OCS EIS/EA
MMS 87-0110

Alaska Outer Continental Shelf

Chukchi Sea
Oil & Gas Lease Sale 109

Final Environmental Impact Statement

Volume II

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

This Environmental Impact Statement (EIS) is not intended, nor should it be used, as a local planning document by potentially affected communities. The facility locations and transportation scenarios described in this EIS represent assumptions that were made as a basis for identifying characteristic activities and any resulting environmental effects. These assumptions do not represent a Minerals Management Service recommendation, preference, or endorsement of any facility, site, or development plan. Local control of events may be exercised through planning, zoning, land ownership, and applicable State and local laws and regulations.

For further information regarding this environmental impact statement, contact:

Ray Emerson or
Laura Yoesting
MMS, Alaska OCS Region
949 East 36th Avenue
Anchorage, AK 99508-4302
907-261-4080

Richard H. Miller
MMS (644) USDOI
18th and C Streets, NW
Washington, D.C. 20240
202-343-6264

For additional copies of this environmental impact statement, please contact the MMS Alaska OCS Region Library at 907-261-4435.

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November 1987

V. REVIEW AND ANALYSIS OF COMMENTS RECEIVED

During the DEIS comment period, comments and testimony were received from a diverse group of individuals; groups; organizations; companies; and local, State, and Federal agencies. Comments ranged from support of the EIS and the proposal to support of various deferral alternatives to postponement or withdrawal of the proposal, and to requests for revision of the EIS.

Letters were received from 10 Federal agencies, 2 State agencies, 1 local government, 6 oil- and gas-related firms, 1 special-interest group, 1 environmental organization, and 1 individual. Public hearings were held in Barrow, Wainwright, Point Lay, Point Hope, and Anchorage, with a total of 34 people testifying.

Major concerns of those commenting were mitigating measures; deferral alternatives; effects on the Chukchi polynya and the spring migration of the bowhead whale; adequacy of the database in the sale area; oil-spill-cleanup technology; development scenarios; the oil-spill-risk analysis; analysis of effects on biological resources; and effects on subsistence.

This volume contains reproductions of all letters received in comment to the DEIS and substantive excerpts from oral testimony given during the five public hearings. Specific comments are bracketed, and responses follow the comments.

Approximately 560 individual comments received a response. Where comments warranted changes in the text of the EIS or presented new, substantive information, the EIS was revised accordingly. Reference to the revised sections is made in the responses to specific comments.

The following list identifies portions of the text where substantial changes have been made.

--A seasonal drilling restriction for the protection of bowhead whales has been evaluated in Section II.H.2. Three other mitigating measures regarding endangered whales have also been evaluated (see Sec. II.H.2).

--The effects of onshore-pipeline spills have been analyzed in Section IV.

--The air quality analysis has been changed to reflect revised EIS definitions of effect levels.

--The information on Major Projects Considered in Cumulative-Effects Assessment (Sec. IV.A) has been revised and updated.

--An updated description of the Red Dog Mine Project is included in Appendix G (Major Projects Considered in Cumulative-Effects Assessment).

--A new section (IV.B.7.a(3)) has been added to the endangered species analysis to address the Chukchi polynya and, specifically, the effects on the bowhead whale spring migration.

--The worst-case analysis on bowhead whales has been revised to analyze the effects of a worst-case situation during the spring migration.

--Appendix H (Alternative Energy Sources as an Alternative to the OCS Program) has been updated and expanded.

A. Letter Comments and Responses

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

Federal Agencies

Department of Defense - Department of the Army
Department of the Interior - Bureau of Indian Affairs
Department of the Interior - Bureau of Mines
Department of the Interior - Fish and Wildlife Service
Department of the Interior - Geological Survey
Department of the Interior - National Park Service
Department of Transportation - Research and Special Programs Administration
Environmental Protection Agency
Marine Mammal Commission
Department of Commerce - National Oceanic and Atmospheric Administration

State and Local Government

State of Alaska - Office of the Governor
North Slope Borough
City of Wainwright

Industry

Alaska Oil and Gas Association
ARCO Alaska, Inc.
Chevron U.S.A., Inc.
Conoco, Inc.
Standard Alaska Production Company
Texaco USA

Other Organizations and Individuals

Alaska Eskimo Whaling Commission
Natural Resources Defense Council and Trustees for Alaska
J.L. Mohr

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 898
ANCHORAGE, ALASKA 99506-0898

REPLY TO
ATTENTION OF:
Regulatory Branch
Special Actions Section

08 MAY 1987

Mr. Ray Emerson
Minerals Management Service
Alaska OCS Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Dear Mr. Emerson:

This letter is written with regard to the Draft Environmental Impact Statement (DEIS) concerning the proposed Chukchi Sea Lease Sale 109. The DEIS was prepared by the Minerals Management Service, United States (U.S.) Department of the Interior, Alaska Outer Continental Shelf (OCS) Region, Anchorage, Alaska, March 1987.

The following comments are offered with regard to the proposed sale:

a. The Corps of Engineers, under 33 CFR 330.5(a)(8) (Enclosure), has issued a Nationwide permit (NWP) for structures associated with oil and gas development on the OCS. The NWP authorizes:

Structures for the exploration, production, and transportation of oil, gas, and minerals on the OCS within areas leased for such purposes by the Department of the Interior, Minerals Management Service, provided those structures are not placed within the limits of any designated shipping safety fairway or traffic separation scheme [where such limits have not been designated or where changes are anticipated, district engineers will consider recommending the discretionary authority provided by 330.8 of this Part, and further subject to the provisions of the fairway regulations in 33 CFR 322.5(l)].

With regard to designated shipping safety fairways and traffic separation schemes, no designated shipping safety fairways or traffic separation schemes exist within the area of proposed sale and none are anticipated at this time.

In addition, the following regional condition has been added to the above noted NWP:

Placement of causeways, gravel islands, pipelines and other support structures in State waters, or in waters of judicially disputed ownership, are not authorized under this NWP.

In the event that the above noted types of work are proposed as part of the exploration, development, or production of areas within the proposed sale, an individual Department of the Army permit would be required prior to their implementation.

b. Subject to Section 10 of the River and Harbor Act of 1899, the Corps has regulatory authority over navigable waters of the U.S. Among the waters included within navigable waters of the U.S. are the territorial seas, all ocean and coastal waters within a zone three geographic (nautical) miles seaward from the baseline. (The baseline is defined as the line on the shore reached by ordinary low tides of the open sea.) In addition, the shoreward limit of jurisdiction of navigable waters in coastal areas extends to the line on the shore reached by the plane of mean high water. See 33 CFR 329 for a complete discussion of navigable waters of the U.S. Further, the Corps has jurisdiction over waters of the U.S. Among the waters of the U.S. are the territorial seas.

As indicated, NWP 8 concerns activities within the area extending from the seaward limit of the territorial seas to the seaward limit of the OCS. Within the territorial seas, however, the NWP does not apply. An individual Department of the Army permit would be required for work within the territorial seas. In these waters, structures and/or work in or affecting navigable waters of the U.S. would be subject to Section 10 of the River and Harbor Act of 1899. Discharges of dredged or fill material into waters of the U.S., including wetlands, would be subject to Section 404 of the Clean Water Act.

c. With regard to the DEIS, recent conversation with members of your staff indicates that the generalized nature of impact discussions within the DEIS is due to the uncertainties of size and location of reserves within the sale area. Further, the DEIS, from the Service's perspective, is designed to address activities associated with the lease sale and exploratory phase of the program only; it is not designed to address activities and impacts associated with development and production. Upon completion of the exploratory phase, a second Environmental Impact Statement would be prepared.

Should exploration indicate recoverable reserves of oil and gas, this office also anticipates that a permit would be required for work associated with the development and production phases of the project. It also anticipates that preparation of EIS would be required as part of the permit application review process. As such, the party/parties involved in development of the sale area, including planning and selection of alternative sites of off-shore and onshore support facilities, pipelines, and other work subject to Federal jurisdiction, should contact the Corps as early as possible in planning the development phase. This will allow sufficient time for permit application review and scoping of issues in advance of EIS preparation.

Further, future environmental documentation should include expanded discussion of anticipated environmental impacts of proposed activities on all areas subject to Federal jurisdiction. These include, in addition to oceanic, coastal, and navigable waters, all other waters of the U.S., including wetlands.

d. Upon completion of the lease sale, the Corps should be informed, by the lessee, of all activities proposed during the exploratory phase to assure that they are subject to the above noted Nationwide permit.

e. DEIS review of the anticipated impacts of exploration, development, and production within the Chukchi Sea indicates that adverse environmental impacts, including adverse impacts to marine mammals, birds, kelp beds, areas of special biological sensitivity, endangered species, subsistence-harvest patterns, and other considerations, greatly increase as development activities approach the near-shore and shore areas. In addition, the location of reserves at the high end of the range of expected find would further increase the significance of adverse impacts. As a result of these findings, and of the unknowns associated with oil and gas exploration, including unanticipated oil spills, fires, and other unforeseen events, this office recommends, at this time, if resource extraction is to occur in the Chukchi Sea, that Alternative VI, the Coastal Deferral Alternative, be considered the environmentally preferred alternative.

Thank you for the opportunity to comment on the Chukchi Sea Lease Sale 109 DEIS. Should you have any further questions regarding the Corps of Engineers' jurisdiction or involvement in the above matter, please contact Mr. Jeffrey Steen at (907) 753-2724.

Sincerely,

Larry L. Reeder

Larry L. Reeder
Chief, Special Actions Section
Regulatory Branch

Public Notice

US Army Corps of Engineers
Alaska District
Regulatory Functions Branch
Pouch 898
Anchorage, Alaska 99506

Date: November 23, 1983

Identification No.: Special Public Notice 84-1

In reply refer to above Identification Number

Proposed Regional Conditioning of Nationwide Permit 33 CFR 330.5(a)(8)

This Public Notice is to inform the general public of a proposed notification requirement associated with the Corps of Engineers nationwide permit which authorizes oil and gas related structures on the outer continental shelf. The subject nationwide permit, as described in 33 CFR 330.5(a)(8), authorizes structures for the exploration, production, and transport of oil, gas and minerals on the outer continental shelf within areas leased for such purposes by the Department of the Interior.

The District Engineer, Alaska District Corps of Engineers (Corps) intends to recommend regional conditioning of this nationwide permit, per 33 CFR 330.7(a) as follows:

"At least 30 days prior to initiation of any activity regulated under this nationwide permit, the permittee must send copies of project plans showing: size, location, and identification markings of the proposed structure/s to the following agencies:

Minerals Management Service
Field Operations Office
949 E. 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Director, Defense Mapping Agency
Hydrologic Center
ATTN: Code NS12
Washington, D.C. 20390

Commander,
17th Coast Guard District (m)
Post Office Box 3-500
Juneau, Alaska 99802

Director, National Ocean Survey
NOAA, Department of Commerce
Rockville, Maryland 20852

Assistant Secretary of Defense
(Manpower, Reserve Affairs and Logistics)
ASD [MRA&L(I)]
Washington, D.C. 20301

A copy of the transmittal letter to these agencies must also be sent to the Chief, Compliance Section, U.S. Army Corps of Engineers, Alaska District, Post Office Box 898, Anchorage, Alaska 99506-0898."

Once this notification requirement has been accomplished, the nationwide permit would be in effect. This proposed notification procedure is not to secure approval from the five listed agencies, but to allow for review under their specific areas of jurisdiction, particularly for impacts to navigation and national security. The advance notice to these agencies will allow them to make comments to the Corps before structures are placed that could impair either of these two specific areas of concern. Other types of approvals may be required from those agencies but not as a process of the Corps' nationwide permit.

Please Note: Since issuance of this Public Notice the addresses have been updated and changes included above (April 1987) (Jrd)

UNITED STATES GOVERNMENT

memorandum

BUREAU OF INDIAN AFFAIRS
JUNEAU AREA OFFICE

DATE: April 30, 1987

REPLY TO ATTN OF: Area Director, Juneau Area

SUBJECT: Chuckchi Sea Sale 109 DEIS

TO: Regional Director, Alaska OCS Region, Minerals Management Service

The Bureau of Indian Affairs has reviewed the subject document and offer the following comments.

Associated with Sale 109 are two primary areas of concern to the Bureau. These are impacts to subsistence uses and resources, and the minimal Native hire opportunities predicted with implementing this sale. The Bureau also recommends the selection of Alternative VI, the Coastal Deferral Alternative, for reasons outlined herein.

Overall, the document is very comprehensive and builds on the impact analysis for Sales 97, 107, 1987-1992, and other leases. Some specific items that need to be addressed in more detail are:

In the summaries of cumulative effects, such as Table S-1, the alternatives are compared on the basis of minor, moderate, and major impact ratings. This kind of analysis does serve a useful purpose for general comparisons; however, it does not support the selection of Alternative I. Given the huge amount of specific information presented on resource values, oil spill risks, cumulative impacts, and the ANILCA Selection 810 evaluation, a more specific comparison of impacts for the alternatives is warranted. On the basis of the information presented, we do not believe that the selection of Alternative I is justified in the analysis.

More specifically, the summary on page IV-B-91 indicates the effects of Sale 109 on the economy of the North Slope Borough (NSB) region will be negligible. This fact, coupled with trade-offs resulting from cumulative impacts and other irreversible commitments, indicates that the indigenous people of the area have very little to gain and potentially very much to lose based on the analysis.

BIA-1

The environmental consequences section for Alternative I (proposed) devotes 142 pages to the effects analysis. However, only 36 pages are dedicated to consequences of implementing the other five alternatives in total. This is an indication that none of the other alternatives will be given serious consideration.

The comparison of effects for all alternatives in Section IV, including the Section 810 Evaluation, indicates the impacts are often the same for all alternatives, either minor, moderate, or major. There are obviously degrees of difference between any one of these ratings, i.e., low moderate v. high moderate; one being closer to minor and the other being closer to major. With this in mind, the Bureau is inclined to believe that impacts to subsistence uses and resources, and sociocultural systems are substantially less in Alternative VI than in Alternative I.

OPTIONAL FORM NO 10
REV 1-80
GSA FPMR 41 CFR 101-11 6
5010-114

GSA JUNEAU 0188

The discussion on employment (III-39 and IV-B-90) indicates that over 99 percent of oil industry jobs are held by workers outside the region. This is incompatible with a pressing need for increased Native employment in a region faced with declining revenues, expenditures, and capital improvement projects. It is stated on III-40 "Employment of Native residents in the petroleum industry is expected to rise quickly between 1985 and 1990 and to peak at 92 employed during 1992" and "After 1992, Native employment would be constrained by industry's demand for labor (ability and willingness to offer industry-employment opportunities to Natives)." The figure of 92 seems minute in comparison to a 1985 NSB population of 8,308 and regional work force of 2,633, and an estimated peak employment of oil industry jobs in 1998 of 4,887. One reason for this disparity in local hire is perhaps somewhat clarified by the last sentence on IV-B-91 which in part reads "...jobs will depend on whether the industry modifies its staffing policies to emphasize more local hire." The Bureau would interpret this to mean that there is a need for industry to modify staffing policies to actively recruit, train, and employ Natives in the eight communities which will be impacted by the exploration and development of the area.

BIA-2

We appreciate the opportunity to comment and look forward to a Final Impact Statement which better addresses the above concerns.

Jake Lestenkof

Response BIA-1

For the most part, the effects of the proposed action (Alternative 1) on biological resources would be low; thus, the deferral alternatives offer a limited change in effects levels (i.e., the decreases in effect are not significant enough to change the level of effect from MINOR to NEGLIGIBLE). However, the deferral alternatives provide some selected environmental advantages that are considered in Sections IV.C through IV.G and summarized in Table II-14 (Comparison of Effects of Proposal, Cumulative Case, and Alternatives).

Similar effect levels have been assessed for both the proposed action and the alternatives because:

1. The deferred areas under Alternatives IV, V, and VI include major portions of the nearshore area that are estimated to contain insignificant quantities of oil and, thus, provide little change in the amount of oil-spill risk.

2. Even when an oil spill is assumed to occur in the proposed deferral areas, the oceanographic and meteorologic conditions would transport an oil spill primarily offshore, away from the coastal areas in a northwesterly direction, including any oil spilled in a lead.

3. Assuming that an oil spill occurred and made contact with a target area or biological resource, effect levels are expected to be low because of the extent of regional populations and recovery times.

4. The transportation scenario for the proposal assumes that onshore oil would be piped from offshore locations to a single landfall site at Point Belcher; therefore, even if Alternative IV, V, or VI is assumed, effects from the transportation scenario associated with the proposal would still occur. Correspondingly, any reduction in the number of oil spills in the deferral area is limited by potential pipeline spills associated with the transport of oil from outside the deferral area to Point Belcher. The selection of Point Belcher as a landfall for the proposed action was based on discussions with industry and the report of the National Petroleum Council (1981). The AOGA has since suggested that pipelines be brought onshore at the nearest landfall site (see Response AOGA-7). Nevertheless, the present MMS scenario, which assumes offshore pipelines to Point Belcher, represents a greater potential for effects from the proposal on biological resources. Effects on these resources would still, for the most part, be MINOR.

In spite of these factors, the deferral alternatives offer some environmental and subsistence advantages that are listed in the text (Secs. IV.E through IV.G) and in Table II-14.

The benefits of the deferral alternatives, which will be presented to the Secretary of the Interior in the Secretarial Issue Document, are summarized as follows:

Eastern Deferral Alternative: Under Alternative IV, air quality of the shoreline north of Naokok Pass would be more protected from offshore emissions because these emissions would be at least 29 kilometers offshore. Deliberate

discharges would not affect water quality in the deferral area. Alternative IV would have localized beneficial effects for the residents of Point Lay by reducing noise and traffic disturbance to beluga whales. This also would reduce the effects of noise and traffic disturbance on Point Lay's subsistence harvest of beluga whales from MODERATE to MINOR. Effects from noise and traffic disturbance also would be reduced on Wainwright's bowhead and beluga whale-subsistence harvests as well as Barrow's beluga harvest in Peard Bay. Slight reductions in disturbance of subsistence harvests of other marine mammals, birds, and marine fishes would also occur. However, the level of effects on subsistence harvests remains MAJOR due to construction activities associated with the proposed landfall and shorebase facilities at Point Belcher. Oil-spill, disturbance, and habitat-alteration effects on spotted seals and beluga whales could be locally reduced near Peard Bay and Kasegaluk Lagoon. Potential disturbance of birds from air and boat traffic moving along the coast may be substantially reduced in the important Kasegaluk Lagoon and Peard Bay feeding, molting, and nesting habitats, thereby reducing local disturbance of several thousand birds. Removal of drilling discharges and platform-construction activities in the area would reduce the potential for adverse effects on the kelp-bed communities and would slightly benefit fish.

Southern Deferral Alternative: The air quality of the shoreline west of Cape Sabine would be more protected from offshore emissions under Alternative V because such emissions would be at least 29 kilometers offshore. This alternative would have localized benefits for water quality by eliminating the possibilities of spills and deliberate discharges occurring within the deferral area. Slight reductions in effects on fishes would result from elimination of drilling discharges and platform-construction activities within the deferred area, although the overall level of effect remains the same as for the proposal. It could reduce platform- and pipeline-spill effects on the Cape Lisburne and Cape Lewis seabird populations. The combined effects of oil spills, disturbance, and habitat changes on marine mammals could be reduced somewhat in the Point Hope/Cape Sabine coastal area. Effects from noise and traffic disturbance also would be reduced on Point Hope's bowhead and beluga whale-subsistence harvests. Slight reductions in disturbance of subsistence harvests of other marine mammals, birds, and marine fishes also would occur. However, the effect level on subsistence harvests remains MAJOR due to construction activities associated with the proposed landfall and shorebase facilities at Point Belcher.

Coastal Deferral Alternative: The localized benefits of Alternative VI include the following:

The magnitude and rates of air-pollutant emissions would be lower than those for the proposal and would occur at least 41 kilometers from shore. Effects on water quality would be slightly lower than those for the proposal because platform spills and deliberate discharges would not occur in the deferred area.

Elimination of drilling discharges and platform-construction activities from nearshore waters under this deferral alternative reduces potential effects of these activities on kelp beds and invertebrates. Although the extent of localized effects is reduced, the level of effect is expected to remain MINOR, the same as for the proposal. The probability that oil spills would contact areas of particular concern for marine plants and invertebrates declines only slightly under this deferral alternative.

Slight reductions in effects on fishes would result from decreased drilling discharges and platform-construction activities in nearshore waters.

This alternative would defer exploration and production from the coastal habitat of over a million marine and coastal birds. It also would remove the potential for exploration and production activities within most of the spring-migration corridor used by pinnipeds and beluga whales and could reduce local effects on walruses and spotted seals.

Overall, endangered whales would be somewhat less likely under this alternative to be contacted by oil. No exploratory-drilling sites or production platforms would be located within the bowhead whale spring-migration corridor and coastal area heavily used for gray whale feeding, resulting in a slight decrease in noise-producing activities.

This alternative would remove the possibility of exploration or production occurring within the subsistence-hunting area, which would decrease noise from boats and seismic and traffic disturbance as well as eliminate the presence of platforms in the deferred area. Bowhead and beluga whales are the subsistence species most affected by noise and traffic disturbance and thus are the harvests that may be affected by this alternative. However, icebreakers could still be in the area and could cause disturbance to bowheads and thus curtail or reduce the bowhead harvest. If it were a short whaling season, noise and traffic disturbance of Point Lay's beluga whale harvest would be reduced from MODERATE to MINOR under this alternative; and noise and traffic disturbance of Barrow's and Point Hope's beluga harvest would be reduced from MINOR to NEGLIGIBLE.

Response BIA-2

Petroleum-industry employment opportunities for local residents were projected on the basis of industry's current hiring practices. Unless these practices change (probably in response to increased training of local residents), the number of residents likely to be hired will continue to be relatively modest.

United States Department of the Interior

BUREAU OF MINES

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

April 15, 1987

TO : Regional Director, Minerals Management Service
Alaska Region, 949 E. 36th Ave., Anchorage, Alaska

FROM : Donald P. Blasko, Chief
Alaska Field Operations Center, Anchorage, Alaska

SUBJECT : Review of Draft Environmental Impact Statement, Proposed Chukchi Sea Lease Sale 109 prepared by Minerals Management Service, Alaska OCS Region, March 1987 (MMS 87-0009).

An infrastructure which might result from activities of the Proposed Chukchi Sea Lease Sale 109 would have an effect on the development of the extensive coal deposits, sand and gravel deposits, and the mineral deposits within the northwestern portion of Alaska. **BOM-1**

Coal deposits are located along the northwest coast of Alaska including the area from Point Hope to Point Barrow. These coals occur in the Northern Alaska Coal Field and range from subbituminous in the northern portion to bituminous in the southern portion. (Refer to R. D. Merritt's Map of Alaska's Coal Resources, St. AK., DGGS, Spec. Rept. 37, 1986.)

Historically coal mining has occurred all along the northwest coast of Alaska, beginning with the discovery of coal at Cape Beaufort in 1826. Known coal mines include those at Wainwright, Kuk River, Cape Dyer, Corwin Mine and Bluff, Kukpuk River, Thetis Mine, and Cape Sabine, to name a few. Most of the coal mined from these deposits was used by ocean-going steamships, and for local home heating.

Transportation of the mined coal was limited to shallow draft ships and small boats. These limitations have kept the development of Alaska's northwest coal deposits to a minimum mainly home dwellers in those areas within close proximity of the deposits.

Presently the State of Alaska is conducting studies for the use of coal not only for home heating, but also for electrical generation in the communities of northern and interior Alaska. One such study involves the Deadfall Syncline coal deposit located 31 km. northeast of Cape Beaufort. Such communities as Wainwright, Point Hope, and Barrow, to name just a few, could become users of this coal.

Any developments involving road construction along the coastline of northwestern Alaska will increase the potential for coal mining to meet the local community needs. At present, coal development is restricted due to lack of roadways needed for the transportation of coal to the local communities.

Development of a roadway infrastructure in northwestern Alaska would also open up those potential sand and gravel deposits located along the major rivers, coastal waters, intertidal areas, and the barrier islands and spits. These sand and gravel deposits could be extensively used in the development of the Chukchi Sea oil and gas deposits, and for local community construction needs.

Also affected would be the development of mineral deposits located in northwestern Alaska, including the Red Dog Mine and the Lik deposit. Other mineral deposits in the DeLong Mountain area could become economically feasible if a transportation network was in place.

Thus, the Proposed Chukchi Sea Lease Sale 109, could have a dramatic effect on the development of Alaska's natural resources in the northwestern section of the state. It would open that portion of the state to the development of it's vast coal deposits, sand and gravel deposits, and mineral deposits.

Donald P Blasko

Donald P. Blasko
Chief, AFOC

DPB/ap

Response BOM-1

Potential linkages between Sale 109 and other resource development in the area are discussed in the cumulative analyses (Sec. IV) of the EIS. Projects incorporated in this analysis include the potential coal development in the vicinity of Cape Beaufort (the Deadfall Syncline coal deposit), mining from the Red Dog Mine, and potential mining from the Lik deposit. Potential linkages of infrastructure are identified specifically in the scenario for the high-resource case (Appendix C).

