal.

The effects of processing tar sands are similar to those of oil shale. These include solid tailings from extraction, cooling water and blowdown streams, thermal discharges, and off-gases. Under controlled conditions, these residuals can be minimized.

Underground extraction without mining can result in thermal additions, contamination of aquifers, surface spills, surface-earth movements, noise pollution, and emission of gases.

Hydroelectric Power: Hydropower is energy from falling water, which is used to drive turbines and produce electricity. Conventional hydroelectric developments convert the energy of natural stream flows falling from a height into electric power. Pumped-storage projects generate electric power by releasing water from an upper to a lower storage pool and then pumping the water back to the upper pool for repeated use. A pumped-storage project consumes more energy than it generates but converts offpeak, low-value energy to peak, high-value energy. A more detailed discussion of this energy source is found in Chapter 9 of Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975).

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago, hydroelectric plants supplied as much as 30 percent of the electricity produced in the United States. Although hydroplant production has steadily increased, thermal electric-plant production has increased at a faster rate.

From 1970 to 1980, hydroelectric-power production has fluctuated slightly between 220 and 300 billion kilowatt hours--about 4 percent of total United States' energy production. As a proportion of total United States' electricity production and installed generating capacity, hydroelectricity has dropped from 16 percent to 12 percent, although the latter has increased from 55.1 to 76.4 million kilowatts. Much of the recent hydroelectric development has been pumped-storage capacity.

It is likely that hydroelectric power will continue to represent a declining percentage of the total United States' energy mix due to high capital costs, seasonal variations in waterflows, land-use conflicts, environmental effects, competitive water use, and flood-control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining, and free-flowing river reaction.

Hydroelectric projects do not consume fuel and do not cause air pollution. However, use of streams for power may displace recreational and other uses. Water released from reservoirs during the summer months may change ambient water temperatures and lower the oxygen content of the river downstream, thereby adversely affecting indigenous fish. Fluctuating reservoir releases during peak-load operation also may adversely affect fisheries and downstream recreation.

Screens placed over turbines prevent the entrance of fish; small organisms may pass through or may be killed. Fish may die from nitrogen supersaturation, which results at a dam when excess water escapes from the draining reservoir. High nitrogen levels in the Columbia and Snake Rivers pose a threat to the salmon and steelhead resources of these rivers. Other adverse effects to water quality include possible saline-water intrusion into waterways and decreased ability of the waters to accommodate moderate waste discharges.

Air quality will be affected only by dust and emissions during the construction phase. Afterwards, if the impoundment is used for recreation, motor exhaust could occur.

Solar Energy: Applications of solar energy must take into account the following:

- Solar energy is a diffuse, low-intensity source requiring large collection areas. Only a small portion of the potential energy is utilized.
- Its intensity is continuously variable with time of day, weather, and season.
- Its availability differs widely between geographic areas.

Potential applications of solar energy show a wide range. Among them are:

- Thermal energy or water heating, space heating, space cooling, and combined systems of the buildings.
- Renewable, clean-fuel sources; combustion of organic matter; bioconversion of organic materials to methane; pyrolysis of organic materials to gas, liquid, and solid fuels; and chemical reduction of organic materials to oil.
- Electric-power generation, thermal conversion, wind-energy conversion, and ocean-thermal difference.

Solar-energy-collection systems are now commercially available nationwide. Additional detail on this resource alternative is found in Chapter II of Energy Alternatives: A Comparative Analysis (United States Government Federal Policy Task Force Review Group, Solar Energy Analysis, 1978; Solar Energy Progress and Problems, EPA, USDOE, and Lawrence Berkeley Laboratories et al., 1978).

Among the disadvantages of solar energy are high capital costs, expensive maintenance of solar collectors, thermal-waste disposal, and distribution for local thermal balances.

The environmental effects so far identified with solar energy are relatively minimal. The primary effects of the use of this energy source on a wide scale will be land use. Due to the low density of the energy, large areas will be necessary for the collectors. However, the land use compares favorably with other forms of energy use, such as coal extraction.

To date, the only other known area of concern is thermal pollution. Direct use in space heating has no thermal effects. There may be some localized thermal pollution from solar electric-power generation, which will have to be collected and transferred to the generator, but the problem is not expected to be significant. Finally, solar plants can operate only intermittently, thus, the energy will either have to be stored or backup fossil-fuel plants will have to be built. These will have their own sets of environmental constraints.

Oil Imports: Spurred by new discoveries and competition, Middle East oil production expanded in the 1950's and 1960's. New markets were opened and prices softened. The real price of oil fell from 1948 to 1972. Simultaneously, United States consumption of oil increased while production stayed constant; imports were relied upon to make up the difference.

In 1973, the Arab-Israeli war was accompanied by an embargo imposed by OPEC against nations supporting Israel. The vulnerability of the importers to their own heavy demand became evident, and a huge price increase followed. This marked the end of the so-called era of "cheap energy," and efforts were made to curtail imports. Another large price increase occurred in 1979.

Three avenues were pursued for reducing imports: conservation, or reduced net-energy demand per unit output; alternative energy; and increased domestic production.

The results of these efforts for reducing imports seem to have been mostly successful. The underlying market structure for energy has been altered. World demand for oil peaked in 1977 and appears to be in an irreversible structural decline. Gross national products have been rising along with nonenergy output, alternative-energy sources, and non-OPEC production. Oil is wholly responsible for declines in energy use.

The OPEC produced 32 million barrels per day (mbd) in 1977. Current projections of energy consumption until the year 2000 show rates of one-half of that projected in 1972. The USDOE is currently projecting a 0.9-percent annual growth rate (actual growth was 1.9% annually from 1970-1979) and a 3 percent annual economic growth. The dimensions of the structural change for the United States in 1981 are as follows:

- Total energy consumption was down 5 percent.
- Petroleum consumption was down (8%) for the third straight year.
- Oil consumption as a percentage of total energy consumption was down 9 percent.
- Imports of petroleum were down for the fourth straight year. Imports in May 1981 were 5.2 mbd, the lowest in 10 years. This was 20 percent less than in 1980 and 38 percent less than in 1979.
- Imported petroleum as a percentage of total petroleum consumption was down 5 percent.
- Imported petroleum as a percentage of total energy consumption was down 27 percent.
- Dollar value of gross national product has been steadily declining since 1970.

It is reasonable to assume OPEC will affect the bulk of the world's oil production for the remainder of the century, due mainly to the short term in elasticity of the supply of substitutes, and will set prices based on factors besides price-cost relationships. Brief derivations from this leadership position may be noted in the short term due to world price adjustments. Thus, the less dependent the United States is on OPEC, the less vulnerable the United States is to large, erratic price changes. Imports from the Middle East also bring problems of stability of supply, balance of payments, currency exchange rates, and United States' offloading capacity.

The United States will probably remain somewhat dependent on imported energy throughout this century and, as the 1970's showed, there are situations in the Middle East that could lead to major disruptions in supply or huge price increases. However, the propensity for such anomalies is less than in the past, due primarily to the following:

- As mentioned above, the underlying market structure for energy has been altered, and demand for oil has declined drastically. Associated with this, OPEC will have considerable spare capacity, and price cohesiveness will be difficult to maintain.
- All OPEC nations need to produce oil to finance development. The goal of many OPEC nations is to maximize oil's long-term contribution to the national economy rather than to maximize short-term profits. If revenue falls below a certain level where OPEC nations are not realizing an acceptable income, domestic tensions may ensue.
- The OPEC economies, especially Saudi Arabia's, are more interdependent with the West than previously. The OPEC has invested interest and financial reserves in the West, imports a large amount of goods from the West, and has its oil prices tied to Western currency-exchange rates.
- The presence of strategic stockpiles provides both a deterrent to international disruptions in world markets and a cushion for smoothing price and supply shocks. Current stockpile inventories on most Western nations are at record levels.

The OPEC's output and pricing structure also will depend on its balancing of:

- future vs. present proceeds;
- benefits vs. cost of rapid modernization; and
- discipline in the market vs. the political unit of OPEC.

The primary hazard to the natural environment of increased oil imports is the possibility of oil spills, which can result from accidental discharge, intentional discharge, and tanker casualties. Intentional discharges would result largely from uncontrolled unballasting of tankers. The effects of chronic, low-level pollution are largely unknown. The worldwide tanker casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident such as the breakup of the Torrey Canyon in 1967 or the Amoco Cadiz in 1978 can have disastrous results. Of more concern than tanker spills is the effect on the social and economic environment. The potential for a future embargo under this option is such that American productivity and policy could become subservient to foreign influence, having both economic and security implications for the Nation. On a more subtle level, political alignments and policies of the United States could become tied to those of foreign oil powers. This option is the least acceptable for continued American energy independence.

Natural Gas Imports: Imports of natural gas via pipeline have come largely from Canada, with small amounts also coming from Mexico. In 1980, net pipeline imports from Canada were 881 billion cubic feet, about 4.4 percent of the total natural gas used in the United States. These imports were about 33 percent of Canada's natural gas production.

The natural gas-import situation continues to be highly uncertain. A major reason for this uncertainty is the disparity between prices for natural gas and alternative fuels in this country and the price of crude oil in world markets.

The United States and Canada concluded an agreement in March 1980 that established a formula for escalating the price of Canadian imports. The formula prices Canadian gas at the Btu-equivalent price of Canadian crude oil imports, minus an adjustment that reflects savings to Canada of certain transportation costs. In response to escalated Canadian prices, demand in the United States for Canadian gas dropped sharply. Consequently, Canada has foregone the opportunity to raise its export price. What modifications, if any, the Canadians will make to their pricing formula and what minimum amounts of Canadian gas Americans must take under existing contracts are matters currently being examined on both sides of the border.

Mexico could be a significant source of future imports because of its relatively large natural gas-resource base. Imports from Mexico were of a local nature until 1957 and have declined since 1969. In September 1979, an agreement was concluded between the United States and Mexico regarding the importation and pricing of natural gas. A base price was specified to be escalated in proportion to the average price of five crude oils traded on the world market. However, the rapid increase in world oil prices between the time the agreement was concluded and the time the price escalation began brought the price of Mexican gas substantially below both oil parity and the Canadian gas price. Consequently, Mexico requested and received the same price as the Canadians.

Natural gas imports are expected to be eliminated in the long run, as domestic natural gas production will nearly satisfy decreasing demand and synthetic gas from coal can provide the balance and replace imports.

The environmental effect of increasing gas imports derives mainly from the possible increased use of land for pipeline construction. A further effect is the risk of explosions and fires. Fluctuations of supply could influence quality of life, productivity, and employment. American policies also could become influenced by decisions of foreign gas producers, much as they could under the option of increasing oil imports.

Liquefied Natural Gas Imports: The growing shortage of domestic natural gas has encouraged projects to import liquefied natural gas (LNG) under long-term contract. Large-scale shipping of LNG is a relatively new industry. Several LNG projects are now under consideration on the Pacific, Atlantic, and Gulf Coasts. The security of foreign LNG is questionable. The complexity of the length of time involved in implementing these proposals has been increased by the need for negotiating preliminary contracts, securing the approval of the Federal Energy Regulatory Commission and the exporting country, and making adequate provision for environmental and safety concerns in the proposed United States' facilities. The authority to construct and operate facilities to implement imports and exports must be obtained separately from the Federal Energy Regulatory Commission. The cost of liquefying and transporting natural gas, other than overland by pipe, is high.

The United States imported 85 billion cubic feet of LNG from Algeria in 1978. In March 1980, Algeria announced that it was demanding oil-price parity, free-on-board, for gas it exported to the United States, and it subsequently discontinued deliveries. The free-on-board price does not include transportation, terminal, and regasification costs, which are substantial.

The environmental effects of LNG imports arise from tankers; terminal, transfer, and regasification facilities; and transportation of gas. The primary hazard of handling LNG is the possibility of a fire or explosion during transportation, transfer, or storage.

Receiving and regasification facilities will require prime shoreline locations and channel dredging. Regasification of LNG will release few pollutants to the air or water.

LNG imports will influence the United States' balance of payments. This effect will depend on the origin and purchase price of the LNG, the source of the capital, and the country (United States or foreign) in which equipment is purchased and LNG tankers are built.

Geothermal Energy: Geothermal energy is primarily heat energy from the interior of the earth. It may be generated by radioactive decay of elements such as uranium or thorium and friction due to tidal or crustal plate motions. There are four major types of geothermal systems--hot-water, vapor-dominated, geopressured reservoirs, and hot-dry-rock systems.

In addition to electricity, geothermal energy can offer a potential for space heating, industrial processing, and other nonelectric uses in many areas that presently are highly dependent upon oil and gas for energy needs. However, geothermal electric-generating plants are smaller than conventional plants and require a greater amount of steam to generate an equal amount of energy. This is due to the fact that temperatures and pressures associated with geothermal areas are lower than those created at conventional power plants.

The greatest potential for geothermal energy in the United States is found in the Rocky Mountain and Pacific regions; some potential (geopressured-geothermal) exists in the Gulf Coastal Plain of Texas and Louisiana. The geyser field in California, which has been producing power since 1969, is the most extensively developed source of geothermal energy in the United States. Exploration efforts also are under way in Imperial Valley, Salton Sea, Mono Lake, and Modoc County, California.

Geothermal energy presently accounts for less than 1 percent of total United States' energy production. The environmental problems associated with geothermal energy principally result from a number of gases that are associated with geothermal systems and that may pose health and pollution problems. These gases include ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, and others. However, adverse air-quality effects are generally less than those associated with fossil-fuel plants. Also associated with geothermal energy systems are saline waters that must be disposed of and isolated from contact with groundwater regimes.

Land-quality problems stem from disturbance due to construction of related facilities and possible ground subsidence which, in turn, can cause structural failures and loss of groundwater-storage capacity.

Other Energy Sources: The high cost and rapidly shrinking reserves of traditional energy fuels have encouraged research into new and different sources for potential energy. Some of these alternative sources have been known for decades, but high costs and technical problems have prevented their widespread use. These sources include tidal power, wind power, organic fuels, and ocean-thermal gradients, among others.

The date of commercial availability of such alternatives will depend on the cost of the traditional energy fuels, the level of federally subsidized research through Energy Research and Development Administration assistance, and the solution of engineering and technical problems.

Environmental effects of these alternatives are difficult to assess, especially since a great amount of research and development remain to be completed before operational scale systems can be developed, tested, and evaluated for production and application.

Combination of Alternatives: A combination of some of the most viable energy sources available to this area, discussed above, could be used to attain an energy equivalent comparable to the estimated production within the anticipated field life of these proposed actions. However, this combination of alternatives, in order to attain the needed energy mix peculiar to the infrastructure of this area, would have to consist of energy sources attainable now or within the suggested timeframe that are transferable to the technology presently used. Viable substitutes would have to be available for the petroleum and natural gas required by the petrochemical industrial complex, the petroleum used for the transportation sector, and the electricity and fuels used in residential and commercial sectors.

Part II of the Energy Alternatives: A Comparative Analysis, particularly Chapter 16, "Comparing the Economic Costs of Energy Alternatives," discusses the factors that must be involved in developing technically and economically appropriate energy alternatives.

With favorable technologies and economies, the most viable domestically available energy alternative would probably consist of the use of coal, oil shale, tar sands, and biomass to produce synthetic liquids; nuclear energy and coal to compete for the utility market; and renewables to supply a sizable portion of total energy requirements. The environmental effects of each of these alternatives have been discussed briefly in the previous paragraphs of this section. The rest will be a long-term energy-supply transition from crude oil and less dependence on oil imports. Such patterns will require new, efficient technologies; major capital investments; and a high rate of growth in coal production.

The future United States' energy-source mix will depend on a multiplicity of factors—the identification of resources, research and development efforts, development of technology, rate of economic growth, the economic climate, changes in lifestyle and priorities, capital investment decisions, energy prices, world oil prices, environmental quality priorities, government policies, and availability of imports.

It is unlikely that there will ever be a single definitive choice among energy sources or that development of one source will preclude development of others. Different energy sources will differ in their rates of development and the extent of their contributions to total United States' energy supplies. Understanding of the extent to which they may replace or complement offshore oil and gas requires reference to the total national energy picture.

It is difficult to predict the extent to which the development of alternative energy supplies may be necessary since other factors are involved, such as the continuing success of energy conservation by the American public, overcoming technical and economic barriers that presently exist in developing other alternative-energy sources, and improving resource-recovery methods to increase the rate of recovery. For more information on these alternative approaches to our Nation's energy needs, refer to the following: Energy Alternatives: A Comparative Analysis (University of Oklahoma, 1975), which was prepared under contract for BLM; and the Final Environmental Statements for OCS Sales 58 (USDOI, BLM, 1979) and 70 (USDOI, MMS, 1982).

APPENDIX J

FATE AND EFFECTS OF EXPLORATORY-PHASE OIL AND GAS DRILLING DISCHARGES IN THE CHUKCHI SEA PLANNING AREA, OCS LEASE SALE 126

(Prepared by the USEPA)

APPENDIX

Fates and Effects of Exploratory Phase Oil and Gas Drilling Discharges in the Chukchi Sea Planning Area, Lease Sale 126

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INTRODUCTION

PURPOSE OF EVALUATION

The U. S. Environmental Protection Agency (EPA) intends to issue a National Pollutant Discharge Elimination System (NPDES) general permit for effluent discharges associated with oil and gas exploration in the Outer Continental Shelf (OCS) Lease Sale 126, Chukchi Sea Planning Basin, Alaska. Authorized discharges from oil and gas drilling operations include drilling muds and cuttings, sanitary and domestic wastewater, desalination unit discharges, boiler blowdown, uncontaminated ballast and bilge water, blowout preventer fluid, excess cement slurry, deck drainage, non-contact cooling water, fire control system test water, and test fluids.

Sections 402 and 403 of the Clean Water Act (CWA) require that NPDES permits for such ocean discharges be issued in compliance with EPA's guidelines (Ocean Discharge Criteria authorized under Section 403 of the CWA) for preventing unreasonable degradation of ocean waters. Section 301(c) of the CWA provides that the discharge of pollutants to ocean water is unlawful except in the terms of an NPDES permit. Under EPA's regulations (40 CFR 122.28[a][2]), EPA may issue a single general NPDES permit to a category of point sources located within the same geographical area if the regulated point sources:

- involve the same or substantially similiar types of operations;
- discharge the same types of wastes;
- require the same effluent limitations or operating conditions;
- require similar monitoring requirements; and
- in the opinion of the EPA Regional Administrator, are more appropriately controlled under a general permit than under individual permits.

EPA has decided that general permits are more appropriate for effluent discharges associated with oil and gas exploration than individual permits, and EPA expects to issue a general permit for exploratory drilling operations for Sale 126. However, EPA may issue individual NPDES permits for areas requiring special consideration, such as areas of sensitivity or of biological concern, and may elect to issue individual NPDES permits for future development and production operations in the Lease Sale 126 area.

Before EPA can issue an NPDES permit to a new source, an environmental review must be conducted pursuant to Section 511 (c)(1) of the CWA. EPA expects to adopt the Sale 126 Final Environmental Impact Statement (FEIS) in order to satisfy this requirement. Ocean discharges must also be evaluated with respect to the Ocean Discharge Criteria developed in accordance with Section 403(c) of the CWA. EPA, therefore, agreed to be a cooperating agency in the development of the EIS. The Minerals Management Service (MMS) of the U. S. Department of Interior (DOI) requested that EPA provide an appendix that evaluates the fate of exploration-phase deliberate discharges, and the effects of these discharges on receiving water quality and biological populations.

SCOPE OF EVALUATION

This appendix evaluates the effects of waste discharges that would be provided for by the general NPDES permit that will be proposed for offshore oil and gas exploration in the Chukchi Sea Planning Basin under federal OCS Lease Sale 126. The appendix evaluates only deliberate wastewater discharges occurring during exploration. It does not evaluate impacts of exploration caused by noise, construction, spills, or other factors; and does not include discharges that occur during development and production.

CURRENT EVALUATION

MMS has presented three development scenarios which assume different numbers of exploration and delineation wells (Table 1) (DOI 1989). The average exploration and delineation well in the Chukchi Planning Area will be about 3170 meters (10,400 feet) deep, will use about 603 tonnes (660 short tons) of dry mud and will produce about 772 tonnes (850 short tons) of dry rock cuttings (DOI 1989).

The first scenario is the low case. Two exploration wells are projected to be drilled in 1992 using a total of 1,206 tonnes (1,319 short tons) of drilling muds and producing a total of 1,544 tonnes (1,700 short tons) of dry rock settings.

The second scenario is a base case projection which assumes that exploration will result in the discovery of approximately 910 million barrels of commercially recoverable hydrocarbons. This scenario projects 28 exploratory wells and 11 delineation wells between 1992 and 1998 with discharges of 23,517 tonnes (25,634 short tons) of dry mud and 30,108 tonnes (32,818 short tons) of dry rock cuttings.

The third scenario is a high case projection which assumes that the exploration phase will result in the discovery of 1,700 million barrels of commercially recoverable hydrocarbons. Activity is assumed to continue through 2001 with 37 exploration and 16 delineation wells projected. Approximately 44,616 tonnes (34,835 short tons) of drilling muds and 40,932 tonnes (44,616 short tons) of cuttings are expected to be produced during the seven-year period.

Table 1. Estimated Annual Production of Drilling Muds and Cuttings During Exploration and Delineation Activities in the Chukchi Sea Planning Area, Lease Sale 126[1]

		Exploration[2]				Delineation[3]		
	Year	Number of Rigs	Number of Wells	Mud (Tonnes)	Cuttings (Tonnes)	Number of Wells	Mud (Tonnes)	Cuttings (Tonnes)
Low Case	1992	2	2	1,206	1544	0	0	0
	Total		2	1,206	1544	--	--	--
Base Case	1992	4	4	2,412	3,088			
	1993	5	6	3,618	4,632	4	2,416	3,088
	1994	5	6	3,618	4,632	3	1,809	2,316
	1995	4	4	2,412	3,088	3	1,809	2,316
	1996	3	3	1,809	2,316	1	603	772
	1997	3	3	1,809	2,316			
	1998	2	2	1,206	1,544			
	Total		28	16,884	21,616	11	6,633	8,492
High Case	1992	4	4	2,412	3,088			
	1993	6	6	3,618	4,632	4	2,412	3,088
	1994	5	6	3,618	4,632	3	1,809	2,316
	1995	5	5	3,051	3,860	3	1,809	2,316
	1996	4	4	2,412	3,104	2	1,206	1,544
	1997	4	4	2,412	3,088	2	1,206	1,544
	1998	3	3	1,809	2,316	1	603	772
	1999	2	2	1,206	1,544	1	603	772
	2000	2	2	1,206	1,544			
	2001	1	1	603	772			
	Total		37	22,311	28,580	16	9,648	12,352

Source: DOI 1989

1 Estimated number of wells and hypothetical drilling schedule.
2 The average exploration well is assumed to use 603 tonnes (660 short tons) of dry mud and 772 tonnes (850 short tons) of cuttings.
3 The average delineation well is assumed to use 603 tonnes (660 short tons) of dry mud and 772 tonnes (850 short tons) of cuttings.

DESCRIPTION OF ALTERNATIVES

This section first notes the estimated schedule for activities in the planning area and discusses the requirements applicable to EPA in its development of NPDES permits. Finally, it describes the alternatives being considered as a part of the development of the NPDES permit for the sale area.

Sale 126 (Figure 1) is currently scheduled to be held in May, 1990. Exploratory drilling in the blocks leased as a result of this sale could begin in 1992. The first delineation well could be drilled in 1993, the second drilling season. Drilling of exploration and delineation wells could continue through 1998. The amount of time to drill and test exploration wells is estimated to be about 90 days (DOI 1989).

CLEAN WATER ACT PERMIT REQUIREMENTS

Sections 301(b), 304, 306, 308, 401, and 403(c) of the Act provide the basis for NPDES permit conditions. The general requirements of these sections fall into two categories, ocean discharge criteria and technology-based effluent limitations. These sections are described below.

OCEAN DISCHARGE CRITERIA

EPA'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 as (40 CFR 125.121[e]):

"(1) Significant adverse changes in ecosystem diversity, productivity and stability of the biological community within the area of discharge and surrounding biological communities,

(2) Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms, or

(3) Loss of aesthetic, recreational, scientific or economic values, which is unreasonable in relation to the benefit derived from the discharge."

The determination of unreasonable degradation must be based on the following factors: quantities, composition, and potential for bioaccumulation or persistence of the pollutants discharged; potential transport of such pollutants; the composition and vulnerability of the biological communities exposed to such pollutants; the importance of the receiving-water area to the surrounding biological community; the existence of special aquatic sites; potential effects on human health; existing or potential effects on recreational and commercial fishing; applicable requirements of approved Coastal Zone Management Plans; marine water quality criteria developed pursuant to section 304(a)(1) of the CWA; and other relevant factors.

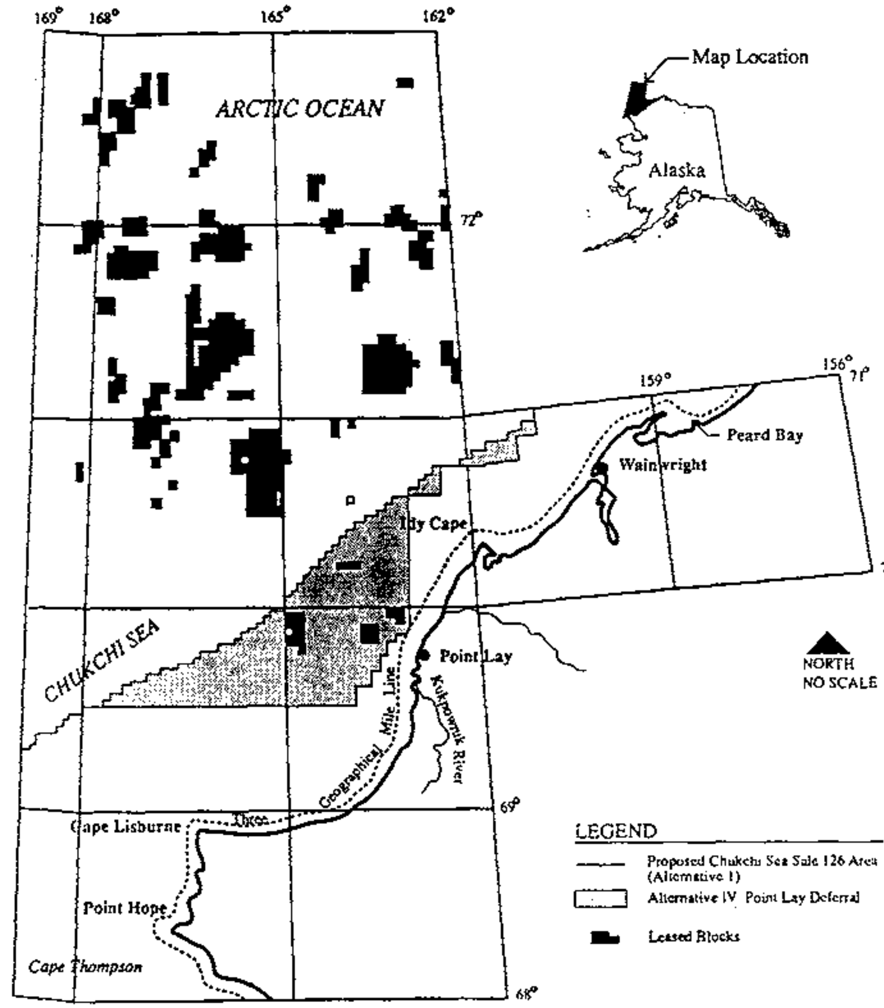

Figure 1. Chukchi Sea Lease Sale 126

If the EPA Regional Administrator determines that the discharge will not cause unreasonable degradation of the marine environment based upon the above criteria, 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 cannot 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 may not be issued unless the Regional Administrator, on the basis of the best available information, determines that: (1) such discharge will not cause irreparable harm (as defined in 40 CFR 125.121[a]) to the marine environment, (2) there are no reasonable alternatives to the on-site disposal of these materials, and (3) the discharge will be in compliance with certain specified permit conditions (40 CFR 125.123[d])

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

The CWA requires particular classes of industrial discharges, including those associated with oil and gas exploratory drillings, to meet technology-based effluent limitations established by EPA. The CWA provides for implementation of these effluent limitations in three stages.