The potential for developing sand and gravel resources in the area is addressed only from the perspective that such resources will be needed for the development that is hypothesized for Sale 109. The potential for developing sand and gravel resources for export markets is considered unlikely.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

FAIRBANKS FISH AND WILDLIFE ENHANCEMENT OFFICE
ECOLOGICAL SERVICES/ENDANGERED SPECIES BRANCH
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. **FWS-1**

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. **FWS-2**

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". **FWS-3**

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
Warren Matumeak, NSB, Barrow
Patty Wightman, DGC, Fairbanks
Al Ott, ADF&G, Fairbanks
Larry Dietrick, ADEC, Fairbanks
Bob Cannon, ADLWM, Fairbanks

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

FAIRBANKS FISH AND WILDLIFE ENHANCEMENT OFFICE
ECOLOGICAL SERVICES/ENDANGERED SPECIES BRANCH
Room 222, Federal Building, Box 20
101 12th Avenue
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. **FWS-4**

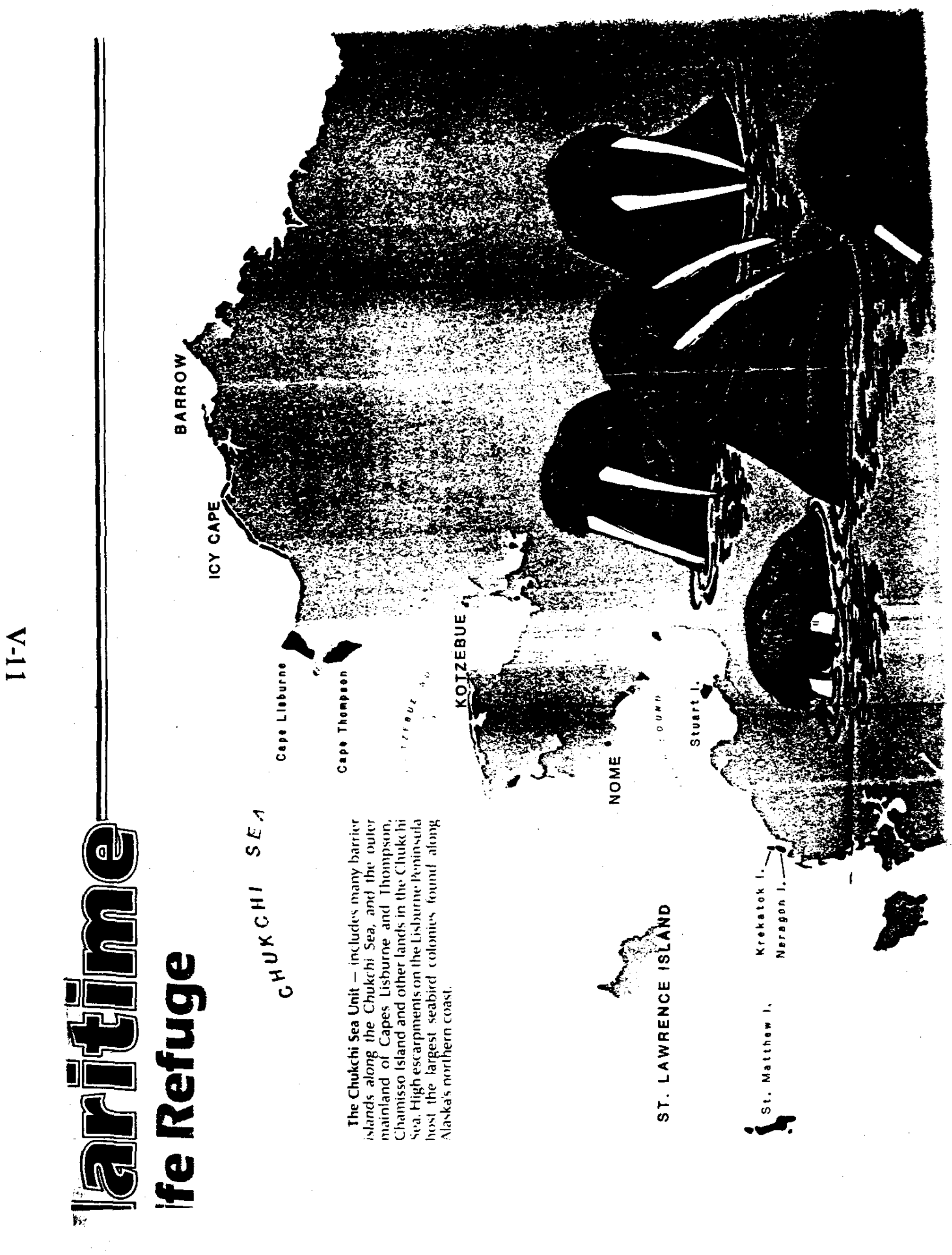
More detailed maps of the Alaska Maritime National Wildlife Refuge are in preparation, and may be obtained from the Refuge Manager, 202 West Pioneer Avenue, Homer, Alaska 99603; telephone: 235-6546. Thank you for considering these additional comments in your EIS preparation.

Sincerely,

Paul E. Gertler

Paul E. Gertler
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. Env. Officer, Anchorage
Ron Morris, NMFS, Anchorage
Rich Sumner, EPA, Anchorage
John Warren, DO&G, Anchorage
Warren Matumeak, NSB, Barrow
Patti Wightman, DGC, Fairbanks
Al Ott, ADF&G, Fairbanks
Larry Dietrick, ADEC, Fairbanks
Bob Cannon, ADLWM, Fairbanks



Response FWS-1

Graphic No. 3 (Major Projects Included in the Cumulative Assessment) has been revised to reflect the State of Alaska lease-sale schedule of January 1987. No separate transportation corridor is hypothesized for Sale 97. The pipeline route hypothesized for Federal OCS Sale 97 was revised in the Sale 97 FEIS to be consistent with the route hypothesized for Sale 109. Sale 97 is included in Table IV-2 (Major Projects Considered in Cumulative-Effects Assessment) and in Appendix G, which contains more complete descriptions of projects included in Table IV-2. These projects form the basis of the cumulative-effects assessments throughout Section IV and Appendix C.

Response FWS-2

The onshore pipeline route hypothesized in the Sale 97 EIS was revised for the Sale 109 EIS on the basis of additional analysis of the terrain and existing-trail systems. The route change was incorporated in the Sale 97 FEIS (USDOI, MMS, 1987a); thus, both the Sale 97 and 109 proposals include the same hypothetical onshore pipeline infrastructure from Point Belcher to TAP Pump Station No. 2. The hypothetical scenario developed for Sale 109 in Section II.A describes the assumptions associated with developing a pipeline/road system between these two sites; environmental effects in Section IV are analyzed by resource at an appropriate level.

Although the potential for the Sale 109 support road to become open to public use is identified in the Section IV.B.13 summary, it is noted in Section II that it probably would be maintained as a private road. Opening the road to uncontrolled public access is not considered a foregone conclusion. After 10 years in operation, the Dalton Highway--a public highway--still is not open to the public north of Chandalar, except for public tours regulated by permits. Pump Station No. 2 is north of this point; thus, it is unlikely that the road hypothesized for the Sale 109 scenario would be open to the general public without extensive consideration. Moreover, it is not certain that the road hypothesized for this scenario would be developed as a public highway. Thus, in the event that the Sale 109 support road is developed by industry as a private road, it is unlikely that it would be open to uncontrolled public access.

Response FWS-3

Neither the Sale 109 EIS nor any previous MMS EIS's have included a practice of "diluting" or averaging potential effect levels but rather have predicted what the expected level of effect would be assuming development of the proposal. The discussion in Section IV.B.5 (cumulative effects) mentions the possibility of MAJOR effects on either brant, snow geese, murres, or auklets; but the sequence of events required for this possible MAJOR effect to occur (a large oil spill occurring and contacting habitat when the birds are concentrated) is an extremely remote possibility. The estimated MODERATE level of effect on marine and coastal birds represents the likely or expected effect level, assuming that all of the identified development projects occur.

Response FWS-4

A statement concerning the location of Alaska Maritime National Wildlife Refuge units was added to Section III.B.3, and these refuge units have been identified on Graphic No. 1. The potential effects of the proposal on Alaska Maritime National Wildlife Refuge units, such as Cape Lisburne and Icy Cape, are covered under the analysis of effects on marine and coastal birds (Sec. IV.B.5).

The use of Peard Bay for offloading barges is possible but considered unlikely at this time due to potential complications with permafrost. If it were seriously considered, approval by the Corps of Engineers would be required before any construction could occur. Detailed, site-specific analyses could be written by the MMS, the BLM, and/or the COE. At this level of analysis (lease-sale stage), the effects of dredging, road, and barge facilities on migratory-bird habitats at Peard Bay would be similar to the effects of facility construction at Point Belcher. Disturbance of migrating birds would be temporary during construction, and habitat effects would be local near the facility site--representing a MINOR effect on bird populations.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
WGS-Mail Stop 423
DES 87-8

MAY 4 1988

Memorandum

To: Regional Director, Minerals Management Service, Anchorage, Alaska

From: Assistant Director for Engineering Geology

Subject: Review of draft environmental statement for the proposed 1988 Outer Continental Shelf Oil and Gas Lease Sale 109 in the Chukchi Sea, Alaska

We have reviewed the statement as requested in a memorandum of March 6 from the Director, Minerals Management Service.

The draft statement evaluates impacts of offshore oil spills and their mitigation in some detail; however the statement should similarly analyze potential impacts of leaks and spills from the proposed 640-kilometer pipeline to extend from Point Belcher to the Trans Alaska Pipeline Pump Station No. 2 and should discuss possible mitigation. **USGS-1**

The exploration and production of oil could require mining large amounts of gravel. The potential sources of this gravel should be identified. The statement should discuss the environmental impact of gravel operations, pipeline construction, and the related facilities such as roads, pumping stations, and helipads. **USGS-2**

for James F. Devine

Copy to: District Chief, WRD, Anchorage, Alaska

Response USGS-1

Oil spills projected to occur along the onshore-pipeline route through the NPR-A to the TAP have been compiled and added to Table II-1. The effects of onshore-pipeline spills have been added to Section IV.B. The onshore-oil-spill statistics upon which these spill estimates are based were developed by the DOI specifically for the NPR-A (USDOI, BLM, 1983). There is a 69-percent chance that a pipeline spill of greater than 239 barrels would occur in any single year during the productive life of the proposal. Sixty percent or 13 of the 22 spills greater than 239 barrels would occur in wetlands (see Carufel, 1982). Only ground water in the shallow active layer--a fraction of a meter to perhaps a few meters thick--could be contaminated by a pipeline spill. Deeper ground water underneath the impervious permafrost would not be at risk from oil spilled on the surface or in the active layer above the permafrost. Pipeline spills on the North Slope along the TAP generally have not caused serious contamination of ground water because of cleanup efforts and the relative impermeability of cold, wet, or frozen ground to crude oil. On the other hand, one winter spill (nonoil industry) of fuel oil several years ago at Barrow penetrated frozen but unsaturated gravel and is slowly moving downslope within the active layer, threatening a lake used for drinking-water supplies.

The MMS has no authority over an onshore pipeline and cannot stipulate special requirements to mitigate spill damage. The USDOI does have some ability to promote mitigation through the BLM, and the BLM would be involved in EIS preparation and permit decisions to pipe Sale 109 oil through the NPR-A. Because onshore mitigation techniques tend to be site-specific, discussion of such mitigation is best left until development is being considered, when oil is found in commercial quantities and a pipeline planned.

Response USGS-2

Because the location of a pipeline from a landfall site to the TAP is purely hypothetical, potential sources of gravel can be identified only generically at this time. The text in Section II.A.2 has been expanded to identify the general sources of gravel that could be used. Assumptions covering other aspects of the hypothetical infrastructure already are included in Section II.A.2. Descriptions are given for the roads, pipelines, pump stations, and helipads that are assumed. These assumptions are used in Section IV to assess the potential effects of hypothetical development on the environment.

United States Department of the Interior

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

IN REPLY REFER TO:
L7617(760)

MAY 6 1987

Memorandum

To: Regional Director, Minerals Management Service, Alaska Region

From: Associate Director, Planning and Development

Subject: Draft Environmental Impact Statement (DEIS) - Proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 109 - Chukchi Sea, Alaska (DES-87/8)

The National Park Service (NPS) manages four units in Northwest Alaska: Cape Krusenstern National Monument, Noatak National Preserve, Kobuk Valley National Park, and Bering Land Bridge National Preserve. All four units are at risk for some impact as a result of the oil production possible under proposed Chukchi Sea Sale 109. We believe that a map which depicts these parklands should be included in the final EIS. Such a map appears in the General Management Plan for Cape Krusenstern National Monument, a copy of which was recently delivered to your EIS Coordinator Laura Yoesting. **NPS-1**

Cape Krusenstern would be impacted most by this project and the proposed Hope Basin sale. Cape Krusenstern contains world class archeological sites and was established as a national monument by Congress to preserve these important cultural resources as well as ". . . to protect habitat for seals and other marine mammals; to protect habitat for and populations of, birds and other wildlife, and fish resources; and to protect the viability of subsistance resources."

The DEIS should more completely address potential impacts to onshore cultural resources which are treated superficially compared to offshore cultural resources. The sale could ultimately have both direct and indirect effects on Cape Krusenstern National Historic Landmark and Archeological District (2,300,000 acres) and to the important archeological values in Cape Krusenstern National Monument (659,807 acres), as well as the Ipiutak National Historical Landmark located at Point Hope. **NPS-2**

The Northwest Alaska Transportation Corridor (the Red Dog Road) runs through part of Cape Krusenstern National Monument on a 100-year easement owned by the NANA Regional Corporation. The terms and conditions of the easement were determined by an Act of Congress. One of the alternatives for moving oil from the Chukchi Sea involves a pipeline along the road corridor. Substantial modifications to the use of those lands, such as proposed in the DEIS, would probably require approval by Congress. **NPS-3**

We are concerned that following an OCS sale in the Chukchi Sea there will be a commitment to additional and extensive supporting development in a part of Alaska that is currrently undeveloped and supports a subsistence oriented Native population and the wildlife on which they depend. Although the environmental impacts of tanker routes, a North Slope pipeline and road, and a Cape Beaufort/Kivalina pipeline and road are only lightly touched on, the ultimate utility of the OCS sales mandates one of these actions. As noted on page IV-A-2:

> "NEPA requires that consideration be given in the EIS to the cumulative effect 'on the environment which results from the incremental impact of the (proposed) action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions' (40CFR 1508.7)."

The DEIS Timetable (Table II-1) assumes pipeline construction will begin in 1995—only eight years in the future. Therefore, it seems that the cumulative environmental impacts of those actions should be thoroughly addressed prior to the OCS sale. **NPS-4**

Historically, post calving movement of caribou from the Utukok River uplands has brought large numbers of animals into the Cape Krusenstern/Kukpuk River area. The construction of a high-case pipeline could divert and/or exclude caribou from a significant segment of this region. **NPS-5**

Some discussion of the musk oxen population in the coastal area between Cape Lisburne and Cape Krusenstern would be appropriate. At least 90 musk oxen reside in that area. Musk oxen have been eliminated from this area of the state, probably during the 1800's. In the 1970's the State of Alaska reintroduced animals near Cape Thompson. The population has grown and spread out since that time. The Alaska Department of Fish and Game and the National Park Service are monitoring the movements of the musk oxen in this area. **NPS-6**

Page III-37 - The Western Arctic herd of caribou ranges north from the Huslia and Buckland Rivers (at a minimum). Some researchers consider all caribou north of the Yukon River as part of this herd. **NPS-7**

Figure IV-2 - The Tanker Route which would serve the high-resource pipeline between Cape Beaufort and Kivalina is not shown. **NPS-8**

Figure IV-10 - If this includes the cumulative impacts it should depict the tanker route for the Hope Basin sale. **NPS-9**

Figure IV-13 - The oil spill retention capability of the Cape Krusenstern National Monument shore is high to very high and that of the Bering Land Bridge Preserve is medium to very high. A spill could greatly affect marine resources, migratory birds, anadromous fish, and the lives of people dependent on those resources in all four NPS units. Your risk analysis, however, indicates that contact with the shoreline is highly unlikely. We would like to see the shoreline of Cape Krusenstern and the Bering Land Bridge units treated as areas of special biological and cultural concern. **NPS-10**

Page IV-B-42 - Analysis of the impact of low altitude overflights on seabird colonies, caribou, and other wildlife does not take into account the increased number of people who will be attracted to the sale area with personal aircraft. Additional hunting impacts and an increased non-Native population can be anticipated. We believe that these issues should be included in the project impact assessment. **NPS-11**

Page IV-B-85 - Current harvest regulations for the Western Arctic Herd of caribou are very lenient. It may be premature to state that "current regulation of the caribou harvest should prevent overhunting." The combination of an increased number of hunters, improved access, and lenient regulations most likely could not be tolerated by the herd. **NPS-12**

A more detailed description of road traffic levels and seasonality is necessary to evaluate the statement that:

> "The road traffic along the Sale 109 pipeline corridor and daily aircraft survellience (1 helicopter flight/day) of the pipeline would cause brief flight reactions by some caribou and would temporarily delay—for perhaps a few hours or no more that a few days—caribou movements across the pipeline corridor. This would represent a MINOR effect on the caribou of the Western Arctic herd."

Until the amount of road traffic and its timing is estimated and a definite road route laid out, it is not possible to determine the impact on wildlife. Additionally, there is no assessment of the impact of the high-case (Cape Beaufort/Kivalina) pipeline and road on caribou and other wildlife. **NPS-13**

Page IV-M-2 - Subsistence uses by residents of Kivalina should probably be included in the analysis of impacts because of the shipping port and the high-case pipeline. Villagers are also dependent on many of the migratory animals (bowhead whale, migratory birds, and caribou) which will suffer moderate (i.e., regional) impact under Sale 109. **NPS-14**

Page IV-B-46 - Is the "short causeway for a ship terminal associated with the Red Dog Mine Project" to be constructed regardless of which pipeline route is chosen? A better description is needed of what is proposed. **NPS-15**

To fully comprehend the environmental impacts of oil production in the Chukchi Sea, we recommend additional assessment of the environmental impacts of the oil delivery system, whether by road and pipeline or by tanker, prior to proceeding with Sale 109. **NPS-16**

With regard to air quality, air pollutant emissions from proposed exploration, development and production activities in the proposed lease sale are significant, particularly nitrogen oxides (NO_x) and volatile organic compounds (VOCs). Based on the Minerals Management Service (MMS) emissions estimates, air quality permits (such as Prevention of Serious Deterioration (PSD) or State New Source Review) may be required for the activities associated with the proposed lease sale. **NPS-17**

The DEIS states that there is a potential for relatively high NO_x concentrations at the shoreline, possibly approaching the National Ambient Air Quality Standard for that pollutant. It concludes that the effect of the proposed lease sale on air quality is expected to be "moderate," but this term seems ambiguous. No air quality modeling analyses were included in the document to better quantify the expected air quality impacts. Without quantitative analyses, the potential air quality impact of proposed lease sale activities on NPS units cannot be properly assessed. **NPS-18**

There is discussion of possible acid rain impacts on terrestrial resources, but not of air pollutant impacts on these resources. NO_x and VOCs combine in the presence of sunlight to produced ozone (O_3). Several species of trees and other plants are sensitive to O_3. We believe the final EIS should include an identification of air pollution sensitive resources and the possible air pollution impacts on those resources from the lease sale activities. **NPS-19**

NO_x and sulfur dioxide (SO_2) are oxidized in sunlight and produce fine particles - nitrates and sulfates respectively. Nitrates and sulfates scatter and absorb sunlight, thereby reducing visibility. No visible impact analysis was included in the DEIS. Visibility impacts could be significant considering the pristine air quality of the lease sale area. **NPS-20**

The DEIS lists available control measures for major OCS oil and gas emission sources. Those control measures are commonly used and are indicative of Best Available Control Technology (BACT). The document should specifically state that the control measures will be applied to the emission source. **NPS-21**

Also, the DEIS states that no further air quality analysis is required if MMS exemption levels are not exceeded. We tend not to agree with this use of the exemption levels, which are based on distance from shore. Our Air Quality Division is now participating in the Departmental negotiated rule making efforts to revise these MMS air quality regulations. **NPS-22**

We appreciate the opportunity to review and comment on this document.

David L. Jervis

for James W. Stewart

Response NPS-1

In response to this comment, Figure III-36 has been amended to show the boundaries of the National Wildlife Refuges and National Park Service areas in the NANA Region.

Response NPS-2

The text in Section III.C.4 and Appendix C has been amended to address this concern.

Response NPS-3

A statement has been added to the scenario discussion for the high-resource estimate (Sec. II.G.2.b) and to Appendix C (Analysis of Potential Effects Resulting From the High- and Low-Resource Cases) to indicate that Congressional action modifying the terms and conditions of the road easement through the Cape Krusenstern National Monument probably would be required before the oil and gas industry could install a pipeline along the portion of the road from the Red Dog Mine that traverses the monument.

Response NPS-4

As noted in the NPS comment, the effects of the potential infrastructure associated with Sale 109 should be addressed prior to the OCS sale. The Section IV analysis of the proposal serves just that purpose; the effects of such infrastructure are first considered in the context of the existing environment and activities in the Alaskan Arctic and then within the context of future activities when the proposal is reconsidered along with other potential activities in the Alaskan and Canadian Arctic in the cumulative analysis. Given the hypothetical nature of most of this development, the level of analysis of pipeline construction in Section IV is considered appropriate.

Response NPS-5

Studies of caribou movements and distribution in association with the TAP and the Kuparuk River oil pipeline have shown that caribou successfully cross these pipeline corridors and continue to use rangeland on either side of the pipelines (Cameron, Whitten, and Smith, 1981; Curatolo and Murphy, 1986; and Eide et al., 1986). Therefore, construction of a Sale 109 high-case pipeline from Cape Beaufort to Kivalina (see Fig. IV-23, Sec. IV.B.8) is not likely to divert and/or exclude caribou from rangeland in the Cape Krusenstern/Kukpuk River area.

Response NPS-6

Musk oxen were not identified as a scoping issue to be addressed in the Sale 109 EIS, and we do not think that a discussion of the effects of the proposal on musk oxen is warranted at this time. The Sale 109 mean-case development scenario--with a pipeline corridor running from Point Belcher to the TAP--would not include any habitats used by musk oxen. Even the high-case pipeline corridor would not cross specific habitats of this musk oxen population.

Response NPS-7

The most recent findings of caribou-research biologists indicate that all of the caribou north of the Yukon River do not belong to one herd (Calef, 1980; Davis, 1980). There are four recognized Alaskan caribou herds that range north of the Yukon River--the Western Arctic, Teshekpuk Lake, Central Arctic, and Porcupine caribou herds.

Response NPS-8

Figure IV-2 represents only the mean-resource scenario with cumulative case for the oil-spill-trajectory analysis; this point has been clarified in the figure caption. The MMS provides a complete OSRA--including a combined probability analysis--for only the mean-resource case. The high- and low-resource cases are analyzed in Appendix C, with the OSRA limited to projections of numbers of spills and conditional probabilities of spill contacts (assuming that a spill occurred at a specific launch point). Displaying a potential tanker route would be of limited benefit because of the constraints on the OSRA for the high-case analysis, and would create a level of detail beyond the scope of this EIS.

Response NPS-9

The OSRA considers only future OCS sales up to 1 year in advance of the sale being analyzed (Sec. IV.A.1.a). Sale 109 is scheduled for May 1988; and Hope Basin Sale 133 is scheduled for May 1992--4 years later. Information necessary for inclusion of future sales in the cumulative OSRA--resource estimates, area of call, and transportation scenarios--is too tentative for meaningful analysis this far in advance.

Response NPS-10

The only oil-spill risk to these two areas is from tankering south of the Sale 109 area in the high- and low-resource-case scenarios. Spills within the Sale 109 area pose no risk to the shores of the Cape Krusenstern National Monument or the Bering Land Bridge Preserve. The ITL and authority of the MMS would apply only to oil-spill-contingency plans for exploration and production sites within the bounds of Sale 109, and not to oil-spill-contingency plans for tankering or tanker-loading operations. A development EIS would precede any potential large-scale tankering from the Sale 109 area; an ITL concerning these two areas--if at risk--would be more appropriate in that EIS.

Response NPS-11

Although there will be an increase in the non-Native population, this increase is not expected to cause significant effects on the population in the proposed Sale 109 area (see Sec. IV.B.11.a(2)). In general, non-Natives also are not likely to participate extensively in subsistence hunting, particularly since non-Natives who move to the area usually are employed and consequently do not have extensive free time or the economic need to harvest subsistence resources. Few of the small number of people who temporarily or permanently move to the area would be expected to have personal aircraft. The increased number of aircraft, if any, would be insignificant and would not cause much effect on subsistence hunting and fishing.

The cumulative-effects analyses in Section IV.B.5 (Marine and Coastal Birds), Section IV.B.6 (Pinnipeds, Polar Bears, and Beluga Whales), and Section IV.B.8 (Caribou) consider increased numbers of people, motor vehicles, and aircraft from other projects as well as increases in vehicle and air traffic associated with the North Slope communities.