Best practicable control technology currently available (BPT) was required no later than July 1977. BPT represents the average of the best existing performances of well-known technologies for control of traditional pollutants. EPA set effluent limitation guidelines requiring BPT for the Offshore Subcategory of the Oil and Gas Extraction Point Source Category (40 CFR Part 435, subpart A) on April 13, 1979 (44 FR 22069). BPT for this subcategory limits the discharge of oil and grease in produced water to a daily maximum of 72 milligrams per liter and a 30-day average of 48 milligrams per liter; prohibits the discharge of free oil that would cause a sheen on the water surface in deck drainage, drilling fluids, drill cuttings, and well-treatment fluids; requires a minimum residual chlorine content of 1 milligram per liter in sanitary discharges; and prohibits the discharge of floating solids in sanitary and domestic wastes.

Toxic pollutants are controlled by the best-available technology economically achievable (BAT) (40 CFR 401.15), while conventional pollutants, such as oil and grease, biochemical oxygen demand, pH, suspended solids, and fecal coliforms are controlled by the best conventional pollutant control technology (BCT). Controls by BAT and BCT are to be achieved as expeditiously as practicable, but in no case later than three years after the date of final promulgation of technology-based guidelines. In no case are BAT or BCT to be less stringent than the already existing BPT. Permits must impose effluent limitations which control non-conventional (i.e., neither toxic nor conventional) pollutants by means of BAT.

Finally, effluent limitations based on the best-demonstrated control technology must be imposed with the development of new-source performance standards (NSPS).

BAT/BCT effluent limitation guidelines and NSPS for the Offshore Subcategory were proposed by EPA in August 1985 (50 FR 34592). The guidelines are slated to be

proposed again in June 1990. The reproposal will address all applicable wastestreams (drilling muds and cuttings, produced water, produced sand, deck drainage, well treatment fluids, work overfluids, sanitary wastes, and domestic wastes). Promulgation of these guidelines and standards is not expected until July 1991, although proposed rules have been published (53 FR 41358).

EPA Region 10 BAT requirements in permits (1) prohibit the discharge of all oil-based muds, diesel oil, and cuttings with either an oil content greater than 10 percent by weight, or cuttings which contain diesel oil, or those that cause a sheen; (2) limit the mercury and cadmium content of barite to 1 milligram per kilogram and 3 milligrams per kilogram (dry weight basis), respectively; (3) set limits for the biochemical oxygen demand of sanitary waste and require a residual chlorine content of no less than 1.0 milligram per liter in the wastes; (4) controls drilling mud and cuttings toxicity via the drilling fluid formulation process; and (5) set other limits on miscellaneous discharges. Such requirements were incorporated in the general permits for the Bering and Beaufort Seas (49 FR 23734), for Norton Sound (50 FR 23578), for Cook Inlet, the Chukchi Sea, and Beaufort Sea (53 FR 37846).

This appendix is based largely on EPA's evaluation (against these criteria) of the effects of discharge resulting from oil and gas exploratory drilling on previous leases issued by MMS for Lease Sales 87, 97, and 109. Preliminary conclusions concerning the fate and effects of drilling effluent discharges, including the results of modelling studies, have been incorporated into this document.

LAND DISPOSAL ALTERNATIVES

Land disposal must be considered as the alternative to ocean disposal of drilling muds if the NPDES permit conditions are not met or if there is insufficient information to determine that there will be no unreasonable degradation to the marine environment. In the event that EPA decides (on the basis of the Ocean Disposal Criteria Evaluation [ODCE]) to prohibit discharges of drilling muds from exploratory operations , several alternatives and techniques for land disposal are available. These include:

- storage in pits or sumps;
- storage in abandoned gravel pits and quarries;
- direct disposal over land surfaces; and
- subsurface injection or burial.

All land disposal alternatives for offshore drilling will require transportation of drilling muds and fluids to disposal sites. This could be accomplished by barging in the open water and in some locations by truck during the ice-covered season. During freezeup and spring breakup, the muds would have to be stored on site if land disposal is required.

COMPOSITION AND QUANTITY OF MATERIALS DISCHARGES

This section describes and quantifies the various discharges expected from oil and gas drilling rigs during exploratory and delineation activities. Attention is given to the drilling muds and the specialty additives they contain.

TYPES OF DISCHARGES

Exploratory oil and gas well drilling can produce a wide range of waste materials related to the drilling process, maintenance of equipment, and personnel housing. The major discharges to be expected from exploratory drilling are drilling fluids (muds), and drilling cuttings and washwater. For exploration wells drilled in 1989 in the Chukchi Sea, discharges of drilling mud did not exceed 100 barrels per hour (2,600 barrels total) and discharges of cuttings ranged up to 90 barrels per hour (1,500 barrels total). Other discharges may include sanitary and domestic wastes, desalination-unit discharge, boiler blowdown, test fluids, deck drainage, non-contact cooling water, blowout-preventer fluid, uncontaminated ballast and bilge water, and excess cement slurry.

MISCELLANEOUS DISCHARGES

Sanitary waste discharge is expected to be under 37,850 liters (10,000 gallons) per day per rig (Menzie 1983), which consists of chlorinated, perhaps secondary treated, effluent. Upon discharge, immediate dissolved oxygen demand is exerted, which represents the oxygen demand of organic compounds that are rapidly oxidized. Calculations described in EPA (1984a) indicate that the dissolved oxygen depression resulting from the discharge of treated sewage effluent during offshore exploratory drilling will not be significant when ambient dissolved oxygen concentrations are at least 1 milligram per liter above the dissolved oxygen standard for aquatic life. No standards exist for OCS waters; however, in Alaskan inshore waters the standards are 6 milligrams per liter at the surface, 5 milligrams at depth. Since the ambient dissolved oxygen concentration in the receiving water exceeds 8 milligrams per liter, sewage effluent discharge is not expected to significantly impact dissolved oxygen concentrations in the ocean.

Domestic waste (shower and sink drainage) is not expected to produce a significant discharge flow, usually less than 30,280 liters (8,000 gallons) per day, and is sometimes reused to make drilling mud rather than discharged directly (Jones & Stokes Associates 1984). Average discharge rates from an Alaskan offshore exploration rig are presented in Table 2. Sanitary and domestic discharges from three wells drilled in 1989 ranged from 15,140 liters (4,000 gallons) per day to 49,205 liters (13,000 gallons) per day.

The blowout preventer may be located on the sea floor or on the drilling platform. This device is designed to contain pressures in the well that cannot be contained by the drilling mud. Fluid may be discharged when the blowout preventer is actuated, generally on a weekly basis for testing. Some self-contained blowout preventers are now in use. The primary constituents of blowout preventer fluid are ethylene glycol and water (Jones & Stokes Associates 1984). This is not highly toxic; Price et al.

1974, report the LC$_{50}$ for brine shrimp to be 20,000 mg/l. Zajic and Himmelman (1978) consider the hazard of this compound to be "minor." Some proprietary formulations are also used. The volume of fluid discharged when the device is actuated needs to be monitored. A representative discharge estimate obtained from industry discharge monitoring reports is 757 liters (200 gallons) per day. This estimate may be high (Jones & Stokes Associates 1984). Blowout preventer discharges ranged from no discharge to 481 liters (127 gallons) per day from three wells drilled in the Chukchi Sea Lease Area in 1989.

Cement, along with spud mud and cuttings, will be discharged from drillships. It will also be discharged on the ocean floor in the early phases of drilling before the well casing is set, and during well abandonment and plugging. Excess cement slurry will result from equipment washdown after cementing operations. The exact composition of the cement is not documented. Consequently, its composition should be either defined or an aquatic toxicity test conducted to define its hazard potential. It is generally expected to be nontoxic (Jones & Stokes Associates 1984). Discharge volumes ranged from no discharges to 56,775 (15,000 gallons) per day from wells drilled in 1989 in the Sale 109 area.

Desalination-units may discharge on the order of 757,000 liters (200,000 gallons) per day per rig of water having salinity twice that of ambient seawater, although discharges from three exploration wells drilled in 1989 only discharged up to 87,000 liters (23,000 gallons) per day. Boiler blowdown may be discharged once or twice a year per rig in volumes up to 666 liters (176 gallons). Both of these discharges may contain biocides or chemicals used to combat corrosion and scaling. The volume of boiler blowdown is so small that it is unlikely to be a significant source of pollution. Desalination-unit water could result in significant mass loadings of pollutants into the immediate marine environment if the chemicals are not consumed or detoxified prior to discharge.

Test fluids are discharged from the well upon completion of drilling. These may consist of formation water, oil, natural gas formation sands, any acids or chemicals added downhole, or any combination thereof. Test fluids are generally stored and treated for oil removal and pH before being discharged or flared. Approximately 1 percent of the total test fluids will have a pH of 2. During a typical 5-day well test, this may involve 8,000 liters (2,110 gallons) of water. The addition of strong acidic fluids downhole could cause significant leaching of heavy metals from the formation and residual drilling muds. The remaining test fluids will have a pH of 5 to 8.5, with about 97 percent of the volume above pH 6.5. The permit will require neutralization (pH 6.5 to 8.5) of all spent acidic fluids before discharge.

Some deck drainage and fire control system test water may be produced and discharged during summer months. This would consist of rain and washwater from the deck and drilling floor, as well as water used to test the fire control system. Gutters normally carry the drainage to a sump tank where oil is separated and removed before the water is discharged. Oil is the primary pollutant in deck drainage, with a reported range of 24 to 450 milligrams per liter, but these discharges may also contain small quantities of detergents used in cleaning procedures and spilled drilling mud or chemicals (Mors et al. 1982).

Table 2. Representative Discharges from Alaskan Offshore Exploration Rigs[1]

Discharge, Units	6/10-6/30	7/01-7/31	8/01-8/31	8/31[2]	9/01-9/30	10/01-10/12
Drilling Mud						
Average BPH	30	10	21.2	ND[3]	39	137
Total Maximum BBL	4,406	2,845	1,679		4,679	2,165
Cuttings						
Average BPH		1	0.3	ND	5	1
Total Maximum BBL		389	109		1,956	75
Washwater						
Average BPH	257[4]	236[5]	172[6]	ND	217[7]	139[8]
Total Maximum BBL	35,148[4]	79,213	58,698		78,950	15,294
Deck Drainage						
Average GPD	13,430	13,006	13,940	21,600	25,080	12,150
Total Maximum GAL	282,000	403,200	418,200	21,600	752,400	145,800
Sanitary Waste						
Average GPD	2,225	2,427	2,075	2,280	2,124	2,068
Domestic Waste						
Average GPD	7,419	8,084	6,917	7,600	7,080	6,892

1 Compiled from EPA Region 10 discharge monitoring reports for a selected representative Alaskan offshore exploration semi-submersible rig at two wells in the Navarin Basin, 1985 season. BPH = barrels per hour; BBL = barrels; GPD = gallons per day; GAL = gallons.
2 Rig relocated to new exploration block.
3 No discharge.
4 Includes cuttings.
5 Maximum mud, cuttings and washwater reported as 532 BPH.
6 Maximum mud, cuttings and washwater reported as 438 BPH.
7 Maximum mud, cuttings and washwater reported as 575 BPH.
8 Maximum mud, cuttings and washwater reported as 875 BPH.

Generally, except for an elevated temperature, the composition of non-contact cooling water will not significantly differ from ambient seawater (Jones & Stokes Associates 1984). Oil-water separators are used to treat bilge waters for removal of petroleum hydrocarbons prior to discharge. While ballasts waters are untreated, the permit prohibits discharges that will produce an oil sheen.

The volume of non-contact cooling water can vary depending on the system used. Closed-system, air-cooled designs require no cooling water, whereas other systems may discharge up to 7 million liters (1.87 million gallons) per day. Reported temperatures range from 15° to 29°C (62° to 84°F), much higher than ambient seawater. Biocides may be used to control fouling in the heat exchange units (Zimmerman and de Nagy 1984). The volumes of cooling-water discharge could result in significant mass loadings of pollutants into the immediate marine environment if the chemicals are not consumed or significantly detoxified prior to discharge.

Bilge waters are treated for removal of oil prior to discharge. Ballast waters are not treated; however, the permit will prohibit discharges that produce an oil sheen.

In summary, discharges other than drilling mud and cuttings are expected to represent only small pollutant loadings from offshore exploratory drilling operations using properly designed and functioning equipment. Potential pollutant loadings could result from deck drainage, biocides, corrosion inhibitors, and scale preventors and the following precautions appear warranted:

- cooling-water and desalination-unit discharges (and any other high volume discharge) should be monitored for volume of discharge and the chemical composition and concentration of biocides, corrosion inhibitors, or other chemical additives;
- heavy metal concentrations in spent test fluids should be determined;
- oil separators or sump tanks should be used for deck drainage, and the oil disposed of safely; and
- no solid waste should be thrown into the sea.

COMPOSITION OF DRILLING MUD

GENERAL COMPOSITION

Drilling muds are 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 drilling of a specific hole.

Drilling muds serve several other functions in addition to removing solids. These include creating pressure to counteract pressure encountered in the formation at depth and controlling the flow of fluids between the formation and the hole. As the hole becomes deeper and encounters different formations, the type of mud may need to be changed or the composition altered.

Six generic water-based mud (WBM) types have been evaluated and approved by the EPA during previous permit development. Table 3 lists the basic components of each mud and the maximum allowable concentration of each base component (53 FR 37846). Maximum values represent the present authorized maximum concentrations. Each mud differs in its basic components, and a single mud type can vary substantially in composition. Specialty additives may also be incorporated. Oil-based drilling muds may be used but are not allowed to be discharged because they violate the effluent limitation of no discharge of free oil. "Oil-based" means that the mud or fluid contains oil as the continuous phase, with water as the dispersed phase. Additionally, the discharge of drilling muds and associated cuttings which have been contaminated by diesel oil is prohibited.

METALS

The presence of potentially toxic trace elements in drilling muds and cuttings is a concern. Metals, including lead, zinc, mercury, arsenic, vanadium, and cadmium, can be present as impurities in barite; chromium is present in chrome lignosulfonates and chrome treated lignite (Crippen et al. 1980; Menzie 1982). According to Ayers et al. (1980), drill pipe dope (15 percent copper, 7 percent lead) and drill collar dope (35 percent zinc, 20 percent lead, 7 percent copper) also contribute trace metals to the muds and cuttings discharge.

Trace metal concentrations expected in drilling muds used in oil and gas exploratory drilling are given in Table 4. Two values are given. The metals content of the generic muds prior to use was analyzed by CENTEC (1984) and these values are reported in Column 1. The metals content of the discharges, which consist of both generic muds and additives, is reported in DMRs, and maximum metal concentration values from the reported data are given in Column 2. The difference in concentrations is substantial for barium, cadmium, chromium, lead, mercury, nickel, and zinc. Arsenic and copper change very little. This difference can be attributed to authorized specialty additives, incidental contamination from pipe dope, and differences in laboratory analyses and sample sources.

The range of metal concentrations in the drilling discharge is compared to average concentrations of the metals observed in the Earth's continental crust and in Alaskan OCS sediments (Table 5). With the exception of copper, all the listed metals can occur at concentrations greater than average continental crust or Alaskan OCS sediments. Barium in drilling muds is present at two orders of magnitude or greater concentration than any other trace metal.

Table 3. Authorized Drilling Mud Types

Components	Maximum Allowable Concentration (lb/bbl)
1. Seawater/Freshwater/Potassium/Polymer Muds	
KCl	50
Starch	12
Cellulose Polymer	5
Xanthum Gum Polymer	2
Drilled Solids	100
Caustic	3
Barite	575
Seawater/Freshwater	As Needed
2. Seawater/Lignosulfate Mud	
Bentonite[1]	50
Lignosulfate, Chrome, or Ferrochrome	15
Lignite, Untreated or Chrome-treated	10
Caustic	5
Lime	2
Barite	575
Drilled Solids	100
Soda Ash/Sodium Bicarbonate	
Cellulose Polymer	5
Seawater/Freshwater	As Needed
3. Lime Mud	
Lime	20
Bentonite[1]	50
Lignosulfate, Chrome, or Ferrochrome	15
Lignite, Untreated or Chrome-treated	10
Caustic	5
Barite	575
Drilled Solids	100
Soda Ash/Sodium Bicarbonate	2
Seawater/Freshwater	As Needed
4. Non-Dispersed Mud	
Bentonite	50
Acrylic Polymer	2
Lime	2
Barite	180
Drilled Solids	70
Seawater/Freshwater	As Needed
5. Spud Mud	
Lime	2
Bentonite[1]	50
Caustic	2
Barite	50
Soda Ash/Sodium Bicarbonate	2
Seawater	As Needed
6. Seawater/Freshwater Gel Mud	
Lime	2
Bentonite[1]	50
Caustic	3
Barite	50
Drilled Solids	100
Soda Ash/Sodium Bicarbonate	2
Cellulose Polymer	2
Seawater/Freshwater	As Needed

Source: 53 FR 37846

[1] Attapulgite, sepiolite, or montmorillonite may be substituted for bentonite.

CHROME LIGNOSULFONATES

Chrome lignosulfonates are present in two of the six generic muds approved for offshore drilling. When added to drilling fluids, chrome lignosulfonates adsorb to the clay component, inhibiting flocculation and loss of viscosity during use. However, chrome lignosulfonates are readily soluble in water (approximately 500 grams per liter [Knox 1978]), and the extent to which they may be displaced from drilling muds during use, or by seawater ions after discharge, has not been determined. Chrome lignosulfonates resist decomposition and persist in the marine environment for long periods of time. They are a major source of chromium, and their impacts on the biota will be addressed in a later section. The proportion of total chromium in the discharge that is actually combined with used lignosulfonates is unknown (Liss et al. 1980).

Marine sediments are the likely repository for discharged chrome lignosulfonates. The fate of these compounds in marine sediments is unclear. Because they are water soluble, the potential exists for slow release into sedimentary pore waters and/or reintroduction into bottom waters by resuspension or bioturbation, increasing their availability to marine organisms. All evidence points to minimal degradation by either abiotic (strictly chemical) degradation (Sarkanen and Ludwig 1971) or microbial breakdown (Crawford 1981). This evidence is supported by published studies of lignin distributions in marine sediments that indicate minimal in situ degradation periods in excess of 10,000 years (Hedges and Van Green 1982). This indicates that chrome lignosulfonates will persist in the sediments for long periods of time.

SPECIALTY ADDITIVES

In addition to the substances listed in Table 3 that make up the six generic mud types approved for use by EPA, a group of downhole additives are used for specific problems that may be encountered in the course of drilling. These additives can range from simple inorganic salts to complex organic polymers. Table 6 lists the more common additives in water-based drilling muds. Among the additives used in large enough quantities to result in significant mass loadings to the environment are: spotting materials, lubricants, zinc compounds, biocides, and materials added to prevent loss of circulation.

Spotting materials 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 spotting compounds are oil based. Previous oil and exploration NPDES permits have authorized, with restrictions, the use of mineral oil as a spotting agent (53 FR 37846). The discharge of muds and cuttings contaminated by diesel oil, spots, or oil-based muds is prohibited. In normal situations, 8,000 to 32,000 liters (50 to 220 barrels) of spotting material are sent downhole in a concentrated pill (not diluted throughout the mud system) (EPA 1984b).

Table 4. Selected Trace Metal Concentrations Expected in Generic Drilling Muds and in Muds and Additives Discharged in Alaskan Waters

	Maximum Concentration (mg/kg)	
Metal	Generic Muds[1]	Muds Discharged in Alaskan Waters[2]
Arsenic	17.2	11.8
Barium	1,240	298,800
Cadmium	0.7	5.5
Chromium	908	1,820
Copper	77.3	47.7
Lead	52.2	1,270[3]
Mercury	0.7	19[4]
Nickel	9.8	88[5]
Vanadium	n/a[6]	235[5]
Zinc	90.4	3,420

[1] CENTEC (1984). The muds were hot-rolled prior to analysis to simulate chemical changes induced by downhold conditions.
[2] EPA (1988b). Reported in mg/kg solids.
[3] Only one operator, using Generic Mud #8, discharged muds with this high concentration of lead. The average of 100 records is 33.1 mg/kg with a standard deviation of 127.8 mg/kg.
[4] Only one operator, using Generic Mud #7, discharged muds with this high concentration of mercury. The average of 100 records is 0.36 mg/kg with a standard deviation of 1.86 mg/kg.
[5] Northern Technical Service, 1981, p. 91. Reported in ppm drilling fluid.
[6] Not available.

Table 5. Comparison of the Range of Trace Metal Concentrations in Standard Drilling Muds and Average Earth's Continental Crust

Metal	Drilling Muds[1] (mg/kg dry weight of whole mud)	Continental Crust (mg/kg)[2]
Arsenic	11.8	1.8
Barium	298,800	425
Cadmium	5.5	0.15
Chromium	1,820	120
Copper	47.7	60
Lead	1,270	14
Mercury	19	0.08
Nickel	88	84
Vanadium	235	120
Zinc	3,420	70

[1] From Table 3. Maximum metals concentration of muds and additives discharged to Alaskan waters.
[2] Ronov and Yaroshevsky 1972, pp. 252-254.

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Concentrations within the pill may approach 100 percent oil. When the drill string is unstuck, the spotting material can sometimes be brought out as a plug to a separate holding tank and residual oil content in the mud will remain at approximately 2 percent. However, if the drill string remains stuck, the pill of spotting material is left downhole with the abandoned drill string. If the oil is left to mix with the drilling muds, average concentrations of up to 10 percent oil can be reached in the drilling muds.

Lubricants are added to the drilling mud when high torque conditions are encountered on the drill string. These lubricants can be vegetable or mineral oil or asphalt-based compounds such as Soltex. When needed, these lubricants are used to treat the entire mud system (roughly 320,000 liters [2,000 barrels]) with concentrations of 5.5 to 140 kilograms per cubic meter (2.5 to 63 pounds per barrel).

Zinc compounds (e.g., zinc carbonate) are used as sulfide scavengers when formations with hydrogen sulfide are encountered. The entire mud system is treated with zinc compounds as needed. Typically, concentrations of 1.5 to 5.5 kilograms zinc compounds per cubic meter of mud (0.6 to 2.5 pounds per barrel) are used, resulting in 450 to 1,800 kilograms (990 to 4,000 pounds) of zinc carbonate (240 to 940 kilograms (530 to 2,070 pounds) of zinc) in the drilling mud. The zinc sulfide and unreacted zinc compounds are discharged with the drilling mud into the environment.

In cases of lost circulation to the mud system, combinations of cellophane, mica, and walnut hulls are added to the mud in one of two methods. The entire system can be treated with typically 0.2 to 2.0 kilograms (0.5 to 5 pounds) per barrel, which results in 220 to 2,200 kilograms (484 to 4,840 pounds) of the additives to the system.

Alternately, a pill of 100 to 200 barrels with a concentration of 9 to 27 kilograms (20 to 60 pounds) per barrel can be sent downhole (EPA 1984b). When drilling is resumed, the additives are separated out from the drilling mud and discharged with the cuttings

COMPOSITION OF CUTTINGS

The trace metal concentrations listed for the earth's continental crust are an indicator of the concentrations to be expected in the cuttings. It should be noted, however, that the trace metal concentrations in mud and the natural rock could vary well beyond the range noted in Table 5. Most of the trace metals in the cuttings are likely to be located in the mineral structure of the rock formation. Cuttings typically occur as granular material similar to coarse sand.

QUANTITY OF DRILLING MUDS AND CUTTINGS

The estimated quantities of drilling muds and cuttings to be disposed of under each scenario are described on page 2 of this appendix and are given in Table 1. A total of 19,680 tonnes (21,648 short tons) of drilling mud and 31,652 tonnes (34,817 short tons) of cuttings are projected under the high case scenario.

The rate of discharge during a well drilling operation is quite variable. There are periods of no discharge when drill bits are changed or casing is placed. During the actual drilling and circulation of the drilling mud, cuttings are brought up from the hole, removed by solids control equipment (approximately 90 to 95 percent efficient), and discharged relatively continuously. Drilling mud is discharged in bulk when mud type is changed, during cementing operations, or at the end of drilling. Bulk discharge rates have been reported to range from 4,800 to 190,000 liters per hour (30 to 1,200 barrels per hour) with the total volumes discharged over 1.5 to 3.5 hours and ranging from 15,900 to over 320,000 liters (100 to 2,000 barrels).

FATE AND TRANSPORT OF MUDS AND CUTTINGS

This assessment relies extensively on the results of computer simulation modeling of dispersion and dilution of drilling muds. Oceanographic conditions are briefly described, then the model and verification studies are presented, and the results of the modeling runs are discussed.

Factors influencing the transport and persistence of discharged drilling muds and cuttings include oceanographic characteristics of the receiving water, depth of discharge, discharge rate, and method of disposal. Because ice covers the lease sale area during most of the year, three disposal methods are discussed in this section: on-ice disposal, open-water disposal, and below-ice discharge. Oceanographic influences include tide, wind, freshwater overflow, ice movement, stratification, and current regime.