Response NPS-12

Current or recent caribou-harvest regulations over the past 10 years or more have been sufficient to allow the Western Arctic caribou herd to recover from past overharvest (Davis et al., 1980). Thus, it is reasonable to assume that current enlightened harvest regulations will prevent excessive overharvest of this herd.

Response NPS-13

The Sale 109 onshore-pipeline-support road would parallel the pipeline and would be included in the pipeline corridor shown in Figure IV-23 (Sec. IV.B.8). The amount of traffic along the road would be highest during the construction period, with several hundred vehicles per day, as discussed in Section IV.B.8. After construction is complete, traffic levels would be considerably lower (less than 100 vehicles/day on average). An assessment of the high-case scenario for caribou is included in Appendix C (Page C-12).

Response NPS-14

The Section 810 Evaluation and Findings (Sec. IV.M) has been deleted from the FEIS as a result of the Supreme Court decision (AMOCO Production Co. et al. v. Gambell et al. 107 S. Ct. 1396 [U.S. March 24, 1987], reversed in part, vacated in part, and remanded 774 F.2d 1414 [9th Cir. 1985]), which found that the ANILCA does not apply to the OCS. For detailed information, see Response NSB-6.

Response NPS-15

More detail on the design features of the Red Dog Mine dock have become available and have been added to the text of Appendix G. The Red Dog Mine project is independent of any development associated with Sale 109. If the road from the Red Dog mine were used for oil development, as hypothesized in the high case, the road corridor developed by lessees would dovetail into an infrastructure that is currently under construction. Dock facilities probably would not be shared due to the different loading requirements of bulk ore versus liquid-petroleum products.

Response NPS-16

The analyses of the potential transportation systems for transporting Sale 109 oil production are considered appropriate to the nature of the action being covered by this EIS. Environmental assessments of tanker transportation and a combination of pipeline-and-tanker transportation from the Arctic are discussed in Appendix C (high- and low-resource cases). An assessment of an onshore pipeline to the TAP is discussed in Section IV.B of this EIS.

Response NPS-17

Air-quality permits of the nature cited by the commenter are not required on the OCS. However, the MMS will not issue drilling permits or development permits for operations that would exceed the emission limits or permissible air-pollutant concentrations at the shoreline that have been established in USDOI regulations.

Response NPS-18

Definitions for effects levels are provided in Table S-2. The effects level for air quality, with regard to Federal-air-quality standards, has been revised downward to MINOR in the FEIS as result of further analysis. The current unavailability of an air-quality model for the Sale 109 area and the alternative procedure used to evaluate effects on air quality in this EIS are discussed in Section IV.B.1.a. As concluded in Section IV.D.1, use of the air-quality model would likely have resulted in a finding of lower effect levels for nitrogen-oxide emissions than those estimated in this EIS. Also note that the effects level assessed for air quality is for air over the closest land to the sale area. The NPS lands are too far away from the sale area to be affected by what are relatively low emission levels in a regional context.

Response NPS-19

The text in Section IV.B.1.a has been amended to address this concern.

Response NPS-20

Visibility standards apply only to Class I Areas, of which there are none in the Sale 109 airshed. The closest Class I Area to the Sale 109 area is Denali National Park; at 900 kilometers distance, the park is too far away to be affected.

Response NPS-21

This concern is addressed in Section IV.B.1.a. The MMS does not require Best Available Control Technology if such technology is not necessary to meet onshore air-quality standards.

Response NPS-22

The EIS analysis assumes that existing laws and regulations are in force; the USDOI does not require further air-quality analysis if USDOI exemption levels are not exceeded.

U.S. Department of Transportation
Research and Special Programs Administration
400 Seventh St., S.W.
Washington, D.C. 20590

MAR 16 1987

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

Dear Sir:

We have reviewed the Draft Environmental Impact Statement for the proposed 1988 Outer Continental Shelf Oil and Gas Lease Sale 109 in the Chukchi Sea (MMS 87-0009).

The DEIS discusses the probable need for pipelines in developing this area. However, there is no mention of the Federal pipeline safety regulations in Title 49 CFR Part 192 - Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards and Title 49 CFR Part 195 Transportation of Hazardous Liquids by Pipeline. These regulations are applicable to the design, installation, testing, operation and maintenance of pipelines transporting natural gas and hazardous liquid both onshore and offshore in the United States. The Office of Pipeline Safety, Research and Special Programs Administration, Department of Transportation is responsible for issuing and enforcing these pipeline safety regulations. **DOT-1**

We trust this oversight will be corrected.

Thank you,

Paul J. Cory, P.E.
Senior Petroleum Engineer

Response DOT-1

In all past Notices of Sale for Alaska OCS lease sales, an ITL describing the role of the DOT and referencing the regulations in Title 49 CFR, Parts 192 and 195, has been included; this practice also is anticipated for Sale 109. The DOT's responsibilities have been added to the description of the Purpose of Stipulation No. 4 (Transportation of Hydrocarbons) in Section II.H. The EIS analysis is based on the expectation that all applicable existing laws and regulations are enforced.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

MAY 12 1987

REPLY TO ATTN OF: WD-136

Mr. William Bettenberg
Director, Minerals Management Service
Department of the Interior
Washington, D.C. 20240

Dear Mr. Bettenberg:

The Environmental Protection Agency (EPA) has reviewed the draft Environmental Impact Statement (DEIS) for the proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 109 in the Chukchi Sea. 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 has been involved with this EIS for some time. We requested to be a cooperating agency in the preparation of this EIS in scoping comments submitted in June, 1985. EPA and the Minerals Management Service (MMS) agreed that EPA would prepare an appendix to the EIS dealing with the fate and effects of exploratory phase oil and gas drilling discharges. MMS provided us with a preliminary draft of the water quality section of the EIS in October, 1986, and comments were provided on these sections. We now offer the following comments on this DEIS.

This DEIS is well written with clear concise discussions that use current information about the environment and biological resources found in the area. We noted several changes and improvements in this DEIS compared to the EISs that we have reviewed in the past. Specific improvements include: discussions of the oil spill retention capability of various beach types; presentation of the limitations of oil spill clean-up methods; discussion about the limitations associated with the derivation and use of hydrocarbon toxicity values; and identification of secondary air quality effects.

However, we have several concerns that are summarized in the paragraphs that follow. Our concerns are fully described in our enclosed detailed comments. Most of our comments are aimed at improving the data base for decision making on the leasing options for the proposed sale area.

Environmental Consequences

We have several concerns described below that suggest the approach used to assess impacts has resulted in an understatement of the significance of potential impacts.

First, we are concerned about the analysis of effects on endangered bowhead whales, particularly with regard to the potential for long-term impacts due to noise and disturbance from potential development activities in the spring migration corridor. The FEIS would be improved by an expanded discussion of these effects and the potential consequences. **EPA-1**

Second, we are concerned about the new criteria that MMS has used for determining which future actions should be included in the cumulative effects analysis. The criteria appear to be somewhat restrictive. Application of these criteria resulted in only existing projects (no future projects) being used for the cumulative effects analysis. The Council an Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA require that an EIS consider the effects from the proposed action in addition to past, present, and reasonably foreseeable future actions. **EPA-2**

Third, we are concerned about the possibility that several of the effects from a variety of activities could cause a more serious effect than is anticipated from any one effect-producing activity. The DEIS provides no real synthesis of the combined effect of a variety of activities. The potential exists for a "synergistic" response: several minor effects associated with various activities could result in an overall moderate or major effect to a biological population. **EPA-3**

Finally, more prominent use and display of seasonal conditional probabilities would improve the discussion of oil spill impacts and facilitate the review. Conditional probabilities represent the probability that if oil is spilled at a specific location it would contact either land or a biological resource. The conditional probabilities give the EIS reviewer a better understanding of what resources could be at risk if oil is spilled. This information is essential in order to assess the significance of oil spill impacts. **EPA-4**

Alternatives

Our major concern about this lease sale is the scope of the proposed action itself. The DEIS analyzes six alternatives: I-Proposal, II-No Sale, III-Delay the Sale, IV-Eastern Deferral, V-Southern Deferral, and VI-Coastal Deferral.

Leasing in this area will pose some degree of risk to the biological resources, habitat, and human populations and their associated socioeconomic systems. Given the sensitivity of the biological resources and the natural stresses that they must survive, any additional stress or impacts could be significant. Each of the deferral alternatives represents some reduction of the risk of spilled oil affecting biological resources and habitat. Deferral of blocks would also eliminate or reduce noise and disturbance effects.

We believe that all three of the deferral alternatives deserve special consideration. The three deferral areas encompass the most important environmental and resource concerns in the sale 109 area.

We are particularly concerned about impacts associated with the Eastern and Southern Deferral areas. These areas contain no estimated hydrocarbon resources. Their deferral would provide significant protection to important coastal habitats without a loss in potential oil prospects. Further, it makes good sense to us to delay leasing of the coastal subarea (Alterative VI) until the Chukchi Sea studies of behavioral responses of endangered bowhead whales are completed.

Mitigation

We support the proposed stipulations and Information to Lessees (ITLs) presented in the DEIS. We will reconsider these mitigation measures in light of any new information presented in the FEIS.

Conclusions

The DEIS has identified environmental impacts associated with the proposed action. We believe that these adverse impacts could be reduced by implementation of any or all of the deferral alternatives in conjunction with implementation of appropriate mitigation. We strongly support a combination of Alternatives IV and V. However, due to the uncertainties about long term disturbance effects on the spring migration of bowhead whales and the more complete protection to bird habitat, we recommend the selection of the Coastal Deferral Alternative. We are rating the proposed action, Alternative I, EC-2 (Environmental Concerns-Insufficient Information). The "insufficient information" rating is based on the need for more comprehensive and detailed discussions and revised analysis of impacts on bowhead whales. **EPA-5**

Thank you for the opportunity to review this DEIS. Should your staff wish to discuss our comments, please have them call Salli Brough at FTS 399-4012.

Sincerely,

Robie G. Russell
Regional Administrator

Enclosure

cc: Alaska OCS Region

SUMMARY OF THE EPA RATING SYSTEM
FOR DRAFT ENVIRONMENTAL IMPACT STATEMENTS:
DEFINITIONS AND FOLLOW-UP ACTION *

Environmental Impact of the Action

LO--Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities with no more than minor changes to the proposal.

EC--Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EO--Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category I--Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information

The draft EIS does not contain sufficient information for EPA fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment

U.S. ENVIRONMENTAL PROTECTION AGENCY
CHUKCHI SEA LEASE SALE 109
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
DETAILED COMMENTS

INTRODUCTION

As noted in our letter we have several concerns about the proposed action. There are several aspects of the DEIS which could be revised and expanded. We believed that this would strengthen the document and provide the Secretary and the public with a clearer picture of the environmental consequences of oil and gas exploration, development, and production activities in the sale area. We also noted several changes and improvements in this DEIS compared to the EISs that we have reviewed in the past. A discussion of these improvements, our concerns, and recommended changes to the EIS are presented in the discussions that follows.

IMPROVEMENTS

This DEIS is well written. It contains current information about the environment and the biological resources found in the area. The various discussions are clear and concise. Many discussions have been expanded and provide additional helpful information. With regard to the impacts discussion, the DEIS presents a more balanced analysis of potential effects than in previous EISs. The review of the DEIS was made easier by providing definitions within the text rather than in an attached glossary.

We have provided many comments and suggestions for improving lease sale EISs in our scoping, DEIS, FEIS and Proposed Notice of Sale comments for other lease sales. We have noted several changes in this DEIS relative to these prior suggestions.

- A discussion of the oil spill retention capability of various beach types along the Chukchi Sea coastline has been provided. The discussion is accompanied by an informative figure showing the various beach types and the relative vulnerability to spilled oil.

- The oil spill clean up discussion provides information about the limitations of clean-up methods associated with sea states . A figure that presents the frequency of sea states in the sale area is provided. Related to this topic, there is some mention of the visibility conditions in the area and the frequency of fog which could hamper clean-up activities and the mobilization of clean-up equipment.

- The hydrocarbon toxicity discussion has been improved. The EIS reviewer is given the toxicity ranges associated with various life stages and aquatic communities as well as a discussion of the limitations associated with the derivation and use of the toxicity values.

We are pleased to see that the air quality discussion acknowledges that there will be secondary effects even if standards and exemption levels are met.

ALTERNATIVES CONSIDERED

The lease sale 109 DEIS evaluates several alternatives. These alternatives include: I. Proposed Action; II. No Sale (No Action); III. Delay the Sale; IV. Eastern Deferral; V. Southern Deferral; and VI. Coastal Deferral. The proposed action will offer 29.5 million acres of the OCS in the Chukchi Sea. The mean resource estimate for this sale area is 2.68 billion barrels (BBL) of oil. There is a 20 percent chance of recoverable oil being found. There is a greater than 99 percent chance that one or more spills of at least 1,000 barrels may occur over the life of the field. The estimated number of spills of 1,000 barrels or greater is seven.

Leasing in this area will pose some degree of risk to biological resources, habitat, and human population and their subsistence life style. The relatively simple trophic structure in the Chukchi Sea, the sensitivity of many of the biological populations, and the natural stresses which they must survive warrant that additional human-induced stresses or impacts should be considered significant.

The three deferral alternatives encompass the most important environmental and resource concerns in the Sale 109 area. They contain little potential oil resources as estimated by MMS. In fact the Alternative IV and V subareas contain no oil resources as estimated by MMS. These deferral areas would provide protection to habitats where large proportions of regional populations concentrate for activities that are critical to survival. We believe that all three of the deferral alternatives deserve special consideration as to whether they should be included in this lease sale.

Alternative IV-Eastern Deferral

Deferral of 488 blocks north of Peard Bay to south of Kasegaluk Lagoon would protect the only two kelp beds in the sale area, the Peard Bay bird populations and habitat, and ringed and spotted seals and beluga whale habitat in Peard Bay and Kasegaluk Lagoon. Removing this area from the lease sale would substantially reduce the noise and disturbance effects in Kasegaluk Lagoon and Peard Bay. There would be a significant reduction in the oil spill risk to the marine mammal migration corridor. Thus, there would be a reduction in impacts to beluga whales, spotted seals, walruses, and migrating whales. This alternative would provide some protection to the gray whale concentration areas during the open water season from Peard Bay south to Icy Cape. There is no oil estimated to be found in this deferral area.

Alternative V-Southern Deferral

Deferral of the 288 blocks in this area would significantly reduce the oil spill risk to Cape Lisburne and Cape Lewis seabird populations and the offshore bird foraging area of the Cape Lisburne and Lewis colonies. It would eliminate noise disturbance in the Cape Lisburne area. There would be a decreased chance of an oil spill occurring in the southern portion of the migration corridor. No oil is presumed to occur in this deferral area.

Alternative VI-Coastal Deferral

This alternative would have the same effects as Alternative IV and Alternative V. It encompasses the two previous deferral areas resulting in one continuous broad band of deferred leasing along the entire Chukchi coast from Point Hope to Peard Bay. The most likely number of oil spills is reduced from seven to five by this alternative. There would be a 16 percent reduction in the overall resource potential.

Oil spill risks would be eliminated for the coastal bird habitats off Icy Cape and Ledyard Bay during winter and reduced for the seabird populations at Cape Lisburne during the open water season. Oil spill risks to the entire migration corridor would be reduced significantly. This alternative would eliminate exploratory drilling sites and production platforms within the spring migration corridor used by bowhead whales and other marine mammals and birds.

The coastal deferral alternative would provide a wider buffer zone between the many important coastal habitats (bays, lagoons, river deltas, river inlets, coastal wetlands, and kelp beds) and the critical Chukchi polynya which serves as the spring migration corridor. A broader buffer zone between oil and gas activities and sensitive species and habitats allows more time for oil spill clean-up. It also allows the spilled oil to weather (resulting in reduced toxicity) before it contacts biota and habitat.

ENVIRONMENTAL CONSEQUENCES

Bowhead Whales

We have several concerns about the analysis of effects on endangered bowhead whales. Our primary concern is the potential for long-term impacts from noise and disturbance in the spring migration corridor. Year round, 24 hour per day development and production activities located in the narrow spring lead migration corridor could affect the migration of these whales. Bowhead whales have shown adverse/avoidance reactions as much as seven kilometers or more from a noise source. **EPA-6**

We are also concerned about oil spills in the lead system during spring migration. The DEIS is not clear about whether the bowhead whales are confined to the open water leads or if they can move into the pack ice zone to avoid an oil spill without a significant effect on their migration. **EPA-7**

Finally, avoidance reactions to noise sources and oil spills could affect the bioenergetics of the population. If the bowhead whales expend additional energy in order to swim around noise sources or oil spills during the spring migration, will this adversely affect their migration or future recruitment? EPA-8

The FEIS should provide an expanded discussion of whether a noise source in the spring migration corridor could block or delay migration or whether displacement from the corridor would hinder migration. It should also discuss whether avoidance is likely and whether this would represent an energy drain that could physiologically stress individuals. The FEIS should give special consideration to this point of vulnerability in the proposed action. EPA-9

EPA expressed concern for the effects of oil and gas activities on bowhead whales in our comments on Sales 87 and 97 in the Beaufort Sea. The behavioral responses of bowhead whales to drilling activities and noise is information that is needed to fully evaluate the impacts from oil and gas activities for both the Beaufort and Chukchi Seas. EPA-10

Our concern about the potential long-term noise and disturbance effects on whales is compounded by the fact that the Biological Opinion prepared by the National Marine Fishery Service will only address the impacts associated with exploration activities. Exploration activities can be timed to avoid the critical spring migration period and they will occur for only a few years. However, a development platform in the spring migration corridor would represent a long-term source of noise and disturbance. The effects of this on the bowhead spring migration and whether this would jeopardize the population would not be addressed until a commercially producible field has been located and a Biological Assessment prepared.

If the development/production location is in or near to a critical location like the spring migration corridor, it may not be possible to fully protect the population or mitigate the impacts once a field has been discovered. Oil companies, as part of the lease sale agreement, are entitled to produce whatever resources they find. We question the feasibility and probability of purchasing the oil, prohibiting production, or seasonally restricting production. The courts have ruled that overly restrictive regulations can violate this right to produce. Since exploration will determine the location of any potential production facilities, the FEIS should more fully analyze the effects of development and production, specifically long term noise, on the bowhead spring migration. EPA-11

Cumulative Effects Assessment

The CEQ regulations require that an EIS consider the effects from the proposed action in addition to past, present, and reasonably foreseeable future actions. In this DEIS MMS has presented new criteria for determining which future actions should be included in the cumulative effects analysis. The six criteria that are presented deal primarily with the "reasonably foreseeable future actions" concept. EPA-12

We believe that the criteria developed by MMS are unduly restrictive. By using these criteria only existing projects are included in the cumulative effects scenario for this EIS. This is significantly different from past lease sale EIS's. Past lease sale EIS's have used a number of future projects in the analysis of cumulative effects. Application of these six criteria in this EIS has eliminated all future projects from consideration.

The six criteria are of significant concern. Many appear to directly counter the CEQ regulations at 40 CFR 1508.7. Comments on each criterion follow.

Criterion 1 implies that only actions (effects caused by projects) for which a permit or other regulatory approval is necessary, need to be considered in a cumulative effects analysis. Adverse effects from non-permitted activities could be ignored. The CEQ regulations are specific in requiring that "past, present, and foreseeably future actions" be included in a cumulative effects analysis "regardless of what agency or person undertakes such other actions" (emphasis added).

Criterion 2 would further narrow the field of projects (effects) to those which are or would be subject to an EIS. Again, the CEQ regulations are clear in defining cumulative effects as including "individually minor but collectively significant actions taking place over a period of time."

Criterion 3 would require that a project must be advanced in planning and design before it is included in the cumulative effects analysis. This appears to be a narrow approach. Related discussion can be found for criterion 5.

Criterion 4 would require project impact zones to overlap or abut. Impacts can extend beyond physical disturbance boundaries. Of particular concern is the application of this criterion to migratory species. For migratory species the cumulative effects analysis should include the past, present, and future activities that occur throughout their migratory range. This criterion is contrary to the approach taken by MMS for the analysis of cumulative effects in the recent five-year oil and gas leasing schedule. Again the CEQ regulations provide guidance which appears to not have been considered in developing this criterion. Specifically, indirect effects can be removed in time or distance and cumulative effects are not defined on the basis of proximity.

Criterion 5 attempts to define "reasonably foreseeable." Significant commitment need not exist for events and impacts to be reasonably foreseeable. Zoning and community plans are a good example. If an area is zoned for an industrial park, cumulative effects to traffic, runoff, water quality, noise, air quality, for example, can be reasonably foreseen regardless of whether a developer plans to break ground within a week or a monthly or a year.

Criterion 6 basically appears to combine criteria 1, 2, and 3. It seems to require "authorized/permitted" projects, significant impacts resulting from other actions (requiring and EIS), and timing requirements such that the other action is close in time to the proposed action. As discussed above, criteria 1, 2, and 3 appear to be counter to the CEQ regulations and the intent of NEPA.

Combined Effects

We are concerned about the potential for synergistic effects from a combination of effect producing activities. The conclusion statements imply that the "combined effects" from all effect-producing activities (oil spills, drilling discharges, construction activities) will be no greater (or less) than the effects from any individual effect-producing activity. We are concerned about the possibility that the effects from a variety of activities could interact to cause a more adverse or serious effect than is anticipated from any one activity. Is it possible that several minor effects from various activities could result in a moderate or major effects to a biological population?

We expressed this concern in our comments on the DEIS for lease sale 97 in the Beaufort Sea. We have not seen the response to this particular comment since the lease sale 97 FEIS is not yet available for review. We believe, however, that this is a significant concern. The DEIS for this lease sale discusses this concept and we are therefore taking this opportunity to comment on this issue again. **EPA-13**

The DEIS (p. IV-B-73) states that "the effects of several stimuli could be purely additive or, in combination, could have synergistic effects that would lead to changes that are greater than the sum of changes due to the individual stimuli or sources." This discussion is found in the cumulative effects discussion for bowhead whales. We concur with this concept and support impact analysis based upon it.

We suggest that in the FEIS and subsequent lease sale EISs MMS analyze the "combined effect" of the numerous effect producing activities on each biological resource for both the proposed action and alternatives as well as for the cumulative case. Some discussion of the likelihood of a biological population encountering a combination of activities within a given time frame(24 hours, week, month, migration period, open-water feeding period, molting period, staging period, etc.) is needed to support the overall effect conclusion. This is particularly important given the sensitivity of the biological resources and the natural stresses which they must survive in this sale area.

Fish

The discussion in the affected environment is quite frank about the limited research and data for many of the biological populations in the Chukchi Sea. Of particular concern, however, is the limited nature of the baseline information for anadromous fish populations. Anadromous fish are an important subsistence resource to the numerous native settlements along the Chukchi Sea Coast.

The DEIS points out that several studies that include anadromous fish were conducted in relation to oil and gas activity in the Northern Bering Sea and the Beaufort Sea. The DEIS also acknowledges that the Chukchi Sea represents a transition zone between the fish communities of the Beaufort and Bering Seas (p. III-24). Therefore, the extrapolation of the more extensive understanding of fish abundance and fish population dynamics from either the Bering or Beaufort Sea to the Chukchi Sea may not be valid. Further the limited baseline information about Chukchi anadromous fish populations may not be representative of long-term anadromous fish abundance and distribution patterns. The Chukchi Sea synthesis report that includes anadromous fish data through 1983 acknowledges this problem. The DEIS does not present results of fish studies conducted since 1983 that could resolve this concern. **EPA-14**

We suggest that MMS reconsider their impact conclusion for the effects of oil spills on anadromous populations. The DEIS identifies moderate effects for some individual species. If the limited fishery data base may not be truly representative of long term abundance and distribution patterns, then MMS should consider a more conservative approach. The overall oil spill effect should be no less severe than the moderate effects identified for specific populations.

Conditional Probabilities

It was difficult to compare the relative merits of each of the alternatives when combined probabilities were used for the discussion of impacts for the Proposal and the Coastal deferral alternatives and conditional probabilities were used for the Eastern and Southern deferral alternatives.

As we have stated in the past, the use of conditional probabilities provides much useful information. We would like to reference our comments on this subject found in our January 9, 1986, comments on the Beaufort Sea Sale 97 DEIS. Use of conditional probabilities (annual and seasonal) for assessing environmental consequences allows the EIS reviewer to: **EPA-15**

- identify launch points that represent the greatest risk to vulnerable/sensitive habitats and biological communities;
- identify the targets (sea, ice, biological resource areas, land segments) most likely to be contacted by spilled oil;

- determine the season that these targets are most susceptible to oil contact;

- determine if the seasonal risk of oil spill contact corresponds with the seasonal presence of biota; and

- distinguish clearly the differences in oil spill risk between the proposed alternative and the deferral alternatives.

Conditional probabilities indicate the likelihood of spilled oil contacting land or sea targets assuming there is an oil spill. Combined probabilities indicate the likelihood of an oil spill occurring and the likelihood of spilled oil contacting land or sea targets. However, if the probability of spill occurrence is low, it does not logically follow that the effect of a spill will be negligible. Thus, the conditional and combined probabilities both provide important information to the decision-maker, but conditional probabilities are needed so that the public and decision-makers can fully assess the signficance of potential impacts.

Presenting the information from the oil spill trajectory analysis for each alternative as well as the combined probabilities allows EIS reviewers to make a reasoned judgment about the need for additional mitigating measures or potential deferrals of launch point areas that pose a significant risk to critical habitat or sensitive biota.