Table 6. Authorized Mud Components/Specialty Additives

Product Name	Generic Description[1]	Maximum Allowable Concentration (lb/bbl unless otherwise noted)[2]
Aktflo-S	Aqueous solution of non-ionic modified phenol (equivalent of DMS)	3[2]
Aluminum stearate	----	0.2
Ammonium nitrate	----	200 mg/L nitrate or 0.05 lb/bbl
Aqua-Spot	Sulfonated vegetable ester formulation	1% by vol.
Bara Brine Defoam	Dimethyl polysiloxane in an aqueous emulsion	0.1
Ben-Ex	Vinyl acetate/maleic anhydride copolymer	1[2]
Bit Lube II	Fatty acid esters and alkyl phenolic sulfides in a solvent base	2
Calcium carbide	----	As needed
Cellophane flakes	----	As needed
Chemtrol-X	Polymer treated humate	5[2]
Con Det	Water solution of anionic surfactants	0.4[2]
D-D	Blend of surfactants	0.5[2]
DMS	Aqueous solution of nonionic modified phenol	3[2]
Desco CF	Chrome-free organic mud thinner containing sulfomethylated tannin	0.5
Duovis	Xanthan gum	2
Durenex	Lignite/resin blend	6[2]
Flakes of silicate	----	45

Product Name	Generic Description[1/]	Maximum Allowable Concentration (lb/bbl unless otherwise noted)[2/]
mineral mica		
Gelex	Sodium polyacrylate and polyacrylamide	1[2]
Glass beads	----	8
LD-8	Aluminum stearate in propoxylated oleylalcohol	10 gal/1500 bbl
Lube-106	Oleates in mixed alcohols	2
Lubri-Sal	Vegetable ester formulation	2.0% (by vol)
MD (IMCO)	Fatty acid ester	0.25[2]
Milchem MD	Ethoxylated alcohol formulation	0.04 gal/bbl or 0.3 lb/bbl[2]
Mil-Gard	Basic zinc carbonate	As needed
Nut hulls, crushed granular	----	As needed
Phosphoric acid esters and triethanolamine	----	0.4
Plastic spheres	----	8
Poly RX	Polymer treated humate	4[2]
Resinex	Reacted phenol-formaldhyde-urea resin containing no free phenol, urea, or formaldehyde	4[2]
Selec-Floc	High molecular weight poly-acrylamide polymer packaging in light mineral oil	0.25
Sodium chloride	----	50,000 mg/L chloride
Sodium nitrate	----	200 mg/L nitrate or 0.05 lb/bbl

Product Name	Generic Description[1]	Maximum Allowable Concentration (lb/bbl unless otherwise noted)[2]
Sodium polyphosphate	----	0.05
Soltex	Sulfonated asphalt residuum	6
Sulf-X ES	Zinc oxide	As needed
Therma Check	Sulfono-acrylamide copolymer	1
Therma Thin	Polycarboxylic acid salt	4
Torq-Trim II	Liquid triglycerides in vegetable oil	6
Vegetable plus polymer fibers, flakes, and granules	----	50
VG-69	Organophilic clay	12
XC Polymer	Xanthan gum polymer	2
XO_2	Ammonium bisulfite	0.5
Zinc carbonate and lime	----	As needed

Source: 53 FR 37846

1 Any proprietary formulation that contains a substance which is an intentional component of the formulation, other than those specifically described, must be authorized by the Director.

2 If a listed product will be used in combination with other functionally equivalent products, the maximum allowable concentration (MAC) for the sum of all of the products is the lowest MAC for any of the individual products. Four examples of functionally equivalent products are: (1) Aktaflo-S and DMS, MAC = 3 lb/bbl; (2) Ben-Ex and Gelex, MAC = 1 lb/bbl; (3) Chemtrol-X, Durenex, Poly RX, and Resinex, MAC = 4 lb/bbl, and (4) Con Det, D-D, MD (IMCO), and Milchem MD, MAC = 0.25 lb/bbl. For these examples, the MAC for any combination of the products is given in parentheses. For guidance on whether other products are considered to be functional equivalents, contact the regional office of EPA.

THE CHUKCHI SEA PLANNING AREA ENVIRONMENTAL CONDITIONS

The lease area encompasses continental shelf and ocean basin waters. The proposed Sale 126 encompasses about 12 million hectares (29 million acres) located offshore along the Alaskan coast north from Cape Lisburne to Peard Bay and extending offshore to 169° W. Longitude and northwards to 73° N. Latitude. All of the water depths in the lease sale area are less than 60 meters. The majority (75 percent) of Sale 126 lies in water depths between 40 meters (130 feet) and 60 meters (200 feet).

METEOROLOGY

The lease sale area is in the Arctic climate zone. The mean annual temperature is -12°C. Low levels of solar energy during the winter (roughly October to May) produce low temperatures and a harsh environment. The sun remains below the horizon for 49 consecutive days during midwinter.

SEA ICE

The lease sale area is essentially ice covered for all but four months of the year. Breakup typically begins as early as May. Open water conditions typically persist though September, when the refreezing process begins. Open water leads frequently occur early in the melt season along the coastal zone.

Sea ice in the nearshore region is more mobile during the breakup and freezeup periods than it is during winter. The ice is primarily driven by winds and by ocean current forces. Displacement of the ice may be up to several miles per day during these periods. As a first approximation, wind-driven sea ice moves at a rate of about 2.5 percent of the velocity of the wind (Pritchard and Stringer 1981). During the spring the sea ice is relatively weaker than it is in the winter, and in the fall it is relatively thinner.

Based on observation of the dynamic behavior and the location of the structural types of sea ice, the winter ice regime of the coastal Chuckchi Sea may be divided into the landfast ice zone, shear or stamukhi zone, and the pack ice zone (Figure 2). The lease area is within the pack ice zone. The location of these zones varies spatially and temporally and is strongly influenced by bathymetry and the position of offshore island sand shoals. The boundaries between these zones are, for the most part, gradational.

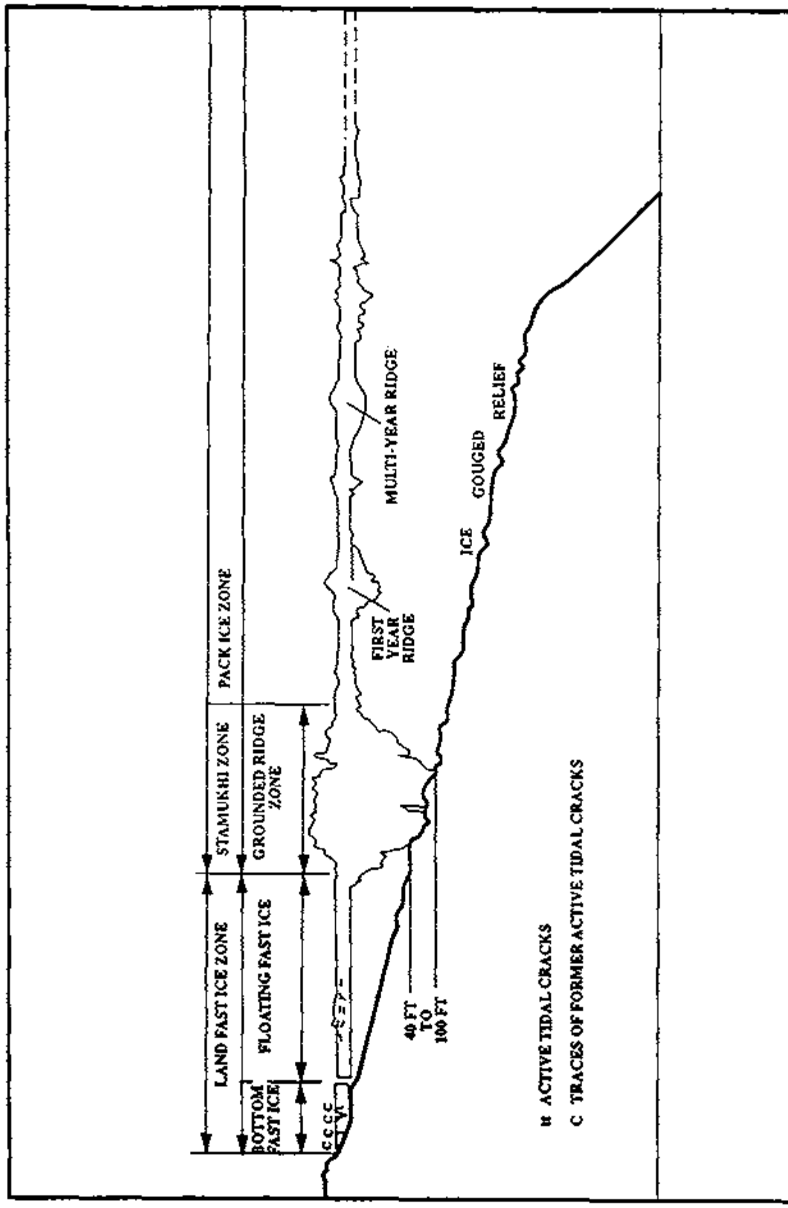


Figure 2. Winter Ice Zonation of the Chukchi Sea Coast

CIRCULATION

A warm current, originating in the Bering Strait flows northeastward through the Chuckchi Sea. This water converges toward the coast near Pt. Barrow where it enters the Beaufort Gyre. Nearshore currents have the same general northeasterly drift of the offshore flow, however they may be locally disrupted by topography and storms.CURRENTS

Currents measured in the Chukchi Sea during the summer months range from less than two to greater than 50 centimeters per second, the latter being measured at the onset of a storm in mid-August. Details of these measurements for the lease sale area are given in the Sale 109 ODCE (EPA 1988b).

TIDES

Tides in the lease sale area are semi-diurnal and of low amplitude, with a range between 2 to 20 centimeters (1 to 10 inches). Semidiurnal tides in Ledyard Bay have an amplitude of 3 centimeters (1.1 inch). Meteorological tides (storm surges) are much more important than astronomical tides in coastal waters. Variations in water level of +3 meters to -0.9 meters (+10 feet to -3 feet) may result from a storm surge.

STRATIFICATION, SALINITY, AND TEMPERATURE

Nearshore salinity measurements have identified a two-layer system. The upper layer, consisting of fresher water from riverine input, rests on top of a layer containing more saline oceanic water. The surface layer shows a marked decrease in salinity in proximity to major rivers such as the Kukpowruk River. Freshwater input also causes a marked division between nearshore and offshore waters, often occurring near the 6 meter (20 foot) isobath. Details of the relevant studies may be found in the Sale 109 ODCE (EPA 1988b).

In general, the summer surface salinity over the shelf ranges from less than 5 to 30 parts per thousand. At 10 meters (33 feet) salinities range from 25 to 30 parts per thousand and at 30 meters (100 feet) salinities vary from 31 to 32.5 parts per thousand (EPA 1984b). Surface and 10 meter (33 foot) temperatures range from -1 to 6°C. At 30 meters (100 feet), they vary from -1 to 7°C (EPA 1984b). In the winter, the lack of freshwater supply to the coast and salt leaching from sea ice both contribute to a weak winter stratification.

At these cold temperatures, water densities are determined by salinities and not temperatures.

SEDIMENT TRANSPORT

Several factors influence the rate and quantity of sediment transport in the Chukchi Sea, including ice gouging, entrainment in sea ice, wave action, currents, and bioturbation. Sediments on the inner shelf landward of the 20 meter (66 foot) isobath are influenced strongly by waves and currents. The bulk of sediment on the Alaskan shelf is transported northwards on the inner shelf because this is the prominent current direction. However, there are a number of embayments along the coast within which currents are weak. Erosion and transport of sediments to and from these regions is infrequent.

The Sales 87, 97, and 109 ODCE (EPA 1984b, 1988a, 1988b) also noted that sediments experience intensive reworking by currents in areas landward of the 15 meter (50 foot) isobath. Such processes are also active in the Chukchi Sea coastal waters. Catastrophic transport associated with severe storms is an important transport mode and is particularly effective in the fall months when such storms are associated with fresh ice which enhances the erosion and often entraps sediments in new ice. In the spring, the breakup of this dirty ice may result in sediment being deposited large distances from the point of entrapment. Sediment transport is variable and extremely limited over most of the lease area. Discharged material is anticipated to remain at its initial settling location.

SUMMARY

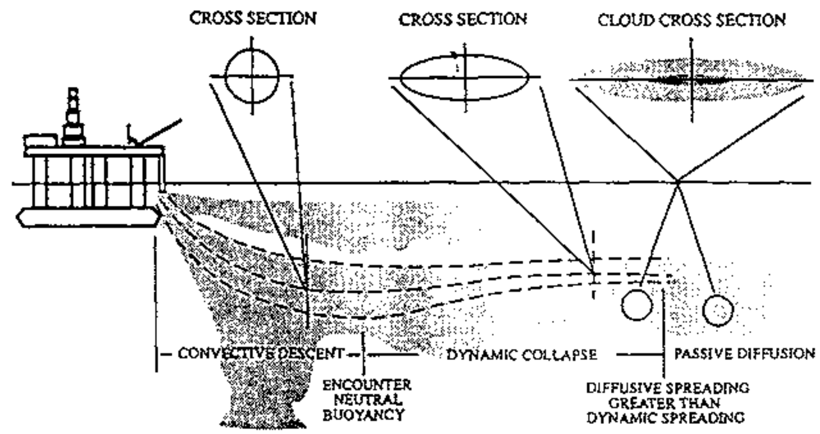
The Lease Sale 126 oceanographic conditions can be summarized as follows:

- The area is ice covered much of the year, except for open water during a four month summer.
- Current speeds are between 2 to 4 centimeters per second (0.04 to 0.08 knots) with speeds of 10 to 15 centimeters per second (0.2 to 0.3 knots) over the continental shelf and in some eddies. Current speed and water exchange are increased with wind stress.
- The water column is stratified in summer and relatively homogeneous in winter.
- Sediment transport occurs primarily during the summer and transition seasons.
- Sediment is transported by intense storms and, in shallower waters, ice; otherwise, natural sediment transport rates are low.

THE OFFSHORE OPERATORS COMMITTEE MODEL

The prediction of the fate of discharged muds and tailings relies on a computer model developed by a consortium effort of offshore operators. The Offshore Operators Committee (OOC) model was developed to describe the fate of offshore drilling mud discharges and has been used in all Ocean Discharged Criteria Evaluations prepared for Alaskan waters. The model simulates the amount of material settling on the bottom. It is discussed in detail in Brandsma et al. (1983), Tetra Tech (1984), and EPA (1984b, 1988a).

Field and laboratory experiments provide a qualified understanding of discharge plume behavior (Figure 3). The studies indicate that discharge of drilling mud and cuttings separate into an upper and lower plume (EPA 1984b, 1988a). The upper



NOTE: CROSS-SECTIONS ARE SHOWN AT THREE STAGES OF THE PLUME. A HEAVY CLASS OF PARTICLES IS DEPICTED SETTLING OUT OF THE PLUME AT AN EARLY STAGE. LIGHTER PARTICLES ARE SHOWN SETTLING DURING THE DYNAMIC COLLAPSE PHASE. VERY FINE PARTICLES ARE SHOWN LEAVING THE PLUME SHORTLY AFTER DISCHARGE AND REMAINING NEAR THE SURFACE TO FORM THE VISIBLE PLUME.

SOURCE: ADAPTED FROM BRANDSMA ET AL. 1980.

Figure 3. Idealized Discharge Plume Behavior.

plume is subject to physical transport processes very different from those influencing the lower plume. The lower plume contains the bulk of the solids (over 90 percent) and descends rapidly (faster than the rate predicted by Stokes' law for individual particles). The lower plume usually has not been studied.

The lower plume initially forms a circular jet with negative buoyancy and momentum. As the jet descends, ambient fluids are entrained and the plume grows larger and less dense. The jet remains in a convective descent phase until it reaches the level of neutral buoyancy or hits the seafloor where it spreads radially outward. At the level of neutral buoyancy, the material in the jet travels at mean velocity similar to the ambient fluid (EPA 1984b, 1988a, 1988b).

Most field experiments indicate that discharged drilling materials settle mainly near the discharge point. Advection of discharged solids strongly influences solids accumulation patterns, especially in shallow water. Increased currents can resuspend or laterally transport effluent flows away from the discharge point (EPA 1984b, 1988a).

Several studies have been conducted to determine the magnitude of initial dilution of drilling discharges, including several studies from the Beaufort Sea area. Details of these studies may be found in the Sale 87 ODCE and the Sale 97 ODCE. Due to difficulty of obtaining measurements for the lower plume, dilution data refer only to the upper plume. Overall, solids dilutions from 1,000:1 to greater than 10,000:1 have been measured in the upper plume at the edge of the mixing zone (100 meters [330 feet]) during OCS studies. Due to the presence of sea ice, which is a dominant feature of the lease sale area, dilution may be much less than observed elsewhere because under-ice currents are weaker. Dilutions on the order of 200:1 -- several orders of magnitude lower than dilutions typical of open water -- were observed by Northern Technical Services (1983) from a discharge from Tern Island, a gravel island in the nearshore Beaufort Sea.

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Virtually all solids and some soluble components present in drilling mud discharges are eventually deposited in seafloor sediments downcurrent from the discharge point. Deposition characteristics and patterns are extremely variable and are strongly influenced by several factors, including type and quality of mud discharged, hydrographic conditions at the time of discharge, and height above the bottom at which discharges are made (EPA 1984b, 1988a, 1988b).

According to the Sale 87 ODCE and the Sale 97 ODCE (EPA 1984b, 1988a), studies have shown that accumulation of drilling materials on the seafloor is inversely related to the energy dynamics of the ambient environment. A low energy environment does not possess currents capable of removing or vertically mixing deposited material.

Metals associated with the drilling muds have been shown to accumulate in surficial bottom sediments, but the distribution is extremely uneven. Of the drilling mud components, barium is present in the highest concentrations in sediments downcurrent of the discharge point. This is due to its high concentration in the drilling mud, insolubility, and high density. Generally, there is a gradient of decreasing concentration of deposited materials with distance from the discharge point. The greatest deposition usually occurs directly under or a short distance away from the

discharge point. Major deposition usually occurs within 100 meters (330 feet) of the discharge point, and background level concentrations of heavy metals are usually achieved within 1,000 meters (3,300 feet) downcurrent (EPA 1984b, 1988a).

The OOC model uses LaGrangian calculations to track material settling out of a fixed pipe. A Gaussian formulation is used to sum the three components and to track the distribution of solids to the bottom. Although there are limitations to this model (it does not account for mud flocculation, and it does not simulate produced water), it is considered one of the best available for modeling discharge plume behavior in water depths greater than 5 meters (16 feet) and when surface waves induce variations in water depth of less than 10 percent (Tarnay, undated).

The model simulates the effluent plume through three phases: the jet-phase (convective) descent; the dynamic collapse of the plume; and a later passive diffusion phase. In addition, the model simulates an upper cloud of material which appears as particles of mud separate from the main plume during its convective descent phase. The spread of muds and cuttings on the bottom increases with water depth; in-water dilutions also are greater with increasing depths.

Inputs to the model include data from three parametric categories; drilling mud characteristics, discharge conditions, and ambient conditions (Table 7). Drilling mud characteristics consist of bulk density, discrete particle classes, and concentration, density, and settling velocity for each particle class. Discharge conditions include rate, duration, orientation, and position of discharge, and rig type. Ambient conditions include water depth, density profile, current velocity, and wave conditions.

For the model simulations, it was assumed that 10 percent of the mud separated in a linear fashion during the convective descent phase of the main plume. Initial concentrations of suspended solids in the discharge are assumed to be 1,441,000 milligrams per liter. Ocean currents are assigned a constant magnitude and direction for each model run, although in reality they vary with depth and time. A consequence of this assumption is overestimation of solids accumulations on the bottom and underestimation of dilutions. Typical drilling rig and discharge characteristics are assumed for a rig of 60 by 70 meters (200 by 230 feet), a discharge nozzle radius of 10 centimeters (4 inches), and a vertical angle of discharge. The model assumes the discharge occurs 0.3 meters (1 foot) below the sea surface, although in reality the depths are greater than this to ensure the discharge is below the wave action at the surface. It is assumed that 1,000 barrels per hour are discharged, which is at the upper limit of discharge rates (Tarnay, undated).

The model has been calibrated using field measurements taken at several continental shelf drilling sites including the Gulf of Alaska. The field studies and modeling effort suggest the following conclusions:

- Drilling muds tend to be rapidly diluted over space and time. Concentrations can be reduced three to four orders of magnitude within 100 meters (330 feet) of the discharge, and five to six orders of magnitude within 800 meters (2,600 feet).

Table 7. Summary of OOC Model Inputs

Category	Variable	Typical Value[1]
Discharge Conditions	Rate	100-1,000 bbl/h
	Duration	30-60 min
	Angle (from horizontal)	90°
	Depth Below Surface	0.3 m (1.0 ft)
	Nozzle Radius	0.1 m (0.33 ft)
	Rig Length	70.1 m (230 ft)
	Rig Width	61.0 m (200 ft)
	Forced Separation of Fine Particles	yes
Drilling Mud Characteristics	Bulk Density	2.09 g/cm³ (17.4 lb/gal)
	Initial Solids Concentration	1,441,000 mg/l
	Tracer Concentration	100 mg/l
Receiving Water Characteristics	Current Velocity	2-30 cm/sec
	Wave Height	0.61 m (2 ft)
	Wave Period	12 sec
	Density Gradient	<0.10

Source: Tetra Tech 1984

[1] Typical values used for all model runs unless otherwise specified.

- Greatest deposition occurs beneath or slightly downcurrent of the discharge point. In shallower waters, a majority of sedimentation occurs within 100 meters (330 feet) of the discharge point, and background concentrations of trace metals and suspended solids are reached within 1,000 meters (3,300 feet). Deeper waters result in greater dilution, wider dispersion, and lower depth of accumulation.

- Metal distribution in bottom sediments is uneven, generally with a gradient of decreasing concentration associated with distance from the outfall.

DRILLING FLUID FATE FROM OPEN WATER DISPOSAL

Dilution of muds and cuttings discharge during the open water season should be aided by dynamic oceanographic processes. Other OCS studies indicate that dilutions on the order of 2,000 to 1 can occur 100 meters (330 feet) from the discharge point (EPA 1984b). These dilutions occurred in areas with currents ranging from 10 to 80 centimeters per second. Average currents are expected to be less than 15 centimeters per second in the lease area.

DILUTION PREDICTED BY THE OQC MODEL

A computer model was developed to describe the initial dilution of drilling mud discharges to the marine environment and has been adopted by the Offshore Operators Committee (OOC). A description of the OOC Model parameters, assumptions, limitations, and model results for Sale 109 may be found in the Sale 109 ODCE.

Model results do not include cuttings. These are expected to be of coarser grain size than muds and will, therefore, settle more quickly. Cuttings will affect a smaller area than muds, but will accumulate to greater depths.

DILUTION, DISPERSION, AND SOLIDS ACCUMULATION

Over 99.6 percent of the Sale 126 area lies in depths of 20 meters (65 feet) or greater.

The OOC model has previously been used to predict initial dilution and solids deposition of drilling mud discharges for other Alaskan OCS areas. The results of representative model runs which bracket Sale 126 depths are shown in Table 8.

Minimum dilution is defined as the inverse of the largest concentration found at any depth at a given distance from the source. A dilution of 1000:1 means that a tracer with an initial concentration of 100 mg/l would have a concentration of 0.1 mg/l at 100 meters from the discharge.

Normal operating procedure requires several discharges of drilling mud in the course of drilling one well. It is unlikely that there will be repeated deposition in one area except directly beneath the outlet, given the changing currents and a narrow deposition footprint. Thus, examples modeled by Tetra Tech (1984) assume the total solids discharged were 114,634 kilograms (52,000 pounds).

The deposition pattern along the axis of the current is given for depths of 40 meters (130 feet) (Figure 4) and for 70 meters (230 feet) (Figure 5). (Peaks in the histogram are artifacts of the model corresponding to different settling patterns for different particle size classes.) The total amount of discharge is accounted for if it is assumed that the material settles to a uniform depth over an 8 degree arc of a circle.

Approximately 86 percent of discharged solids will be deposited on the seafloor within 914 meters (3,000 feet) down-current of the discharge point for depths of 70 meters (230 feet).

DRILLING FLUID FATE FROM ABOVE-ICE DISPOSAL

The nearshore Chukchi Sea is generally ice covered from October through May and the majority of the Sale 126 area lies far enough offshore that pack ice may persist throughout the year. In these offshore areas, disposal above the ice may be the only available method.

Disposal above ice is usually accomplished by deposition on the ice in large frozen chunks with no layering attempted. 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, when greater wind and water

Table 8. Minimum Solids and Dissolved Fraction Dilutions Predicted by the OOC Model for a Point 100 Meters (330 Feet) from Discharge for Deeper Tracts

Water Depth (m)	Water Depth (ft)	Minimum Dilution Particulate	Minimum Dilution Dissolved
20	66	1,092	1,082
70	231	1,803	2,702

Source: Tetra Tech 1984

Model Conditions: Total discharge rate = 1,000 barrels per hour
Current speed = 10 centimeters per second

movement are present. Mud discarded as large chunks may not be dispersed to the same extent as the layered discharges. The presence of muds on the ice affects the solar heat intake of ice. Consequently, melting of dirty ice will be faster than surrounding clean ice; the effects would be confined to the local area.

A detailed discussion of dilution and dispersion of drilling effluent using above-ice disposal techniques is presented in the Sale 109 ODCE. This discussion applies equally well to the Sale 126 area.

DRILLING FLUID FATE FROM UNDER-ICE DISPOSAL

The nearshore Chukchi Sea is covered by ice for approximately eight months of the year, from early October through late May. Oceanographic conditions during ice cover are very different from those of open water season. This in turn affects effluent dispersion. In an NPDES permit issued for the Lease Sale 126 area, under-ice disposal would likely require special authorization from the Regional Administrator.

CURRENTS. Current velocities are much lower under the ice pack than during the open water season. Under-ice currents are typically 5 centimeters per second, which is fast enough to enhance dilution, but significantly lower than the approximately 20 centimeters per second required to resuspend bottom sediments (EPA 1984b; Houghton et al. 1980). A more detailed discussion of under-ice currents may be found in the Sale 109 ODCE.

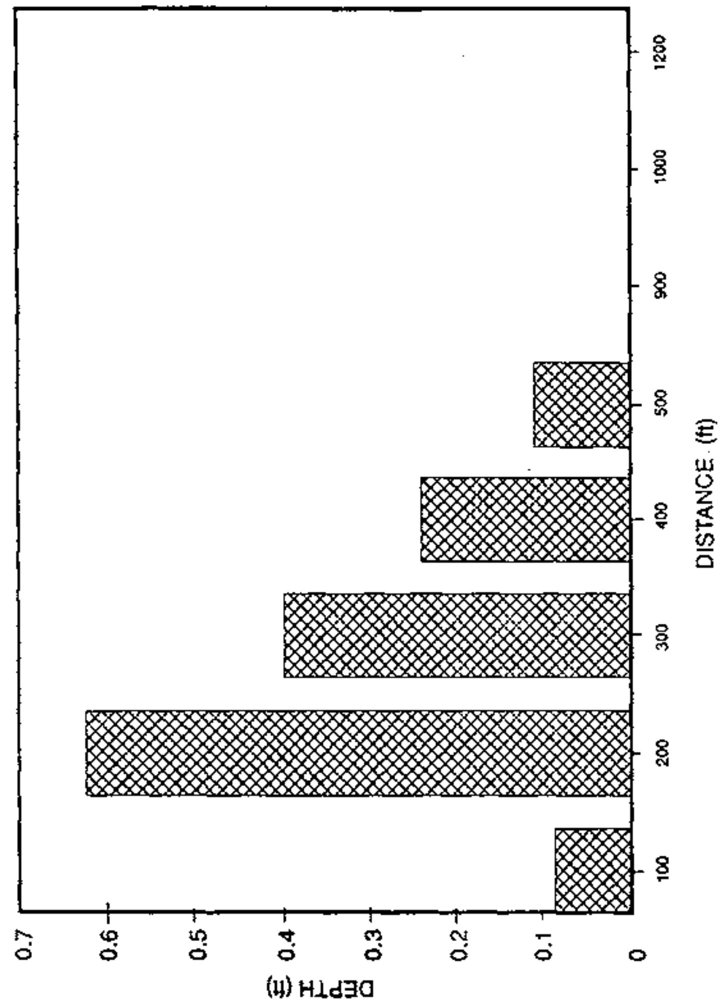

Figure 4. Solids Deposition Pattern Modeled by OCC for a Drilling Mud Discharge into Water 40 m Deep with Current Speed of 20 cm/sec.