WATER QUALITY

We noted several changes in the water quality effects analysis compared to the same section in the lease sale 97 DEIS and the preliminary draft water quality affects discussion for this lease sale that we reviewed in November 28, 1986. The changes represent improvements in the overall discussion and presentation of water quality effects.

We would like to point out that Table III-4 (after p. III-16) has incorrect saltwater criteria values for the metals presented. The values shown on this table were the criteria published in the Federal Register in November 1980. New criteria values have recently been developed. MMS should refer to Appendix I (p. I-18) for the correct criteria except for zinc. Since we prepared the table on p. I-18 in Appendix I the zinc criteria have been finalized (52 FR 6213). The acute zinc level (1-hour average concentration) is 0.095 ppm (or mg/l) and the chronic level (4-day average concentration) is 0.086 (mg/l). The FEIS should update the criteria on Table III-4 and indicate whether acute or chronic criteria are being used. Table III-4 also indicates that the saltwater criteria are for the dissolved phase of the metals. EPA's criteria values are based on the total recoverable methodology for measuring metal concentrations rather than the dissolved metal methodology. **EPA-16**

We agree with the conclusions about the likely effects from discharge of muds and cuttings during exploration. However, during development/production there will be three times more mud and four times more cuttings discharged over a longer period of time (several years). We agree that water column effects are likely to be negligible. However, we are reluctant to agree that the effects from development/production discharges on bottom sediment and benthic epifauna and infauna would also be negligible. Additional analysis is needed to fully support this conclusion. Any differences in grain size distribution, organic content, and chemical content between natural sediment and muds and cuttings could have significant effects on benthic communities. The exact location of these discharges relative to important feeding areas for bottom feeders like gray whales and walruses could have significant adverse effects as a result of trophic relationships. **EPA-17**

The water quality discussion in the DEIS fails to adequately characterize the discharge of muds and cuttings and to explain the nature of their fate and effects in the receiving water. This problem could be easily corrected by including a reference to Appendix I in this discussion. Our appendix focuses on these issues as part of our regulatory responsibilities. **EPA-18**

AIR QUALITY

Table III-3 presents measured pollutant levels for Prudhoe Bay. We would like to point out that the Drill Site 9 and Well Pad A monitors were not located in areas of maximum impacts from existing sources. Air emissions have increased significantly since the monitoring was completed. Ambient air monitoring is currently ongoing at Prudhoe Bay and Kuparuk in locations which will better represent maximum existing concentrations. However, the background levels measured at Prudhoe Bay in 1979 and 1980 may be appropriate background levels for Sale 109. **EPA-19**

As in the previous Lease Sale 97 EIS for Beaufort Sea, no air quality modeling was performed. However, we do not disagree with the conclusion that air quality impacts will be moderate. Impairment of visibility was not identified as a potential impact. We believe it should be discussed as a result of increasing concern about this issue relative to existing north slope sources. **EPA-20**

Response EPA-1

A new subsection entitled "Effects of Oil Spills and Noise Disturbance in the Spring Lead System" (Sec. IV.B.7.a(3)) has been added to the text to address this concern.

Response EPA-2

The criteria for identifying projects for cumulative analysis that were presented in Section IV.A.2 of the DEIS are not new to EIS's for Arctic sales. These criteria were used in both Norton Sound Sale 57 (USDOI, BLM, 1982d) and Sale 100 (USDOI, MMS, 1985c) FEIS's. The criteria presented in the DEIS were intended to provide the reader with the range of events typically included in a cumulative analysis, thereby providing perspective for the fact that "foreseeable future"--in the context of this EIS--is interpreted quite liberally. As a reader can note in the Section IV cumulative analyses, assessments are not limited only to those projects that fall within the existing-project category. However, to avoid any misunderstanding, the criteria and the perspective they provided have been removed from the EIS.

Response EPA-3

The approach to analysis in the EIS is to use a systematic method of examining effects on a species or species group from each effect-producing activity (oil spills, noise/disturbance, drilling discharges, etc.) and then examine 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 are further considered in the oil-spill-risk and the cumulative-case analyses for each resource. Most effect-producing activities are short-term, localized, and usually not additive; therefore, they are not "synergistic." Also, the probability of any two effects occurring at the same time and at the same place and to the same individuals in the population is extremely remote. "Synergistic" as well as "antagonistic" effects have been documented with some heavy metals and the combination of heavy metals and organic chemicals using lower-trophic-level organisms in controlled laboratory experiments. Quantitative potential synergistic effects with upper-trophic-level organisms in which two activities have a greater than additive effect have not been documented. Without more specific direction from the commenter, the present EIS methodology in determining effects should be more than adequate.

Response EPA-4

Seasonal conditional probabilities are discussed in Sections IV.A.1.c, IV.A.2.b, IV.A.2.c, IV.B, IV.E, IV.F, and IV.G and are displayed in Appendix A, Tables A-9 through A-14. The conditional probability is not a "risk" to a resource. Risk involves estimating the likelihood of spills occurring, of such spills contacting the habitat of that resource, and of what damage occurs to the resource if the habitat is contacted. The overall likelihood of spills occurring somewhere in the sale area and contacting resource targets is given by the combined probabilities. Because the combined probabilities--not the conditional probabilities--provide an overall estimate of likelihood of resource contact with oil, the combined probabilities are emphasized in the EIS.

Response EPA-5

In response to the EPA's and other commenters' concerns, a new section addressing the spring migration corridor of the bowhead whales has been added to the EIS (see Sec. IV.B.7.a(3)).

Response EPA-6

See Response EPA-1.

Response EPA-7

See Response EPA-1.

Response EPA-8

See Response EPA-1.

Response EPA-9

See Response EPA-1.

Response EPA-10

The analyses in the Sale 87 and 97 EIS's and in this EIS have used recent scientific data on behavioral responses of bowhead whales to drilling activities and noise. The MMS believes that information currently available is adequate for a basic understanding of the effects of oil and gas activities on bowhead whales. However, additional studies regarding noise effects on bowhead whales are planned and in progress. Also, much is being learned from industry monitoring studies in the vicinity of drilling activities.

Response EPA-11

A new section (Sec. IV.B.7.a(3)) has been added to the text to address this concern. Within this section we have analyzed the effects of noise and disturbance on the bowhead whale spring migration using the best available scientific information. The MMS is currently planning a study that will better address the concern about the effect of production activities on migrating bowheads in or near the spring lead system. It is anticipated that this study would be completed prior to the time that any development would be proposed in the area of the spring lead system. Furthermore, the MMS is fully aware of the concern by the NMFS, the EPA, the NSB, and others for the safety of bowhead whales migrating through the spring lead system. The MMS intends to execute its responsibility under the Endangered Species and Marine Mammal Protection Acts, as amended, and will take no action that would be likely to jeopardize the bowhead whale population.

The NMFS Biological Opinion concluded that the leasing and exploration phases of Sale 109 are not likely to jeopardize the continued existence of any endangered or threatened marine cetaceans, including the bowhead and gray whales. In addition to the Biological Opinion on leasing and exploration, the NMFS also provided its views on the Sale 109 development and production phase: "Based on currently available information and technology and the absence of effective mitigating measures, we believe that development and production activities in the spring lead systems used by bowhead whales for their migration would be likely to jeopardize the population." The NMFS provided the following two reasonable and prudent alternatives that the MMS could adopt to avoid the likelihood of jeopardy from oil spills and noise: ". . .either (1) the lease blocks within 25 miles of the nearshore lead system should be deferred from the lease sale, which would be met by adopting the Coastal Deferral Alternative VI (MMS, 1987), or; (2) if leasing and exploration activities occur in those areas, development and production activities should not be approved in these blocks 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."

Response EPA-12

See Response EPA-2.

Response EPA-13

See Response EPA-3.

Response EPA-14

Some of these issues are addressed in Response NOAA-6. We are unaware of studies conducted since 1983, although an MMS study will be conducted soon in the Chukchi Sea region. Further analysis of potential effects on anadromous fishes has been added to the text in Section IV.B.4. The overall effect of the proposal is not less than the most likely effect on any particular fish species; the text has been clarified in this regard.

Response EPA-15

The rationale behind the use of combined and conditional probabilities in the analyses of deferral alternatives is discussed in Section IV.A.1.c. The merit of a deferral alternative in reducing spill risk is not easy to demonstrate when that alternative does not significantly reduce the likelihood of oil spills occurring and contacting resources, which is the case in Alternatives IV, V, and VI. The merits of such an alternative may be predicated on nonspill-related concerns, such as noise and use conflicts. The relative merits--including those related to oil spills--of the deferral alternatives and the proposal are compared by the EIS analysts for individual resources. The conclusions of these comparisons are summarized in Table S-1.

o The conditional probability is not a "risk" to a resource. Risk involves estimating the likelihood of spills occurring, of such spills contacting the habitat of that resource, and of what damage occurs to the resource if the habitat is contacted.

o Conditional probabilities cannot be used to estimate which targets are most likely to be contacted by spilled oil. Only combined probabilities provide this information. The highest conditional probabilities, greater than 99 percent, indicate only that the hypothetical spill point in question is within the target area. That is, the probability of a spill contacting the target area is high because the spill is assumed to have occurred within the target area. The EIS reviewer should place little emphasis on this obvious conclusion.

o The requested information is provided by seasonal combined probabilities--not seasonal conditional probabilities. Seasonal conditional probabilities cannot determine the season during which targets are most likely to be contacted by oil in the Chukchi Sea. About 62 percent of oil production and, therefore, spill risk would occur during the 7.5 months of oceanographic winter. Any valid estimate of whether spills are more likely to contact a resource in summer than in winter would have to take into account that fewer spills would be expected during the short summer than during the long winter. Combined probabilities--but not conditional probabilities--take this factor into account and are, therefore, used for this purpose in the EIS.

o Seasonal conditional probabilities should not be compared to seasonal presence of resources because that comparison is already incorporated in the statistics. If a biological resource is vulnerable to oil spills only on a seasonal basis, the Sale 109 OSRA models only spill contacts with the habitat for that resource during that season. If a resource is vulnerable during only part of a season, spill contacts with the resource target are counted only for that portion of the season. All such restricted-vulnerability targets are noted in footnotes to the OSRA tables in Appendix A. For example, the note to Table A-21 states that during winter, Whale Migration Corridor B is a target only between April 1 and June 15, e.g., when whales could be migrating through the area.

o Both combined and conditional probabilities are used to evaluate the relative merits of deferral alternatives. Combined probabilities are used to estimate the likelihood of contact with spills, and conditional probabilities are used to verify the point of origin of such spills. For the purpose of analyzing effects, this EIS assumes that spills occur (Table II-1). The effects of oil-spill contacts are considered in the EIS, regardless of their probabilities. However, the bottomline effect level for a resource in the EIS assumes oil-spill contact only if such contact is likely to occur.

Complete OSRA's for Alternatives I and VI and the cumulative case are presented in the EIS and tabulated in Appendix A. The OSRA's for Alternatives IV and V are identical to the analysis for the proposal (Alternative I) (because of the absence of resource in the deferral areas) and are not separately tabulated to avoid duplication. Conditional probabilities are included in the EIS for all hypothetical launch points used in the trajectory analysis covering deferral alternatives (see also Response EPA-4).

Response EPA-16

Table III-4 in Section III.B.6 has been amended to address this concern. The USEPA (1986) does not designate whether standards are "chronic" or "acute" nor does USEPA always list two standards. Where two standards exist, Table III-4 reports the more stringent standard.

Response EPA-17

Table IV-14 in Section IV.B.2.b compares chemical concentrations in drilling muds to those in sediments of the Chukchi Sea Planning Area. For heavy metals of concern, only the mercury and zinc contents of mud have the potential to be as much as a hundredfold higher than the background content of the sediment.

The muds and cuttings from development and production platforms would be rapidly and extensively dispersed in the shallow (generally less than 100 meters) Chukchi Sea basin due to storms and ice scour, even though the amount of muds and cuttings would be considerably greater than the amount discharged during exploration. Thus, grain sizes of the bottom sediments in the proposed Chukchi Sea Sale 109 area are not expected to be significantly changed. Several hundred thousand cubic meters of muds and cuttings would be discharged into several thousand square kilometers of natural bottom sediments. The chemical contaminates in muds and cuttings, such as barium and cadmium, are present as natural elements at some level in the Chukchi Sea marine environment. The addition of more cadmium from muds and cuttings, for example, into the Chukchi Sea is not expected to exceed the cadmium-tolerance level now present in walruses, since these animals would be feeding on clams over a large part of their range from year to year and thus would not be likely to ingest clams with high levels of cadmium every year or every season.

As noted in the EIS section on lower-trophic-level organisms, NEGLIGIBLE effects are not predicted for phytoplankton, zooplankton, or benthic communities (see analysis in Sec. IV.B.3.c).

Response EPA-18

Appendix I and its findings are already referenced in Section IV.B.2.b.

Response EPA-19

Section III.A.5 includes a discussion of the location of Well Pad A and Drill Site 9 relative to the predominant winds and their influence on measured concentrations of pollutants at Prudhoe Bay. The data from more recent air-quality monitoring at the Prudhoe Bay/Kuparuk/Lisburne complex are proprietary and have not been released to the MMS by the USEPA or industry.

Response EPA-20

This concern is addressed in Response NPS-20.

MARINE MAMMAL COMMISSION
1625 EYE STREET, N.W.
WASHINGTON, DC 20006

5 May 1987

Mr. Alan D. Powers
Regional Director
Minerals Management Service, Alaska Region
U.S. Department of the Interior
949 East 36th Avenue
Anchorage, Alaska 99508-4302

Dear Mr. Powers:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the "Chukchi Sea Sale 109 Draft Environmental Impact Statement" and offers the following comments and recommendations concerning possible impacts on marine mammals and their habitat in and near the proposed sale area.

GENERAL COMMENTS

The Draft Environmental Impact Statement (DEIS) provides an assessment of possible impacts from a proposed action to lease up to 5,448 blocks (approximately 29.5 million acres) of submerged OCS lands in the Chukchi Sea off northwest Alaska for the purpose of oil and gas exploration and development. It also assesses the possible effects of six alternative actions and provides information on 10 species of marine mammals including four endangered whales (i.e., bowhead, gray, fin, and humpback whales). It concludes that possible effects on all species of non-endangered marine mammals and endangered bowhead and gray whales are likely to be minor under each of the leasing alternatives, and that possible impacts on endangered fin and humpback whales are likely to be negligible under each leasing alternative. Consultations with the National Marine Fisheries Service, as required by section 7 of the Endangered Species Act, on the effects of the proposed action on endangered whales were initiated on 25 March 1986, however, the results of those consultations were not available at the time that the DEIS was prepared. The results of these consultations should be included in the final document and the text of the FEIS should be modified as necessary to incorporate the recommendations contained therein. **MMC-1**

The DEIS provides a concise and useful review of relevant information on the abundance, distribution, trophic relationships, and subsistence take of both non-endangered marine mammals and

endangered bowhead whales. It also provides a reasonably thorough review of the types and possible effects of oil spills and activities expected to occur as a result of the proposed and alternative actions. It does not, however, provide clear descriptions of the uncertainties concerning factors, such as the expected number, timing, and location of oil spills, the location and extent of development activities, and the potential effects of oil spills, disturbance, etc. on marine mammals and other living marine resources. Also, as noted below, some of the conclusions concerning possible adverse effects on marine mammals appear to be speculative and based upon unstated assumptions rather than derived from critical evaluations of the existing data base. **MMC-2**

With respect to polar bears, beluga whales, and bowhead whales, the Commission believes that the conclusions in the DEIS regarding projected impact levels resulting from Alternative IV (the eastern deferral alternative) and Alternative VI, (the coastal deferral alternative) should be modified to indicate that expected impacts associated with these alternatives likely would be less than those from the Proposed Action. The coastal habitat shoreward of the southeastern boundary of these leasing alternatives includes habitat of particular importance to polar bears, beluga whales, spotted seals, and bowhead whales and we believe that an absence of exploration and development activity in these deferral areas would significantly reduce potential impacts to each of these species. **MMC-3**

With respect to potential impacts on both endangered and non-endangered marine mammals, the DEIS should be modified to: a) emphasize the importance of post-sale monitoring efforts that would be undertaken as part of the Alaska Environmental Studies Program; b) consider the possibility that oil spills and/or disturbance associated with the Proposed Action will cause foraging marine mammals to move to adjacent and already occupied areas increasing animal densities in those areas to levels which will damage or deplete food supplies; c) consider the cumulative impacts of oil spills and/or disturbance on affected marine mammal populations throughout their respective ranges, rather than just within and immediately adjacent to the proposed sale area; and d) consider the possible cumulative effects of subsistence harvesting and other activities, as well as oil and gas exploration and development, on non-endangered and endangered marine mammals. **MMC-4** In addition, recent information suggests that algal communities associated with ice edge environments may represent particularly productive and important components of Arctic (as well as Antarctic) marine ecosystems. The DEIS should be expanded to consider that information and the potential effects of oil spills on those communities and the food chain which they support. **MMC-5**

The DEIS identifies a number of potential mitigating measures including stipulations for an orientation program and for protection of biological resources, and notices of "information to lessees" on bird and marine mammal protection, areas of special biological sensitivity, protection of endangered whales, endangered whales, the Chukchi Sea Biological Task Force, and subsistence whaling and other subsistence activities. These measures would help reduce potential impacts on marine mammals and other marine species and we recommend that they be included as part of the Proposed and Alternative Actions which involve leasing.

SPECIFIC COMMENTS

Pages I-1 to I-5, Leasing Process: This section identifies major steps and information sources for planning and managing offshore areas to be leased for oil and gas development. The introductory paragraph notes that the Alaska OCS Region Environmental Studies Program provides relevant information to help determine potential effects of oil and gas activities on the environment and that it is a vital part of the leasing process. The Commission strongly supports the Service's view regarding the importance of this Program in the leasing and lease management processes.

For additional information on the Program, the reader is referred to Appendix D of the DEIS. Among other things, the Appendix notes that, "[a]s 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 [and]... [t]his has been the most recent change in the focus of the Alaska ESP." The Commission also shares the Service's view that the change in Program orientation to better reflect post-sale monitoring efforts is both timely and necessary. To better reflect this point in the body of the DEIS, we suggest that something like the words "...predict, detect, monitor, and otherwise..." be inserted between the words "...to help..." and "...determine the potential effects of..." in the fourth sentence of the paragraph beginning on the bottom of page I-1. **MMC-6**

Page I-15 to I-16, Section I-D-3-h: This section of the DEIS provides a series of subparagraphs that describe the rationale supporting the Service's conclusion that impacts on endangered whales are likely to be minor. The first sentence of the third subparagraph states that the "[r]isk of a major spill (1,000 barrels or greater from blowouts or fuel spills) from an exploratory well is low (0.5%/well)." It is not clear why this sentence refers only to exploratory, and not to development wells. It seems to us that all phases of development should be considered. In addition, the subparagraph should note that, while the risk per well might be low, the actual impact could be greater if a large number of wells are drilled. For example, if 200 wells are expected to be drilled, and the risk per well is 0.5%, the cumulative risk would be 100% or virtual certainty that a major oil spill is likely to occur. In this same regard, it is important to differentiate between the risk of an event occurring **MMC-7**

V-29

and the impact of that event should it occur. That is, while there may be a very small risk of an oil spill occurring, it does not necessarily follow that the impact of a spill would be small.

The fifth subparagraph also refers to exploration activities and it is not clear why development and production activities as well as exploration activities are not considered. **MMC-8**

The sixth subparagraph notes that "[p]reliminary results for spring oil-spill/bowhead whale-interaction simulations at two locations along the bowhead-migration corridors in the Chukchi Sea Sale 109 area indicated that in one case about 0.6 percent of the bowhead population and in the other case about 1.5 percent were contacted by spilled oil within a 10-day period following a computer simulated 10,000-barrel spill." Given an estimate of 4,417 whales in the western Arctic bowhead whale stock, this would mean that 27-62 whales could be contacted by oil. This is about the same to twice the number of whales taken annually by Alaska Natives for subsistence purposes and, if contact with oil results in decreased survival or productivity, the impacts could be substantial. In this same context, it is not clear why: (1) the simulation was based upon a 10,000-barrel spill rather than a 100,000-barrel spill as in the worst-case analysis beginning on Page IV-I-1; and (2) why the worst-case analysis considered what would happen if an oil spill occurred during the fall (September-November), rather than during the spring migration through or near the Sale 109 area. **MMC-9**

Page II-14, Mitigating Measures that are Part of the Proposed Action and Alternatives: This paragraph briefly lists examples of laws, regulations, orders, and provisions that are considered part of the Proposed and Alternative Actions. Because of the importance of verifying the accuracy of predicted impact levels and detecting any significant unforeseen effects associated with leasing alternatives, it would be useful to expand this paragraph to reference the monitoring efforts that would be conducted through the Alaska Environmental Studies Program as among the various requirements of the OCS Lands Act. **MMC-10**

Pages II-17 to II-18, Stipulation No. 3, Protection of Biological Resources: This potential stipulation would advise lessees that they may be required to: conduct biological surveys, relocate the site of operations, demonstrate on the basis of site-specific surveys that their activities will not adversely affect biological resources, limit operations to certain periods of time, or otherwise modify their operations to protect biological resources. This stipulation offers important safeguards for protecting biological resources and the Commission recommends that it be included as part of each leasing alternative, including the Proposed Action.

With respect to this stipulation, we note that certain highly migratory species, such as bowhead whales, beluga whales, spotted seals, and polar bears, may be affected by activities of **MMC-11** lessees. Thus, it may be desirable or necessary to request that lessees conduct or provide cooperative support for studies that may extend beyond the immediate boundaries of their respective lease tracts. Therefore, the Commission recommends that something like the words "or provide partial support for" be inserted between the words "to conduct" and "biological surveys" in the first sentence of the stipulation. Similarly, the word "site-specific" in point number 2 of the first sentence of the second paragraph of the stipulation should be changed to something like "biological."

Pages II-19 to II-26, Potential Information to Lessees: This section identifies potential measures to advise lessees of information on Minerals Management Service policies and practices, information regarding special concerns, and existing legal requirements. These types of information offer essential forms of guidance to lessees and, subject to the following comments and recommendations, we recommend that they be included as a part of each leasing alternative, including the Proposed Action.

With respect to these notices, we note that it may become necessary or desirable to modify information in these Notices over the course of the field development and production to reflect new findings, such as those that might result from post-sale monitoring studies conducted as part of the Alaska OCS Region Environmental Studies Program. Therefore, we also recommend that the Service advise lessees that these "ITL's" may be revised and updated as new information warrants, and that new ITL's may be issued to advise lessees on information topics not addressed in its initial list of applicable notices. MMC-12

Pages II-20 to II-21, ITL No. 1 -- Information on Bird and Marine Mammal Resources: This notice advises lessees of legal provisions regarding the need to avoid "taking" marine mammals and endangered species and advises aircraft and vessel operators to maintain certain distances from known or observed wildlife to avoid disturbance. It would be useful to expand the notice to advise vessel and aircraft operators that they should not divert their craft off course for the purpose of observing wildlife. In addition, the analysis of effectiveness for this "ITL" notes that several species or groups of species (e.g., bowhead whales, gray whales, walruses, and certain seals) are of particular concern relative to this potential stipulation. Polar bears should be added to this list. MMC-13

Pages II-21 to II-22, ITL No. 2 -- Information on Areas of Special Biological Sensitivity: This notice states, in part, that "[l]essees are advised that prior approval must be obtained before dispersants are used" in the vicinity of an area of special biological sensitivity. The notice should be expanded to identify from whom this approval must be obtained. MMC-14

Pages II-22 to II-23, ITL No. 3 -- Information on Protection of Endangered Whales: This potential stipulation advises lessees that the Service's lease manager intends to limit or suspend oil and gas drilling activity when endangered whales are close enough to be jeopardized by potential oil spills and/or associated noise disturbance, and that the lessee may be required to conduct suitable monitoring programs concurrent with exploratory operations to determine if whales are in the vicinity of their activities. The Commission supports this stipulation and recommends that it be included as part of each leasing alternative, including the Proposed Action.

Pages II-23 to II-24, ITL No. 4 -- Information on Endangered Whales: This stipulation is similar to ITL No. 3 and it advises lessees that the Service's lease manager intends to limit or suspend certain noise producing activities, including geophysical-seismic surveys, when endangered whales are close enough to be jeopardized by potential noise related disturbance. It differs from ITL No. 3 in that it does not reference possible requirements that lessees conduct suitable monitoring programs concurrent with these activities. The reason for this is not self-evident and it seems to us that there would be merit in combining this ITL with ITL No. 3 to advise lessees that they may be required to conduct suitable monitoring programs in association with noise producing activities such as geophysical-seismic surveys as well as oil and gas drilling activities. Alternatively, the reason for omitting reference to possible monitoring requirements for noise producing activities, including geophysical-seismic surveys, should be explained. MMC-15

Pages II-25 to II-26, ITL No. 7 -- Information on Subsistence Whaling and Other Subsistence Activities: This notice advises lessees of the importance of subsistence hunting and notes that waters within 20 miles of the coast are used extensively by Alaska Eskimos during the period from April to June. To provide the lessees with a better basis for avoiding effects on subsistence hunting by Alaska Natives, it would be useful to expand the notice to identify the preferred hunting areas and seasons during which polar bears, beluga whales, seals, and other species are taken for subsistence purposes within the leasing area. MMC-16

Unnumbered Pages Following Page II-27, Table II-14: This table presents a summary and comparison of effects of the proposed and alternative actions. Some of the conclusions set forth in this table and elsewhere in the DEIS are based on a number of unstated and, perhaps, unjustified assumptions. For example, in the section entitled "Pinnipeds, Polar Bears, and Beluga Whales" it is stated that "...losses of walruses, seals, polar bears, and beluga whales would be replaced within one generation, representing MINOR effects." This conclusion assumes that the potentially affected populations of these species are currently increasing or are at or near carrying capacity levels. If their populations are declining or stabilized below carrying capacity due to harvest or other non- MMC-17 natural mortality, the additional mortality could cause or contribute to the decline such that losses would not be replaced unless and until hunting or other sources of mortality were eliminated or reduced.

Similarly, a statement is made that "[t]he seven oil spills may have some local long-term effects on benthic prey of walruses and bearded seals; however, the amount of benthic habitat and prey affected is likely to be very small in comparison to the amount of benthic resources available in the Chukchi Sea." This statement assumes that there would be suitable, unoccupied habitat near the areas that could be affected by the oil spills and/or that movement of walruses and bearded seals from affected areas to areas already occupied will not result in walrus or bearded seal densities greater than the available food supplies can support. MMC-18

Additional examples are the statements that "...because the walrus herds are widely distributed along the ice front, only a small proportion of the calf population is likely to be disturbed or injured (as a result of disturbance-induced stampedes)" and that "...vessel traffic from the proposal is not likely to block or significantly delay marine mammal migrations." The first of these two statements assumes that the location of walrus nursery herds and the ice that they are on would be stationary with respect to air traffic patterns and that a significant number of animals would not drift or move through areas that would be affected by noise or disturbance from associated activities. The second statement assumes that there always would be alternatives to the migratory corridors being blocked and that delays in migration would have no subsequent effects on survival or reproduction. The latter assumption also applies to the conclusions that effects on endangered bowhead and gray whales are "expected to be short-term and temporary in nature consisting of movements away from the sound source..." MMC-19

Pages III-17 to III-18, Epontic Community: This section provides information on the community of plants, animals and fish associated with the undersurface of sea ice. As we understand it, recent studies of ice edge environments in both the Antarctic and Arctic suggest that these areas may be highly productive marine habitats whose associated food chains may be of great importance to many marine species, including marine mammals. For example, receding pack ice and associated currents may be important factors in the timing and development of spring phytoplankton blooms along the ice edge. As possible, this section of the DEIS should be expanded to consider recent information on the potential importance of ice edge communities to the regional marine ecosystem. Subsequent sections of the DEIS should consider the effect of oil spills on the associated food chains. MMC-20

Pages III-29 to III-34, Pinnipeds, Polar Bears and Beluga Whales: This section provides a useful and succinct distillation of relevant information on the abundance, distribution, trophic relationships, and subsistence take of species of seals, walrus,

polar bears, and beluga whales in and adjacent to the leasing area. The presentation appears to be based on a thorough review of the available literature and the description of what is known about these species is presented clearly and in an appropriate level of detail. As discussed below, to provide a better basis for assessing the reliability of the information presented, it would be useful to expand this, and perhaps other sections of the DEIS, to better reflect uncertainties in available information. MMC-21

Page III-32, Pacific Walrus: The first paragraph of the section notes that the Pacific walrus population numbers about 250,000 animals and that about 150,000 animals summer in the Chukchi Sea. It should be noted that Pacific walrus may be composed of two or more discrete stocks. The animals which summer in and adjacent to the proposed sale area may be part of an eastern stock which winters in the southeastern Bering Sea. A separate western stock of Pacific walrus also may exist which summers off the Chukotsk Peninsula and winters in the northwest Bering Sea and Anadyr Gulf. The degree to which these two groups mix or remain discrete is presently unknown. In addition, it should be noted that the referenced population estimates are from the early 1980's and that, if the population presently is declining as indicated in the last sentence on page III-32, the actual population may be substantially smaller than indicated by the referenced estimates. MMC-22

Pages III-33 to III-34, Polar Bears: The first paragraph of this section indicates that there are two possible distinct populations in Alaska (i.e., in the Chukchi Sea and the Beaufort Sea). It would be useful to note that, while the two populations are thought to be more or less discrete, information currently is insufficient to determine the degree to which animals in the Beaufort and Chukchi Seas constitute discrete stocks. The second and third paragraphs of the section note that there is substantial annual variation in the seasonal distribution and local abundance of polar bears in the Alaska Beaufort and Chukchi Sea coasts, and that drifting pack ice off the coast of the Chukchi Sea probably supports greater numbers of polar bears than shorefast or polar pack ice. It should be noted that the effects of ice drift patterns, topography, and lead development on polar bear movements and distribution are not clearly understood and, thus, a detailed assessment of habitat use patterns is not possible at this time. The fifth paragraph of the section provides information on denning locations and seasons. It would be useful to note that the significance of pack-ice denning relative to mainland denning has not yet been determined and that further research is needed to determine precisely which areas are most critical for successful denning. MMC-23

Page III-34, Beluga Whales: The first paragraph of the section notes that the North American population of beluga whales is estimated to be at least 30,000 animals and that an estimated 2,500 - 3,000 animals frequent bays and estuaries of Kotzebue Sound and the Alaska Chukchi Sea coast during the summer months. MMC-24

As we understand it, the degree of intermixing and interbreeding among whales that summer in different regions, including the Kasegaluk Lagoon, is not known but that beluga whales summering in Kasegaluk Lagoon may represent a discrete population of animals. It would be useful to expand the paragraph to note this point. In addition, to indicate the reliability of estimated whale abundance in the Sale area, something like the following should be inserted at the beginning of the last sentence of the paragraph: "Although systematic surveys and population estimates have not been conducted along the Chukchi coast of Alaska,..."

Unnumbered Page Following Page III-48, Table III-18: This Table provides information on annual subsistence harvests of marine mammals. It notes that harvest data for polar bears between the years 1962 and 1971 are not available. As we understand it, data on polar bear harvests during these years are available from the Alaska Department of Fish and Game and should be included on this Table. This comment also applies to Table III-19. **MMC-25**

Page IV-A-2, Second Paragraph: This paragraph identifies criteria used for identifying projects to be considered in the cumulative effects assessment. Criteria (4) requires that "...the geographic area of the influence of the proposed actions is contiguous to or overlaps with the region that is the subject of environmental assessment in this proposal." Certain projects that are not necessarily contiguous to or overlapping the region considered in this proposal may affect highly migratory species, such as endangered whales and other marine mammals, found within the proposed sale area only seasonally. We believe that such projects should be considered in the assessment of cumulative impacts, and, to reflect this point, this criteria should be rewritten to read something like the following: **MMC-26**

> "(4) the environmental effect of the proposed action may affect the environment, including seasonally occurring living resources, within the region that is the subject of environmental assessment in this proposal;..."

Page IV-A-2, Third Paragraph: This paragraph refers the reader to Appendix G of the DEIS for a description of existing and planned projects considered with respect to assessing cumulative impacts. Project 17 in Appendix G identifies oil and gas development in the Canadian Beaufort Sea. Citing a 1982 reference, it notes that transport of Canadian hydrocarbons west is not currently being considered. The second paragraph on page IV-A-3 notes that westward tankering of Canadian crude oil is not higher than third in preference. **MMC-27**

As we understand it, Canadian interests are still actively considering a year round tanker corridor through the Beaufort, Chukchi, and Bering seas which would be kept open throughout the winter by icebreakers and which would include lightering operations beyond the U.S. territorial limit off Barrow. If this

understanding is correct, Appendix G and this section, including Table IV-1, should be updated to identify and, as appropriate, consider the operation and effect of a large scale tankering operation.

Pages IV-A-17 to IV-A-20, Toxicity of Oil in the Marine Environment: This section discusses factors related to the toxicity of oil in the marine environment and notes, among other things, that "...low-molecular-weight components [of spilled oil] are more toxic but are rapidly lost through evaporation and solution during the first days of a spill." It does not, but should, indicate how evaporation or other factors would be affected if the oil is entraped in or under ice. **MMC-28**

Page IV-B-49 to IV-B-50, Carryover Paragraph: This paragraph notes, among other things, that some polar bears and newly born seal pups are likely to suffer direct mortality from oiling through loss of thermo-insulation and resulting hypothermia. The paragraph should be expanded to note that oiling of seal pups, polar bear cubs, and/or nursing seals or bears also could result in ingestion of oil and disruption of mother-pup bonds causing the death of dependent pups or cubs. **MMC-29**

Page IV-B-50, First Complete Paragraph: It is true that the referenced studies by Geraci and St. Aubin provide a basis for making judgements concerning the possible effects of oil contact on beluga whales. However, there is no justification for concluding that the study results are directly applicable and, therefore, "...providing sufficient insight." Therefore, the word "sufficient" in the third line of this paragraph should be deleted. **MMC-30**

Pages IV-B-51, First Paragraph: Among other things, this paragraph states that ringed, spotted and bearded seals, walruses, and beluga whales are capable of moving from an area of local prey depletion to other locations of prey abundance; that breeding ringed seals may be an exception because they remain in local areas during the pupping season; and that reduction of food organisms (Arctic cod and epibenthic crustaceans) would persist for no more than one season due to rapid recruitment of these food organisms and "represents a MINOR effect." Although ringed, spotted, and bearded seals, walruses, and beluga whales obviously are capable of moving from an area of local prey depletion to other locations of prey abundance, it does not necessarily follow that: there will be areas of prey abundance near areas where prey is depleted; the animals will in fact move; the displaced animals will be able to find these alternative feeding areas; the alternative areas will not already be occupied; and, if they are already occupied, the increase in predator density will not result in depletion of food supplies and ultimately affect greater numbers of animals than would have been affected in the spill site itself. **MMC-31**

Page IV-B-52, First Complete Paragraph: This paragraph should be expanded to indicate the size of the area that could be affected by a 100,000 barrel spill and the densities (and thus number) of ringed, spotted, and bearded seals that might occur in such areas. Also, the last sentence of the paragraph should be expanded to indicate some of the assumptions upon which it concludes that "[l]ost seals would be replaced *within one generation* or less, representing MINOR effects." That is, something like the following should be added to the end of the sentence:

> "...provided the populations are stable or increasing at the time of the spill and the spill does not result in any significant degradation or destruction of food supplies or other essential habitat components."

MMC-32

Page IV-B-52, Second Complete Paragraph: This paragraph should be expanded to indicate the number of polar bears denning on Wrangle Island that likely would pass through the lease sale area *after* they leave the Island.

MMC-33

Page IV-B-53, First Complete Sentence: This sentence should be expanded to indicate some of the assumptions upon which it is concluded that no more than 10-30 polar bears are likely to encounter oil spills and that bears that are killed will be replaced *within one generation or less*. That is, something like the following should be added to the end of the sentence:

> "...assuming that polar bears will avoid and not be attracted to oil slicks and that the affected polar bear population is not declining or stabilized due to Native subsistence hunting or other possible forms of non-natural mortality."

MMC-34

Page IV-B-53, First Complete Paragraph: The last sentence in this paragraph states that "[t]he death of some highly stressed walruses attributed to one or more oil spills would be considered a MINOR effect on the Pacific walrus population." The rationale for this conclusion is not self-evident. Does it, for example, take into account the possibility that the walrus population may be at or near the largest population supportable by available food supplies, and thus be subject to substantial nutritional stress at the present time, or, as indicated on page III-32, that the population *might* currently be declining due to present high harvest levels?

MMC-35

Page IV-B-53, Second Complete Paragraph: The last sentence in this paragraph should be expanded to indicate that the stated conclusion assumes that the affected beluga whale population(s) is (are) increasing or stabilized (as a result of natural mortality) and that oil spills will have no significant adverse effects on food supplies or other essential habitat components.

MMC-36

Pages IV-B-53 to IV-B-54, Carryover Paragraph: This paragraph contains a number of statements that are not supported by the data or references to supporting data. As examples, it is not self-evident why:

- the effects of oil spills on the number or availability of Arctic cod and epibenthic crustaceans would be short-term (one season or less), with rapid recruitment from adjacent areas after the spill has dispersed;

- oil spill reduction of pelagic food sources of spotted seals and beluga whales also is likely to be local near the spill site and short-term due to the rapid recruitment of pelagic fish from adjacent areas; and

- oil contamination is not likely to affect overall clam resources in walrus feeding areas.

MMC-37

Pages IV-B-54 to IV-B-56, Waterborne Noise: The first paragraph of this section identifies sources of waterborne noise associated with the proposed action. The list of sources, and the analysis of waterborne noise effects in the following paragraphs of the section, should be expanded to consider noise and disturbance effects from oil spill clean-up operations.

MMC-38

Page IV-B-57, First Complete Paragraph: This paragraph describes the likelihood of bowhead whales encountering an oil spill of 10,000 barrels under open-water conditions. It should be expanded to indicate the probability of contact if the spill occurred in the spring and accumulated in a lead or polynya through which bowhead whales may migrate. Likewise, the worst-case analysis described in section IV-I should be expanded to assess the possible consequences of a large oil spill occurring and accumulating in the near-shore lead system during the spring bowhead migration.

MMC-39

Page IV-B-60, Conclusion: For reasons noted above, this statement would be more accurate if it was revised to read something like the following:

> "The effect of the Proposed Action on pinnipeds, polar bears, and beluga whales cannot be predicted accurately, but is not likely to be more than MINOR provided that the stated assumptions are correct."

MMC-40

Pages IV-B-60 to IV-B-65, Cumulative Effects: This section, like the preceding section, should be revised and expanded to provide a clearer indication of the uncertainties and assumptions upon which the conclusions are based. Also, the discussion of cumulative effects does not consider the cumulative effect of various factors throughout the range of the *affected marine mammal populations*. For example, the section on cumulative effects of oil spills only considers spills expected to occur and affect the proposed sale area. However, all marine mammal populations occurring in the

MMC-41

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proposed leasing area are migratory and spend parts of their life cycles in other proposed leasing areas.

Therefore, to provide a more complete and accurate assessment of cumulative effects of oil spills on the marine mammal populations of concern, this section should be expanded to consider cumulative effects of spills occurring throughout their respective population ranges. For example, walruses in the proposed sale area are part of a population that migrates seasonally between the southeastern Bering Sea and the western Beaufort Sea and, thus, the discussion in this section should consider the effects of oil spills occurring throughout the walrus population's range, including those oil spills expected to occur and potentially affect walruses in the St. George, Navarin, Norton, and North Aleutian basins.

In addition, the subsection entitled "Overall Cumulative Effects" should consider the effects of subsistence hunting and other possible human activity on marine mammal populations. The subsection entitled "Conclusions" should be revised to take into account these additional analyses.

MMC-42

Page IV-B-66, Second Paragraph: This paragraph describes results of a study by Braithwaite, Aley, and Slater (1983) of the filtering efficiency of bowhead whale baleen fouled with crude oil. The paragraph notes that, after eight hours of rinsing, filtering efficiencies began to increase. It should be noted that fresh crude oil was used in this study and that, because bowhead whales are likely to ingest weathered oil which would differ in consistency from that used in this study, cleansing rates observed in this study could differ significantly from those that might occur following an actual spill.

MMC-43

Page IV-B-67, Second Complete Paragraph: The third sentence of this paragraph cites results of a study which indicates that the highest levels of naphthalene residue, a hydrocarbon indicator, were found in toothed whale blubber, particularly Arctic beluga whales and narwhals. The results of this study should be discussed in the section of the DEIS concerning the effect of oil spills on beluga whales.

In addition, the sixth sentence of the paragraph states that "...bowheads may be capable of metabolizing and excreting polynuclear aromatic hydrocarbons from oil; so it is unlikely that petroleum hydrocarbons would accumulate to harmful levels in bowhead tissues...". The conclusion in this sentence does not follow from its premise. That is, if bowhead whales "may be capable" of metabolizing and excreting polynuclear aromatic hydrocarbons, it is possible, not likely, that petroleum hydrocarbons would not accumulate to harmful levels.

MMC-44

Page IV-B-71, Third Complete Paragraph: The last sentence in this paragraph notes that: "[f]or the first 7 years, bowheads would be exposed to industrial noise only during their fall migration; but

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for the remainder of the life of the field, the whales also would be exposed during the spring migration period." It should be noted that most, if not all, of the noise-effect studies done to date have been in relatively open water areas in the summer and fall and that it is not known whether bowhead whales will respond to noise in relatively confined lead systems in the same way that they respond to noise in circumstances which have been investigated.

MMC-45

Page IV-B-72, Conclusion (Effect on Bowhead Whales): The conclusion in this paragraph, which states that the effect of proposed Sale 109 on the bowhead whale population would be MINOR, would be true only if all of the underlying assumptions are true. That is, contact with oil will not affect the longevity or productivity of bowhead whales; oil will not affect bowhead whale food supplies in ways which will result in decreased bowhead survival or productivity; disturbance from vessel, aircraft, drilling, and other related operations will not result in decreased survival or productivity; and the western Arctic bowhead population presently is increasing in size. There are a number of uncertainties concerning the validity of these assumptions and, thus, uncertainty concerning the validity of the conclusion that the effect of the Proposed Action on the bowhead whale population would be minor.

MMC-46

Pages IV-B-73, First Complete Paragraph: This paragraph discusses the cumulative risk of oil spills on bowhead whales. It should be expanded to consider exposure to oil spills resulting from drilling activity in the Canadian Beaufort Sea and associated tankering of oil through the Beaufort, Chukchi, and Bering seas.

MMC-47

Page IV-B-73, Fourth Complete Paragraph: The second sentence of this paragraph states that if bowhead whale "calf losses occur over several years due to continued activities in the sale area, a reversal of the apparently increasing population numbers would occur..." Information sufficient to conclude that the size of the bowhead whale population is increasing is not provided here or elsewhere in the DEIS and, thus, this sentence should either be revised to delete the reference to an increasing bowhead whale population, or a reference or data should be provided to support the assertion that the bowhead whale population is apparently increasing in size.

MMC-48

Pages IV-G-5 to IV-G-6, Effects on Pinnipeds, Polar Bears and Beluga Whales: This paragraph states that "(t)he effect of the Coastal Deferral Alternative on pinnipeds, polar bears and beluga whales is likely to be minor, the same as for the proposed action." The coastal habitats included in the deferral are particularly important as seasonal denning areas for polar bears and as summer habitat for beluga whales. Thus, while it may be true that possible effects would be minor in both cases, it also is true that the alternative likely would have less effect on polar bears, beluga whales, and spotted seals. We therefore recommend that effects of this alternative on these species be

identified as likely to be less than that of the Proposed Action. This same comment also applies to the effects of Alternative IV (the Eastern Deferral Alternative) on polar bears, beluga whales and spotted seals.

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

Sincerely,

David W. Laist
Policy and Program Analyst

cc: Mr. William D. Bettenberg

Response MMC-1

Endangered-species consultation for proposed Sale 109 was initiated by the MMS with the NMFS on March 25, 1986. Prior to receiving the Biological Opinion, the MMS provided the NMFS with additional information on several occasions and conducted informal discussions on the progress of the consultation. The MMS received the NMFS Biological Opinion on endangered whales on September 1, 1987; the Sale 109 FEIS incorporates the NMFS' recommendations and the Opinion is included in Appendix B.

Response MMC-2

Section IV.A.1 (OSRA) provides a clear description of the estimated number, timing, and location of hypothetical oil spills. The OSRA and other assumptions are part of the "understood" basis for the predictive EIS analysis and a foundation for the Secretary of the Interior's decision regarding the proposed action. Assumptions about the extent and location of development activities are given in Section II.A and Table II-1. Conclusions regarding the likely or expected adverse effects on marine mammals are based on (1) the assumptions stated in Section IV.A; (2) information on the biology of marine mammals in the proposed sale area given in Sections III.B.4 and III.B.5; and (3) existing information on the effects of oil spills, noise and disturbance, and habitat changes discussed in Section IV.B.6.a(1) and (2), IV.B.6.b(1) and (2), and IV.B.7.

Response MMC-3

See Response BIA-1. The analyses of Alternatives IV and VI recognize that the effects of oil spills and noise and disturbance on marine mammals could be reduced under both of these alternatives. (Oil-spill risk is reduced from 34% under the proposal to 21% under the Coastal Deferral, Alternative VI. See Secs. IV.E.6 and IV.G.6, which recognize a reduction in oil-spill risks under Alternatives IV and VI.) However, effects on marine mammals are still likely to be MINOR, since populations of these marine mammals could still be affected by offshore activities and oil spills occurring in the western part of the Sale 109 area--which would still be leased under Alternatives IV and VI (see Table II-14, Summary and Comparison of Effects of the Proposal, Cumulative Case, and Alternatives).

Response MMC-4

The following statements respond to recommended modifications of the Section IV.B.6 analysis (Pinnipeds, Polar Bears, and Beluga Whales).

(a) The presale EIS cannot give specific information on postsale environmental monitoring. Postsale monitoring will be established if and when oil and gas exploration and development actually occur.

(b) There is no evidence to document or suggest the possibility that oil spills (short-term effects) and/or noise disturbance (brief displacement effects) associated with the proposal would cause foraging marine mammals to be permanently displaced, or that there would be long-term movement to adjacent and already occupied areas--thus increasing animal densities in those areas to levels that would damage or deplete food supplies. This concept never has been adequately documented in terrestrial ecosystems with stationary habitats and nonmigratory mammal populations, let alone demonstrated in marine environments with highly mobile populations.

(c) The EIS assesses the potential effects of the proposal on marine mammal populations or segments of populations that are present in the proposed sale area. To consider all projects--past, present, and future--over the entire range of a species population would be an impossible task in a sale-specific EIS. Many individuals and regional populations present in other parts of a species' range are not going to be affected by the proposal. The entire range of highly mobile marine mammals is covered in the FEIS on the Proposed 5-Year OCS Oil and Gas Leasing Program (USDOI, MMS, 1987b)--the appropriate place for an overall perspective.

(d) In the cumulative analysis, the EIS does consider other projects--such as the Red Dog Mine--as well as oil and gas activities.

Response MMC-5

The only new information on ice-algal productivity in the Chukchi Sea that we are familiar with is Parrish (1987, as cited by Schell, 1987, oral comm.). When new information is alluded to, it would be helpful if the commenter would provide references (at least authors' names) so that we can more readily find and examine the material in question. Some discussion of trophic interactions, including input from ice algae, is found in Section III.B.1.d (Trophic Interactions); and the discussion of effects on trophic interactions is found in Section IV.B.3.a(3)(d).

Response MMC-6

The text in Section I.A has been amended to address this concern.

Response MMC-7

The section in the DEIS referred to by the commenter described the MMS' rationale for not evaluating a seasonal drilling restriction as a mitigating measure; it was not a justification for concluding MINOR effects on endangered whales. This section has been deleted from the EIS, since a seasonal drilling restriction is analyzed in the FEIS. The effects of both exploration and development and production on endangered whales are evaluated in Section IV.B.7. Should a commercially producible quantity of oil be discovered and development and production be proposed, a developmental EIS would be written in which it would be determined what, if any, mitigating measures would be needed during development and production.

In regard to the commenter's example of 200 wells assuring a virtual certainty of a major spill, a probability distribution must be used to calculate the probability of a spill with a greater number of wells. The example of 200 wells drilled would result in a 63-percent probability of one or more spills of 1,000 barrels or greater. The MMS projects that 43 wells would be drilled during exploration and delineation; at this activity level, the probability of one or more oil spills of 1,000 barrels or greater occurring is 19 percent (see Sec. IV.A.1 for additional information on oil-spill risks). However, the MMS realizes that the probability of an event occurring does not minimize the

potential effect of that event, should it occur. Therefore, throughout the analysis of oil-spill effects (Secs. IV.B through IV.G), we have discussed the effects that would result should a spill occur and contact the habitat of the various species.

Response MMC-8

This concern is addressed in Response MMC-7.

Response MMC-9

A spill volume of 10,000 barrels rather than 100,000 barrels was used for the computer-simulated oil-spill/whale-interaction model because a 10,000-barrel spill was more representative of average-size oil spills, which would be more likely to occur. The initial results--included in the Sale 109 DEIS--were essentially a few sample runs made by the contractor to demonstrate the capability of the model. As a result, spill points generally were selected in areas of high whale use rather than in areas more susceptible to oil spills, in accordance with the assumed Sale 109 exploration and development and production scenario. After delivery of the final report on the oil-spill/whale-interaction model (from which the affected bowhead population figures were cited in the DEIS), the contractor notified the MMS of an error in the model code and provided us with a corrected final report. As a result of corrections in the model code, the estimated percentage of the bowhead population that would be contacted by a simulated oil spill was reduced from 0.6 and 1.5 percent in the DEIS to 0.1 and 0.5 percent. Now that the model code has been delivered to the MMS, we anticipate having it available for use in predicting oil spills for future lease sales in the Bering, Chukchi, and Beaufort Seas. Oil-spill/whale-interaction simulations could be run for spills in a number of areas and time periods, with varied spill volumes--a capability that the MMS has not had in the past.