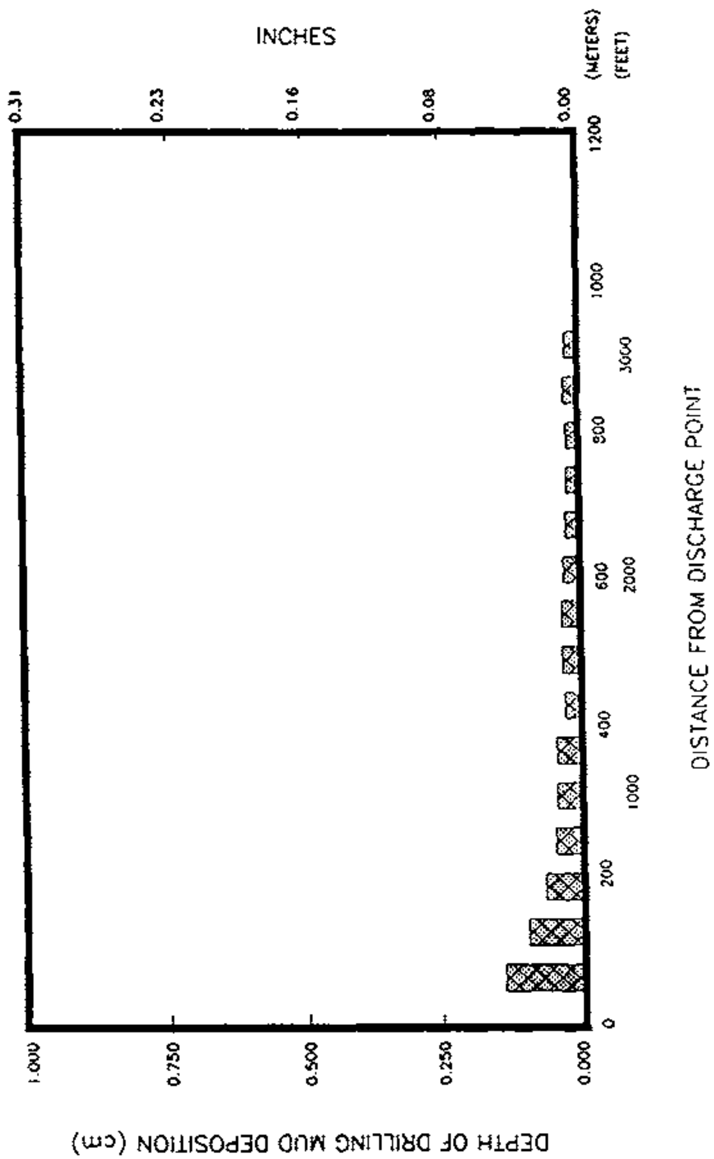

Figure 5 Solids Deposition Pattern Modeled by OOC for a Drilling Mud Discharge into Water 70 m Deep with Current Speeds of 10 cm/sec

STRATIFICATION, SALINITY, AND TEMPERATURE. The degree to which mixing and dispersion of drilling discharges will occur is influenced by the degree to which the water column is stratified. Greater vertical differences in temperature and salinity increases the degree of density stratification, which reduces dilution and dispersion of discharges (National Research Council 1983).

Marked seasonal fluctuations in salinity and temperature distribution occur in the lease sale area. Nearshore temperatures and salinity characteristics are strongly affected by seasonal ice formation. During freezing, only 15 to 20 percent of the solutes are incorporated into the ice, and waters below tend to have increased salinities and densities.

SEDIMENT TRANSPORT. Of the factors influencing sediment transport, ice gouging and sediment entrainment in sea ice predominate during the winter months. The effect of ice in intensifying currents in shallow water and mitigating wind stress on the water are also significant factors. A detailed discussion of these factors appears in the Sale 87 ODCE and Sale 97 ODCE. These procedures would be relevant only in the shallowest (<20 meters deep) lease acreage.

DILUTION, DISPERSION, AND SOLIDS ACCUMULATION. Of all the disposal methods described, below-ice discharge introduces the largest peak concentration of muds to the environment. A stratified, low energy environment exists throughout the winter months, restricting dilution and increasing solids accumulation.
Current velocities are generally less than 5 centimeters per second during ice cover, depending on location.

DISCHARGE WITH SHUNTING

Shunting increases the depth at which the discharge enters the water, i.e., reduces the functional water depth. For example, a 30 meter (100 foot) shunt pipe discharging in water depth of 70 meters (230 feet) is equivalent to a surface discharge with 40 meters (130 feet) water depth.

SUMMARY

The Sales 87, 97, and 109 ODCE all summarize the results presented in this section which may be applied to Sale 126.

The results of field studies and computer modeling of discharges in the nearshore Beaufort Sea and other OCS areas support the following conclusions for Sale 126:

- Drilling muds tend to be diluted rapidly over both space and time. Dilutions of 1,000 to 2,000:1 are generally achieved within 100 meters (330 feet) of the discharge.

- A minimum dilution of 1000:1 at the edge of the mixing zone for any given well may be considered as a conservative estimate for the Sale 126 area.

- 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 of discharges.
- Based on OOC model results, the total area within Sale 126 receiving drilling mud and cuttings to a depth greater than 1 millimeter during open water is estimated to be 49 to 90 hectares (121 to 222 acres) for the 39 wells expected.

WATER QUALITY

WATER-QUALITY CRITERIA

The 403(c) regulations allow a 100-meter (330-foot) radius mixing zone for initial dilution of drilling effluent. At the edge of the mixing zone, EPA marine water-quality criteria must be met. Compliance with water-quality criteria is assessed in this section.

Marine water-quality criteria (45 FR 79318, 50 FR 30784, 51 FR 43665, and 52 FR 6213) are stated as acute (or one-hour average concentration) and chronic (or four-day average) values. The chronic criteria are applicable to a relatively constant flux of pollutants. Acute criteria values are applicable to instantaneous releases or short-term discharges of pollutants. As drilling mud discharges are periodic with durations of only a few hours, the acute criteria are applicable to drilling-mud discharges (Petrazzuolo 1981).

The water quality criteria have been developed using several different operationally defined concentrations for the metals, including "dissolved," "active" (a term no longer in use), "total recoverable," and "total" concentrations. These classifications refer to the types of filtration and degree of acid-digestion a sample receives and are a first-estimate of the form of the metal in the sample (e.g., bound, unbound). In the past EPA has considered the estimated dissolved metal concentrations to be sufficiently similar to the operationally defined "active" and "total recoverable" concentrations to permit comparison with the criteria. The discharges from exploratory phase oil and gas drilling are to open waters and occur intermittently for a few hours at a time. Dissolved metals concentrations are of most concern under these conditions since these are immediately available and are bioavailable (O'Donnel et al. 1985).

Due to a lack of total recoverable metals data, estimated dissolved metals concentrations are also utilized here. However, the Region will consider requiring permittees under future oil and gas general permits to report total recoverable metals data instead of total metals. Hence in the future it would be possible to conduct direct comparisons with the water quality criteria using total recoverable metals data.

The dilution achieved within 100 meters (330 feet) of the discharge has been predicted in the section entitled "Fate and Transport of Muds and Cuttings." The worst case predicted by the computer model was a discharge of 1,000 barrels per hour into 40 meters (130 feet) of water and a current speed of 10 centimeters per second. The

dilution achieved at the edge of the mixing zone was approximately 1000:1. This dilution value can be applied to the expected concentration of dissolved metals in the drilling mud to determine metal concentrations at the edge of the mixing zone. Dissolved metals concentrations are considered closer to "active" or "total recoverable" concentrations than "total" values. Concentrations of metals in the whole mud will be used to estimate dissolved metals concentrations (Table 9). Table 9 also presents the maximum allowable water quality criteria for the metals considered. A comparison of these values shows that all dissolved metal concentrations at the edge of the mixing zone are well below the acute criteria.

Over a period of months or years, leaching or diffusion of dissolved metals from deposited muds is also expected to be insignificant. Only a small fraction (about 0.1 percent) of the metal concentrations in whole mud is expected to be in the dissolved state; the remaining metals are bound to the solid phase. The dissolved portion is probably lost to the water column during plume descent. After deposition on the seabed, some additional metals can be expected to dissolve into the interstitial water under certain sediment conditions. However, after equilibrium is established, the concentrations of metals in the interstitial water will not be any higher than the estimated dissolved concentrations. These dissolved metals would be dispersed throughout the water column during a sediment resuspension event or slowly diffused upward from an undisturbed mud deposit. Metals released to the water column will likely readily adsorb onto naturally occurring suspended sediments. The dissolved phase of metals and other chemicals tends to be more bioavailable than the particulate phase (Lockhart et al. 1982; O'Donnel et al. 1985). Particulate-bound chemicals have variable bioavailability that depends on the chemical and biological species and environmental conditions considered (Anderson et al. 1977).

EFFECTS ON MARINE BIOTA

INTRODUCTION

The Lease Sale 126 area includes waters to depths of 60 meters and encompasses two major marine environments: cold offshore and bottom waters representing outer shelf waters; and warmer, nearshore waters dominated by inshore portions of the Alaskan Coastal Current (Aagaard, 1984; Hachmeister and Vinelli, 1985). Studies of Chukchi Sea biology have only recently intensified, and many features of this ecosystem are still poorly understood.

The Chukchi Sea and Beaufort Sea coastal ecosystems were compared by Truett (1984). Major points of this comparison that are germane to the current evaluation are summarized below.

Table 9. Comparison of Expected Dissolved Metals Concentrations at the Edge of the Mixing Zone in Sale 126 to Marine Water Quality Criteria

	Dissolved Concentrations[1] ppm		Marine Criteria[4] ppm	
	In Discharge[2]	100 m from Discharge[3]	1-hr. Avg.	96-hr. Avg.
Arsenic	0.024	0.000024	0.069 (trivalent)	0.036 (trivalent)
Barium	298	3.0	No Criterion	No Criterion
Cadmium	0.004	0.000004	0.043	0.0093
Chromium	1.3	0.0013	1.1 (hexavalent)	0.05 (hexavalent)
Copper	0.088	0.000088	0.0029	No Criterion
Lead	0.820	0.00082	0.14	0.0056
Mercury	0.00036	0.00000036	0.0021	0.000025
Nickel	0.088	0.000088	0.075[5]	0.0083
Vanadium	0.235	0.000235	No Criterion	No Criterion
Zinc	1.350	0.00135	0.095[6]	0.086[6]

[1] Based on whole mud concentrations as reported in EPA 1985.
[2] Dissolved concentrations in ppm (mg/l), representing 0.1 percent of total concentration in muds.
[3] Assumed dilution 1000:1. Corresponding to discharge of 1,000 bbl/m into water depth of 40 m and current speed of 10 cm/sec.
[4] From 50 FR 30784. One hour average concentration (ppm) not to be exceeded more than once every three years on the average (acute exposure levels) and 96 hour average concentration not to be exceeded more than once every three years on the average (chronic exposure levels). Both are based on the total recoverable method which is operationally defined as the concentration of metal in an unfiltered sample following treatment with hot strong mineral acid (EPA 1979).
[5] From 51 FR 43666. Final criteria, based on total recoverable method.
[6] From 52 FR 6213. Criteria based on total recoverable method.

PHYSICAL CONDITIONS

The coastal Chukchi Sea:

- has more open water both spatially and temporally than does the Beaufort Sea;
- is more influenced by Bering Sea water than by Arctic Ocean water;
- is pervaded to a greater extent by cold, salty marine water;
- has a large polyna or lead system that persists each spring in or just offshore of the deep nearshore environment;

- has fewer natal stream sources of anadromous fish; and
- has large cliffs suitable for seabird nesting.

COASTAL FOODWEBS

Chukchi Sea coastal foodwebs have:

- a greater annual primary productivity than those of the Beaufort Sea, with more of the water column primary production settling to the bottom;
- a greater diversity and higher biomass per unit area of benthic feeders;
- a smaller percentage (biomass) of epibenthic mysids in diets of nearshore vertebrate consumers;
- a greater diversity of marine prey fish species; and
- a greater diversity and biomass of planktivorous fish-eating predators.

VERTEBRATE FAUNA

The coastal Chukchi Sea vertebrate fauna has:

- more species and greater biomass of marine mammals per unit area than the Beaufort Sea;
- more species and greater unit area biomass of marine fishes;
- fewer species and a lesser biomass per unit area of non-salmonid anadromous fishes;
- a lower density of feeding and moulting oldsquaw ducks; and
- a greater abundance of cliff-nesting seabirds (the Beaufort Sea has essentially none).

The detritus-based benthic infauna and epifauna form the basis of food trophic levels in the Chukchi Sea. These benthic communities are expected to be more vulnerable than other marine communities to drilling mud and cutting discharges during oil and gas exploration, and are therefore, of primary concern to activities associated with Lease Sale 126.

Most of the important species (as defined by Truett 1984) in the Chukchi Sea are associated with the nearshore area (20 meters and shallower). Exceptions include walrus and bearded seal, (which utilize the pack ice edge and are, therefore, often in the deeper water areas of the Barrow Arch during summer) and marine fishes. Most of the Sale 126 area is located in waters between 30 and 50 meters deep; the biology of these deeper environments is less studied than the nearshore environments. Exploratory drilling in the nearshore area would have potentially greater primary and secondary impacts on important marine biota than drilling in the offshore area.

IMPORTANT PLANKTONIC SPECIES

PHYTOPLANKTON

Phytoplankton productivity in the Chukchi Sea is greatest during the approximately five week-long summer period. However, production in open water leads can begin as early as late March. Epontic (attached under-ice) algae, primarily diatoms, probably contribute significantly to production in these waters. Maximum phytoplankton production is controlled by available nutrients, which are influenced by water column stratification during summer (Morris 1981).

EFFECTS ON PHYTOPLANKTON

No sensitive or unique marine sites of critical importance to phytoplankton productivity have been identified. The possible impacts of drilling mud discharges on marine phytoplankton include:

- Decreased primary production due to light reduction from increased turbidity;
- Decreased primary production and/or increased mortality due to direct acute or sublethal toxic effects of trace metals; and
- Stimulation of primary production by trace nutrients in the discharge (Jones & Stokes Associates 1984).

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ZOOPLANKTON

The few existing studies of zooplankton in the nearshore and offshore Chukchi Sea were summarized by Truett (1984). One implication of a hypothesized zooplankton community composed of inefficient phytoplankton grazers suggests that much of the phytoplankton production would sink to the bottom and be consumed by benthic communities. This hypothesis is supported by the character of the Chukchi Sea benthic community discussed later in this chapter.

EFFECTS ON ZOOPLANKTON

Possible impacts to zooplankton include:

- Decreased growth, altered behavior, and/or increased mortality due to the direct acute or chronic effects of toxic materials in drilling muds;
- Interference with feeding or respiratory activity due to increased suspended solids concentrations; and

- Indirect enhancement or inhabitation of zooplankton population resulting from impacts on phytoplankton (Jones & Stokes Associates 1984).

Both cadmium and mercury affect plankton. Exposure to 100 micrograms cadmium per liter seawater for 10 days reduced dinoflagellate population growth by 20 percent (Prevot and Soyer-Gobillard 1986). Five micrograms cadmium per liter seawater for 10 days reduced diatom spore formation by 35 percent and 15 micrograms cadmium reduced spore formation by 81 percent (Sanders and Cibik 1985). Low levels of cadmium (2.0 ug) and mercury (0.2 ug) reduced fatty acid content and therefore the nutritional quality of marine diatoms (Jones et al. 1987). However, these concentrations of metals are not expected to be reached.

The suspended particulate phase of a reference drilling mud and a used production mud significantly increased hydranth shedding in the coelenterate _Tubularia crocea_ after 48 hours exposure to 100,000 parts per million (Michel et al. 1986). The liquid phase was more toxic, with concentrations of 10,000 parts per million increasing coelenterate shedding.

The effects of drilling muds on the marine algae _Skeletonema costatum_ were investigated (EG&G Bionomics 1976a, 1976b). The EC50 (concentrations at which a designated effect is displayed by 50 percent of the test organisms) with barite was 385 ppm and with freshwater lignosulfonate was 430 ppm without agitation. With agitation, the EC50s increased to 1,650 ppm and 16,000 ppm respectively. Various lignosulfonate formulations were tested in agitated mixes (EG&G Bionomics 1976a, 1976b); the lowest EC50 was 1,325 ppm with IMCO RD-123+spot.

The effects of two drilling muds and eight mud additives on the primary production of natural assemblages of Californian marine phytoplankton were assessed by Alldredge et al. (1986). Short-term (4-hour) exposure to barium sulfate, lignosulfonate, and a reference drilling mud concentrations over seven orders of magnitude did not affect primary production, and the used drilling mud significantly enhanced production. Long-term exposure (120 hours) to 10 micrograms of X-Pel-G or Soltex or to 100 milligrams iron lignosulfonate per liter significantly reduced production. In no case was the species composition altered. Plankton are unlikely to be exposed to drilling mud discharges for this length of time.

CONCLUSIONS

Several factors suggest that the discharge of drilling muds will have a limited effect on plankton:

- It is assumed that most toxic metals will be bound to muds and ligands and will not be available in the water column.
- Expected dissolved concentrations of metals in the drilling-mud discharges at the edge of the mixing zone are within the EPA water quality criteria, which were established to protect marine life.

- The dilution of muds is rapid. At the edge of the mixing zone, dilutions of greater than 1,000:1 fold are expected for particulates. Concentrations of over 1,000
ppm will probably be present for only 100 meters (330 feet) down-current of the discharge.

- The residence time of the drilling muds will be much shorter than the 96-hour time period of bioassay tests.

- The area affected by detectable discharge plumes is very small relative to the area of the total lease sale area (Jones & Stokes Associates 1989).

BENTHIC COMMUNITIES

Benthic communities of the Chukchi Sea outer shelf region in the Lease Sale 126 have not been intensively studied. The most comprehensive investigation of the infaunal benthos of the eastern Chukchi Sea was conducted by Stoker (1978), who studied the distribution, biomass, trophic relationships, and productivity of the fauna based on data collected during 1970-74. The faunal composition of the eastern Chukchi Sea was noted as being similar to that found in the eastern Bering Sea. Two major faunal assemblages were identified from the Barrow Arch samples: one group was dominated by the polychaete Maldane sarsi, the echinoderm Ophiura sarsi, the sipunculoid Golfingia margaritacea, and the bivalve Astarte borealis; the second group was dominated by the bivalves Macoma calcerea, Nucula tenuis and Yoldia hyperborea and the amphipod Pontoporeia femorata. These findings indicated that Chukchi Sea infauna is dominated by detritus feeders.

Evidence from marine mammal feeding studies indicates that burrowing bivalve molluscs are an important component of benthic infaunal communities (Truett 1984). The epifauna of the Chukchi Sea outer shelf seems to be dominated by echinoderms (Frost et al. 1983; Truett 1984); however, little is known about the Lease Sale 126 area.

The benthic communities of the nearshore Chukchi Sea appear similar to those studies in the nearshore western Beaufort Sea. The general composition, biomass and diversity of these communities are lower than that of communities south of Point Hope (Truett 1984).

EFFECTS ON BENTHIC COMMUNITIES

The National Research Council (NRC) (1983), Ferbrache (1983) and Jones & Stokes Associates (1984) have summarized the work of Petrazzuolo (1981), Neff (1981) and Brandsma et al. (1983), identifying the potential detrimental benthic impacts of discharged drilling fluids and cuttings in low-energy environments as:

- physical smothering of bottom-dwelling organisms;

- changes community structure and benthic habitat (i.e., sediment chemistry and texture), making it unsuitable for certain species, e.g., interference with burrow construction and feeding or interference with settlement of benthic larvae; and

- introduction of substances which may have negative effects upon metabolism, health, behavior, or reproductive capability of benthic species (i.e., toxicologic effects).

SMOTHERING. Research and data collection efforts indicate that if a depositional mound or cuttings pile remains on the seabed following discharge, population depressions and/or changes in the benthic community will occur. The suspended solids content of these discharged fluids consists mainly of barite and bentonite. Cuttings are generally sand grain sized and settle out at relatively short distances from the point of discharge.

A localized reduction of individuals and numbers of species due to smothering effects will be most likely in areas where deposition of cuttings on the benthos exceeds 1 centimeter and persists for more than a few days (Jones & Stokes Associates 1984). More subtle community changes may result from alteration of substrate characteristics. Species will be favored which are more tolerant of the deposition of increased silt/clay components derived from drilling fluids. Increased requirements for feeding, respiration and reproductive energy may cause adverse impacts, and decreased larval recruitment may occur (Menzie et al. 1980). Menzie noted reduced abundances in polychaetes, molluscs, and crustaceans up to 370 meters from a well site in low energy mid-Atlantic OCS drill site in 120 meters of water. However, hake (Urophycis spp.) and crabs (primarily Cancer borealis) were apparently attracted to the drill site. Abundance of sand stars (Astropectin americanus) appeared unaffected.

Species attracted to the harder substrates of intact mounds may colonize this newly formed area in response to a "reef effect" (Northern Technical Services 1981; Menzie et al. 1980). Increased predation resulting from the attraction of predator species may result in a net reduction of prey species as an indirect impact (Menzie et al. 1980). Such an indirect impact could reduce localized nearshore reproductive success and recruitment of important motile epifaunal species (i.e., gammarid amphipods), with attendant impacts to higher trophic levels.

TOXICITY. Houghton et al. (1980) identified ligno-sulfonates and caustic soda (sodium hydroxide), through an effect on pH, as the most acutely toxic components of water-based drilling fluids. The NRC (1983) identified diesel fuel (No. 2 fuel oil) and biocides as two of the most toxic constituents which may be present in some drilling muds. In light of this, EPA Region 10 permits for offshore drilling operations have prohibited the discharge of diesel oil and limited the toxicity of drilling muds. The toxicity of new drilling-mud additives must pass a toxicity-based criterion prior to their discharge.

Generally, the animals tested in laboratory bioassay studies have a remarkably high tolerance to whole drilling muds (EPA 1984b). Dock shrimp larvae had the lowest LC50 (lethal concentration for 50 percent of the test organisms) of any Alaskan organisms tested in an unmixed whole mud (LC50 of 600 ppm) (Carls and Rice 1984). However, it is possible the mud used was formulated with a component containing hexavalent chromium, which is highly toxic to marine life and is not be permitted by EPA Region 10. Other low EC50s for a high molecular weight polymer are 10,000 ppm for Mya arenaria and 14,000 ppm for the amphipod Orchestia traskiana (KCL-XC-polymer) (EPA 1984b).

The toxicity of drilling muds and barite to the primitive vertebrate lancelets (Branchiostoma carbaeum) was tested in flow-through aquaria (Clark and Patrick 1987). Lancelets were kept in 1:1 clean sand:test sediment, with additional treatments of daily additions of barite or lime to the depth of 0.15-0.23 centimeter (0.06-0.09 inch). Although burrowing was reduced, making the animals more susceptible to predation, neither barite sediment nor barite additions were toxic to lancets. Seawater/lignosulfate mud (Mud #2, Table 3) and lime mud (Mud Type #3, Table 3) were toxic to buried animals after 7 days, and to animals on the surface within 24 hours. Lightly treated lignosulfate was toxic to both buried and surface lancets within 24 hours. Drilling muds are one to two orders of magnitude more toxic to mysids (Mysidopsis bahia) than they are to lancets (Gaetz et al. 1986).

Although few studies have been conducted, it is possible that other benthic organisms emerge from drilling mud deposits. This would not only make the animals more susceptible to predation, but would attract predators to selectively feed in the area of drilling mud deposits, increasing the chance of heavy metal accumulation through the food web.

BIOACCUMULATION. Heavy metals can be highly persistent in the environment and have the potential to bioaccumulate in marine organisms and to biomagnify through food webs, possibly leading to man. Benthic organisms are particularly susceptible since they live on and in drilling-mud deposits. Mercury, cadmium, and barium are of most concern due to toxicity. Mercury and arsenic are of concern because of their propensity to bioaccumulate. Anderson et al. (1987) report that marine species have demonstrated little bioaccumulation from exposure to sediments contaminated with heavy metals, with the exception of mercury, cadmium, and copper.

Mercury, one of the few metals to biomagnify (increase in concentration up trophic levels) may be in excess of 10 parts per million in some drilling muds. Concentrations of mercury in ocean sediments range from <10 to 2,000 parts per billion with a mean of 100 parts per billion (D'Itri 1972). Although mercury discharged in drilling muds is largely inorganic and not bioavailable, virtually any mercury compound may become a bioaccumulation hazard for organisms since bacteria common to most natural waters are capable of biomethylating the metal (Callahan et al. 1979). Several studies have reported sediment and organism mercury concentrations to be correlated, with bioconcentrate factors of 0.01 to 0.57 (O'Conner and Rachlin 1982), although some organisms, such as polychaetes, probably absorb mercury from the water through their epidermis (Jensen and Baetrup 1988). The polychaete Neris virens exposed to 9 parts per billion mercury as mercuric chloride in aquaria water had a bioconcentration factor of 930 with a constant rate of uptake. Constant rates of mercury uptake have been observed for over 72 days in marine polychaetes (Kendall 1978).

Cadmium can accumulate to high levels in marine organisms without causing apparent ill-effects, due perhaps to proteins such as metallothionein that detoxify non-essential metals (Hamer 1986; Langston and Zhou 1987). Several studies have reported sediment and organism cadmium concentrations to be correlated. Cadmium bioconcentration factors for oysters range from 0.008 (Atwood et al. 1979) to 40 (Neff et al. 1978) times that of sediment. The soft shell clam, Macoma accumulates cadmium primarily from water (Langston and Zhou 1987). Macoma exposed to 100 micrograms cadmium per liter of seawater had a linear uptake of cadmium. The elimination rate from the soft tissue was very slow (1 percent of the accumulated cadmium was eliminated daily) while the elimination rate was faster from the shell (46 percent in 7 days).

Barium is considered a chemical of concern due to its high concentration in drilling muds and propensity to settle on the substrate, although it has low toxicity. Bioaccumulation has been described in non-Alaskan species. Mariani et al. (1980) found barium in benthic organisms to be about 10 times that of sediment concentrations. Expected barium concentrations in the drilling muds are 298,800 parts per million (Table 4).

ALTERATION OF SEDIMENT CHEMISTRY AND TEXTURE. Alteration of sediment characteristics is expected to affect the benthos more subtly than smothering and over larger areas. Menzie et al. (1980) noted reduced abundances of polychaetes, echinoderms, molluscs, and crustaceans up to 370 meters (1,200 feet) from a well site in a low-energy mid-Atlantic OCS site in 120 meters (390 feet) of water. The authors could not attribute the population depressions to any one factor, but instead suggested four possible mechanisms: fish and large epibenthic invertebrates attracted to the drilling area reduced benthic populations through predation; mobile crustaceans emigrated from the discharge area; altered sediment composition adversely affected feeding and survival of some benthic species; and altered sediment composition inhibited larval recruitment. The initial impact zone was recolonized and commenced recovery within a year of cessation of drilling-mud discharge.