The MMS agrees that the worst-case analysis for the bowhead whale should address the spring migration; the text in Section IV.I has been amended accordingly.

Response MMC-10

If the Sale 109 area shows some potential and industry is actively interested in exploration, a field monitoring effort--probably similar to that conducted in the Beaufort Sea--will be initiated. Further, the monitoring plan undoubtedly would be continued in conjunction with any development and production that followed in the Chukchi Sea. The Beaufort Sea monitoring program and the Beaufort Sea study results have proven fruitful, and a substantial baseline data set exists to assess perturbations in that area. The MMS also has instituted a hydrocarbon-chemistry and heavy-metal determination on sediments and bivalves in the Beaufort. In addition, the MMS has systematically monitored seabird colonies for several years. In FY's 1987 and 1988, the MMS will support the FWS in their marine mammal-tissue analysis. Limited seabird-tissue samples also will be collected for analysis and archival.

V-37

Response MMC-11

The MMS does not believe that the changes suggested by the commenter are necessary. The primary purpose of proposed Stipulation No. 3 (Protection of Biological Resources) is to protect benthic communities, such as kelp beds, on the lease itself, not to study migratory species. The appropriate place to address the need for additional biological surveys--over and above benthic surveys--is at the time of exploration-and-development-plan review and during the State consistency-review process on a site-specific plan.

Response MMC-12

We agree with the commenter that an ITL is essentially a form of guidance to the lessees. The intent of the ITL's is to advise the lessee of specific concerns, policies, and administrative requirements related to the sale. The MMS does not anticipate that there would be significant revision or modification of these ITL's as a result of studies because studies are not directed at the administrative issues addressed by the ITL's; however, the ITL's provide flexibility to accommodate new information. If new information that changes the need, intent, or purpose of ITL's is revealed through future studies, the MMS can issue Notices to Lessees (NTL's) or action letters on exploration plans after the lease sale to specifically address the issue. (ITL's are issued as part of the lease itself; NTL's are issued postlease.) During the review of an exploration plan or a development and production plan, additional issues may be identified and additional mitigating measures can be placed as conditions for approval of the plan at that time. This process allows the MMS to review each site-specific plan relative to currently available information and to develop and implement appropriate mitigating measures to protect the environment, where appropriate.

Response MMC-13

Under the guidelines of potential ITL No. 1 (Information on Bird and Marine Mammal Protection), vessel and aircraft operators would be in violation of the recommended criteria if they diverted their crafts off course for the purpose of observing wildlife. Therefore, the MMC-suggested revision to ITL No. 1 is not necessary.

The text in Section II.H.2 (Effectiveness of ITL No. 1) has been amended to address this concern regarding polar bears.

Response MMC-14

As noted in Section IV.A.2.e, permission from the USCG on-scene coordinator must be obtained for the use of dispersants in spill response. The chain of command for receiving permission for dispersant usage would be detailed in the lessee's oil-spill-contingency plan prior to any exploration; therefore, it is not necessary to duplicate this information in the ITL.

Response MMC-15

ITL No. 4 does not directly reference possible monitoring requirements for noise-producing activities. However, it does state that a Notice to Lessees (NTL), similar to NTL No. 86-2 for the Beaufort Sea, will be issued prior to

proposed Sale 109. Monitoring requirements for endangered whales during geophysical seismic operations are contained within NTL No. 86-2 for the Beaufort Sea (and likewise will be specified within the Sale 109 NTL), which lists performance standards for preliminary activities.

Although they could have been combined, ITL Nos. 3 and 4 were not combined because ITL No. 3 was developed mainly to protect whales from oil spills, and ITL No. 4 was developed to protect whales from noise disturbance.

The commenter is referred to two new potential mitigating measures that are evaluated in the FEIS: Stipulation No. 6, Industry Site-Specific Bowhead Whale-Monitoring Program, and ITL No. 5, Information on Endangered Whales and MMS Monitoring Program. These measures are directly relevant to concerns about monitoring the effects of oil and gas activities on endangered whales.

Response MMC-16

ITL No. 9 (Information on Subsistence Whaling and Other Subsistence Activities) states that lessees should consult with local communities to develop a program that would minimize disturbance of subsistence-hunting activities. Information regarding hunting ranges and seasons would be discussed during consultation with the communities. This information also is provided in Section III.C.2.b of this EIS. As can be seen by the length of the description of subsistence activities in Section III of this EIS, to include descriptions of all the hunting areas in an ITL would be inappropriate.

Response MMC-17

Table II-14 presents a summary of analyses and conclusions, the rationales of which are thoroughly developed in Section IV.B. There is no conclusive evidence that any species of nonendangered marine mammal population that occurs in the proposed sale area is declining or is stabilized below carrying capacity due to harvest or other unnatural mortality, especially to the degree that the few mortalities potentially associated with oil spills or other potential effects from the proposal would cause further losses that would last beyond one generation. In order for the potential losses of a small number of marine mammals, such as polar bears (perhaps 30 deaths over the 30-year life of the proposal) and walruses (perhaps 50 to 100 deaths at most over the 30-year life of the proposal), to cause an effect lasting for more than one generation, these species' populations would have to be at a substantially lower level than they currently are--which would be an unreasonable assumption. The EIS does not assume that potentially affected marine mammal populations are necessarily increasing or are at or near carrying-capacity levels; on the other hand, the EIS does not assume that pinniped, polar bear, or beluga whale populations are endangered or severely depleted, since there is no evidence to suggest that. The EIS assumes that the status of marine mammal populations varies from year to year, with some populations declining to increasing over the life of the proposal.

Response MMC-18

The EIS does not assume that there would be unoccupied walrus-feeding habitats near the small areas (a few km^2/spill) of bottom sediments that may be contaminated by the estimated seven oil spills over the life of the field. In the first place, it is very unlikely that most of these spills and oil would significantly contaminate the benthic habitat, even in local areas, let alone that the contamination would persist for more than 1 year due to the natural mixing and dispersion of bottom sediments.

Response MMC-19

Contrary to the comment, the EIS does not assume that the location of walrus-nursery herds and the ice that they are on would be stationary relative to air-traffic routes. Because the ice front is always moving, the EIS assumes just the opposite. Due to the constant movement of the ice front (understood per Sec. III.A.3 [Physical Oceanography] and Sec. III.A.4 [Sea Ice]), aircraft would not be flying over the same ice floes and pinniped-haulout or nursery areas on the ice. Thus, the same concentrations of walruses and seals would not be repeatedly disturbed. In fact, the nursery-haulout areas would have to be located under an aircraft flight path at the time when an aircraft passed overhead (and only if at a low altitude) in order to be disturbed. Such a sequence of events is likely to be very uncommon or rare, even with a number of drilling platforms present in the sale area. The EIS does not need to assume that there would be alternative migration corridors, since there is no evidence that icebreakers or drilling platforms would actually block the whale-migration corridors. Drilling platforms are no more than a few hundred meters wide or long, while the ice-lead system/migration path is about 20 kilometers or more wide.

Response MMC-20

See Response MMC-5.

Response MMC-21

The purpose of Section III is to describe the environment that may be affected by the proposal--not to examine the uncertainties in available information. The purpose of the EIS is to come to a conclusion with a specific effect level--such as MINOR effects on pinnipeds, polar bears, and beluga whales--based on the best available scientific information and on exploration and development assumptions made about the proposal. It is the judgment of the MMS that the information available is adequate for the purposes of allowing the Secretary of the Interior to make a decision concerning leasing.

Response MMC-22

This concern is addressed in Response MMC-21.

Response MMC-23

This concern is addressed in Response MMC-21.

Response MMC-24

There is no data available to indicate that the Kasegaluk Lagoon beluga whales are a discrete population from the whales that migrate through the sale area during the spring. Any speculation on stock-population discreteness is not

critical for the EIS assessment or for the Secretary to reach a decision concerning leasing. The abundance of beluga whales in the proposed sale area is quite reliable, since most of the beluga whales occurring in the sale area have been surveyed and censused on their summer range in Canada or in Kotzebue Sound during the spring.

Response MMC-25

Prior to 1971, polar bear-harvest data were compiled by totals for the State--not by community (Schliebe, 1987, oral comm.)--and are not included in these tables. In 1980, the FWS began collecting harvest data to document the sex, age, chronology, and locations of harvested polar bears. Data for 1980 to 1982 were revised to reflect more current harvest data (see Tables III-17, III-18, and III-19).

Response MMC-26

The criteria for identifying projects considered in cumulative-effects assessment have been removed from the text (see Response EPA-2). We concur that projects not contiguous to or overlapping are appropriately included in this EIS; a review of the projects in either Table IV-2 or Appendix G will show that projects from western Canada to the Bering Strait are included. The cumulative analyses in Section IV.B.7, which address highly mobile marine mammals, include projects in the Bering as well as Chukchi Seas. The entire range of highly mobile marine mammals is covered in the FEIS on the Proposed 5-Year OCS Oil and Gas Leasing Program (USDOI, MMS, 1987b)--the appropriate place for an overall perspective.

Response MMC-27

The text in Appendix G (Project No. 17) has been revised to reflect recently announced plans to develop the Amauligak Field in the Canadian Beaufort Sea.

Response MMC-28

The text in Section IV.A.2.f has been amended to address this concern.

Response MMC-29

The possibility of oil ingestion by nursing seal pups and polar bears that become oiled is discussed in Section IV.B.6.a. Disruption of the mother/pup bond is likely to be a problem only with subarctic pinnipeds such as northern fur seals, which are believed to use their sense of smell to identify their young and to congregate in large herds where identification of young is difficult. Ice seals found in the Arctic use vocalizations to identify mother and pup; walruses also probably use vocalizations to identify mother and calf, whose bonds are very strong.

Response MMC-30

Extrapolating the results of studies on one species to another is not always subject to great uncertainty. Beluga whales, dolphins, and porpoises are closely related cetacean species. Knowledge of the effects of oil contact on dolphins is applicable to beluga whales.

Response MMC-31

This concern is addressed in Response MMC-4(b).

Response MMC-32

A 100,000-barrel oil spill occurring in the spring-ice-lead system (marine mammal-migration corridor) would encompass an area of less than 1 square kilometer as a continuous oil slick before being encapsulated in the ice. Oil from the spill that did not freeze into the ice would pass across the lead system as a narrow, broken band of oil--perhaps 100 meters wide--and would persist in the local system for no more than a few days before being pushed beyond the ice or before drifting past the lead due to the wind. The densities of ringed, spotted, and bearded seals would be less than 10 per square kilometer. The text of Section IV.B.6.a(3) has been amended to include the area of the spill and the density of seals. The EIS does not assume that the seal populations are stable or increasing in order for the expected effect to be MINOR; and no long-term degradation or destruction of food sources is likely to occur--even from a large spill of 100,000 barrels or more (see Sec. IV.B.6.a(2)).

Response MMC-33

The number of polar bears moving through the proposed sale area is not known but would vary considerably from year to year and season to season as the distribution of polar bears changes with ice conditions and the availability of prey (seals) (see Sec. III.4.b).

Response MMC-34

If an estimated 10 to 30 bears were directly or indirectly killed by oil spills, this would represent a MINOR effect on the polar bear population (about 2,000 bears) present in the proposed sale area because natural recruitment would replace killed individuals within one generation, regardless of whether the population was stable or increasing.

Response MMC-35

There is no conclusive evidence that the Pacific walrus population is under stress due to being at or near habitat carrying capacity or food limitation. If the population were declining due to high harvest rates, this increased harvest would reduce the stress on the walrus population--if the population were at carrying capacity--and on its food sources. Because walruses are likely to suffer few or no lethal effects from contact with oil (see Sec. IV.B.6.a, Effects of Oil Spills), few individual walruses are likely to die regardless of the population's status; and the death of a small number of walruses would be a MINOR effect regardless of the population's status.

Response MMC-36

Oil spills are very unlikely to have any effect on the availability of beluga whale-food sources due to the abundance of their prey and to their ability to move from one area of food abundance to another (see Sec. III.B.6.a(2),

Indirect Effects of Oil). The few--if any--beluga whales killed from short-term (probably not more than a few minutes') contact with an oil spill would have NEGLIGIBLE effects on the whale population, regardless of the population status.

Response MMC-37

Effects of oil spills on the number or availability of arctic cod, epibenthic crustaceans, clam resources of walruses, and other pelagic or benthic food sources of seals and beluga whales discussed in Section IV.B.6.a(3) are supported by the analyses given in Section IV.B.3 (Effect on Lower-Trophic-Level Organisms) and Section IV.B.4.a(2) (Effect on Fishes).

The text in Section IV.B.6.a(3) has been amended to include references to Sections IV.B.3 and IV.B.4.

Response MMC-38

Oil-spill-cleanup operations would include the same types of noise sources discussed in Section IV.B.6.b(1) (see Airborne Noise [aircraft] and Waterborne Noise [boats]).

Response MMC-39

The text in Sections IV.B.7.a and IV.I has been amended to address this concern.

Response MMC-40

The uncertainty of effect prediction is understood and need not be stated in the conclusion. The analysis is based on assumptions that are described in Sections II.A and IV.A.

Response MMC-41

These concerns are addressed in Responses MMC-4(c) and MMC-26 in regard to cumulative effects, and in Response MMC-2 in regard to uncertainties in environmental assessment and assumptions made in the analysis.

Response MMC-42

The text in Section IV.B.7.a(1) has been amended to address this concern.

Response MMC-43

One of the highest levels of naphthalene residue was not found in beluga whales but rather in harbor porpoises, with no apparent adverse effect on the porpoises (Geraci and St. Aubin, 1982). The text in Section IV.B.7.a(1) has been amended to address this concern regarding bioaccumulation of petroleum hydrocarbons in bowhead whales.

Response MMC-44

The text in Section IV.B.7.a has been amended by adding a section on potential effects on spring-migrating bowheads.

Response MMC-45

There are uncertainties associated with predicting the potential effects of any project. The MMS believes that the EIS conclusions express the most likely level of effect based upon the best scientific data available for the Sale 109 area.

Response MMC-46

The text in Section IV.B.7.a (Cumulative Effects) has been amended to address this concern.

Response MMC-47

The text in Section IV.B.7.a (Cumulative Effects) has been amended to address this concern.

Response MMC-48

This concern is addressed in Response MMC-3.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE COMPTROLLER

June 2, 1987

Mr. Richard Miller
Mineral Management Service
Department of the Interior
18th & C Streets, NW
Room 2520
Washington, DC 20240

Dear Sir:

This is in reference to your Draft Environmental Impact Statement on the 1988 Outer Continental Shelf Oil and Gas Lease Sale 109 in the Chucki Sea. Enclosed are comments from the National Oceanic and Atmospheric Administration.

We hope our comments will assist you. Thank you for giving us an opportunity to review the document.

Sincerely,

for

David Cottingham
Ecology and Conservation Division

Enclosure

cc: Bohne

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION COMMENTS ON LEASE SALE 109 IN THE CHUKCHI SEA

The National Oceanic and Atmospheric Administration (NOAA) has reviewed the draft Environmental Impact Statement (DEIS) for outer continental shelf (OCS) oil and gas lease sale No. 109 in the northeastern Chukchi Sea, which is scheduled for May 1988. Our comments on this document follow:

GENERAL COMMENTS

The Chukchi Sea is a frontier area, not only in terms of petroleum development but also in terms of environmental knowledge. Unlike the southeastern Chukchi Sea where intensive, coordinated studies were carried out in the coastal and offshore areas as part of "Project Chariot" in the early 1960s, research in the Sale 109 area has been sporadic. The area has typically been studied as part of a larger research projects (i.e., tracing of advected water from the northern Bering Sea to the Beaufort Sea and beyond) or to compare its biota with those of the nearshore Beaufort Sea (i.e., comparison of the habitat use in Peard Bay with that in the Simpson Lagoon).

Because a lease sale in the northern or southern Chukchi Sea has been on or off the Department of the Interior's OCS planning schedule over the past ten years (Sale 57, with a proposed sale date of December 1978, was included in the OCS Planning Schedule dated June 1975), the intensity of research efforts has varied accordingly. As a consequence, many research needs have not been fulfilled and important data gaps remain to fully evaluate potential impacts of the proposed lease sale and of its alternatives. Some OCS studies, which were initiated recently in the northeastern Chukchi Sea, are still underway. **NOAA-1**

The DEIS presents information on the environment of the lease area in a clear and concise manner. It also however reflects the variable nature of the current environmental data base. Although we differ on some of the conclusions, the discussions of potential impacts to marine mammals and endangered species is more balanced and current than has appeared in other recent DEIS's.

Mitigating Measures

There are three Information to Lessees (ITL's) in the DEIS that are of interest to us. Two are of considerable concern.

° ITL No. 1 - Information on Bird and Mammal Protection.

Recent amendments to the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) now allow for the incidental taking of depleted as well as non-depleted species of marine mammals under certain conditions. It is intended that the same statutory requirements and processes now applied to the incidental taking of non-depleted marine mammals (i.e., Letters of Authorization) will be applicable to depleted species. The standard to be applied in such authorizations is "negligible impact" as contained in subparagraph (5) (A) (i) of the MMPA with reference to the affected population of marine mammals.

Lessees should be advised in this ITL that incidental takings of depleted marine mammals are only allowed when the statutory requirements are met and Letters of Authorization obtained. Regulations are being promulgated for issuing these Letters of Authorization. Activities that are likely to "take" depleted marine mammals will be subject to these regulatory requirements.

NOAA-2

° ITL No. 3 - Information on Protection of Endangered Whales
° ITL No. 4 - Information on Endangered Whales.

These ITL's consider the authority of the Regional Supervisor, Field Operations (RSFO), over oil and gas drilling activities or noise-producing activities that "would be likely to jeopardize the continued existence" (ITL No. 3) or "would be likely to result in jeopardy to the species" (ITL No. 4). We believe the wording of these ITL's are inappropriate, in that these jeopardy determinations are beyond the authority of the Regional Supervisor under Section 7 of the ESA (16 USC Section 1536); and the level of impacts that can be allowed under that provision of the law. As discussed above, the standard of "negligible impact" applies to any allowable "takings" under ESA and MMPA. Takings that are considered more than negligible are illegal and cannot be permitted. The RSFO (via MMS), pursuant to 50 CFR Sections 402.13 and 402.18 must consult with the National Marine Fisheries Service for any circumstances where the effect of the permitted activities is believed to be more than negligible, or exceeds the level of incidental takings permissible in Letters of Authorization. The determination of jeopardy is a more in depth and involved process, the authority for which exists under Section 7 of the ESA, and rests solely, for endangered whales, with the Secretary of Commerce.

Since the RSFO does have authority to limit or suspend oil and gas drilling activities on the lease in situations where the impact is "more than negligible or is unauthorized," we suggest that this standard be used in these ITL's.

NOAA-3

Impacts on the Spring Migration of Bowhead Whales

Our major concern with the leasing proposal is the potential for major long-term impacts resulting from disturbance to the migrations of bowhead whales in the spring-lead systems. We believe that year-round production activities in this migration corridor have the potential to displace, delay, or block successful migrations and the entire population could be affected. The whales would be particularly vulnerable to oilspills in the leads also.

These impacts of year-round activities in the spring migration corridor are not sufficiently considered in the DEIS. Although a Coastal Deferral is proposed (Alternative VI), the level of mitigation associated with the alternative is minimized and stated to be the same as the proposal - MINOR. We believe a more careful and thorough consideration of impacts under the proposal (Alternative I) is neccessary. We believe that such an assessment would show potentially MAJOR impacts could occur during the spring migration. These impacts could be reduced by adopting Alternative VI.

NOAA-4

Coastal Deferral (Alternative VI)

Because of our concern expressed above for the spring migration of bowhead whales, we believe that Alternative VI - the Coastal Deferral - 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 and production activities can be so timed to avoid the spring migration.

NOAA-5

Fishery Impacts Analyses

The DEIS frequently concludes that oil and gas activities will have only MINOR effects on fish populations within the lease area. These conclusions are not well supported by the data analysis. The Chukchi Sea is a frontier area relative to other areas of the North Slope of Alaska, and very little is known about the distribution or abundance of anadromous and marine fish populations within the area. There is very little baseline fisheries data in this area.

The DEIS relies solely upon data collected in 1983 to support its assessment of effects on fish populations, treating it as if it constituted a complete and extensive baseline. The abundance of anadromous and marine fish was low in the Sale area in 1983, but the limitations of the baseline make it difficult or impossible to determine how this relates to a longer time period. Despite the limitations of the baseline

NOAA-6

data, the DEIS continually concludes that effects will be MINOR by assuming that patterns of distribution and abundance observed in 1983 are representative of multi-year patterns that predominate in the sale area. Because it does not consider the possibility of fish to be more abundant than they were in 1983, the DEIS effectively makes only a "best case" assessment. The paucity of data on fish populations in the region makes a "reasoned worst case" analysis more appropriate.

The cumulative effects analysis should also be strengthened. The document should reexamine its assumptions about the ability to mitigate adverse effects on fisheries through existing regulatory processes. It should demonstrate how activities directly associated with the lease sale will interact with other projects to create effects that are cumulative. As currently drafted, the DEIS effectively makes only a "best case" assessment in lieu of a more realistic and comprehensive assessment. **NOAA-7**

Use of Existing Information

The DEIS should consider the substantial amount of available data in the description of the environment, particularly on physical sciences. For example, the OCSEAP Bibliography cites over forty reports submitted since 1983 dealing with the oceanography and meteorology of the Chukchi Sea. The DEIS does not incorporate much of the available information and cites only two of the post-1982 references. Rather, it relies on a review of physical sciences data done by the U.S. Geological Survey in anticipation of Sale 85. Figures III-6 and III-7, depicting ocean circulation in the surface and sub-surface layers, respectively, are taken from Grantz, et al. (1982 B). The two figures in Grantz, et al (1982 b) were drawn after similar figures in Coachman, Aagaard and Tripp (1976); which, in turn, was a review of historic data incorporating information obtained up to 1974. The reader is not given the benefit of the current state of knowledge.

Given that the 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 U.S.C. 1346), the absence of results from those studies in the DEIS is disappointing. As a consequence, the information base depicted in the DEIS does not afford a full and complete consideration of environmental factors in reaching leasing and development decisions, as required under the National Environmental Policy Act (42 U.S.C. 4321-4347). **NOAA-8**

Sea Ice Distribution

The text of this section is well written, but the data base is dated. The data and figures are temporally and spatially too broad to be meaningful. The text does not include information and analysis provided by Stringer and Groves (1986, in part supported as Research Unit 663). This report provides the most comprehensive ice recursion analysis to date. Based on a twelve year record for the Chukchi and Beaufort seas, it includes, among several other attributes, weekly frequency of occurrence and minimum and maximum values of ice coverage, maps of average and median dates of ice break-up and freeze-up for many localities in the study area, a descriptive calendar of significant events related to the ice-edge. **NOAA-9**

Sea Ice Hazards

Very little information is presented with which to evaluate potential hazards to structures, vessels and facilities due to sea ice. We believe it is inappropriate to state that because the petroleum industry has operated in the Canadian Beaufort Sea and other areas with sea ice, safe operations can be expected in the Chukchi Sea as well. To mention just as an example, convergence of the ice floes (or ice cover) is frequently observed in the Beaufort, Chukchi and Bering seas. This generates an additional component of resistance due to increased side friction on ships. Today's ships can be stopped in such pressured ice, and when such pressured ice is in motion, which it usually is, ships may be carried aground or damaged. **NOAA-10**

Structural Icing

The DEIS does not consider structural icing as an hazard to vessels in the Chukchi Sea. Such a hazard in the northern Chukchi Sea is likely to occur in September and October. In the northern Bering and along marine transportation routes further south, meteorological conditions conducive to structural icing are more prevalent (OCSEAP Research Unit 519). The nomogram used by Research Unit 519 was revised in 1984, the new one shows icing rates twice those described by Research Unit 519. Even more recent contributions on the subject are described in NOAA/PMEL Technical Memorandum 66, 1986, and in the Journal of Climatology and Applied Meteorology 1986). **NOAA-11**

Geological Hazards

The DEIS should give greater consideration to hazards to bottom-founded structures due to the morphology and dynamic features of the seabed. Of particular concern are ice gouging, strudel **NOAA-12** scour, storm-generated currents, and sediment with permafrost and associated gas hydrates.

Very little data exist on the strength and engineering properties of sediment on the bottom of the Chukchi Sea, such as those caused by gas-charging of sediments. Gas-charged sediments are widespread in the northern Bering Sea, covering over 7,000 km^2, and in the Beaufort Sea. Such sediments may also be present in the Chukchi Sea but their presence has not been investigated. Much of the gas is usually biogenic; it originates at shallow depths in the seabed, and nearly all of it is methane. The occurrence of thermogenic gas in sediments is apparently much more restricted. Further, as noted in the DEIS, the presence and distribution of perennial and seasonal permafrost in the Sale 109 area is presently unknown. This lack of information is a serious shortcoming in the evaluation of current and future development scenarios.