It has been suggested that low levels of metals in seawater significantly reduce larval settlement. The settling of larvae have been tested in known heavy metal constituents of all drilling muds, in proprietary drilling mud additives, and in samples of drilling mud standards (Morse 1984). Of the heavy metals, larvae were most sensitive to mercury which significantly interfered with settling at minimum concentrations of 2 parts per billion. The additives (Soltex, lignosulfonate, and Drispac) reduced settling at dilutions of 1:100, and drilling mud reduced settling at dilutions of 0.1 milligram mud in 1 liter of water (1:10,000).

An 8-week recolonization study conducted by Tagatz et al. (1985) consisted of boxes containing clean sand (control), 1:10 or 1:3 barite:sand mix, and 1:10 or 1:3 drilling-mud:sand mix placed in 3 meters (10 feet) of water in Santa Rosa Sound, Florida. A total of 1,081 individuals representing 63 species recolonized the boxes. There were 43 species in the control substrate compared with 38 species in the barite:sand mixes, 32 in the 1:10 mud:sand, and 24 species in the 1:3 mud:sand mix. The apparent toxicity of the lime drilling mud was attributed to diesel oil, a component banned from use in EPA Region 10. Although there were significantly fewer individuals in the 1:3 barite:sand mix compared with the control (220 vs 296), species diversity, species dominance, and dissimilarity indices were not markedly affected.

RECOVERY. After cessation of drilling activity, benthic communities will recolonize the area although pioneer species may not be the same as those lost. With time, the pre-existing community will probably recover. Menzie et al. (1980) suggest that benthic communities within the initial impact zone are recolonized and commence recovery within a year following cessation of discharge. The potential for bioaccumulation of metals remains (Crippen et al. 1980), although the discharge of toxic pollutants can be regulated through the NPDES permit.

Crippen et al. (1980) analyzed sediment and benthos for mercury, arsenic, cadmium, lead, and zinc near a drilling site in the Beaufort Sea one year after discharge had ceased. There were suggestions of elevated mercury levels in benthic organisms very near the original discharge site, but no indications of significant bioaccumulation for any of the other metals. The mud discharged had mercury levels far in excess of those which EPA Region 10 would approve for discharge under current NPDES permits.

A field survey was conducted at the Murchison oil-field in the North Sea 16 months after the major cuttings discharges had ceased (Mair et al. 1987). The benthic community was sampled to 2,000 meters (6,600 feet) from the discharge point. Species abundance, diversity, and evenness were significantly lower at the 100-meter (330-foot) station as compared to the reference station, although these community parameters were not significantly different from the reference point 1,000 meters (3,300 feet) from the discharge point. The community recovery was strongly affected by the oil residues from the oil-based drilling muds. Oil-based drilling muds are not permitted under EPA Region 10 permits.

CONCLUSIONS

No geographic areas in the lease sale area of specific importance for benthos potentially affected by the discharges have been identified. The following factors should result in limited benthic community effects from drilling fluids discharges:

- the potential for resuspension and further dispersion and dilution of contaminated sediments by periodic high current velocities and storm events;
- the relatively low numbers and diversity of infaunal organisms in areas of intensive ice-gouging;
- the mobility of many of the trophically important epibenthic organisms (mysids and amphipods); and
- the control of toxic pollutants effected through the BAT and NSPS effluent limitations.

Therefore, it is anticipated that transitory and localized impacts from exploratory drilling may occur on the benthos of the sale area. Due to the limited quantity of materials which would be discharged and the small area affected by those discharges, the impacts would be insignificant.

FISH RESOURCES

Fish resources of the Lease Sale 126 area, like other taxonomic groups, have been the focus of only a few studies. The dominant marine and anadromous fish species found during a recent study were Arctic cod (Boreogadus siada), Arctic staghorn sculpin (Gymnocanthus tricuspis), fourhorn sculpin (Myoxocephalus quadricornis), capelin (Mallotus villosus), shorthorn sculpin (Myoxodephalus scorpius), hamecon (Arteciellus scaber), Arctic flounder (Liopsetta glacialis), and saffron cod (Eleginus gracilis). Pink salmon (Onchorhynchus gorbuscha) and boreal smelt (Osmerus mordax) were the primary anadromous species found in the Chukchi Sea, while ciscoes and whitefish (Coregonus spp.), Arctic char (Salvelinus alpinus), and chum salmon (O. keta) were represented by very few captured specimens (Fechhelm et al. 1984).

Arctic cod are very abundant and widely distributed in the Chukchi Sea; they are also known to congregate near the underside of ice, and around open water fissures in winter. Saffron cod, fourhorn sculpin, sandlance (Ammodytes hexapterus), Pacific herring (Clupea harengus pallasi), and capelin all spawn in shallow, coastal waters where they deposit adhesive eggs on various substrates, including vegetation.

Pink salmon and boreal smelt use larger river systems and estuaries in the area, such as the Kokiik, Utukok, Kukpowruk, and Kuk, as spawning and rearing areas (Fechhelm et al. 1984). These rivers all flow into the Chukchi Sea between Wainwright and Point Lay.

EFFECTS ON FISH RESOURCES

Fish and most mobile pelagic species can avoid discharge plumes and areas of high turbidity resulting from exploratory drilling operations. Jones & Stokes Associates (1984) suggests that although some studies have indicated that fish may be attracted to a discharge plume, it is likely that stresses induced by particulates in the main body of the plume would restrict fish to the plume edges. These factors also mean that fish may not experience significant exposures to toxic concentrations of pollutants in the discharge. Following cessation of discharge, fish will return to a discharge area, particularly if the settlement of discharged cuttings and drilling fluids provides significant microrelief (i.e., creation of new habitats).

While little is known regarding the threshold at which effects from smothering or toxic effects on demersal fish eggs could occur, the wider dispersion of discharged drilling fluids in deeper areas could result in a large area being covered with more than 1 mm of muds and cuttings. This could result in the smothering of fish eggs of cottids, Arctic cod and other demersal fish (Jones & Stokes Associates 1984). However, under actual field conditions, the area affected is relatively small, but still could exceed the 100 m mixing zone established by EPA.

Finally, the limited effects that the discharges could exert on benthic communities, phytoplankton, and zooplankton suggest negligible reductions in food supplies of fish (Jones & Stokes Associates 1984). Thus, only minor impacts on fish are anticipated from exploratory phase discharges.

MARINE MAMMALS

The seasonal distribution of marine mammals in the northeast Chukchi Sea was summarized by Morris (1981):

Winter/Spring:	
Pack Ice	polar bear
Flaw Zone	bowhead whale, 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, bowhead, and beluga whales
Coastal Lagoons	beluga whale, spotted seal

The coastal zone of the Chukchi Sea is inhabited by marine mammals only during summer and autumn. Frost et al. (1983) summarized all available data for marine mammal sightings which included: spotted seal, walrus, beluga whale, harbor porpoise, killer whale, minke whale, and gray whale.

In the coastal waters, Frost et al. (1983) found that the greatest concentration of marine mammals occurs in and near Kasegaluk Lagoon, which is used by 2,000 to 3,000 beluga whales and at least 2,000 to 3,000 spotted seals. Spotted seals are less numerous, but still abundant, near the mouths of the Kuk and Kugrua Rivers.

Some walrus have been seen hauled out of Cape Lisburne every summer since 1975. Killer whales have been seen off Point Lay and Wainwright during most years; minke whales have been sighted at Cape Lisburne. Harbor porpoises have been observed near Wainwright, in Peard Bay, and near Barrow, and likely pass along the entire coast. Gray wales feed along the entire Chukchi Sea coast but are most common between Icy Cape and Barrow (Frost et al. 1983).

The feeding habits of marine mammals in the lease sale area were summarized by Morris (1981):

Plankton eaters:	bowhead whale
Benthos eaters:	gray whale, ringed seal, bearded seal, walrus, spotted seal
Fish eaters:	beluga whale, ringed seal, spotted seal, bearded seal
Mammal eaters:	polar bear, killer whale

The gray whale and the Bering Sea or western Arctic stock of the bowhead whale are considered endangered species.

EFFECTS ON MARINE MAMMALS

Effects on marine mammals resulting from exposure to discharges, acute and chronic toxicity, and bioaccumulation and food supply effects are unlikely (Jones & Stokes Associates 1984). The high mobility of marine mammals combined with the intermittent and brief duration of drilling effluent discharges and the dilution of discharge plumes are all factors that contribute to the unlikelihood of impacts to marine mammals.

It should be noted that the greatest potential for impacts, although highly unlikely, is from effects to benthic food supplies of certain mammalian species. Walrus, bearded seals, and gray whales are primarily benthic feeders. Walrus and bearded seals feed on infauna, particularly bivalve molluscs. There are indications that large populations of walrus in recent years may be drastically reducing supplies of bivalves in the coastal Chukchi Sea, with resulting pressure on walrus populations (Truett 1984).

Gray whales feed on ampeliscid amphipods by plowing and straining benthic sediments. Carrying capacity of the Chukchi Sea for gray whales is determined by the numbers and locations of dense patches of prey (Truett 1984). Gray whales are dependent on areas rich in benthic amphipods during the summer feeding period; they fast while on their wintering grounds (Morris 1981).

The addition of impacts to benthic communities from drilling discharges, although deemed minor to negligible when considered separately, need to be considered in light of carrying capacity limitations for walrus and gray whale populations in the coastal Chukchi. Cumulative impacts in localized areas may become important if these areas support important food resources for these species.

MARINE AND COASTAL BIRDS

The marine and coastal bird fauna of the Lease Sale 126 area includes loons, procellarids (fulmars and shearwaters), cormorants, waterfowl (including brant, eiders, and oldsquaws), shorebirds, larids, (jaegers, gulls, and terns), and alcids (auks and their relatives). Few birds are present in the area during the winter, but several million individuals may use the area during the spring, summer, and fall (Truett 1984). Landforms in the area that provide important bird habitat include: coastal cliffs (nesting), barrier islands and spits (nesting), lagoons and semi-enclosed bays (feeding and moulting), and wetlands and gravel beaches (feeding). Marine environments are used extensively by certain bird species for feeding, while open water leads associated with the Chukchi Sea polynya are important migratory pathways and feeding areas in spring (Truett 1984). Table 10 summarizes a number of special areas used by marine and coastal birds.

Table 10. Summary of Special Bird Sites in the Chukchi Sea Area

Site	Importance
Coastal Environment:	
Cape Lisburne	The Northernmost seabird colony in western North America. Provides essential cliff-nesting habitat for about 80 percent of all nesting alcids and larids in Barrow Arch.
Kasegaluk Lagoon	The most important coastal lowland habitat for non-cliff-nesting birds in NE Chukchi Sea and Barrow Arch. Mud flats, salt marshes, beaches, and protected waters provide essential summer and fall feeding, molting and staging habitat for waterfowl, shorebirds, gulls, and terns. Salt marshes are only known major resting and feeding stop for Alaskan and Canadian Arctic Slope populations of black brant between Beaufort Sea and SE Bering Sea.
Point Hope	The split and associated wetlands are a noteworthy are for non-cliff-nesting birds in Barrow Arch.
Peard Bay	Provides important molting and staging habitat for oldsquaws, and feeding and staging habitat for red phalaropes.
Marine Environments:	
Ledyard Bay	Rich feeding habitat for many bird species; perhaps the most important such habitat in the Barrow Arch. Important staging and molting area for common and king eiders.
Water off Cape Lisburne	Significant lat summer and fall feeding habitat for majority of alcids and larids nesting at Capes Lisburne and Lewis.
Open Leads and Polynyas	Vital winter resting and feeding habitat for black guillemots and possibly other species.
Offshore Spring Lead	Part of a major spring migration route for birds entering eastern Chukchi and western Beaufort Seas from Bering Sea.
Seasonal Ice Edge	Provides essential fall feeding habitat for migrating Ross' and ivory gulls. Resting and feeding habitat for a variety of nonbreeding and post breeding species.

Source: Truett 1984

EFFECTS ON MARINE AND COASTAL BIRDS

Impacts to bird populations from drilling mud and cuttings discharges are unlikely; however, some secondary impacts at special aquatic sites are possible. Most coastal and marine birds occur in the Chukchi from spring to fall. Concentrations of cliff-nesting and other species in certain areas are dependent on marine fauna, including benthic infauna and epifauna, as food. Several bird habitats in the Sale 126 area were identified by Truett (1984) as being particularly vulnerable to impacts from oil and gas activities due to large concentrations of birds utilizing nesting and feeding resources. These locations include the marine environments of Ledyard Bay, and waters off Cape Lisburne where benthic infauna and epifauna are heavily utilized by foraging birds.

Effects on marine and coastal birds resulting from toxicity, bioaccumulation, or food supply effects are not expected to occur (Jones & Stokes Associates 1984).

COMMUNITY EFFECTS

Overall, larvae and planktonic organisms are most sensitive to constituents in the water column, and effects on the biota will primarily be a function of dilution and dispersion of the discharge plume and duration of discharge. Since dilution is rapid and metals concentrations are within EPA water quality criteria (set to protect marine life) within 100 meters (330 feet), effects to the plankton biomass are expected to be transient and localized.

The benthic community is the most likely to be affected physically and toxicologically because of potential exposure to large amounts of drilling mud solids. Effects on the benthos will be primarily a function of the depth and areal extent of solids deposition. Since the area affected is small, population depressions in the benthic community are not expected to have serious impacts on marine species higher up on the trophic web.

Benthic community structure is changed in the immediate vicinity of the discharges due to smothering, in particular by cutting piles which may be a few meters high and 100 to 200 meters (330 to 660 feet) in diameter in a non-dispersive environment (Battelle Ocean Sciences 1987). However, the fresh habitat is rapidly recolonized, and field studies show little change in benthic communities one year following cessation of drilling activity, providing oil-based drilling muds are not used.

Mercury and cadmium bioaccumulation through the trophic links is of some concern. Plankton in the discharge plume are exposed to these metals and have the potential to ingest them. The benthic polychaete, Capitella capitata, feeding on phytoplankton-zooplankton debris contaminated with mercury and cadmium show a significant metal accumulation (Windom et al. 1982). It is also possible that pioneer species reinvading the areas smothered during mud deposition are selected prey for fish and mammals. Although minimal bioaccumulation of metals during exploratory drilling is expected because of the limited volumes of drilling muds and cuttings discharged, tissue analyses of benthic species pioneering the mud deposits should be conducted.

Based on an assessment of the sensitivities and susceptibilities of Alaskan marine organisms to drilling mud and drilling mud components, the biological communities in Sale 126 do not appear to be at unreasonable risk from toxicity caused by limited offshore exploratory phase discharges of drilling mud. However, the potential for significant effects on all communities increases when large-scale production is considered.

COMMERCIAL, SUBSISTENCE, AND RECREATIONAL HARVESTS

INTRODUCTION

In light of the information presented in the ODCE 109, it appears there are no commercial fisheries in the Lease 126 Sale Area (EPA 1988b). Trawl survey results for the Chukchi Sea do not indicate any potential for commercial harvests. In addition, EPA (1988b) reported that there are no recreational harvests of marine species in the Barrow Arch area.

SUBSISTENCE HARVESTS

Morris (1981) reported a great variety of fish, bird, mammal, and perhaps some invertebrate species are harvested by local villagers under subsistence regulations. Several species including bearded seal, spotted seal, ringed seal, walrus, cods and flounders are benthic feeders and therefore must be considered in an evaluation of effects of exploratory drilling discharges. Impacts to the benthos are expected to be insignificant because of the small quantities of mud to be discharged and the small areas to be impacted.

The maximum subsistence areas for fish, seals and walrus are located near Point Hope, between Point Lay and Wainwright and in the Barrow Arch. These areas should

be considered special aquatic sites when evaluating the potential impacts of discharges from drilling activities along the nearshore three-mile limit. More detailed information concerning subsistence use of marine resources by the Chukchi Sea communities of Point Hope, Point Lay and Wainwright can be found in Truett (1984).

HUMAN HEALTH EFFECTS

Ingestion of organisms that have accumulated significant concentrations of heavy metals or petroleum hydrocarbons from drilling mud is the principal potential source of adverse human health effects caused by discharge of drilling muds and cuttings into the marine environment. Human health affects are most likely to result from chronic ingestion of marine organisms that have accumulated high levels of metals, primarily barium, lead, mercury, and cadmium.

Barium, which is present in large concentrations in drilling muds, could be accumulated marine organisms by human ingestion of enough contaminated seafood in a short enough time period of time to pose a human health threat is unlikely. Petrazzuolo (1981) assessed human health risk based on reported barium concentrations in biota and concluded that a human would have to eat 5 to 15 kilograms (11 to 33 pounds) of contaminated seafood in a short period of time (biological half-life of barium is less than 24 hours) in order to be at risk.

Organic mercury is readily taken up by marine biota and accumulates in the liver and kidney (Hamer 1986). Mercury accumulation by pilot whales can be high enough to pose a health risk to human inhabitants of the Faroe Islands (Andersen et al. 1987), and seal meat has been found to contain high levels of mercury (Botta et al. 1983). The potential for chromosome mutagenicity was high in Greenlandic Eskimos having a high proportion of seal meat in their diet, and seal meat consumption was positively correlated with human blood concentrations of mercury and cadmium (Wulf et al. 1986).

The body burden of metals in birds and animals from areas remote from major human activity (the Antarctic and the Canadian Arctic) are relatively high (Steinhagan-Schneider 1986; Eaton and Farent 1982). The increases in metal body burdens of animals consumed by humans attributable to drilling mud discharges are expected to be minor, since drilling mud discharges are periodic and of small volume. However, incrementally small additions of heavy metals from diverse sources do increase the potential for bioaccumulation of metals through the food chain. Metal content of drilling muds should therefore be minimized.

EFFECTS OF LAND DISPOSAL

Land disposal of drilling muds and cuttings is generally unattractive as sites fill and new disposal locations must be found. Although land disposal has been considered for operations off the Canadian coast (Lamm 1982) and in the Beaufort (Dranjnich 1983; Cooper Consultants, Inc. 1986a) and Chukchi Seas (Cooper Consultants, Inc. 1986b). However, if the drilling mud composition is such that ocean disposal would violate the conditions of the NPDES permit, or if there is insufficient information to determine that there will be no unreasonable environmental degradation to the discharge site, on-land disposal is the only option.

On-shore disposal options include placing the mud in existing quarries, building pits or sumps, of direct land disposal. For each of these options, shipping traffic, docking facilities, and haul roads are required.

The construction of pits or sumps removes land from other uses. The magnitude of land loss is dependent on the volume of waste to be disposed and the amount of time that would be required to reclaim the lands with vegetative cover. Snow can accumulate in the pits over winter, and flooding is a danger during spring break-up. Furthermore, drilling muds and fluids that could not be safely disposed of at sea probably contain toxic materials such as oil and grease, heavy metals, synthetic and natural organic compounds, high concentrations of salt, and have a high biochemical oxygen demand.

Accumulated pit water must be disposed of to avoid a lagoon forming which may attract waterfowl and other wildlife and pose potential hazards to them. Land disposal of pit water can stress the vegetation; for example, willows are particularly sensitive to salt concentrations over 4,000 milligrams per liter (Cooper Consultants, Inc. 1986a).

French and Rossiter (1985) monitored the impacts of placing waste drilling fluids upon tundra. It was found that (1) no significant deleterious changes in water quality occurred in adjacent Hoodoo River as a result of overland seapage of waste effluent, (2) leaching of heavy metals appeared to be slow and soluble components were quickly diluted to background levels, and (3) terrain disturbance was considerably less than that which might have occurred if a sump had been constructed. These short-term results suggest that direct surface disposal of waste fluids may be an acceptable procedure in those polar semi-desert environments where the potential for permafrost terrain disturbance is high.

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APPENDIX K

THE U.S. DEPARTMENT OF THE INTERIOR'S AUTHORITIES, RESPONSIBILITIES, AND RESPONSE ACTIONS WITH THE T/V EXXON VALDEZ OIL SPILL

THE U.S. DEPARTMENT OF THE INTERIOR'S AUTHORITIES, RESPONSIBILITIES, AND RESPONSE ACTIONS ASSOCIATED WITH THE T/V EXXON VALDEZ OIL SPILL

Shortly after midnight on March 24, 1989, the 987-foot vessel T/V Exxon Valdez struck Bligh Reef in Prince William Sound, Alaska. What followed was the largest oil spill in U.S. history. The resultant oil slick contacted coastlines in Prince William Sound, along the Kenai Peninsula, Cook Inlet, and the Shelikof Strait. Experts are assessing the environmental and economic implications of the T/V Exxon Valdez oil spill. The job of cleaning up the spill is a continuing process; and, although the initial response proceeded slowly, major steps have been taken.

The very large spill size, the remote location, and the character of the oil all tested spill-preparedness and -response capabilities. Government and industry plans, individually and collectively, proved to be wholly insufficient to control an oil spill of the magnitude of the T/V Exxon Valdez. Initial industry efforts to get equipment onscene were slow. And, once deployed, the equipment could not cope with the spill.

Authorities and Responsibilities: The U.S. Department of the Interior (USDOI) has four areas of responsibility for oil spills or releases of hazardous substances. Two entail response activities, and two are associated with USDOI's role as a trustee for natural resources. The authorities for these activities are the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and the Clean Water Act (CWA) (amendments to the Federal Water Pollution Control Act) Section 311. Executive Order (EO) 12580 names the members of and delegates certain responsibilities to the National Response Team, of which USDOI is a member.

Following oil spills or releases of hazardous substances, the USDOI--as a member of the National Response Team and Regional Response Teams--provides response assistance along with other Federal agencies in support of the U.S. Coast Guard (USCG) or the Environmental Protection Agency (EPA) in the manner described in the National Contingency Plan and the Regional Contingency Plans. The USDOI's focus in response assistance is based on the full range of the Department's jurisdiction and expertise. (The USDOI also responds to oil spills or hazardous-substance releases on its own lands, in compliance with Superfund provisions for Federal facilities.)

As a trustee for natural resources, the USDOI is authorized to seek compensation for--or restoration of--natural resources under its trusteeship that may have been injured by releases of oil or hazardous substances. Federal trust responsibilities encompass those natural resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States. Under CERCLA/CWA and EO 12580, the USDOI is a trustee for migratory birds and certain marine mammals (e.g., walruses, polar bears, and sea otters) and for its park, refuge, and Native-allotment lands. Trustee activities may include participating in negotiations with potential responsible parties along with any other natural resource-trustee agency, EPA, USCG, and the Department of Justice to agree upon either compensation for injured natural resources or measures to be taken for the restoration or rehabilitation of injured resources.

Where injury to natural resources has resulted from the release of oil or hazardous substances, the USDOI is responsible for developing regulations that may be used by Federal or State natural resource trustees in assessing damages. Use of these regulations is not required, but trustee claims based on these regulations have the force and effect of a "rebuttable presumption" in court.

Specific Responses: Within the USDOI, notification of the T/V Exxon Valdez oil spill was first received by the Alaska Bureau of Land Management (BLM) and immediately thereafter by the USDOI's Regional Environmental Officer (REO) in the Alaska Office of Environmental Project Review, the USDOI member on the Alaska Regional Response Team (ARRT). The REO's office became the central point for coordination of ARRT members in Anchorage and coordination for USDOI support to the response efforts led by the USCG. The Regional Environmental Assistant's (REA) office at the headquarters of the USCG's Federal On-Scene Coordinator (OSC) in Valdez became a key coordination point for natural resource-related activities and for USDOI logistical support throughout the first few weeks of the spill.

In addition to the Office of Environmental Project Review, USDOI's response involved five bureaus and the Office of Aircraft Services (OAS) on the basis of: (1) land, natural, and cultural resource jurisdiction (Fish and Wildlife Service [FWS], National Park Service [NPS], and Bureau of Indian Affairs [BIA]); and (2) expertise and logistical support (BLM, Minerals Management Service [MMS], and OAS).

- Fish and Wildlife Service: The FWS concentrated its short-term efforts on documenting the numbers, species, and locations of migratory birds and sea otters in areas affected or potentially affected by the spill and on documenting effects on sea otters and migratory birds and their habitats. The FWS provided resource information throughout the planning of cleanup operations, participated in aerial reconnaissance of proposed cleanup sites, and monitored onsite-cleanup operations. The FWS also monitored Exxon-funded rescue and rehabilitation operations for birds and sea otters and provided personnel and logistic support for capture of eagles and sea otters.

- National Park Service: The NPS, with the assistance of the Interagency Incident Command Team (ICT), organized and supervised documentation of prespill conditions at Kenai Fjords, Katmai, and Lake Clark National Parks and Aniakchak National Monument. Activities included water-quality sampling, shoreline-vegetation surveys, cultural resource surveys, and wildlife counts. The NPS documented wildlife effects and provided technical assistance in beach-cleanup operations. The NPS personnel worked closely with the USCG to establish priorities for placing oil-containment booms and monitoring onsite-cleanup operations.

- Bureau of Indian Affairs: The BIA provided information to Exxon to ensure that cultural resources were identified and protected during shoreline-cleanup operations.

- Bureau of Land Management: The BLM provided personnel and equipment to the REO's office in Anchorage and the REA's office in Valdez and mobilized ICT personnel and equipment to support response activities in the Seward, Kodiak, and Homer zones. In addition, BLM provided and deployed remote weather-tracking stations for the National Oceanographic and Atmospheric Administration (NOAA) and fuel bladders to support remote aerial and boat operations in Prince William Sound.

- Office of Aircraft Services: The OAS provided air support to USDOI bureaus and other Federal and State agencies.

- Minerals Management Service: The MMS initiated the following actions after the T/V Exxon Valdez oil spill: (1) assisted other bureaus and agencies during the oil spill, (2) funded studies (including data collection) associated with the spill, and (3) worked to improve oil-spill planning and response.

The Alaska OCS Region of MMS provided personnel assistance to meet other bureau needs during the Exxon Valdez oil spill. For example, they provided staff support to the REO during the first 3 weeks of the spill; and regional staff worked on otter capture and surveillance, assisted in bird identification and census at the bird-mortality centers, and participated on the Resource Assessment Team.

On April 18, 1989, Secretary of the Interior Lujan directed MMS to immediately review current oil-spill-planning and response requirements for OCS oil and gas operations. In response to this directive, the MMS Director organized a task force to evaluate spill planning, training, drill and inspection requirements, and procedures for each MMS OCS Region. The MMS task force undertook an intensive review of MMS regulations and policies to define needed changes in cleanup and oil-spill-containment provisions.

The Alaska OCS Region initiated two task forces to review current oil-spill-contingency plans (OSCP's) in relation to MMS regulations. The Shell Western Exploration and Production, Inc.'s, Chukchi Sea OSCP and the Amoco Production Company's Belcher OSCP were reviewed. Both plans met MMS requirements.

The Alaska OCS Region implemented a "tabletop" oil-spill-response drill. This response drill is a test for a major spill simulating a blowout with a 5,000-barrel-per-day flow. The objective is to walk through the response and to exercise the knowledge of the OSC. The MMS completed an exercise with Shell Western at the Burger Prospect in the Chukchi Sea.

The Alaska OCS Region also made a physical inventory of the oil-spill-response equipment at the oil-spill-response cooperatives. This inventory included a physical count to make sure equipment was onsite and to verify the usable condition of the equipment. These inventories were conducted at Alaska Clean Seas, at the Cook Inlet Response Organization, and in Canada.

On April 18, 1989, Secretary of the Interior Lujan announced that the USDOI would expand its current research program for improving oil-spill-response technology. The funding planned for the program, $6 million over a 3-year period, will be evenly shared by the American Petroleum Institute. The money will fund research in oil-spill detection, containment, and cleanup technology. These activities will be coordinated with other executive branch agencies including the Department of Transportation, EPA, and NOAA, as well as other countries, including Canada.

APPENDIX L

OIL-SPILL RESPONSE

OIL-SPILL RESPONSE

I. FATE AND BEHAVIOR OF SPILLED OIL

The spilled-oil fate and behavior description, in general, and in specific regard to surface spills, subsurface spills, summer broken-ice spills, and winter broken-ice or under-ice spills as contained in Sale 100 FEIS, Section IV.A.1.a (USDOI, MMS, 1985), is incorporated by reference; a summary of this description, as augmented by additional material, as cited, follows. This section addresses additional oil-spill concerns for proposed Sale 126 related to the Chukchi Sea Planning Area ice conditions. In this section, oil-weathering rates are calculated from the weathering model described in Payne (1984) and Kirstein and Redding (1988).

In this spill-behavior discussion, oil-spill cleanup is not considered or assumed. It is likely that cleanup would be attempted but, historically, at-sea cleanup has not been very effective. Success depends too greatly on local ice, oceanographic, and weather conditions; type and oil quantity; logistics; and shoreline character. Readers are referred to Appendix L, Section III, for a discussion of oil-spill-cleanup technology and effectiveness.

Spills 1,000-bbl or greater from pipelines and platforms pose the greatest spill risk to the study area. In the Chukchi Sea, 53 percent of spill risk is derived from pipelines and 47 percent from platforms.

A pipeline spill would almost always be a subsurface spill. Most platform spills--because platform spills are much more likely to occur during production than during exploration--would occur as surface spills. Pipeline and platform spills are more likely to be crude oil but could be fuel oil. In the Outer Continental Shelf (OCS), 7 of 12 1,000-bbl-or-greater platform spills were of stored oil, either stored crude or fuel oil. Stored-oil spills could be as large as blowout spills. For example, Endicott Reservoir preliminary development plans called for storage of 50,000 bbl of diesel for potential shutdown (crude oil could congeal in the pipeline).

A winter spill that resulted from the proposed action most likely would be into moving pack ice. Most proposed sale areas contains pack ice, the previously unoffered Chukchi Sea portion of the proposed sale area has little landfast ice, and most undiscovered resources are thought to be in deeper waters.

A. Surface Spills: Oil spills spread less in cold water than in temperate water due to the increased oil viscosity. In the Sale 126 area, an oil spill would spread less, remaining 100-fold thicker than a slick in a more temperate climate. In the Chukchi Sea, a 22,000 bbl open-water spill (average size 1,000-bbl-or-greater pipeline or platform spill) may physically cover 2 to 5 km^2, and a 100,000 bbl spill may cover 5 to 14 km^2 (Table L-1).

The oil spill, however, would not remain as one continuous slick over such a small area. Winds 4.4 m per second or greater would cause a slick to break into windrows. Waves, slick movement, and changes in winds and ocean currents all tend to spread the slick discontinuously over the ocean surface. In open water in the Chukchi Sea, within 30 days, the slick could spread discontinuously over an area 200-fold greater than the actual oiled surface area. As weathering and spreading forces continued, the oil would separate further into individual tarballs or pancakes.

The oil composition affects how an oil slick would weather. North Slope and the crude that may be found in the Chukchi Sea and resulting characteristics may vary considerably, but generalizations could be made. Volatile component evaporation accounts for the largest loss from most crude-oil spills, on the order of 25 percent within the first 24 hours. Over the oil-slick life, evaporation accounts for about one-sixth to two-thirds of slick mass. For Prudhoe Bay-like crude, with a high residual content, approximately 9 percent of a spill would evaporate in 1 day at 2°C and a 6-m-per-second (11-kn) wind (calculated from Payne 1984). Higher wind speeds or warmer temperatures would increase the initial evaporation rate but would not

Table L-1
Spill-Size Examples for Spills in the Open-Water Season in the Chukchi Sea Planning Area

	Summer Spill[1/]			Meltout Spill[2/]		
Time After Spill:	3 Days	10 Days	30 Days	3 Days	10 Days	30 Days
				22,000-bbl Spill		
Oil Remaining (%)	83	72	58	84	65	44
Thickness (mm)	1.6	08	0.4	2.1	1.0	0.5
Thick-Slick Area (km^2)[3/]	1.8	3.1	4.8	1.2	2.0	3.0
Discontinuous-Slick Area (km^2)[4/]	57	260	1,100	1,400	1,600	2,200
				100,000-bbl Spill		
Oil Remaining (%)	85	76	63	88	70	48
Thickness (mm)	2.6	1.3	0.7	3.5	1.7	0.9
Thick-Slick Area (km^2)	5.1	8.8	14	3.4	5.7	8.5
Discontinuous-Slick Area (km^2)	120	570	2,300	3,000	3,500	4,800

Source: Calculations are based on the oil-weathering model of Kirstein and Redding (1988). These examples are of a Prudhoe-Bay type crude, which is considered the best analog for undiscovered crude in the Chukchi Sea Planning Area.

1/ September spill, 11 kn windspeed, 2°C, 0.7-m waves; average weather based on Brower et al. (1988).
2/ Time after meltout. Spill assumed to occur in May into first-year pack ice, pools 2 cm thick on ice surface for 10 days at 0°C prior to meltout into 50-percent ice cover, 0°C, 11 kn windspeed, negligible waves.
3/ This is the area of oiled surface.
4/ Calculated from Equation 6 of Table 2 in Ford (1985); the discontinuous area of a continuing spill or the area swept by an instantaneous spill of the given volume. Note that ice dispersion occurs for about 60 days prior to Meltout Day 0.

appreciably increase the slick mass percentage that eventually escapes into the atmosphere. Volatile components total only 18 percent of Prudhoe Bay crude.

A diesel fuel spill would behave similarly, but diesel is missing both the most volatile and least volatile components found in crude oil. Under the conditions assumed above for a Prudhoe Bay crude, a light diesel would initially evaporate more slowly than the crude, on the order of 3.2 percent over the first day, but overall, a larger percentage of diesel would evaporate.

Competing with evaporation is dissolution, which chiefly involves the volatile aromatic fraction. Compared to evaporation, dissolution is very slow; usually most volatiles evaporate rather than dissolve. Dissolved hydrocarbon concentrations underneath a slick, therefore, tend to remain low (see Sec. IV.B.1 of this Environmental Impact Statement [EIS]). Over time, about 5 percent of a slick would dissolve.

Winds, waves, and currents break off oil droplets from a slick and mix them into the underlying water. The greater the turbulence, such as in a storm, the more rapidly oil is lost from the slick. Oil droplet dispersion into the water, not dissolution, is the major mechanism for getting oil into the water column. Mousse formation (water-in-oil emulsion) slows but does not stop dispersion from a slick.

For Prudhoe Bay-like crude, with a relatively small volatile component, dispersion could be important in removing oil from a slick. A 22,000-bbl Prudhoe Bay crude spill would initially have a 9.7 grams per m^2 per hour dispersion rate (Table L-2). Dispersion would initially remove about 2.4 percent of the oil slick per day, about 13 percent over 10 days, and about 18 percent over 30 days. Storm winds and waves could greatly increase dispersion rates.

The slick character changes through time. Many crudes, including Prudhoe Bay crude, form mousse. Most Canadian Beaufort Sea crudes, however, do not (Bobra and Fingas, 1986). After initial weathering, roughly 40 percent of the Prudhoe Bay-like crude may remain as tarballs, pancakes, or mats. For arctic open waters, tarballs could form within days to months, depending on weather, mixing energy, oil type, and nucleation sites availability to initiate tarball formation (Payne, 1982, 1984; MacGregor and McLean, 1977).

B. Subsurface Spills: Subsurface spills could occur from leaks through the seafloor pipelines or from subsea well blowouts. Blowouts or pipeline spills would disperse small oil droplets and entrained gas into the water column. A trunk pipeline--with gas removed--would emit only oil droplets.

Most oil would rise rapidly to the water surface to form a slick. Droplets less than 50 microns in size, a category including about 1 percent of total spill volume, could be carried several kilometers down-current before reaching the water surface. Buist, Pistruzak, and Dickins (1981) found that 90 percent of the oil reached the surface within 50 m of the discharge point in a simulated subsurface gas-and-oil blowout at a 20-m-water depth in the Canadian Beaufort Sea.

Oil droplet release allows some increase in the oil dissolution, but the rapid oil rise to the surface suggests that this increase in dissolution must be fairly small. Oil that reached the surface would weather and behave similarly to a surface spill.

C. Summer Broken-Ice Spills: The Sale 126 area is mostly covered by pack ice in summer. Therefore, a summer spill would most likely be into first-year or multiyear broken ice.

An oil spill in broken ice would spread between ice floes into any gaps greater than about 8 to 15 cm (Free, Cox, and Schultz, 1982). A large, instantaneous spill would push loosely packed ice floes away from the spill, creating a larger gap at the spill site. In more closely packed ice--because fresh crude oil is less dense than sea ice--crude oil would have a tendency to overflow rather than underflow ice (Thomas, 1983). Any waves within the ice pack also would tend to pump oil onto the ice. Approximately 25 percent of the oil spilled in pancake ice would be present on the pancake top due to pumping (Stringer and Weller, 1980). More viscous

Table L-2
Total Hydrocarbon Concentration Examples for Spills in the Open-Water Season
in the Chukchi Sea Planning Area

	Summer Spill[1/]			Meltout Spill[2/]		
Time After Spill:	3 Days	10 Days	30 Days	3 Days	10 Days	30 Days
			22,000-bbl Spill			
Concentration (ppm[1])	.16	.09	.04	.03	.05	.04
			100,000-bbl Spill			
Concentration (ppm)	.23	.13	.07	.04	.09	.08

Source: USDOI, MMS, 1989.

1/ Concentration is based on the discontinuous area calculated from Equation 6 of Table 2 in Ford (1985) and a 10-m water depth.

2/ Time after meltout. Spill assumed to occur in May into first-year pack ice, pools 2 cm thick on ice surface for 10 days at 0°C prior to meltout into 50-percent ice cover, 0°C, 11 kn windspeed, negligible waves.

and/or weathered crudes may adhere to porous ice floes, essentially concentrating oil within the floe field and limiting the oil dispersion. Such concentration was observed in the Ethel H. (Deslauriers, 1979) and Kurdistan (Reimer, 1980) spills.

Initial spillage could entrain some oil on the ice floe underside; however, due to oil's buoyancy, most oil would remain in the water between floes. Oil would move from underneath first-year ice when differences in ice and underlying water velocities are approximately 15 to 25 cm per second (Cox and Schultz, 1981). Velocities would have to be greater than 20 cm per second to move oil underneath the rougher multiyear ice relief. In the Chukchi Sea Planning Area, strong currents and 15 to 25 cm per second differential velocities are possible.

In broken, first-year ice, brine channels allow relatively rapid oil movement from underneath the ice to the ice surface. Thomas (1983) calculates a maximum 0.4 mm per hour oil-flow rate through decaying first-year ice. Any ice--wave action oscillation, slight floe uplifting from collisions, overturning, or tilting that results from uneven melting--also tends to remove oil from underneath the ice. Multiyear ice does not contain continuous brine channels. Entrapped oil release from multiyear ice would be slower than from first-year ice but would still occur.

Oil between or on ice floes is subject to normal evaporation. Some additional oil dispersion occurs in dense, broken ice through floe grinding action (Reimer, 1980). This floe grinding action also promotes mousse formation. With floe grinding, Prudhoe Bay crude forms a mousse within a few hours, an order of magnitude more rapidly than in open water (Payne, 1984).

D. Winter Under-Ice Spills: A winter spill under unbroken, landfast ice or pack ice would most likely be a pipeline spill. The oil would rise to the ice underside as described for a summer pipeline spill rising to the water surface.

Oil spreading along the ice underside is controlled by several factors. Separate oil droplets or small pools of approximately 0.2-mm thickness would not coalesce or flow into hollows underneath the ice (see Buist, Pistruzak, and Dickins, 1981). Approximately 2 mm of additional oil could be accommodated in the skeleton ice crystals beneath the solid-ice layer. Thicker oil layers coalesce or spread under the ice until an equilibrium 0.8 cm thickness is reached (Rosenneger, 1975). If a sufficient oil volume is instantaneously spilled, oil would spread into hollows underneath thinner ice. In first-year late winter ice, such hollows could store 150,000 to 300,000 bbl per km^2 (Stringer and Weller, 1980). Multiyear ice, which is rougher, could store 1.8 MMbbl per km^2 in under-ice relief (Kovacs, 1977).

More than 90 percent of the proposed sale area lies in the pack-ice rather than the landfast-ice zone (Roberts, 1987). A spill into winter ice would, therefore, more likely be into multiyear pack ice than landfast ice. The greater multiyear ice storage capacity would not be well-used in a real spill situation due to ice movement over the spill.

A 1,000-to-25,000-bbl-per-day-pipeline spill may spread as a ribbon, approximately 100 m wide and 0.3 to 8 mm thick, on the moving pack ice underside. Greater than 25,000-bbl spills would pool within the ribbon into hollows on the ice underside. Only a spill rate greater than 75,000 to 150,000 bbl per day would fill the ice underside storage capacity and result in a wider ribbon. The ribbon length depends on spill duration; and the ribbon would grow at the ice drift speed, approximately 5 km per day in the Chukchi Sea Planning Area (see Sec. III.A.3.a of this EIS). Faster ice movement may occur in a storm, resulting in a longer, but thinner, oiled ice ribbon.

Differential velocities between ice and underlying water greater than 15 to 25 cm per second would move oil out of ice underside hollows. Fifteen to 25 cm per second velocities are possible in the Chukchi Sea Planning Area. Even with 15 to 25 cm per second velocities, oil may not move more than a few kilometers from its original ice underside location. New ice would form beneath the under-ice oil within 5 to 10 days, isolating it from currents and further weathering. Grease ice and also slush ice beneath the ice cover should retain spilled oil and limit its spread and movement (Martin, 1981; Truett, 1985).

Because of these and other factors, a winter spill (or whatever part of a winter spill that is not cleaned up) is a fresh, unweathered spill when the ice melts.

To get into a lead or a polynya earlier than breakup, oil would have to be spilled in a polynya or a polynya would have to form through the ice-entrapped spill; that is, it would have to break the ice in the middle of the frozen spill. If such breakage occurred in the latter case, appreciable quantities of oil could not be released unless breakage occurred through a relatively rare, thicker oil pool. Such pools would be isolated and small; therefore, only minimal quantities of oil would be released into the forming polynya.

Oil released into the polynya would be blown to its downwind edge, where it would accumulate in a band. The oil would then be either frozen into the ice or contained behind accumulating brash ice (floating ice fragments not more than 2 m across). It is possible that the cold, saline water formed as the polynya freezes could incorporate relatively high dissolved hydrocarbon concentrations into a sinking denser water plume. This plume would then spread out at some equilibrium depth in deeper water as a relatively stable and distinct layer (see Sec. IV.C.1 of this EIS).

In the Chukchi Sea Planning Area, oil would start melting out of first-year ice in June; oil spilled earlier in winter would melt out earlier. Oil in multiyear ice would be released more slowly, perhaps 1 to 3 months later, with 10 percent of the oil taking more than 1 year for release.

E. Winter Broken-Ice Spills: The most likely winter spills from platforms in the proposed Sale 126 area would be spills into broken pack ice. Spills from platform-stored oil would collect in open water or broken ice in the lee of bottom-founded production platforms.

Blowouts provide a mixed spill mode. A subsea blowout would place oil into the broken ice in lee of the platform. The subsequent winter spilled oil fate would be similar to a subsea-pipeline leak under ice. Rather than underneath the ice, a surface blowout would place oil into broken ice and on top of the ice. Such surface release would likely result in appreciable, but incomplete, volatile hydrocarbon evaporation prior to breakup. Thus, a surface blowout--or any other spill on top of the ice--would be partially weathered during winter.

Most oil spilled into winter broken ice would be rapidly frozen into the pack ice. Because the oil would be frozen into new ice, brine channels would be present and would allow most oil to be released during breakup.

II. EXTENT AND PERSISTENCE OF OILED SHORELINE

If an oil spill occurs and contacts shore, two important but nonbiological questions arise: (1) how much shoreline would be contaminated and (2) how long would the contamination persist? In winter, Chukchi Sea landfast ice may keep spills offshore, away from the shoreline, and any oil that did reach shore would not penetrate into the frozen beach until it thaws in spring. For these shorelines, spills during the open-water season are a greater hazard than spills during the winter.

A. Extent of a Shoreline Spill: An offshore spill that reaches shore is not likely to reach the shoreline in its entirety; contact could occur with the shoreline in several locations, or the spill could be "smeared" along a single location, depending on the winds and longshore current. How long a stretch of coastline could be coated by an oil spill is difficult to quantify but could be estimated on the basis of a study by Ford (1985).

Ford used multiple regression and 39 spill case histories in which coastline was oiled to develop empirical equations predicting how much coastline would be oiled if oiling occurred. (Note that not all spills reach shore.) Ford found the volume spilled accounted for 59 percent of the variance in the historical record. Volume and latitude was a slightly more precise estimator, accounting for an additional 6 percent of the variance. Wind speed, water temperature, and wave height did not significantly correlate to the amount of shoreline oiling.

The Equation 13 (Table 4 in Ford, 1985) relating shoreline oiling to volume alone is a more appropriate predictor than the equation relating oiling to both spill volume and latitude. The correlation to latitude is caused by a an increase in shoreline complexity as latitude increases. However, the historical spill record Ford uses encompasses a narrow latitude range.

Based on Equation 13, if a 22,000 bbl spill occurred and contacted land, about 50 km of coastline would be oiled. For a 100,000 bbl spill, oiling would be on the order of 90 km. However, it would be possible for a spill to contact severalfold longer or shorter stretches of coastline than these averages or, alternatively, not contact any shoreline at all.

A 100,000-bbl-or-greater spill and, in particular, long-duration spills are depicted less precisely in the oil-spill-risk analysis than are instantaneous spills. The oil-spill-risk analysis could still be used to represent the risk from such spills.

For 100,000 bbl-or-greater spills, the spill center of mass is represented accurately. However, the oil spreading over different trajectories through time and space results in more frequent oil contacts to land but with each contact involving only a total spill fraction. For such spills, the conditional contact probabilities from an individual hypothetical spill site represent the total spill fraction that would contact that environmental-resource area or land segment, disregarding weathering and cleanup. Such spill/model-trajectory behavior is demonstrated by both the Santa Barbara spill of 1969 (Amstutz and Samuels, 1984) and the Exxon Valdez spill of 1989 (Jayko and Spaulding, 1989). (The conditional probability would normally represent the likelihood that the environmental-resource area or land segment was contacted by the entire spill.) Note, however, that there are additional constraints on specific shoreline stretch oiling potential. These constraints are discussed in the Sale 87 FEIS, Section IV.A.1.d (USDOI, MMS, 1984). This discussion is incorporated by reference; a summary follows. The Chukchi Sea tidal range is low (10-30-cm average), and marsh or delta tidal flat habitats would have to be inundated by seawater during a storm surge to allow appreciable inland oil stranding. These dual restraints on oil stranding reduce the oiling likelihood and degree to marsh and delta tidal flats to less than that implied by probabilities from the oil-spill-risk analysis.

B. Persistence of Stranded Oil: The shoreline oil-retention characteristics along the U.S. Chukchi Sea coast are described in the Sale 109 FEIS, Section IV.A.1.d (USDOI, MMS, 1987). This description is incorporated by reference; a summary follows. An oil-persistence discussion relates to that oil remaining after cleanup or to situations where cleanup could cause more damage than if the spill is left in place. Marshes; low tundra shores; and low, vegetated barriers, may be areas where most cleanup operations--contaminated soil and vegetation removal or even heavy foot traffic--could cause permanent scars in the landscape and ecosystem. Newer techniques, such as low-pressure hosing coupled with clipping of oiled vegetation, provide both ecologically and technologically sound means of cleaning some of these areas. Thus, cleanup is a viable option to mitigate shoreline oiling and oil persistence.

Oil persistence on various shoreline types has been investigated both experimentally through small, deliberate test-plot spills and by monitoring oil persistence following accidental spills. In these studies, oil persistence is highly correlated with shoreline type, largely due to the physical processes in both oil weathering and natural oil dispersion (Hayes, Gundlach, and Getter, 1980; Michel et al., 1990).

Based on these empirical data, several studies have rated the Chukchi Sea coastline oil-retention potential. Most Chukchi Sea coastline has moderate to high retention potential, with less than half of the coast in the high category (EIS Fig. IV-A-11; Hayes and Ruby, 1979; Woodward-Clyde Consultants, 1981; Robilliard et al., 1985). Stranded oil, if not cleaned up and if in a zone of high oil-retention capacity, could persist for decades along at least some oiled shoreline (Gundlach, Domeracki, and Thebeau, 1982). In many locations, persistence would be less due to the rapid Chukchi Sea coastline retreat rate; stranded oil would erode along with the shoreline.

III. OIL-SPILL-CONTINGENCY MEASURES

A. Federal Laws: Environmental protection from oil spills is regulated under the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR part 300) required by section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 U.S.C. 9605) and by Section 311 (c) (2) of the Clean Water Act as amended (33 U.S.C. 1321 (c) (2)).

Section 311 of the Clean Water Act provides the overall framework for oil spills and designated hazardous substances, including national policy and responsibilities. It is the policy of the United States that the spiller assumes complete financial responsibility for removal actions. If the predesignated On-Scene Coordinator (OSC) determines that timely and/or adequate removal actions are not being carried out, then the Federal Government would initiate cleanup. The Government may then bring action against the responsible party to recover all cleanup costs up to the liabilities set by Federal Law.

The CERCLA significantly broadens the scope of spill reporting and response. Specifically, the act requires that the National Response Center be notifies of any release of a reportable quantity of a hazardous substance to the environment.

The Resource Conservation and Recovery Act (RCRA) addresses problems related to the generation, disposal, and management of waste materials in the United States. These regulations require that generators, transporters, and disposers of hazardous wastes must obtain EPA identification numbers. During spill situations where hazardous waste is recovered and transported to a disposal sites, the shipment must be accompanied by a manifest which includes the EPA generator and transporter identification number.

The Oil Pollution Act of 1990, Public Law 101-380, has a direct effect on some provisions of the OCS program. The Oil Pollution Act of 1990 establishes an Interagency Coordinating Committe on Oil Pollution Research. Membership of the Committe includes representatives of NOAA, DOE, DOI (includes MMS and FWS), DOT, DOD, EPA, NASA, and the U. S. Fire Administration in the Federeal Emergency Management Agency, and other Federal Agencies that may be designated by the Presedent. The Oil Pollution Act of 1990 also requires a study of potential spills in the Arctic Ocean. The Secretary of the Interior, in consultation with the Governer of Alaska, is to conduct a study of the issues of recovery of damages, contingency plans, and coordinated actions in the event of an oil spill in the Arctic Ocean. The Secretary is to submit a report to Congress by January 31, 1991.

B. National and Regional Oil and Hazardous Substances Pollution Contingency Plans: The National and Regional Oil and Hazardous Substances Pollution Contingency Plans have been developed in compliance with the Clean Water Act, Section 311 (c)(2) and CERCLA, Section 105. These plans provide for a coordinated and integrated response by departments and agencies of the Federal and State Governments to protect the public health and environment and to minimize adverse effects due to oil and hazardous substances discharge, including containment, dispersal, and removal.

The OSC is the Federal official predesignated by the EPA or USCG to provide on-scene coordination and direction of all aspects of a spill and subsequent removal actions. The OSC is predesignated as part of the planning and preparation for response to pollution incidents. The OSC maintains a responsibility to ensure that the proper initiation, containment countermeasures, cleanup, and disposal actions take place. An official from any agency with responsibility under the Regional Contingency Plan may assume the role of the OSC until the predesignated OSC arrives.

The Regional Response Team (RRT) provides the appropriate regional mechanism for planning and preparedness activities before a response action is taken and for coordination and advice during such response action. The two principal components of the RRT mechanism are a standing team, which consists of designated representatives from each participating Federal agency, State and local governments, and incident-specific teams where participation would relate to the technical nature of the incident and its geographic location. Both the national and regional plans contain the responsibilities and the functions of the OSC and the RRT and are available for review at the EPA and USCG offices.

The standing RRT would serve to recommend changes in the regional response organization as needed, to revise the regional plan as needed, and to evaluate the preparedness of the agencies and the effectiveness of local plans for the Federal response to discharges and releases.

In Alaska, the entire coastal area is a geographic zone of responsibility covered by the Alaska Region Oil and Hazardous Substances Pollution Contingency Plan. The purpose of the regional plan is to provide for a coordinated and integrated Federal and State agency response posture in Alaska at the RRT level. At the same time, this provides the predesignated OSC with guidance and assistance for preparing local contingency plans and responding effectively to pollution incidents.

Members of the Alaska Coastal RRT are designated representatives from the USCG, EPA, State of Alaska, Federal Emergency Management Agency, and the following Federal departments: Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, Justice, Labor, and State. The following are available to assist the RRT, OSC, and SSC in performing their duties: national special forces on call, such as the USCG's Pacific Strike Team and the Environmental Response Team established by the EPA; a computerized national inventory of pollution-response and -support equipment for locating specialized equipment tailored to the characteristics of the spill; memoranda of agreement and interagency agreements to explicitly define areas of responsibility in cases where overlapping jurisdiction may exist; and specialized functional groups within the RRT to provide expertise and leadership in areas such as public information, pollution-control techniques, damage assessment, and protection of living marine resources.

C. <u>Joint Contingency Plan Against Pollution in the Bering and Chukchi Seas</u>: This plan, including the operational appendix, was established under the agreement between the Government of the U.S.A. and the Government of the U.S.S.R. concerning cooperation in combatting pollution in the Bering and Chukchi Seas in emergency situations. The plan primarily addresses international matters and is meant to augment pertinent existing plans. The implementation of the plan is the joint responsibility of the U.S. Coast Guard (Department of Transportation) and the U.S.S.R. Marine Pollution Control and Salvage Administration, attached to the U.S.S.R. Ministry and Merchant Marine.

D. <u>MMS Pollution Prevention and Response Regulations</u>: The general and permanent rules for oil, gas, and sulphur operations in the OCS are regulated by 30 CFR part 250. Subpart C regulates pollution prevention and control. Pollution prevention is the top priority. The lessee is directed to prevent unauthorized discharges of pollutants into the offshore waters. Inspections are an integrated part of pollution prevention. Inspections on a daily basis could be required to prevent discharges of pollution. Pollution-response equipment shall be inspected at least monthly. In addition, spills are to be reported immediately if greater than one barrel and within 12 hours if less than one barrel.