Anchor Ice

The presence of anchor ice in the northern Chukchi Sea has been demonstrated (Research Unit 205) but not discussed in the DEIS. Anchor ice (Not the same thing as ice-bonded sediment mentioned on p. III-3) can be found wherever there is turbulent, super-cooled water, for example in shallow areas of the Beaufort Sea and in the Chukchi Sea. Under certain conditions, its distribution can be widespread if not ubiquitous over large areas. Its presence and subsequent lifting is potentially dangerous to bottom-founded structures. Experimental data have shown that anchor ice is able to lift up to 122 g of sediment per liter of ice-sediment mixture by buoyancy force alone. **NOAA-13**

Ocean Circulation

As mentioned earlier, the DEIS does not consider much of the existing data on coastal and offshore water circulation. Data are currently available on oceanographic events and features that are relevant to evaluate potential impacts of oil and gas development in the region. These include: the formation and persistence of eddies downstream from promontory land forms along the coast which may retard or trap the transport of water-borne pollutants (Research Units 531, 646, 641), the occurrence and persistence of the flaw lead in the spring (Research Units 646, 663, 567), observational records and simulation of coastal and shelf circulation (Research Units 91, 205, 435, 531, 646), meteorological influences, including storm surges, on water circulation and pollutant transport (Research Units 435, 519, 627, 646), and effect of ice in the transport of spilled oil (Research Units 87, 567, 568). **NOAA-14**

Extreme Events

There is little discussion of extreme oceanographic conditions which must be considered in planning any arctic **NOAA-15**

offshore development. Such conditions are typically described in terms of exceedance probabilities or return periods of the event of phenomenon of interest, e.g., extreme wave height. The information is used to calculate design wave loads, freeboard elevation, estimated sediment erosion and scour, and predict damage to slope protection for gravel islands.

Primary Production

It is simplistic to describe primary production as "conversion of solar energy into carbon by plants" (p. III-16 and elsewhere).

The influence of the Gulf of Anadyr water in the Sale 109 area can only be minimal; its area of primary influence is the Bering Strait and southern Chukchi Sea. It is also incorrect to compare the Bering Strait primary production with data from "any other arctic area" as reviewed by Subba Rao and Platt (1984). Bering Strait data should not be construed to represent arctic conditions or those extant in the Sale 109 area. **NOAA-16**

The DEIS also does not consider the importance of bacteria and mu-flagellates in the context of overall primary productivity of the region. Although data are very few, the importance of these organisms was demonstrated in the Peard Bay ecosystem study (Research Unit 641).

Lower Trophic Level Invertebrates

Wing (1972) provided little or no numerical data on the distribution of zooplankton, except collectively for copepods. Wing (1974, NOAA Technical Report NMFS SSRF-679), is a much more informative reference, describing numerical abundance of over sixty taxa, relationship between hydrography and species distribution, differences between nearshore and offshore zooplankton assemblages. **NOAA-17**

Data on the invertebrates collected with a mid-water trawl from the northeastern Chukchi Sea are described by Wing and Barr (1977, NOAA Technical Report, NMFS SSRF-710). The omission of these studies from the description of the Sale 109 environment makes the already limited data on lower trophic level biota in this region even more meagre. **NOAA-18**

The presence of only two benthic infaunal groups in the Sale 109 area (Figure III-14) can only be viewed in the context of analyzed data, which extend from the southeastern Bering Sea to the northern Chukchi Sea. Any other interpretation of results from the clustering technique used would be misleading. Within the northeastern Chukchi Sea, faunal groups are expected to correspond to five or so distinct sedimentary regimes, as noted by Research Unit 205. **NOAA-19**

Fish Resources

The DEIS does not recognize that the existing information base on fisheries of this area is extremely limited for impact analysis. Too much is made of data from exploratory fishing surveys and extrapolation of information from the southern Chukchi and northern Bering seas. There is no scientific basis to consider the limited data obtained in the nearshore waters of northeastern Chukchi Sea (Research Unit 635) as a baseline. **NOAA-20**

Birds

This section does not discuss the decline in the murre population at Cape Thompson. This species underwent a decline of approximately 40% between early 1960's and 1976, and continued to decline an additional 20% through 1982, the last year the colony was censused. The population loss is probably a response to lowered reproductive success. Since over 90% of the nesting seabirds are rated highly vulnerable and sensitive to impacts from oil spills and other environmental disturbances (p. III-28), the problem of population losses should be viewed in greater detail in the DEIS. **NOAA-21**

Oil Ingested by Bowhead Whale

The question of pathological consequences of oil ingestion by the bowhead whale should be more fully examined. It is stated on p. IV-B-67 (paragraph 3) that "any small quantity of ingested oil would be broken down .... and would not block the intestine (Hansen 1985)." Hansen (1985), a semi-technical review prepared by an MMS employee from which many statements are copied verbatim in this section of the DEIS, provides no reference or documentation to support this statement. Further, the assertion is qualified to apply to small quantities of ingested oil; the possible consequences of a greater amount of ingested oil are not considered. The statement that bowhead whales "possess enzymes capable of metabolizing or detoxifying ... ingested oil (Hansen 1985)" is also without scientific reference or supportive data in the publication cited. **NOAA-22**

The Worst Case Scenario

It is hard to imagine a worst case scenario involving potential impacts on the bowhead whale population that does not consider an oil spill during spring. We do not agree with the specifications of the "worst case scenario" as given in Section IV-I. Because of habit and habitat, bowhead whales during their spring migration in the Chukchi Sea are closely tied to the flow lead zone which normally occurs in the northeastern **NOAA-23**

Chukchi Sea. Oil spilled in the area during spring will tend to concentrate in leads (and breathing holes for seals, etc. in the nearshore), would be pushed against edges of ice floes due to wind, would not be cleaned, and would weather slowly. It would not be possible to herd the whales out of the lead system. An undetermined, adverse impact on a significant portion of the whale population could put further restriction on the subsistence use of the species. The above factors must be considered in any evaluation of impact resulting from a "worst case scenario."

Magnitude of Impacts

We cannot agree with the determination of MINOR impact on various biota given statements on acute mortality, reduced reproductive potential, other sub-lethal effects, and loss of habitat resulting from exposure to spilled oil. As mentioned earlier, reduced reproductive success has been shown to result in a continued, long-term decline of the murre population. In our opinion, the conclusion of MINOR impact is inappropriate to the range and severity of potentially harmful impacts described in the impact analysis. We also find it hard to believe that impact on macrophytes, for which only a couple of incidental observations have been recorded and which do not materially contribute to the overall primary productivity of the region, is MODERATE. **NOAA-24**

A examination of deduced impacts from the proposed action and the alternatives would also show that overall impact on biota does not change after substantial reduction in the lease sale acreage, i.e., alternatives of eastern, southern and coastal deferrals. Since the deferral alternatives were developed ostensibly to protect important habitats and to provide a protective buffer for continued subsistence activities, the impact analysis shows no change because of such deletions. It must be that the existing data base or the data selected for use in the impact analysis do not have sufficient resolution to discern relative changes in the biota due to the alternatives. **NOAA-25**

SPECIFIC COMMENTS

p.II-3. para. 1: Imposing a restriction on downhole operations during the spring (April through June) should not further reduce the average time for the operation of floating units, which is given as August through October. **NOAA-26**

p.II-13, para. 1: It appears from this discussion that the low-resource case would require the use of ice-breaking tankers operating year-round. The nature and feasibility of this form of transportation, and its environmental implications, should be thoroughly addressed in the DEIS as a potential consequence of the proposed lease sale. **NOAA-27** p.II-13, para. 2: It is unclear why the transportation scenario for the high-resource case is different from that for the mean-case, or conversely, why this transportation scenario is not considered feasible for the mean case. Since the impacts associated with the transportation scenarios are a major concern with the proposed leasing, additional detail should be given on the economic and other justifications of each transportation alternative. NOAA-28

p. III-1, para. 1, and Fig. III.1: The location of Blossom Shoals should be shown in Fig. III-1. NOAA-29

p. III-2, para. 6: Figure III-5 does not identify the sand-wave fields mentioned here. NOAA-30

p. III-3, para. 4: It would be helpful to discuss whether permafrost would be expected to be found in the subsea bedrock beneath the seafloor sediments. NOAA-31

p. III-11, para. 3: The Beaufort Sea Gyre is not identified in Figure III-9. NOAA-32

p. III-16, para. 2: Primary production is not "the conversion of solar energy into carbon by plants"; it is the photochemical formation of organic compounds from inorganic carbon fractions (e.g. C02) which is mediated by solar energy and chlorophyll, in the process called photosynthesis. NOAA-33

p. III-17, para. 4: Earlier (p.III-16) it is said that Nitzschia grunowii is the species found in both epontic and plankton communities. NOAA-34

p. IV-A-2, para. 2: We believe that cumulative effects should also include nonadjacent or noncontiguous areas that are within the geographic or migratory range of a species of concern in the proposed action. For example, the bowhead whale could be subject to effects of other activities in noncontiguous regions in the Bering Sea, which would be cumulative to the activities in the Chukchi Sea. These effects should not be ignored. NOAA-35

p. IV-B-2, para. 4: Should not convert State territorial sea distance to metric and give as 5 km. It is by law 3 statute miles. NOAA-36

p. IV-B-13, para. 3: Define what is envisioned for the length of a "short gravel berm". NOAA-37

p. IV-B-16, para. 6: Neither Steele, 1977 or Rossi and Anderson, 1978 are listed in Bibliography. NOAA-38

p. IV-B-22: Given the relatively shallow depths of most of the Chukchi Sea Shelf, it seems more possible that oil and oil-contaminated waters may mix to the bottom than is acknowledged here. NOAA-39

p. IV-B-32, para. 4: The DEIS assumes that the 1983 data on anadromous fish constitute a representative baseline for the lease area, and concludes that effects of oil spills on these populations are minor. However, without additional baseline information, it is difficult to test the validity of this assumption. This conclusion is therefore subject to question.

Given the apparent importance of anadromous fish to native populations within the proposed Sale area, the subject merits more consideration than it has received. The DEIS should consider the potential effects of an oil spill on anadromous fish propulations in the Sale area if 1983 is not representative of abundance patterns for other years. If this cannot be accomplished, then the DEIS should at least consider the reasonable worst case in which the overall effect of oil spills is commensurate with the effects identified for the individual populations, i.e., MODERATE. NOAA-40

p. IV-B-33, para. 3: The conclusion made here appears to be inappropriate. Nothing in the preceding section supports this conclusion and it appears to have been reached without the benefit of a reasoned scientific analysis. If the conclusion cannot be supported with data, it should be modified so that it is commensurate with the preceding data analysis. NOAA-41

p. IV-B-36, para. 6: This paragraph is inconsistent with the analysis presented in previous sections on anadromous and marine fish. Studies of anadromous fish populations along the coast of the Chukchi Sea have been minimal. With current cuts in the budgets of both state and federal resource agencies, it is extremely doubtful that studies of fisheries in the proposed Sale area will be adequate to address the development of an onshore infrastructure for offshore oil and gas activities in this area. NOAA-42

Sentences 7 and 8 demonstrate an admirable, but unrealistic faith in the ability of resource agencies to protect or conserve fishery resources through existing regulatory processes. The ability of resource agencies to effectively mitigate for the adverse effects of onshore development activities obviate the need to adequately assess cumulative effects of the proposed lease sale. This section shgould be strengthened and the conclusion of MINOR impact reexamined. NOAA-43

It is unlikely that conservation efforts will be more effective along the Chukchi Sea coast than they have been on the Beaufort Sea coast. For a more realistic understanding of the efficacy of the resource conservation efforts on the North Slope, it NOAA-44 would be beneficial to examine the administrative records for gravel removal projects from the Sag River, the Endicott project, Alternate A of West Dock, Prudhoe Bay Waterflood, Mukluk, etc.

P. IV-B-36, para. 7: The discussion of existing and future OCS lease sales warrants a considerably expanded discussion which should form the basis for the cumulative effects section. How will construction activities resulting directly from offshore development sanctioned by this Sale exacerbate the effects of other construction onshore? Will there be synergistic or cumulative effects? These questions have not been considered in the DEIS. **NOAA-45**

p. IV-B-38, para. 3: Again, the DEIS cannot ensure that adequate regulatory requirements will be imposed during the permitting process for site-specific operations. Environmental effect is only one of the factors that must be considered by regulatory agencies such as the Corps of Engineers as they decide on the public interest issue and hence the fate of the project. The desirability of decreasing this nation's dependence on foreign oil sources is another factor to be considered along with environmental concerns. Therefore, the conclusion of MINOR should be reconsidered. **NOAA-46**

p. IV-B-35, para. 2: The potential width of the channel within Peard Bay should also be given as this could be more significant than the depth to overall effects. **NOAA-47**

p. IV-B-36, para. 6: Include Army Corps of Engineers in list of permitting agencies. **NOAA-48**

p. IV-B-52, para. 2: While it may be most likely that a few to a hundred seals would be oiled under the given scenario, we believe the numbers could be much higher under certain circumstances. The discontinuous area of the slick is estimated at 500 km2, and could impact areas with seal densities exceeding 5 seals/km2. **NOAA-49**

p. IV-B-53, para. 1: The level of impact may be understated. Assuming that polar bears efficiently scavenge seal or walrus carcasses that were available, the level of pinniped mortality from an oil spill could easily translate into a similar level of mortality to polar bears, i.e. hundreds rather than 10-30 bears as stated here. It is known that bears are keen carrion finders, and are acutely affected by small amounts of petroleum. **NOAA-50**

p. IV-B-53, para. 4: No consideration is given here to a winter oilspill under the ice contaminating the breathing holes or birth lair entrances, that are relied on by ringed seals. Oil under ice may preferentially seek these under-ice cavities in the smoother fast-ice zone. Because of the complete dependence by the seals of these openings, they would be highly **NOAA-51**

vulnerable to oil in these habitats.

p. IV-B-54, para. 4: Define both type of "seismic activities" and "very near" here. **NOAA-52**

p. IV-B-56: The effects of noise produced from year-round production and associated activities in the spring-lead system should also be assessed in this section. Long-term effects of displacement or blockage of this migration path could be substantial, and deserves consideration in the DEIS. **NOAA-53**

p. IV-B-65, para. 6: Bowhead whales would also be subsequently exposed, probably to an even greater extent, during the production phase. **NOAA-54**

p. IV-B-66, para. 1: If the oil slick were in an open lead, it would probably not move out of the area in "several days", but could persist for weeks. **NOAA-55**

p. IV-B-67, para. 1: Contrary to the text, Bowhead whales remove large quantities of zooplankton without drinking seawater, and toxic amounts of oil could certainly be consumed in a similar manner. **NOAA-56**

p. IV-B-67, para. 3: Small quantities of ingested oil may be passed through the digestive tract and may be partially altered chemically. However, larger quantities of ingested oil would not be readily broken down or passed through the digestive system, as petroleum hydrocarbons are essentially indigestible. **NOAA-57**

p. IV-B-71, para. 2: The statement that hearing impairment, even at close range from seismic vessels, is unlikely, should be documented with evidence. **NOAA-58**

p. IV-B-72, para. 2: Again, little has been said in the DEIS regarding the displacement of the spring migration and its potential consequences. Analysis of these effects are important, and should be discussed fully in the DEIS. **NOAA-59**

p. IV-B-74, para 1: Of course, mud plumes have been commonly observed for feeding gray whales in the Chukchi Sea, so bottom feeding is frequent in the region. The gravelly nature of the nearshore substrate may not reveal the mud plumes associated with bottom-feeding in fine sediments such as observed in the Chirikov Basin. **NOAA-60**

p. IV-B-77, para. 3: Should state that these study results are from the Bering Sea, not the California study discussed above. **NOAA-61**

p. IV-B-77, para. 5: Since the production phase is expected to last 20 years or more, more than one generation (given in DEIS as less than 8 years) of gray whales could be displaced from the Point Belcher area. Why is this not considered a MAJOR effect on the local population, and a moderate effect **NOAA-62** on the regional population?

p. IV-B-79, para. 5: The primary prey of fin whales includes small schooling fish. NOAA-63

p. IV-G-2, para. 5: The coastal deferral does not extend as far as Point Barrow. NOAA-64

p. IV-G-6, para. 5: We strongly disagree with the statements and conclusions in this paragraph. Despite the fact that the DEIS has not considered the specific impacts of long-term noise producing activities in the nearshore spring-lead system on migrating bowhead or beluga whales, the conclusion contradicts the acknowledged potential for noise impacts to the major portions of these populations in these times and locations. The temporary potential for disturbance during exploration or construction (improbable during the ice-covered season) are unjustifiably overweighted against the year-round and long-term (20+ years) consequences of production activities in the coastal zone under the proposal. NOAA-65

p. IV-H-3, para. 1: We believe that this "review of knowledge of petroleum activity related effects on cetacean fitness" should be completed before the lease sale is conducted, that production effects also be included, and tha the Coastal Deferral Option be adopted unless mitigation of noise disturbance in the spring leads can be accomplished. NOAA-66

p. IV-I-1, item 1: Noise-producing activities during the production phase should be considered HIGH during the spring. NOAA-67

p. IV-I-1, Scenario: A worst-case scenario should also be developed for one or more year-round production platforms and associated activities operating in the spring lead area for the 20+ year life of the field, with consequent levels of noise disturbance to the annual spring bowhead whale migration. Also, the most realistic assessment of a worse-case oil spill scenario would be for a spill in the spring lead (the highest use area) rather than the fall scenario given. The rationale for the worst-case scenario offered in the DEIS is unclear, but avoids the "true" worst-case situation. NOAA-68

p. IV-I-2, para. 2: Fall use as breeding grounds of this area is inconsequential. NOAA-69

p. Bibliography 26: Morris, B. F. citations 1981 a-c can be cited as NOAA/NMFS Technical Memoranda F/AKR 2-4 respectively. NOAA-70

Response NOAA-1

Although the database for the Chukchi Sea may be variable, there is a substantial database for the Beaufort Sea. In addition, a major 5-year study (ISHTAR) funded by the National Science Foundation is currently being conducted in the area from the northern Bering Sea to the southern Chukchi Sea. The MMS has also funded a major ocean-circulation study in the area from the Canadian/Alaskan border to the northern Bering Sea as well as a Chukchi Sea benthic study.

Thus, study results specific to the Chukchi Sea Planning Area--as well as extrapolations that can be made from the results of studies conducted in adjacent planning areas and ongoing regional studies--provide a credible database for EIS analysis.

Response NOAA-2

With the exception of the endangered-cetacean species (bowhead and gray whales), no other marine mammals (pinnipeds, polar bears, and beluga whales) that commonly occur in the Sale 109 area are designated or considered as depleted by the NMFS or the FWS. A statement has been added to ITL No. 1 (Information on Bird and Marine Mammal Protection) and ITL No. 5 (Information on Endangered Whales and MMS Monitoring Program) informing lessees about the requirements for incidental takes.

Response NOAA-3

As a result of your comment, the wording in ITL No. 3 (Information on Protection of Endangered Whales)--"would be likely to jeopardize the continued existence"--and in ITL No. 4 (Information on Endangered Whales)--"would be likely to result in jeopardy to the species"--has been changed to read "would be likely to result in a threat of serious, irreparable, or immediate harm to the species." This language was extracted directly from 30 CFR 250.12, which specifies conditions under which the RSFO can suspend OCS activities. The MMS believes that this change in language satisfies the intent of this comment, i.e., that jeopardy determinations are beyond the authority of the RSFO and the level of effects that can be allowed under the Endangered Species Act, and that the new language is comparable to and would result in operations being suspended under circumstances similar to those described by the standards suggested: "situations where the impact is more than negligible or is unauthorized."

Response NOAA-4

A new section (Sec. IV.B.7.a(3), Effects of Oil Spills and Noise Disturbance in the Spring Lead System) has been added to the text to address this concern. This analysis discusses the MMS' rationale for expecting MINOR effects as a result of production activities in or near the lead system. Generally, we would expect any oil spilled in the lead system to be blown to the downwind edge of the lead rather than to cover the surface of the water. Toxic vapors should not persist for more than a few hours after the spill or be present in areas other than in the immediate vicinity of a continuing spill. Some individuals probably would contact oil if they attempted to migrate through oil-contaminated leads. Production-platform noise probably would be present in spring leads during only a portion of the time, since production platforms are stationary and lead systems are not; production-platform noise may be masked by the ambient noise of the lead system; and bowheads may not strongly avoid production platforms in a manner similar to gray whales, which often closely approach platforms off the California coast. As mentioned in Section IV.B.7.a, there is a possibility that effects on the bowhead population could be greater than the levels we have projected; but we believe these greater levels of effect to be less likely.

Response NOAA-5

Prior to exploratory drilling, it is impossible to know whether oil might be found beneath or near the spring lead system used by bowhead whales and, consequently, whether there might be a potential conflict between petroleum production and bowhead whales. The MMS agrees that if a commercial quantity of oil were discovered beneath or near the spring lead system, it might be difficult for development and production activities to be timed to avoid the spring migration. However, specific options and alternatives may be developed after the exploration stage as new information or technology is developed and as specific development plans or mitigation measures are proposed.

Response NOAA-6

Although the fish fauna of the northeastern Chukchi Sea has not been well studied (as is remarked in the text), the EIS presents information from available studies and then--based on this information plus general knowledge of life histories--analyzes the potential effects on fishes deriving from proposed Sale 109. The EIS does not, as you state, rely solely on data collected in 1983. Information from other sources, such as Frost and Lowry (1983a; pertinent data collected in 1976) and Alverson and Wilimovsky (1966; data collected in 1959), also is used. The EIS does not treat the 1983 data as a complete and extensive baseline but rather as the available data for the nearshore environment. Whether these data are representative of multiyear patterns remains to be seen. The text has been amended to make this clear. In addition, the MMS has proposed further studies in this area to add to the limited data available.

The text in Section IV.B.4.a has been amended to address the concern about effects on small stocks of anadromous fishes.

Response NOAA-7

The text in the cumulative-effects section (Sec. IV.B.4) has been revised to address some of these concerns. In the formation of cumulative effects, it is not possible for the MMS to comment extensively on how activities associated with the lease sale will interact with other projects since we do not have specific scenarios for the other proposed activities.

Response NOAA-8

A substantial amount of available information was considered during preparation of Section III.A (Physical Considerations) of the Sale 109 EIS. The commenter's reference to sources of substantial amounts of available data is misleading because it implies that more information is available than is the

actual case. The commenter notes over 40 reports dealing with the oceanography and meteorology of the Chukchi Sea that have been submitted since 1983. Section III (Page 669) of the OCSEAP Comprehensive Bibliography (USDOC, NOAA, 1986) lists about 40 citations with publication dates of 1984 or later for Chukchi Basin oceanography and meteorology. However, 12 of these citations are listed in both the oceanography and meteorology categories. Furthermore, the reports listed in the bibliography were produced by only 12 different Research Units (RU's)--separate research-study programs. Thus, a single RU could have generated more than one report regarding the same subject matter. Furthermore, some reports may not be pertinent, i.e., 4 of the citations are progress reports from one RU, 1 citation is a field report, and another is an interim report. These 6 reports offer very little, if any, information that would be useful in the general description of the physical environment. In addition, one of the RU's supports the oil-spill-trajectory-simulation model, as discussed in Section IV.A.1.c of the EIS. About 15 of the reports were published in 1984, which indicates that at least some of the work was in progress prior to 1984; 11 of the RU's began work in 1983 or earlier.

The Barrow Arch (Chukchi Sea Planning Area) Synthesis Meeting was held at Girdwood, Alaska, from October 30 to November 1, 1983. Nine of the 12 RU's noted previously were represented by participants at this meeting. Thus, some of the information contained in the reports published subsequent to 1983 was available and considered for use in this EIS.

Figures III-6 and III-7, used in this EIS to depict the general oceanographic circulation of the planning area, are very similar to the figures used by Aagaard (1986) in a presentation of Chukchi Sea physical oceanography at an OCSEAP/MMS Chukchi Sea Information-Update Meeting held in Anchorage, Alaska, on March 27, 1986. Thus, it is presumed that the general information shown in Figures III-6 and III-7 is still pertinent, even though it is based on historic data.

With regard to the descriptive information base of the EIS, *Regulations for Implementing the Procedural Provisions of the NEPA* (43 FR 55978-56007, November 29, 1978) note the following: "(1) agencies shall reduce excessive paperwork by preparing analytic rather than encyclopedic environmental impact statements [1502.2(a)] and reducing emphasis on background material (1502.10) and (2) the environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration (1502.15)." It would appear from these regulations that a full and complete description of all the environmental factors is not required for an analysis of the effects that petroleum exploitation in the Sale 109 area might have on the affected environment.

Some additional information and citations have been added to Section III.A. Although this information provides a few more details, it does not change the overall description of the physical environment in this EIS.

Response NOAA-9

The description of sea ice in the EIS is a general summary of ice conditions in and adjacent to the Sale 109 area. This summary is not meant to be temporally or spatially specific, except for a few examples, nor is it meant to be encyclopedic (see Response NOAA-8). The citations in the text indicate some of the references that can be used for temporal or spatial details. The text of Section III.A.4 has been revised to include the work of Stringer and Groves (1986). In addition, Figure III-8 has been revised and is based on a figure from Stringer and Groves (1986).

With regard to the dated database, a review of the databases for some of the references used in the sea-ice description shows the following: (1) Webster (1982) used information for a 29-year period from 1953 to 1981, (2) LaBelle et al. (1983) has a bibliography containing references from 1900 to 1982, and (3) Stringer and Groves (1985) used data from 1972 and 1983.