The oil industry lessee is regulated by 30 CFR 250.42 to submit an oil-spill- contingency plan for approval by the Regional Supervisor with or prior to submitting an Exploration or Development and Production Plan. The MMS, Alaska OCS Region, provides guidelines developed in compliment with the USGS/USCG Memorandum of Understanding (MOU) dated December l8, 1980. An oil-spill- contingency plan (OSCP) shall be reviewed and updated annually. Stated in 30 CFR 250.42 and other legal requirements, the OSCP shall contain information on the following: (1) oil-spill-risk analyses, (2) recovery equipment, (3) equipment availability (4) response time, (5) drills, (6) support vessels, (7) dispersant equipment, (8) authority, (9) disposal, (1O) detection and monitoring, and (11) any provision of the regulations dealing with contingency planning, the provision's use, and maintenance of pollution-control equipment, or related training also shall apply in the preparation of contingency plans.

E. Petroleum-Industry Response Organizations: Alaska Clean Seas (ACS) was organized by the petroleum industry to support industry oil-spill-response activities in both State and OCS waters off the Alaskan coast. The ACS organization is divided into Cost Participation Areas (CPA's). The current areas are the ABSORB CPA and the West Coast CPA (Norton Sound, St. George Basin, Navarin Basin, and Chukchi Sea). This cleanup organization and others (such as CIRO) operate through a voluntary private-industry agreement to jointly acquire oil-spill-containment and -cleanup equipment, to train personnel in its use, and to provide a pooled capability of response equipment greater than any one company could provide.

On April 7, 1989, Richard M. Morrow, Chairman of the Board, American Petroleum Institute, and Chairman of Amoco Corporation, announced that the Board of Directors of the American Petroleum Institute had established a top-level task force to review industry operations in the areas of oil-spill prevention and response. On June 14, 1989, the task force approved the following conclusions and recommendations. The Task Force proposes that an industry funded Petroleum Industry Response Organization (PIRO) be established to consist of a Headquarters Group and five Regional Response Centers. Although none of these response centers are in Alaska, Richard M. Morrow has written to Governor Steve Cowper and the Alaskan Congressional delegation saying: "The industry had not at all disregarded Alaska, but is treating it explicitly as a unique, and very important, region which is developing a special contingency plan. The Alaska plan specifically establishes at Valdez a response capability roughly equivalent to that proposed for each of the five regional response centers. In addition API should review local capability in the period before PIRO is established." Vice Admiral John Costello, president of PIRO Implementation, Inc., recently reported that each PIRO response center will be manned and equipped to handle up to 216,000-bbl spills (Oil Spill Intelligence Report, 1990).

On September, 8, 1990, PIRO announced the formation of the Marine Spill Response Corporation (MSRC). The MSRC will be funded by oil companies and others involved in the shipment or receipt of oil by tanker through another newly created organization, the Marine Preservation Association (MPA). The MSRC will consist of a Washington, D.C., headquarters and five response regions with regional centers located in the New York-New Jersey Metropolitan area (Northeast region), Port Everglades in South Florida (Southeast region), Lakes Charles, Louisiana (Gulf region), Port Hueneme, California (Southwest region), and Seattle, Washington (Northwest region). Alaska is considered one of the six prestaging areas for the Northwest region. According to the API task force report, MSRC should play an appropriate response and cleanup role in Alaska. The definition of this role is not yet resolved. Primary response capabilities already in existence must be evaluated before it can be determined what else might be required. Discussions with industry and the state have not yet proceeded to the point where MSRC's role can be completely described for Alaska (MSRC press release, 1990).

F. Petroleum Industry Oil-Spill-Contingency Planning: The oil industry lesee is regulated by 30 CFR 250.42 to submit an OSCP for approval by the Regional Supervisor with or prior to submitting an Exploration or Development and Production Plan. Information on oil-spill-contingency planning for the Chukchi Sea is referenced from the only existing public OSCP's for Sale 109 leases in the Chukchi Sea at this time (Spiltec, 1989; 1990). The Shell Western and Exploration Inc. (SWEPI) and Texaco OSCP's are used as examples only; other oil companies may choose to handle spill response in their OSCP's in a different manner.

(1) Oil-Spill-Risk-Analyses: Predicting oil-slick movement is desirable because it gives some idea of where a slick would migrate and where potential shoreline contamination may occur due to oiling. Knowing slick movement could aid in preplacement of oil-spill-response equipment, and in the event of a spill, aid in effective oil-spill-response actions (including containment, protection of sensitive areas, and spill cleanup). Spiltec (1989, 1990) used the data from the MMS oil-spill-risk analysis with the Rand three-

dimensional model. Each OSCP used the MMS spill-point data closest to its operation area, ranging from 5 to 45 km.

(2) Recovery Equipment: Responses to spills from OCS activities are approached by arranging and ranking lines of defense to prevent spilled oil from affecting identified vulnerable environment. The first line of defense is always offshore mechanical containment. The collection of spilled oil (without containment) is usually not successful (see below).

The type of recovery equipment and its deployment method rest entirely with the operator. However, subject to the prevalent conditions identified in the risk analysis, the equipment should be "state-of-the-art." Based on previous research and development studies, observations, and experiences, currently available "state-of-the-art" equipment is capable of operating in 8- to 10-ft seas and 20-kn winds (46 FR 2911). However, a recent reevaluation of the effectiveness of response equipment by the USDOI (USDOI, MMS, OCS Spill Task Force, 1989) following the Exxon Valdez oil spill was more pessimistic, concluding that most response equipment available in the U.S. does not satisfy the MMS/USCG cleanup and recovery requirements in 8- to 10-ft seas.

This relatively poor rating of response equipment by the MMS task force was attributed in part to the lack of MMS standard protocols for evaluating and comparing equipment performance. That is, MMS has no formal protocol or quantitative procedures for evaluating whether response equipment proposed by lessees is "state-of-the-art" as required by MMS guidelines for OSCP's. Based on the MMS task force analysis, offshore-response equipment in U.S. waters does not meet the level of performance required by MMS, Alaska OCS Region guidelines for Approval of Oil-Spill-Contingency Plans. The MMS task force has recommended that MMS establish a standard test protocol for offshore booms and adopt an existing protocol for oil skimmers to define "state-of-the-art" and minimum performance requirements. These recommendations were presented to the Secretary of the Interior and MMS has implemented modifications and alternative procedures that might improve response and readiness.

(3) Locally Available Spill-Cleanup Equipment: The MMS, Alaska OCS Region, requires a lessee who wishes to drill to have an initial spillresponse capability of 1,000 bbl per day. The Alaska OCS Region used a response capability of 5,000 bbl per day to evaluate SWEPI's and Texaco's OSCP in the Chukchi Sea. During SWEPI's 1990 exploration-well drilling in the Chukchi Sea, oil-spill-cleanup equipment was kept on the drillship, the icebreaking supply boat, and an oil-spill response barge. Table L-3 lists the equipment on the drillship; Table L-4 lists the equipment on the supply boat; and Table L-5 lists the equipment on the dedicated oil-spill-response barge. Beginning in 1991, Texaco and SWEPI will share the oil-spill-response barge Responder, placing the barge at the operation site with the higher risk. Texaco will store oil-spill-response equipment aboard the Kulluk, the supply boats, and the oil-spill response barge. Table L-5a lists the onsite spill-response equipment aboard the Kulluk and supply boats. Texaco and SWEPI are members of ACS/ABSORB and have access to equipment at the ABSORB Deadhorse warehouse. Table L-6 lists the ACS/ABSORB detection and recovery equipment at Deadhorse.

Additional equipment is maintained by additional U.S. companies in the Beaufort Sea, Canadian companies, and the Canadian Beaufort Sea Oil Spill Cooperative at Tuktoyaktuk, NWT (Tables L-7 and L-8). If commercial oil quantities are discovered in the Sale 126 area, additional spill equipment may be stockpiled, either by Alaska Clean Seas or by the field owners.

(4) Response Time: The MMS, Alaska OCS Region, requires initial response equipment mobilization and deployment within 6 to 12 hours of a spill, geography permitting. However, the spiller must be prepared to respond before the spill reaches shore (in less than 6 hours, if necessary). This initial timeframe is for relatively small spills, although MMS has not specifically defined size. The SWEPI considers the equipment listed in Table L-7 to be capable of handling small operational spills. The SWEPI considers the equipment listed in Tables L-3 through L-5 to be capable of handling larger spills.

Table L-3
Chukchi Sea-Based Equipment for
Oil-Spill Response on the Explorer III
Summer 1989

Item	Quantity
Kepner Reel Pak (2 @ 500' each)	1,000 feet
SPC sorbent pads	25 bales
3" MTM transfer pump with weir skimmer and hose	1

Source: Spiltec, 1989.

Table L-4
Chukchi Sea-Based Equipment on the M/V Robert Lemeur
Summer 1989

Item	Quantity
26' Munson aluminum workboats, each with two 140-hp motors	2
Kepner Reel Pak (500'/Pak) w/tow bridle assemblies, "T" connectors, and repair kit	2
Fire-resistant boom	1,000 ft
SLURP weir skimmer (57 lb) w/accessories	1
CSI rope mop skimmer w/200' mop, swivel base, and 3 tail pulleys	1
3M sorbent sheets (200 sheets/bale)	10 bales
3M sorbent rolls (38-lb/roll)	20 rolls
Barite-Bentonite	--
Lost circulation materials	--
10,000 gal storage container	1
2" trash pumps	2
2" diaphragm pump	1
60' lengths 2" suction hose (B.F. Goodrich)	10
30' lengths 2" suction hose (B.F. Goodrich)	5
Multiquip 5-kw generator	2
36' x 9' x 8' spill response building	1
Heavy Duty Electrical Extension cord	200 ft
Barrels, anchors, line, chain, buoys	--
Hand tools, shovels, etc.	--
Plastic liners and bags	--
Polyethylene sheeting	--
Plastic bags	--
Handtools	--

Source: Spiltec, 1989.

Table L-5
Chukchi Sea-Based Equipment on the Responder barge for Oil-Spill Response
Summer 1989[1]

ITEM	QUANTITY
34- x 12-ft tow boats with diesel inboard engines	2
26- x 8-ft aluminum workboats with two 140-hp outboard engines	4
18-ft Avon Searider rigid-hull inflatable boats	2
Kepner Reel Paks, 1,000 ft each with compactible 18- x 23-in boom	2
Kepner Reel Paks, 500 ft each with compactible 8- x 12-in boom	5
3M Fire Boom, 12- to 18-in diameters with 18- to 24-in skirts	3,600 ft
Rope mop skimmers	4
Halliburton Skimmering Barrier with boom, pump floats, reels, separators, etc.	1
SOCK (over-the-side skimmer with power pack, storage tanks, etc.)	1
Transrec Skimmer System (Framo/NOFO Type 250) with reel and power pack, 1,000 ft of NOAS (800 series) Ocean Boom on reel, and an Oil Trawl Collection System (over the side V-shaped barrier with net).	1
10-in Hyde-Vac Suction System (August 1989 delivery)	1
Walosep (WI Model) centripetal/weir skimmer with power pack	1
Komara Disc Skimmers with power pack	2
SLURP Skimmer (portable weir skimmer)	2
Hoses, various	4,150 ft
Pumps, various	4
200-bbl oil/water separators	2
100-bbl oil/water separators	2
Firestone Fabritanks (25,000 gal each)	2
Dracone Barges (2,500 gal each)	2
Bladders (2,500 gal each)	6
Bladders (10,000 gal each)	3
Simplex Helitorches	2
Dispersant spray bucket	1
Drums of Corexit 9527 dispersant	30
3M-type 100 sorbent sheets	40 rolls
3M-type 520 sorbent boom	120 bales
3M sorbent pads	100 bales
Bird scare-away cannons	10
7.5-kw generator	1
13.5-kw generator	1
Life-support boxes	2
Response boxes	2
90-hp Johnson Outboard	1
High-pressure washer	1
Batch mixer	1
Sure-Fire gelling mix	700 lbs

Source: Spiltec, 1989.

1 Below-deck storage tanks (9) on oil-spill-response barge will hold up to 67,000 bbl of recovered oil/water. This list is not a complete inventory.

Table L-5a
Onsite Spill-Response Equipment on Kulluk and Supply Boats
July 1, 1991

ITEM	QUANTITY
26-ft Munson aluminum workboats, each with two 140-hp motors	2
Kepner Reel Pack (500'/Pak)w/tow bridle assemblies, "T" connectors, and repair kits	2
Fire-resistant boom	1,000 ft
SLURP weir skimmer (57 lb) w/accessories	1
CSI rope mop skimmer w/200-ft mop, swivel base, and three tail pulleys	1
3M Sorbent sheets (200 sheets/bale)	10 bales
3M Sorbent rolls (38 lb/roll)	20 rolls
Barite	--
Bentonite	--
Lost circulation materials	--
10,000-gal storage container	1
2-in trash pumps	2
2-in diaphragm pump	1
60-ft lengths 2-in suction hose (B.F. Goodrich)	10
30-ft lengths 2-in suction hose (B.F. Goodrich)	5
Multiquip 5 kw generator	2
36-ft x 9-ft x 8-ft spill-response buildiung	1
Heavy duty electrical extension cord	200 ft
Barrels, anchors, line, chain, buoys	--
Hand tools, shovels, etc.	--
Plastic liners and bags	--
Polyethylene sheeting	--
Handtools	--

Source: Spiltec, 1990.

Table L-6
Response Equipment Maintained
by Alaska Clean Seas in Deadhorse
(July 1989)[1]

ITEM	QUANTITY
<u>DETECTION</u>	
Gas/Oxygen Detector	1
Gas Analyzer	1
Current Meters	2
Ice Auger	8
Orion Tracking System	2
Marker Stake	1,000
<u>CONTAINMENT</u>	
Goodyear Sea Sentry Heavy Duty Boom	2,035 ft
Kepner Compactible 11x15	5,400 ft
EPI Mini Boom	2,000 ft
American Marine Simplex Boom	3,000 ft
Kepner Reel Pak Boom	4,000 ft
Expandi Boom	4,500 ft
Fire Containment Boom	2,500 ft
<u>RECOVERY</u>	
ARCAT II with 12-man liferaft	1
3M Sorbent Boom Type 280	250 bales
3M Sorbent Roll 100	507 rolls
3M Sorbent Pad Type 151	290 bales
3M Sorbent Pad Type 157	400 bales
3M Sorbent Type 356C	85 boxes
MI-30 Disc Skimmer	1
Weir Skimmer	10
214-E Rope Mop Skimmer	10
Barracuda Rope Mop Skimmer	1
MW 62 Rope Mop Skimmer	1
Trans-Vac with Manta Ray Skimmer	2
Destroil Skimming System (pump and float)	1
Arctic Skimmer System (for <u>North Star</u> vessel)	1
Shallow Water Access Mop System (<u>Swamp</u>)	1
<u>DISPERSANTS</u>	
EXXON Corexit 9527	10 drums
ARCO Chem D-609	10 drums
Ship Spray Unit (for <u>ARCAT II</u>)	1
<u>DISPOSAL</u>	
Ignitors	1,700
Helitorch Aerial Ignition System	1
<u>STORAGE</u>	
Firestone Fabritank (2,250 gal)	20
Firestone Fabritank (4,400 gal)	4
Trellecon Bladder	1
Dracone Barge (2,400 gal)	4
Kepner Towable Bladder (1,200 gal)	3
ERI Air Berm (1,000 gal)	1
ERI Air Berm (2,000 gal)	2
ERI Air Berm (3,000 gal)	2
Fast Tank (rapide, 400 gal with liner)	1
Fast Tank (1,500 gal with liner)	2
Fast Tank (2,000 gal with liner)	2
<u>LOGISTICS - VESSELS</u>	
32-ft <u>North Star</u> Workboat	1
21-ft Munson Workboat	2
16-ft Grumman (with trailer and 25-hp outboard)	1
15-ft Gregor (with trailer and 15-hp outboard)	6

Source: The McCloskey Group, 1989.

[1] This is not a complete inventory.

Table L-7
Spill-Response Equipment Onboard the Drilling Barge Kulluk during 1989 Drilling of the Belcher Prospect in the Beaufort Sea

ITEM	QUANTITY
Kepner 48-in Inflatable Offshore Boom mounted on two Kepner Boom Reels	1,000 ft
Zoom 30-in Boom	600 ft
3M Fire-Resistant Boom	1,500 ft
Morris MI-30 Skimmer	2
Storage Bladder (12,000 U.S. gal)	1
Porta-Tanks Water Separator Box (1,200 gal)	2
Pumps	2
8 ft - 10 ft Sorbent boom	25 bales
18 in x 18 in x 3/8 in Sorbent pads	15 bales
36 in x 150 ft x 3/8 in Absorbent	12 rolls
Corexit 9527 dispersant	1 drum
Back pack dispersant spray unit	1
Hose	75 ft
Air-deployable ignitors	20
30-in Sea anchors	2
Orion Tracking Buoys	4

Source: The McCloskey Group, 1989.

1/ This is not a complete inventory.

Table L-8
Response Equipment Maintained by the Canadian
Beaufort Sea Oil Spill Cooperative at
Tuktoyaktuk, NWT, July 1989[1]

ITEM	QUANTITY
DETECTION	
Orion Tracker Buoys	16
Orion Receiver	2
Orion Antenna	1
Argos Buoys	4
Scott Comb. Gas/Oxy Tester	3
CONTAINMENT	
Fireproof Boom c/w ISO Container	250 ft
Arctic Boom Mod/	772,200 ft
36-in Containment Boom	5,100 ft
Bennett Inshore Boom	2,000 ft
RECOVERY	
Morris M130 Skimmer	4
6-in Oil Mop Skimmer	1
Rope Mop Skimmer	1
Slurp Skimmer	1
Lockheed Skimmer	1
DISPOSAL	
100-bbl/day Saacke Burners	2
Dispersant spray system	1
Air-deployable ignitors	2,000
Simplex Heli-Torch	1
TRANSFER	
Oil Separator	1
Pumps, various	9
STORAGE	
Porta Tanks (1,200 U.S. gal)	8
10,000-gal Uniroyal Bladders	3
1,000-gal Canflex Bladders	15
1,000-gal Open-top Canflex Bladder	1
LOGISTICS--VESSELS	
Carrier II Sea Truck (Twin 70 Merc)	1
90-hp Outboard	2
Zodiac with 20-hp outboard	1
39-ft Deployment outboard vessel (Carrier 5)	1
Hiab Model Crane on Carrier 5	1
14-ft Deployment vessel	1
16-ft Deployment vessel	1
27-ft Jet boat	1
LOGISTICS--COMMUNICATIONS	
Marconi DT 39 Radios	3
Raytheon FM Radios	6
Marconi Radios	8
Chargers for above radios	5
Lorad VHF Portable Radios	5
SMR VHF 78 CB Radio	3
LOGISTICS--ANTI-POLLUTION BARGE II	
Barge, 216 ft x 49.5 ft x 9.6 ft, complete with but not limited to the following equipment:	
Free-water knockout system	1
VEP Skimmer	1
Watson Heater Treater/Upgrading	1
5000-bbl/day burner with boom	
1000-gal fuel tanks	2
Oil and water pumping system	1

Source: The McCloskey Group, 1989.

[1] This is not a complete inventory.

Only onsite equipment and that which could be transported from Deadhorse by helicopter could meet this guideline for deployment for most of the sale area. The limited geographic and temporal presence of open water and slow vessel speeds in broken ice would preclude timely transport of spill equipment by sea. For larger spills--those that could exceed the local cleanup-response capability--MMS, Alaska OCS Region, requires that additional equipment be available onsite within 48 hours.

Additional response equipment to handle a large spill in the Chukchi Sea--those that exceed the local cleanup-response capability--would be available from a multitude of sources. Many of these sources and their equipment lists have been inventoried for potential use in the Chukchi Sea, in Alaska Clean Seas (1984), and in the individual oil-spill-contingency plans of lessees. Estimated response times for mobilization and transport of equipment to Prudhoe Bay from these additional sources are given in Table L-9 for air transport and in Table L-10 for sea transport. Equipment stored in Anchorage also could be trucked to Prudhoe Bay within 32 to 40 hours, not including mobilization and loading/unloading times. Mobilization and air-transport times needed to airlift spill-cleanup equipment to Deadhorse would range from 3.3 to 13 hours from sources in Alaska and on the Pacific Coast, assuming available C-130 transport and good weather. Sea transport from Alaskan and other U.S. ports to Prudhoe Bay would not be possible without icebreaker support except during a brief period of relatively open water in late summer. Equipment could reach a summer-spill site by vessel in the Sale 126 area within 1.3 to 3 days from Canadian Beaufort Sea and Chukchi Sea equipment sites. The estimate for the Chukchi Sea assumes an airlift between Kotzebue and Deadhorse.

Thus, additional equipment would be most rapidly and readily available from the Canadian Beaufort Sea area. Flight time for a C-130 between Deadhorse and Tuktoyaktuk would be about 1 hour. Equipment could be shipped from the Canadian Beaufort Sea over a period of 2 to 3 months. U.S. Customs regulations would not interfere. Spill equipment to be used in the proposed sale area would require only a courtesy call to U.S. Customs, who should be notified before equipment is brought within the 3-mi limit, unless true emergency conditions exist. In the latter case, U.S. Customs would accept after-the-fact notification (Union Oil Company of California, 1985).

Equipment stored at Deadhorse or airlifted to Deadhorse would be capable of meeting the criteria of the 48-hour-response time set by MMS. Additional, slower-arriving equipment would still be useful in case of a major spill; but MMS would not consider such equipment in judging whether oil-spill-contingency plans met the MMS 48-hour-response criteria.

Once spill-cleanup equipment reaches Deadhorse or Prudhoe Bay, it could be transported relatively quickly to the spill site within the Chukchi Sea only if it could be carried by helicopter and then only if weather permitted. A helicopter could reach any point in the Sale 126 Area within 3 hours, weather permitting. Pack ice would prohibit ship transport other than by icebreaker over most of the Sale 126 area for most of the year, including summer. Land-vehicle transport of spill equipment would not be safe across appreciable distances on pack ice.

(5) Drills: A drill for familiarization with pollution-control equipment and operational procedures must be held at least once every 12 months. Drill conditions must simulate conditions in the area of operations. In the summer 1989 drilling season, two drills were held by SWEPI. On July 11 and 12, 1989, two days after drilling started at the Klondike Prospect, the first Oil Spill Response Drill (OSRD) occurred in open waters west of Kotzebue Sound. At that time, response equipment, as listed in SWEPI's OSCP, was inspected to ensure all response equipment listed was in place. Table L-11 lists the equipment deployed during the OSRD. In 1990, SWEPI conducted an OSRD in Port Clarence to the satisfaction of MMS.

A Table-Top and Communications Oil-Spill Response Exercise occurred on September 27, 1989, 87 days into a 109-day drilling season. The purpose of the table-top exercise was to evaluate SWEPI's familiarization with the OSCP and communications, and to ensure that the designated spill coordinator was prepared to coordinate a major spill response. This is the first table-top exercise in the Alaska OCS Region. The table-

Table L-9
Estimated Response Times for Mobilizing and
Transporting Equipment to Deadhorse by Air-Cargo Transport

Equipment Owner	Storage Location	Estimated Mobilization Time[1/] (Hours) (Min.)	(Max.)	Transportation Time to Deadhorse[2/] (Hours)	Total Response Time to Deadhorse[3/] (Hours) (Min.)	(Max.)
Alaska Clean Seas	Anchorage	2	5	1.9	3.9	6.9
Beaufort Sea Oil Spill	Tuktoyaktuk	2	4	1.0	3.0	5.0
Alyeska Pipeline Service Company	Valdez	2	5	2.4	4.4	7.4
Cook Inlet Response Organization	Kenai	2	5	2.0	4.0	7.0
	Anchorage	2	5	1.9	3.9	6.9
U.S. Coast Guard	Kodiak	2	5	2.6	4.6	7.6
	Anchorage	2	5	1.9	3.9	6.9
VRCA Environmental Service	Prudhoe Bay	2	5	0	2.0	5.0
	Fairbanks	2	5	1.3	3.3	6.3
	Anchorage	2	5	1.9	3.9	6.9
	Kenai	2	5	2.0	4.0	7.0
Clean Sound	Seattle	2	5	6.1	8.1	11.1
Clean Bay	Concord	2	5	7.1	9.1	12.1
Clean Seas	Santa Barbara	2	5	7.9	9.9	12.9
Clean Coastal Waters	Long Beach	2	5	7.9	9.9	12.9
U.S. Navy	Stockton	2	5	7.1	9.1	12.1

Source: The McCloskey Group, 1989; Spiltec, 1989.

1/ Estimated mobilization times were supplied by equipment owners and are overall ranges that are nonspecific to the type or quantity of equipment required.
2/ Estimated transportation times based on C-130 flight characteristics (300-kn flight speed).
3/ Total response times are the sum of estimated mobilization time and travel times by C-130. They do not include the amount of time required to load the equipment or variations in travel time arising from adverse climatic factors that might be encountered enroute.

Table L-10
Estimated Response Times for Mobilizing and
Transporting Equipment to the ABSORB Area by Surface Vessel[1]

Equipment Owner	Storage Location	Estimated Mobilization Time[2] (Hours)	Estimated Travel Time to Prudhoe Bay (10 Knots)[3] (Days)	(Hours)	Total Response Time[4] Minimum (Days)	Minimum (Hours)	Maximum (Days)	Maximum (Hours)
Alaska Clean Seas	Anchorage	2-5	8	19	8	21	9	0
Cook Inlet Response Organization	Kenai	2-5	8	1	8	3	8	6
U.S. Coast Guard	Kodiak	2-5	8	1	8	3	8	6
	Anchorage	2-5	8	19	8	21	9	0
Beaufort Sea Oil Spill Cooperative	Tuktoyaktuk	2-4	1	6	1	8	1	10

Source: The McCloskey Group, 1989; Spiltec, 1989.

[1] Surface-vessel transportation is available only during the open-water season around Point Barrow. This season is of limited duration--typically 6 to 8 weeks per year.

[2] Estimated mobilization times were supplied by the equipment owners and are overall ranges that are nonspecific to the type or quantity required; vessel availability is assumed.

[3] Travel times to site are from ports near the storage sites to a hypothetical spill site in the ABSORB CPA. These estimates do not include the amount of time required to unload the equipment at the site or variations in travel time arising from adverse climatic factors.

[4] Total response times indicated are the sum of estimated mobilization times and travel times to the spill site.

Table L-11
Spill-Response Equipment Deployed During
SWEPI Oil-Spill-Response Drill for 1989

ITEM		QUANTITY
26'	Munson aluminum workboats	2
34'	aluminum workboats	2
18'	Avon Searider rigid-hull inflatable boat	1
	Transrec Skimmer/Oil Trawl Collection System	1
18" X 23" Kepner Reel Pak compactible boom		1,000 ft
SOCK skimmer		1
Halliburton Skimming Barrier		1

Source: USDOI, MMS, 1989.

top exercise demonstrates communication capabilities and the spill-response coordinators' familiarity with the equipment, strategies, and responses listed in the OSCP. However, as designed, it would be difficult for this type of exercise to demonstrate or assess the capability of a company to actually mobilize a major response effort. In 1990, SWEPI conducted a second Table-Top and Communications Oil-Spill-Response Exercise to the satisfaction of the MMS.

(6) Dispersant Equipment: It is SWEPI's position that physical containment and removal techniques and the possible burning of oil would normally be used in lieu of any chemical dispersants for response to an oil spill in the Chukchi Sea. If relatively fresh oil could move into a region where surface contac, with birds, bears, or whales were highly likely, dispersant use might provide a significant backup-response option. Because dispersant use involves sophisticated equipment and skilled personnel and because it is subject to stringent regulatory control, SWEPI will use trained personnel within its own organization, from ACS, from CIRO, and from contract application firms for any treatment operation. Table L-5 lists dispersant and application equipment availability (Spiltec, 1989). Texaco would evaluate physical-containment and removal techniques and the possible burning of oil, as well as the use of dispersants for response to a spill in the Chukchi Sea. The 30 drums of Corexit 9527 and the helicopter spray bucket aboard the spill-response barge would allow for the immediate treatment of a small operational spill or for the the partial treatment of a major spill (Spiltec, 1990). Should the experimental treatment of a larger spill look promising, backup chemicals and additional application systems could be called for from Deadhorse, Anchorage, Arizona, or British Columbia (Spiltec, 1990).

(7) Disposal: SWEPI'S planned storage/disposal methods include: in-situ burning, incineration, flaring at Marathon's flaring system in Cook Inlet, flaring from a barge offshore, and/or burial/landfills at the North Slope Borough facility at Deadhorse and North Star Borough near Fairbanks (Spiltec, 1989). Texaco's planned storage-disposal methods include Marathons's in-place flaring system in Cook Inlet, flaring from a barge offshore, systems currently available through ABSORB and the Canadian Beaufort Sea Oil Spill Cooperative, burning; and, as necessary, barges and/or tankers could be used to transport recovered oil/water to refineries/incinerators outside Alaska. Regardless of the disposal method, Federal and State government approval is required.

(8) Early Detection, Monitoring and Predicting Spill Movement: Daily pollution inspections are required under 30 CFR 250.41, and inspection records are required to be documented. Orion tracking buoys, radar reflectors (floats), and ice-marking dye were added to the list of equipment to be on the Oil-Spill-Response Barge after MMS assigned a task force to review SWEPI's OSCP. In addition, three Orion tracking systems are located at Deadhorse. These radio-outfitted buoys move with an oil slick. A receiver with a directional antennae can locate the buoy position. Depending on the weather, this system could be available within 12 hours. Texaco would have the same spill tracking equipment available as SWEPI.

IV. EFFECTIVENESS OF OIL-SPILL CLEANUP AT SEA

The 6-to-12-hour and 48-hour response times required of drilling lessees by MMS, Alaska OCS Region, are mobilization and deployment requirements. Cleanup would continue as long as necessary, without any timeframe or deadline. For example, a winter spill in pack ice might require initial onsite response followed by further cleanup of oil melting out and pooling on top of the ice in late spring or summer.

Mechanical cleanup at sea usually is much more effective on low- or mediumviscosity oils than on high-viscosity oils. A low-viscosity oil could be a diesel or fresh, light crude. A medium-viscosity oil could be a lubricating oil or a light, flowing emulsion. A high-viscosity oil would be a weathered crude, bunker oil, or thick emulsion. An oil such as Prudhoe Bay crude initially would have low viscosity but would quickly weather and form an emulsion. In the presence of broken sea ice, this transformation may take as little as 4 hours (Payne, 1984); in the absence of sea ice, it may take perhaps 2 days (Payne et al., 1984). For the summer, 22,000-bbl example in Table L-1, based on the weathering model of Kirstein, Redding (1988), Prudhoe Bay crude would weather into a high-viscosity oil within 4 hours of spillage. The effectiveness of most forms of mechanical recovery of the crude would decrease twofold over this 4-hour period.

Oleophilic-rope recovery systems are a relevant exception to this twofold decrease in oil-recovery rate with increasing oil viscosity. The Alaska Clean Seas has emphasized such devices in its arctic contingency strategy, including development and deployment of the oleophilic-rope skimmer, the ARCAT II. Oleophilic-rope systems at medium international sea states, between Sea State 1 and Sea State 3, could recover high-viscosity oil more readily than lesser viscosity oils. At a lower sea state (Sea State O), highly viscous oils could be recovered at 69 percent of the rate for low-viscosity oils (S.L. Ross Environmental Research Ltd., 1983a).

Chemical dispersion--the use of dispersants to mix the oil into the water rather than attempt to recover the spilled oil--is an alternative technique to mitigate spill damage. Dispersants lose effectiveness even more rapidly than mechanical recovery as oil weathers and becomes more viscous. Oils with in situ viscosities greater than 2,000 centistokes usually cannot be dispersed (The International Tanker Owners Pollution Federation, Ltd., 1982a,b). Based on the weathering model of Kirstein and Redding (1988), under the conditions in Table L-1 for a summer spill of 22,000 bbl, such viscosities would be reached by Prudhoe Bay crude about 8 hours after spillage. In the presence of sea ice, the rapid formation of mousse could preclude effective use of dispersants in even a shorter period of time. Best use of dispersants obviously occurs when they could be applied immediately after the spill has occurred (or near the point of spillage for a continuing spill).

Use of dispersants to treat an oil spill, however, requires the OSC to have the concurrence of the EPA representative to the Government Regional Response Team (RRT) and also the concurrence of the State's representatives. Historically, such permission has been difficult if not impossible to obtain. The reason for this difficulty lies in the perceived toxicity of oil-dispersant mixtures, in questions as to the effectiveness of the dispersant, and in the fact that dispersants remove oil only from the surface of the water and not from the water environment. Detailed information on the effectiveness of a specific dispersant on a specific spilled oil as a function of air and water temperature, dispersant concentration, and age or weathered state of the slick--as well as detailed information on the proposed dispersant-application system--are necessary for an informed RRT decision on dispersant use. Such parameters would be known when any spill-contingency plans were written for production, and approval for dispersant use would be, in theory, more likely during production than has been the case during exploration. In practice, dispersant use may be unlikely even for production oil spills. The RRT had released guidelines for dispersant use in Cook Inlet and Prince William Sound. Inability to demonstrate and evaluate dispersant effectiveness on the Exxon Valdez spill in Prince William Sound in a timely fashion and slowness in mobilizing both dispersants and delivery systems, however, negated potential effectiveness. The USCG OSC decided that no significant proportion of oil was chemically dispersed from the Exxon Valdez spill.

The post-Exxon Valdez report to the Secretary of the Interior by MMS (USDOI, MMS, OCS Oil Spill Task Force, 1989) concluded that "Dispersants have been found to be routinely ineffective in open-ocean application."

The National Research Council (NRC) was requested to "review the state of knowledge in toxicity, effectiveness of application techniques, and effectiveness of commercially available dispersants." In response, the Commission on Engineering and Technical Systems of the NRC convened the Committee of Effectiveness of Oil Spill Dispersants. The committee report, "Using Oil Spill Dispersants on the Sea," reflects a broad database.

Dispersant toxicity depends on concentration, duration of exposure and type of organism. The primary components of dispersants are crucial for evaluating toxicity. All surfactants are toxic at high concentrations. Among the factors controlling toxicity of surfactants to aquatic organisms are ethoxylate chain lengths, presence to esthers versus ethers, and hydrophillic-lipophillic balance (Wells, 1984). The toxicity of dispersant formulations has been studied; a wide range of values is reported (NRC, 1989: Table 3-5). The toxicity of dispersant formulations is influencd by physiochemical and biological factors. These factors are important because toxicity estimates are relative; they depend on the environmental conditions and biological populations being exposed (NRC, 1989).

Because of natural dispersion, oil slicks of less than 10,000 bbl in the open ocean are seldom tracked for more than about 10 days before the oil becomes too dispersed to locate or identify as a slick. Out of necessity or otherwise, natural dispersion has frequently been the chosen response technique in Alaskan waters. The F/V Ryuyo Maru No. 2 grounded off St. Paul Island in 1979. Fuel oil on board could not be safely removed, and the vessel was deliberately blown up at a time when weather would maximize natural dispersion (Reiter, 1981). In Kuskokwim Bay in the summer of 1982, the Cornell Barge No. 8 sunk, spilling some but not all of its load of fuel oil. The remaining fuel oil was deliberately released and allowed to disperse by the Coast Guard. Accidental and deliberate release totaled 2,190 bbl over 3 weeks (Oil Spill Intelligence Report, 1982). The observed slick extended no more than 1 km from the barge, indicating a slick life of no more than a few hours. The tanker Cepheus grounded in Anchorage Harbor and spilled 5,000 bbl of fuel in January 1984. Because of the presence of broken ice in surrounding waters, the spill could not be tracked and no cleanup occurred away from the tanker, but no slick was ever found.

Oil spills do not always disperse this rapidly or completely. Generally, the more asphaltic the oil, the larger the spill, the calmer the water, and the more restricted the water body, the longer a spill would persist. Oil on the water from the Exxon Valdez closed several State salmon fisheries 5 months after the 260,000-bbl spill.

Uncontained burning also is a possible spill remedy. Experiments suggest that burn efficiencies on the order of 50 to 60 percent may be possible if the spill could be immediately set on fire (Laperriere, 1984). However, any delay in ignition would decrease combustion efficiency. In the Exxon Valdez spill, spilled oil was still burnable on day 3, but not after the storm that occurred at the end of day 3.

Thus, the effectiveness of both mechanical recovery and in situ burning of spilled oil at sea decreases rapidly with increasing sea state (roughness of the sea). However, in such worsening sea state, the effectiveness of dispersants and natural dispersion increases. According to S.L. Ross Environmental Research Ltd. (1983a), mechanical cleanup becomes nonfunctional between International Sea States 3 and 4. However, a recent reevaluation of the effectiveness of response equipment by USDOI (USDOI, MMS, OCS Oil Spill Task Force, 1989) following the Exxon Valdez spill concluded that most response equipment available in the U.S. can operate in Sea State 2 or less (waves less than 2-4 ft and winds less than 10-15 kn), although some equipment operates in higher sea states.

Based on this MMS evaluation, sea states would exceed the capabilities of response equipment from 9 to 24 percent of the time in summer months--the range in occurrences of Sea States of 3 or greater--in the Chukchi Sea Planning Area. Ice cover the remainder of the year would eliminate both high sea states and standard uses of most mechanical-response equipment.

This relatively poor rating of response equipment by the MMS task force was attributed in part by the task force to lack of MMS standard protocols for evaluating and comparing equipment performance. That is, MMS has no formal protocol or quantitative procedures for evaluating whether response equipment proposed by lessees is "state-of-the-art" as required by MMS guidelines for oil-spill-contingency plans or something less. Based on the MMS task force analysis, offshore-response equipment in U.S. waters does not meet the level of performance required by MMS Alaska OCS Region Planning Guidelines for Approval of Oilspill Contingency Plans, "state-of-the-art" equipment capable of operating in 8- to 10-ft. seas and 20-kn winds, which are sea conditions equivalent to International Sea State 5. The MMS task force has recommended that MMS establish a standard test protocol for offshore booms and adopt an existing protocol for oil skimmers to define "state-of-the-art" and minimum performance requirements. These recommendations have been presented to the Secretary of the Interior.

In real spill situations, optimum efficiency of cleanup equipment is seldom reached. To some extent, bad weather, equipment failures, and personnel problems could be factored into estimates of cleanup efficiency in oil-spill-contingency plans. In practice, such estimates are usually found to be overly optimistic. Spill cleanup generally requires unexpected modification of procedures and equipment. Equipment or people often do not work as well as hypothesized. This was demonstrated in both the 1987 Glacier Bay and 1989 Exxon Valdez spills of TAP crude in Alaskan coastal waters.

The MMS, Gulf of Mexico (GOM) OCS Region (USDOI, MMS, GOM, 1983), reviewed the historical record of oil-spill cleanup at sea and concluded that such cleanup is usually not very efficient:

> Offshore containment/cleanup operations are generally a major task requiring significant coordination and cooperation, transportation of large equipment, vessel support, aircraft support, set-up and maintenance of a command/coordination post in the field, and properly staged and available equipment. Often, the weather/sea conditions and crew fatigue become the critical factors during offshore operations. The effectiveness of containment/cleanup operations offshore are, in general, marginally effective. It is possible to contain a platform spill if environmental and logistical conditions are right; however, it has been found through experience that conditions are rarely ideal and full containment of a platform spill is not likely. The effectiveness of this type of containment and cleanup operation is estimated to be approximately 5 percent to 15 percent recovery.

Inshore containment/cleanup operations could be either large-scale or moderately sized operations, depending on any particular spill situation. Again, if the task becomes large it requires the same level of coordination and support as an offshore operation. The effectiveness of a containment/cleanup operation in an inshore area largely depends on the unique physical characteristics of the environment and the area of the operation. Beach cleanup is normally effective utilizing hand labor, organic sorbents, and a wide variety of tools from rakes to bulldozers. Utilizing booms and skimmers, containment of a spill moving into an inlet is marginally successful, depending almost entirely on the physical characteristics of the inlet. Containment and cleanup in marshes is very controversial. Modern opinions often lean towards the "NO ACTION" strategy for fear of cleanup operations causing even more damage. The effectiveness of inshore containment cleanup operations could often be much greater than offshore operations. Effectiveness is estimated to be 20 percent to 50 percent containment and cleanup of material moving into the area.

V. EFFECTIVENESS OF OIL-SPILL CLEANUP IN ICE

When a spill is dispersed far from its source or when ice is moving, containment and cleanup are more difficult. Planning an effective surface response with mechanical equipment to spills in pack ice would require that an icebreaker (or icebreaking-supply ship) be locally stationed in both winter and summer as a dedicated oil-recovery vessel (Tebeau, 1987). Icebreakers are expected to be present in the Sale 126 Area during both exploration and production. An appropriate example of such operations would be the exploration drilling conducted by a drillship on Sale 109 leases in the summer of 1989. The drillship was accompanied by three icebreaker/supply vessels that "managed" the ice at the drill site.

In situ burning of spilled oil during heavy ice periods may be a more promising approach. Buoys or other markers would be placed on the ice to track under-ice spills. Exposed oil would be ignited whenever possible.

Existing response capabilities are more effective on landfast ice than on broken or pack ice. Spills on top of landfast ice could be cleaned up fairly easily as long as oil is not pooled to sufficient depth (on the order of several centimeters) to crack the ice and allow some of the oil to flow underneath the ice (Shell Western E&P, Inc. et al., 1984).

Cleanup effectiveness for oil under landfast ice has been measured by Buist, Pistruzak, and Dickins (1981).

Buist, Pistruzak, and Dickins conducted three simulated undersea blowouts totaling 119 bbl under landfast ice in the Canadian Beaufort Sea. The following spring, as the oil rose to the surfaceand pooled on the ice, as much oil as possible was burned or manually recovered. Cleanup efforts ceased only when breakup occurred and the remaining oil naturally dispersed. A total of 125 burns were conducted, more than one burn for each barrel of oil spilled. Overall burn efficiency averaged 51 percent, with average burn efficiencies ranging from 18 to 77 percent in the three spill experiments. An additional 28 percent of the oil (range of 14-51%) was manually recovered. The manual cleanup was labor-intensive, requiring 0.7 man-days per barrel or 350 man-days per square kilometer. Overall, 79 percent (range of 67-88%) of the weathered oil was burned or manually recovered.

Spills in broken or moving ice would be more difficult to handle. The greatest success would be expected when the spill is contained within a small area close to the source of the spill. The ice itself may be useful in restricting the spreading of the oil, keeping the oil thicker and more amenable to burning.

Oil melting out of pack ice would be much more difficult to burn than oil in the Buist, Pistruzak, and Dickins (1981) study. Oil would melt out of pack ice much more slowly than from landfast, first-year ice; some oilwould even take a second summer to reach the top of the ice (see Sec. I of this appendix). In addition, a stationary but continuing spill could spread a ribbon of oil underneath many or even hundreds of kilometers of pack ice (see Sec. IV.N). The manufacture, shipment, temporary storage, and deployment of igniters, helitorches, or gelled gasoline necessary to ignite thousands of oiled melt pools from a major spill is a logistical nightmare.

Burning experiments in broken ice have given promising results with fresh oil, but results have been variable and less promising with weathered oil and emulsions. Field tests in a mud pit at Prudhoe Bay were able to burn 55 to 85 percent of fresh Prudhoe Bay crude, but crude with a flash point of over 30°F could not be ignited (Shell Oil Company et al., 1983). Tests at OHMSETT for fresh crude had burn efficiencies of 85 to 95 percent at 22- to 34-percent ice cover and burn efficiencies of 58 to 79 percent at 78- to 85-percent ice cover. Burn efficiencies of two tests for oil-in-water emulsions were only 10 to 52 percent at 78- to 84-percent ice cover (Smith, unpublished). Some oil burned against retaining barriers in both the field and OHMSETT tests; and the efficiencies are somewhat higher than could be expected for a true, uncontained burn in broken ice. Payne (1984) found that emulsification is accelerated in broken ice (occurring within 4 hours), indicating that a slick would have to be set on fire very soon after spillage in order to obtain a high burn efficiency.

It may be more difficult to burn spilled oil during freezeup than at any other time of year. Martin (1981) has shown that wave action mixes the oil downward into the grease ice. Oil and ice would have to be recovered and the oil separated from ice before burning; there would be only a limited capability for in situ burning.

Partly because of oil-spill risks during broken ice, the State of Alaska has applied two sets of seasonal drilling restrictions in State waters of the Beaufort Sea. Tier-I regulations prohibit drilling during periods of broken ice, during some periods of open water for locations outside the barrier islands, and during the fall bowhead whale migration and freezeup for locations outside the barrier islands. Tier-II regulations allow unrestricted drilling in State waters, with the exception of locations outside the barrier islands during the fall bowhead migration and freezeup. The Tier-II level applies only to "lessees who demonstrate compliance with applicable laws and regulations, including the theoretical and physical capability to detect, contain, and clean up and dispose of spilled oil in broken ice conditions" (see Shell Oil Company et al., 1983).

In 1983, several oil companies participated in a review of applicability of current cleanup techniques to broken-ice conditions (Industry Task Group, 1983) and field demonstrations of capabilities during breakup of landfast ice (Shell Oil Company et al., 1983). A third report (Shell Western E&P, Inc. et al., 1984) provided additional technical documentation of review and demonstrations and constitutes a state-of-the-art manual for cleanup during breakup of landfast ice in the Beaufort Sea.

The cooperative review, the field demonstrations, and resulting reports considered only breakup conditions. Freezeup conditions were deemphasized because of the existence of a seasonal drilling restriction in State waters during the fall bowhead migration.

The State of Alaska had an independent consultant evaluate this demonstration of industry's capabilities (S.L. Ross Environmental Research Ltd., 1983b) and, based on that and its own analysis, granted Tier-II status to the participating oil companies. The conclusion of S.L. Ross Environmental Research Limited provides a concise summary of oil-spill-countermeasure capabilities of industry in broken-ice conditions:

> The industry's technological capability is judged to be very good for removing oil discharged from a large oil well blowout occurring on a gravel island in the Alaskan Beaufort Sea during broken ice conditions (as well as during periods of landfast ice and open water); this is only the case if the blowout is ignited and/or combustion and skimming techniques take place in close proximity to the island. . .. Although industry's overall response capability for gravel-island oilwell blowouts is very good (by virtue of oil burning procedures at or near the well-head) the fact remains that the capability to clean up large oil spills floating amongst moving ice is generally not good, particularly if the oil is thin and weathered.In other words, industry couldeffectively clean up an oil spill in moving ice only if the spill is a platform blowout that could be set on fire without endangering platform integrity. If this is the case, the platform could still be used as a base for cleanup and well-control operations.

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GLOSSARIES

GLOSSARY OF ACRONYMS AND INITIALISMS
(Includes Common Abbreviations and Symbols)

AAC	Alaska Administrative Code
ABSORB	Alaska Beaufort Sea Oilspill Response Body
ACI	Alaska Consultants, Inc.
ACMA	Alaska Coastal Management Act
ACMP	Alaska Coastal Management Program
ACORP	Alaska Cooperative Oilspill Response Planning Committee
ACS	Alaska Clean Seas
ADEC	Alaska Department of Environmental Conversation
ADF&G	Alaska Department of Fish and Game
AEIDC	Arctic Environmental Information and Data Center
AEWC	Alaska Eskimo Whaling Commission
AHF	Allan Hancock Foundation
AINA	Arctic Institute of North America
AMOP	Arctic and Marine Oilspill Program
AMSA	Area Meriting Special Attention
ANCSA	Alaska Native Claims Settlement Act
ANHB	Alaska Native Health Board
ANILCA	Alaska National Interest Lands Conservation Act
ANWR	Arctic National Wildlife Refuge
AOGA	Alaska Oil and Gas Association
APD	Application for Permit to Drill
APFRT	Arctic Peregrine Falcon Recovery Team
API	American Petroleum Institute
ARBO	Arctic Region Biological Opinion
AS	Alaska Statute
ASRC	Arctic Slope Regional Corporation
BACT	best available control technology
BAST	best available and safest technology
bbl	barrel, barrels
Bbbl	billion barrels
BEM	Branch of Environmental Modeling (MMS, Reston, Va.)
BIA	Bureau of Indian Affairs
BIOS	Baffin Island Oil Spill Project
BLM	Bureau of Land Management
BOP	blowout preventor
B.P.	Before the present [time]
bpd	barrels per day
BTF	Biological Task Force
C	carbon
°C	degrees Centigrade or Celsius
CAH	Central Arctic herd
Call	Call for Information and Nominations
CASPPR	Canadian Arctic Shipping Pollution Prevention Regulations
CDU	Conical Drilling Unit
CDF&G	California Department of Fish and Game
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CETA	Comprehensive Employment and Training Act
cf	cubic feet
CFR	Code of Federal Regulations
CIDS	Concrete Island Drilling System

GLOSSARY OF ACRONYMS AND INITIALISMS
(Continued)

CIP	Capital Improvements Program (North Slope and Northwest Arctic Boroughs)
CIRO	Cook Inlet Response Organization
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
cm/sec	centimeters per second
CMP	Coastal Management Program
COE	Corps of Engineers (U.S. Army)
COST	Continental Offshore Stratigraphic Test
CPA	Cost Participation Area
CPC	Coastal Policy Council (State of Alaska)
CRSA	Coastal Resource Service Area
CZM	coastal zone management
CZMA	Coastal Zone Management Act
dB	decibels
DEC	Department of Environmental Conservation (State of Alaska)
DEIS	draft environmental impact statement
DGC	Division of Governmental Coordination (State of Alaska)
DNR	Department of Natural Resources (State of Alaska)
DPP	Development Production Plan
DST	deep-stratigraphic test
DWT	deadweight tonnage
EA	Environmental Assessment
E&D	Exploration and Development (Report)
EEZ	Exclusive Economic Zone
EIS	environmental impact statement
EP	exploration plan
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program
EWC	Eskimo Whaling Commission
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FEIS	final environmental impact statement
FERC	Federal Energy Regulatory Commission
FR	Federal Register
ft	foot
FWS	Fish and Wildlife Service (U.S.)
FY	fiscal year
g	grams
GIS	Geographic Information System
HRD	High-resolution seismic-reflection data
HUD	Department of Housing and Urban Development

GLOSSARY OF ACRONYMS AND INITIALISMS
(Continued)

ICAS	Inupiat Community of the Arctic Slope
in	inch
IPP	Intergovernmental Planning Program
IRA	Indian Reorganization Act
ISER	Institute of Social and Economic Research (UAA)
ISHTAR	Inner Shelf Transfer and Recycling Program
ITL	Information to Lessees
ITM	Information Transfer Meeting
ITU	Integrated Terrain Units
IUM	Information Update Meeting
IWC	International Whaling Commission
JRT	Joint Response Team
kg	kilogram
km	kilometer
km^2	square kilometer
kW	kilowatt
LC_{50}	lethal concentrations at which half the organisms die
LMR's	Land Management Regulations
LNG	liquefied natural gas
m	meter
m^2	square meter
m^3	cubic meter
MARPOL	United Nations Marine Pollution Convention, Annex V
Mbbl	thousand barrels
mi	mile, miles
min	minute
ml	milliliter
MOU	memorandum of understanding
mm	millimeter
MMbbl	million barrels
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MRSC	Marine Spill Response Corporation
m/sec	meters per second
NANA	Northwest Alaska Native Association
NAQS	National Air Quality Standards
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
nmi	nautical mile
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOS	Notice of Sale

GLOSSARY OF ACRONYMS AND INITIALISMS
(Continued)

NPDES	National Pollution Discharge Elimination System
NPR-A	National Petroleum Reserve-Alaska
NPS	National Park Service
NRC	National Research Council
NSB	North Slope Borough
NSBCMP	North Slope Borough Coastal Management Program
NTL	Notice to Lessees
NWAB	Northwest Arctic Borough
NWAFC	Northwest and Alaska Fisheries Center
OCD	Offshore and Coastal Dispersion (Model)
OCRM	(Office of) Ocean and Coastal Resource Management
OCS	outer continental shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act of 1953
OCSLAA	Outer Continental Shelf Lands Act and Amendments
OGJ	Oil and Gas Journal
OMB	Office of Management and Budget (State of Alaska)
OOC	Offshore Operators Committee
OPEC	Organization of Petroleum Exporting Countries
OSC	on-scene coordinator
OSCP	Oil-Spill-Contingency Plan
OSRA	oil-spill-risk analysis
OSRD	oil-spill-response drill
OTA	Office of Technology Assessment (U.S. Congress)
PAH	polycyclic aromatic hydrocarbons
PBU	Prudhoe Bay Unit
PIRO	Petroleum Industry Response Organization
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PSD	Prevention of Significant Deterioration
RD	Regional Director
RRT	Regional Response Team
RS	Regional Supervisor
RSFO	Regional Supervisor, Field Operations
RTWG	Regional Technical Working Group
RU	Research Unit
SID	Secretarial Issue Document
SMA	spring migration area
SESP	Socioeconomic Studies Program
SHPO	State Historical Preservation Office/Officer
SO_2	sulfur dioxide
SOA	State of Alaska
SRA	Subsistence Resource Area
SSDC	Single Steel Drilling Caisson
SWEPI	Shell Western Exploration and Production, Inc.

GLOSSARY OF ACRONYMS AND INITIALISMS
(Continued)

TAP	Trans-Alaska Pipeline
TAPS	Trans-Alaska Pipeline System
TA&RP	Technology Assessment and Research Program
TSP	total suspended particulates
UAA	University of Alaska
USCG	United States Coast Guard
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOE	U.S. Department of Energy
USDOI	U.S. Department of the Interior
USGS	United States Geological Survey
VLCC	very large crude carrier
VOC	volatile organic compound
WSF	water-soluble fraction

Symbols

$^{\circ}$	degrees (Fahrenheit or Centigrade)
$^{\circ}/_{oo}$	parts per thousand (salinity)
$>$	greater than
$\geq$	greater than or equal to
$<$	less than
$\leq$	less than or equal to
μ	Greek "mu" = "micro"
μg	microgram
$\pm$	plus/minus

INDEX

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.