Response NOAA-10

The general features of the Chukchi Sea Planning Area sea-ice regime are described in Section III.A.4. The general relationship of sea ice as a constraint to petroleum exploitation, and the strategies and technologies used or being developed to mitigate the effects of this constraint, are discussed in Section IV.A.3.a. The discussion of sea ice is descriptive because, as noted in Section IV.A.3.a, many factors influence the magnitude of the forces that ice can exert on any structure; furthermore, some of the information needed to evaluate the capability of a manmade structure is proprietary and thus not available to the public. In addition, the technologies that have been and are being developed to operate in the Beaufort Sea-ice environment are discussed in Section III.A.3.a. This format should provide the reader with general background information concerning sea ice and technologies.

The effects that sea ice might have on vessels and offshore facilities are evaluated when exploration plans and development and production plans are submitted--in accordance with 30 CFR 250.34 and Alaska OCS Orders Governing Oil and Gas Lease Operations (Rathbun, 1986), Order No. 2--for public comment and MMS approval.

The MMS Alaska OCS Orders Governing Oil and Gas Lease Operations on the Alaska OCS implement the safety and antipollution measures that the lease operators are required by law to follow. It is through these OCS Orders that standards are set for (1) the design, fabrication, and installation of platforms or other structures and (2) all activities associated with drilling and producing activities. Order No. 2 requires that the lease operator submit evidence that the drilling unit is capable of withstanding the oceanographic, meteorologic, and ice conditions for the proposed area of operations. Order No. 8 states that all new bottom-founded platforms shall be subject to review under the Platform Verification Program. Hence, the design, fabrication, and installation of these units must be reviewed by an independent third party, a Certified Verification Agent, who has the technical expertise to make the necessary evaluations and judgments.

The operational experiences of various types of drilling units in the Beaufort Sea provide a basis for making the qualified statement that there are specific types of units capable of operating in certain areas during certain periods of time. Mobile bottom-founded drilling units are noted as being capable of operating in waters shallower than 30 meters. Waters shallower than 30 meters constitute only a fraction of the Chukchi Sea Planning Area, and most of the shallower-water area lies south of Icy Cape. The operational capabilities of

floating units are limited by environmental factors, principally ice conditions. When ice, oceanographic, and meteorologic conditions begin to threaten the safe operation of the unit, drilling operations are stopped, the well is safely shut in, and the unit is moved off location.

Response NOAA-11

A brief discussion on superstructural icing has been added to Section IV.A.3.a. However, superstructure ice was not considered to be an environmental hazard to Sale 109-area petroleum exploitation at the Barrow Arch Synthesis Meeting (Truett, 1984). In the northern Bering Sea/Norton Sound area, superstructure icing was considered to be a hazard only to (1) floating drilling vessels (low severity) and (2) workboats and service vessels (moderate severity) (Truett, 1985).

Response NOAA-12

The commenter did not state any specific reasons why greater consideration should be given to seabed hazards that might affect bottom-founded structures, other than noting the morphology and dynamic features. The dynamic features of the seafloor sediments are considered in Section IV.A.3.b(2).

The commenter noted a concern regarding ice gouging, strudel scouring, storm-generated currents, and sediments with permafrost and associated gas hydrates. Ice gouging is discussed in Sections IV.A.3.a(1) and (3), and storm-generated currents are discussed in Section IV.A.3.b(1). Ice gouging and storm surges are given about the same consideration in the EIS that they were given in the discussion of environmental hazards in the Barrow Arch (Chukchi Sea Planning Area) Synthesis Meeting (Truett, 1984).

Strudel scour was not noted as a potential hazard at the Barrow Arch Synthesis Meeting (Truett, 1984) and thus was not discussed as a hazard in the EIS. Strudel scour would be less of a hazard along the Chukchi Sea coast than it is along the Beaufort Sea coast. As noted in Section III.A.1.b, in relation to sea-ice decay, there are no major rivers along the Chukchi Sea coast. The landfast-ice zone along the Chukchi coast also is generally narrower than it is along the Beaufort coast, and there is the system of leads and polynyas extending alongshore between the landfast ice and the pack ice that would provide some drainage of potential floodwaters.

As noted at the Barrow Arch Synthesis Meeting, subsea permafrost was considered to be minimal or nonexistent throughout the Chukchi Sea Planning Area, except possibly very near the coast (Truett, 1984). Surficial sediments were thought to be too thin to have retained subsea permafrost. Seismic profiles in the Chukchi Sea also have not shown any likely major areas of gas hydrates (Truett, 1984). Thus, subsea permafrost and gas hydrates were not discussed as hazards in the EIS.

The information about features of the physical environment and potential environmental hazards discussed in the EIS is based on prelease information. Additional information about the physical environment, particularly site-specific information, is required for postlease offshore operations. The exploration and development and production scenarios presented in the EIS are, as noted, only hypothetical. Because the location of potential reservoirs--

and hence exploration and development and production facilities--is unknown, the effects that environmental hazards may have on fixed and mobile drilling units at and in the vicinity of specific sites are more appropriately evaluated when exploration plans and development and production plans are submitted--in accordance with 30 CFR 250.34 and Alaska OCS Orders Governing Oil and Gas Lease Operations--for public comment and MMS approval.

OCS Order No. 2, Paragraph 2.1.1, states that all fixed and mobile drilling units shall be capable of withstanding oceanographic, meteorologic, and ice conditions for the proposed area of operation. The lessee shall submit with the exploration plan and development and production plan evidence to the RSFO of the fitness of the drilling unit to perform the planned drilling operation. Furthermore, Paragraph 2.1.3 states that lessees shall submit a shallow-hazards report and conduct a shallow-geologic-hazard survey or other surveys as required by the RSFO. The shallow-hazards survey includes, but is not limited to, the following: seismicity, active faults, shallow gas, mud slides, steep-walled canyons, steep slopes, buried channels, unstable soil conditions, current scour, ice gouging, bottom and subbottom permafrost, pipelines, anchors, ordnance, shipwrecks, and other potential geologic and manmade hazards (Notice to Lessees No. 83-5).

Geotechnical data for the sediment at specific sites would be required if manmade structures are placed on the seafloor. This data would be included in the exploration plans and development and production plans noted above.

OCS Order No. 8 states that all new bottom-founded platforms shall be subject to review under the Platform Verification Program. Hence, the design, fabrication, and installation of these structures must be reviewed by an independent third party, a Certified Verification Agent, who has the technical expertise to make the necessary evaluations and judgments.

Thus, the concerns regarding potential environmental hazards continue to be recognized and addressed through the requirements of regulations that apply to operations conducted in the postlease phase.

Response NOAA-13

A brief discussion of anchor ice has been added to Section III.A. Although it is capable of transporting entrapped sediment from the substrate to which it is attached, anchor ice does not appear to be a hazard to bottom-founded structures, as noted by the commenter. As noted by Reimnitz, Kempema, and Barnes (1986), storm-generated-anchor-ice formation is a short-lived phenomenon. Furthermore, anchor ice in the Beaufort Sea actually has been observed only out to depths of about 5 meters; the formation of anchor ice in deeper waters--out to depths of perhaps 15 to 20 meters--is based on observations in other regions and the depth to which storms may disrupt the thermocline, at depths of 15 to 20 meters, in the Beaufort Sea in the fall.

Although the phenomenon of anchor-ice formation and its buoyant force have been known for years, anchor ice has not been observed to be a hazard to any of the bottom-founded drilling units, gravel islands, causeways, or test structures located in waters shallower than 20 meters in the Beaufort Sea. At the Beaufort/Chukchi Sea Synthesis Meeting (USDOC, NOAA, 1978; Truett, 1984),

anchor ice was not considered an environmental hazard to any bottom-founded structures.

The commenter does not present any evidence that anchor ice is a hazard to bottom-founded structures--other than noting that a liter of water, when frozen, is theoretically capable of lifting 122 grams of sediment.

Response NOAA-14

This concern is addressed, in part, in Response NOAA-8. The effects of ocean circulation and ice on pollutant transport and the simulation of coastal and shelf circulation are discussed in Sections IV.A.1 and IV.A.2.

Response NOAA-15

The type of information required to calculate design waveloads, freeboard elevation, estimated sediment erosion and scour, and predicted damage to slope protection for gravel islands is more appropriately presented in the explorations plans and development and production plans that are submitted--in accordance with 30 CFR 250.34 and Alaska OCS Orders Governing Oil and Gas Lease Operations--for public comment and MMS approval. See also Response NOAA-12.

Response NOAA-16

The text in Section III.B.1 has been amended to address the first two concerns. The Peard Bay study data in question are not generalizable to the whole region, and the information regarding productivity would not change the analysis in the EIS.

Response NOAA-17

The text in Section III.B.1.a has been amended to address this concern.

Response NOAA-18

The text in Section III.B.1.a has been amended to address this concern.

Response NOAA-19

The text in Section III.B.1.c has been clarified with respect to Stoker's (1981) study, and a citation of oral communication with Phillips (1986) relates to RU 205.

Response NOAA-20

See Response NOAA-6.

Response NOAA-21

The Cape Thompson seabird colony is not located within the Sale 109 area (the Chukchi Sea Planning Area), and it is very unlikely that this seabird population would be affected by the proposal. Therefore, the decline in the colony is not discussed in Section III. The decline in the murre population at Cape

Thompson probably is due to natural fluctuations in the availability of seabird prey (food organisms) and water temperatures.

Response NOAA-22

Geraci and St. Aubin (1986) state that, in fish and mammals, ingested hydrocarbons are metabolized by enzyme systems in the liver and are excreted in the urine. These enzymes are ubiquitous in mammals (Gillette, Davis, and Sasame, 1972) and have been demonstrated in other whale and dolphin species (Geraci and St. Aubin, 1982); and it is reasonable to assume that these enzymes also exist in bowhead whales (Geraci and St. Aubin, 1986). There is no evidence to indicate that small amounts of ingested oil would block the gastrointestinal tract of bowheads. There is evidence that bowheads would be capable of metabolizing small quantities of ingested oil (Geraci and St. Aubin, 1986). There is no evidence to indicate that whales would knowingly ingest large amounts of oil. Testing the hypothesis that bowheads can metabolize and pass crude oil and petroleum products is highly impractical. In the absence of bowhead-specific data, extrapolation from related species constitutes the best data available.

Response NOAA-23

The text in Section IV.I has been amended to address this concern.

Response NOAA-24

The definitions in the EIS relate to spatial and temporal effects on populations, while the comment reveals a strong process orientation. Macrophytes (kelp beds, in particular) are vulnerable to effects because of their apparent rarity. They may be considered important because of their rarity and the opportunity they present for increased habitat and species diversity, rather than for their quantitative contribution to primary productivity.

Oil-spill effects on seabirds are generally short-term events in which birds are directly killed by a spill. There is no evidence to indicate that oil spills will have long-term effects on the reproductive success of seabird populations, either through loss of food sources or through habitat contamination. Oil in the pelagic environment of the seabird populations would not persist as a contaminant for more than 10 to 30 days, and the effect on seabird-food sources (prey) would be short-term due to the rapid recruitment of prey species. Therefore, the effect on birds is likely to be MINOR.

The natural changes in water temperature and ice cover (length of ice season vs. open-water season) on the availability of seabird-food sources (prey) have an effect on seabird reproductive success that is several magnitudes greater than the potential effects of even a large oil spill (several hundred thousand barrels). Annual changes--variations in ice conditions and water temperatures--have affected the reproductive success of all seabird colonies in the northern Bering and Chukchi Seas.

Response NOAA-25

See Response BIA-1.

Response NOAA-26

The text of Section II.A.2.a(2) has been revised to indicate that only the fall bowhead whale migration occurs at a time when drillship operations may be affected.

Response NOAA-27

The low-resource case assumes that transportation of produced crude would be accomplished by offshore loading of tankers. This method of transportation is one option considered feasible in the literature (Han-Padron, 1984). Any particular design would be assessed for technical and economic feasibility at the time when oil is discovered. The environmental implications of this oil-transportation mode are addressed in Appendix C.

Response NOAA-28

The transportation scenario for the high-resource case provides the opportunity to assess a potential alternative transportation method/route. It was selected for the high case rather than the mean case, partly because it relies on technology that is still evolving. The transportation of oil to the TAP via an onshore pipeline, as assumed in the mean case, is based on technology that is already highly developed. Moreover, the TAP is expected to have excess capacity at about the same time that oil could be produced from the Chukchi Sea and, thus, would provide the advantage of using existing industry infrastructure in the Arctic. It is possible that the resources for the high case could be transported in the same manner as for the mean case.

Response NOAA-29

The location of Blossom Shoals has been identified in Figure III-1.

Response NOAA-30

The sand-wave fields were noted in the text of the reference but were not identified, per se, on any of the accompanying figures.

Response NOAA-31

Additional information on permafrost has been added to the text in Section III.A.1.c(2) to address this concern.

Response NOAA-32

The text of Section III.A.4.a(3) has been revised to address this concern.

Response NOAA-33

The text in Section III.B.1.a has been amended to address this concern.

Response NOAA-34

The text in Section III.B.1 has been amended to address this concern.

Response NOAA-35

See Responses MMC-26 and EPA-2.

Response NOAA-36

The Submerged Lands Act (43 U.S.C. 1301-1315) states that the seaward boundary is 3 geographical--not statute--miles from the coastline.

Response NOAA-37

The text in Section IV.B.2.c has been amended to address this concern.

Response NOAA-38

These references have been added to the FEIS Bibliography.

Response NOAA-39

The 50- to 100-meter depths that are common over much of the Chukchi shelf are not likely to suffer much contamination as a result of an oil spill. Information from the North Aleutian Basin Synthesis Report suggests that, in water depths found on the Chukchi and Bering Sea shelves, one might expect 0.1 percent of crude oil spilled to get into sediments within 10 days (Manen and Pelto, 1984). However, water depth is not the only important variable; the presence of a surf that will beat the oil into sediments also is an important factor. Therefore, we would expect the Chukchi Sea, which is calmer than the Bering, to experience the same or a lesser degree of contamination.

Response NOAA-40

See Response NOAA-6. The text in Section IV.B.4.a(1) has been amended to address these concerns. More analysis has been added for anadromous species; however, the analysis still is centered on the 1983 nearshore database as the best available data, even though its limitations are recognized. The overall effect is the highest level of effect that is most likely to be incurred by any species. Many of the higher-order effects (e.g., MODERATE levels) are not the most likely result of the proposed activities; rather, they are less likely to occur because of the particularities of timing of events.

Response NOAA-41

The text in Section IV.B.4 has been clarified to address this concern.

Response NOAA-42

The paragraph cited in Section IV.B.4 is not viewed as being inconsistent with the previous analysis, especially in light of the expanded treatment of anadromous fishes. However, the text has been amended to reduce the emphasis on current or future research.

Response NOAA-43

There are no Sentences 7 and 8 in the referenced paragraph; however, the cumulative-effects discussion of Section IV.B.4 has been amended to address this concern.

Response NOAA-44

The MMS appreciates the comment and the concern; the commenter is referred to Response NOAA-43.

Response NOAA-45

The Sale 109 resource estimate includes all the resources for the Chukchi Sea Planning Area; therefore, the construction that is hypothesized for this lease sale takes into account all the development that would accompany full production from the lease sale area. This level of development is expected to dwarf any development that might occur for other offshore sales in the Chukchi Sea. For example, the resource estimate for the Chukchi Sea portion of the Beaufort Sea Planning Area is insignificant compared to that of the Sale 109 area; development of this area would not add significantly to the magnitude of the construction projected for the Sale 109 area. In the event that State offshore-sale areas are reinstated on the State lease-sale schedule, Sale 109 activities again would overwhelm those of the State because the MMS estimates the probability of hydrocarbons in the State sale areas to be very small and economically recoverable resources to be negligible. As a result, synergistic or cumulative effects are expected to be no different from those described in the EIS.

Response NOAA-46

See Response NOAA-43.

Response NOAA-47

Water depths inside Peard Bay generally are within the 5.5-meter isobath and would not need to be made deeper. If more precise measurements indicated that some dredging were necessary, the channel width would probably be about 130 meters--adequate to handle the large sealift barges, should one be blown sideways.

Response NOAA-48

The U.S. Army Corps of Engineers has been added to the list of permitting agencies in the Section IV.B.4.d cumulative-effects assessment.

Response NOAA-49

The seal species in the Sale 109 area (spotted, ringed, and bearded seals) do not occur in large aggregations. These seals are widely distributed in small groups or as single animals along the broad ice front; thus, large numbers of seals are not likely to be oiled. Seal densities in the Sale 109 area do not exceed five seals per square kilometer, except at coastal-haulout sites that have a very low chance of contact (less than 5%) by a spill within 10 days.

Response NOAA-50

In the EIS, the effect on polar bears from consuming contaminated/oiled seals is not understated but instead probably is overstated. Polar bears range over thousands of square kilometers of ice/water habitats during their search for seals and are not likely to select oiled seals over uncontaminated seals (the vast majority of the seals available to the bears). A possible effect on polar bears from eating oiled seals would only occur within a short period of time (about 3 days) after the seals were oiled. After this short period of time, the contaminated seals would be naturally cleansed of the oil; and/or the oil on a seal would lose its toxic fractions and probably have no effect on the polar bear that eats the seal.

There is no conclusive evidence that polar bears are acutely affected by small amounts of petroleum. In the Canadian study presumably referred to, three polar bears were coated with oil and they consumed large amounts of oil while grooming their fur. Such extensive oiling/contamination of polar bears is not likely to occur in their natural environment--even if the bears do come in contact with a spill. In the Canadian study, the polar bears were forced to enter an enclosed pool that had a layer of oil on it (Oristland et al., 1981).

Response NOAA-51

Oil spills under the ice would not spread appreciably before being encapsulated or frozen in the ice during the ringed seal pupping/denning season, when breathing and access holes in the ice are maintained by the seals (see Fate and Behavior of Spilled Oil in Sec. IV.A.2). Thus, oil spills would not selectively contaminate ringed seal breathing and access holes in the ice.

Response NOAA-52

Jack Lentfer (1983), the principal investigator of an unpublished study on the effects of noise on polar bear denning (cited in Sec. IV.B.6.b) did not define what types of seismic noise were measured from within the polar bear den, nor did he give the distance from the sound source; therefore, "seismic activities" and "very near" cannot be specifically defined in this EIS. Lentfer's general statement about the study results gave no specific details of the study.

Response NOAA-53

The effects of noise produced from year-round production platforms and associated activities are assessed in Section IV.B.6.d (Effects of Construction Activities). There are no data to indicate that production platforms would cause long-term (several years) displacement of marine mammals, nor is there any evidence to suggest that migration paths would be blocked.

Response NOAA-54

The text in Section IV.B.7.a has been amended to address this concern.

Response NOAA-55

The spring lead system is very dynamic. Considerable amounts of new (grease) ice are formed in open leads and leads that frequently open and close. If oil was spilled into a lead, the ice present would restrict the spread of the oil and the spill area would be smaller than that predicted for open-water conditions. The combination of lead/matrix pumping and agitation of grease-ice against larger ice floes would result in an initial increase in oil dispersion in the water column. However, this process would quickly cease, since small-scale grease-ice/oil mixing and agitation against the more stationary ice floes can result in significant water-in-oil emulsification in as short a time as a few hours. The water-in-oil emulsification may reside just under grease-ice at the grease-ice/seawater interface. Grease-ice and any spilled oil within the lead system would be blown in a downwind direction and eventually would accumulate at the downwind edge of open leads. The accumulated grease-ice and oil would then be pushed onto the adjacent ice when the lead closed (Payne et al., 1984). In this way, leads would be purged of spilled oil relatively quickly--in as few as several days (not weeks, as suggested by the commenter)--after cessation of a spill.

Response NOAA-56

The text in Section IV.B.7.a(1) has been clarified regarding this point. Geraci and St. Aubin (1986) estimated that a critical dose of fuel oil for an adult bowhead might be on the order of 200 to 625 liters. They concluded that these quantities are well beyond the limits of what might accidentally or purposely be consumed by a cetacean at sea (Geraci and St. Aubin, 1982).

Response NOAA-57

Bowhead whales are not expected to ingest larger quantities of oil; however, it might be possible for bowheads to pass petroleum hydrocarbons through the digestive system, since this capability has been demonstrated in other marine mammals (e.g., harp seals [Smith and Geraci, 1975]).

Response NOAA-58

The text in Section IV.B.7.a(2) has been amended to address this concern.

Response NOAA-59

See Response NOAA-4.

Response NOAA-60

The text in Section IV.B.7.b has been amended to address this concern.

Response NOAA-61

The text in Section IV.B.7.b(2) has been amended to address this concern.

Response NOAA-62

The number of gray whales expected to be displaced over the long term is unlikely to be a significant portion of the regional population.

Response NOAA-63

The text in Section IV.B.7.c has been amended to address this concern.

Response NOAA-64

The text in Section IV.G.3 has been clarified to address this concern.

Response NOAA-65

The additional analysis provided in Section IV.B.7.a(3) addresses this concern. The MMS does not believe that conclusion contradicts the potential for noise effects. Rather, the conclusion acknowledges that there probably would be effects but that those effects probably would be MINOR. The additional analysis in this new subsection should provide a better foundation for understanding the basis of our conclusion.

Response NOAA-66

The MMS believes that current knowledge is adequate to determine likely effects of the lease sale on endangered cetaceans. Should oil be discovered in a commercially producible quantity beneath or near the spring lead system used by migrating bowheads, the MMS would consult with the NMFS to ensure that development and production activities would not jeopardize the bowhead whale population.

Response NOAA-67

The text in Section IV.I has been amended to address this concern.

Response NOAA-68

The worst-case scenario was changed to incorporate and discuss the points raised in this comment. The worst-case scenario now includes production platforms and a major oil spill in the spring lead system. (See Sec. IV.I).

Response NOAA-69

The text in Section IV.I has been amended to address this concern.

Response NOAA-70

The Bibliography has been amended to address this concern.

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May 1, 1987

Mr. Alan Powers
Regional Director
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Dear Mr. Powers:

The state has reviewed the Department of the Interior's (DOI) Draft Environmental Impact Statement (DEIS) for the Chukchi Sea Outer Continental Shelf (OCS) Sale 109 planning area. Our comments focus on three aspects of the Sale 109 DEIS: (1) the proposed action and alternatives; (2) the proposed mitigating measures; and (3) the environmental impact assessment. Each of these topics are discussed below.

Proposed Action and Alternatives

Your proposal to offer for lease 5,448 blocks or approximately 29.4 million acres (Alternative I) in the Chukchi Sea is not in keeping with the Secretary of the Interior's proposed "focused" leasing policy. Former Secretary William Clark, in his January 12, 1984, address to the OCS Policy Committee in Washington, D.C., first announced new leasing procedures under which the size of lease sale offerings would be reduced:

> concerted effort will be made to avoid dragging through the 22 month planning process those areas where the level of industry interest is minimal and conflicts exist with other uses. Industry interest, information gleaned from earlier sales, and MMS analysis of geological and geophysical information will be carefully examined to refine the original area of consideration into smaller but much more precise areas of leasing interest.

The DOI has continued to publicly support this "focused" leasing policy and has proposed it as a method to reduce potential environmental concerns associated with OCS lease sales in the new five-year leasing program. Given this commitment to reduce the

STATE-1

01-A35LH

size of lease sale offerings and focus on areas of high hydrocarbon potential, we request an explanation of why the preferred alternative in the DEIS is to offer the entire 29.4 million acres contained in the Chukchi Sea planning area.

Consistent with DOI's focused leasing policy, the state strongly recommends that DOI adopt Alternative VI - Coastal Deferral which would defer 1,630 whole or partial blocks located along the eastern shore of the Chukchi Sea extending from 3 to 70 miles offshore. The coastal deferral area is estimated to contain only 16.4 percent of the total projected oil reserves in the Chukchi Sea planning area. However, deferral of this area would provide significant protection to: the Chukchi polynya, an important spring migration corridor for waterbirds and bowhead and beluga whales; denning and feeding areas for polar bears; important summer habitats for spotted seals, belugas, and walrus; offshore subsistence harvest areas for Barrow, Wainwright, Point Lay, Point Hope, and Atqasuk; and important coastal habitats such as Peard Bay, Kasegaluk Lagoon, and seabird colonies and feeding areas around Cape Lisburne and Ledyard Bay.

The Chukchi polynya merits special attention due to the vulnerability of marine mammals and waterbirds to potential oilspill and noise disturbance impacts in this confined ice lead system. The Chukchi polynya is formed when prevailing winter and spring easterly winds move the ice pack away from shorefast ice. This tends to maintain an open ice lead system from January onward. The lead system is extremely important to marine mammals and sea ducks, particularly bowhead and beluga whales and king eiders, as a spring migration corridor. Oilspills in this lead system could severely impact these species because they are concentrated both spatially and temporally. Noise and disturbance caused by industrial activities in this area have the potential to disrupt the spring migration of bowhead whales and subsistence whaling activities, because the whales are confined to the ice lead system. Although exploration could be timed to avoid these potential impacts, it is doubtful that production activities could be seasonally constrained.

STATE-2

As we have stated before, 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. In the case of the Chukchi polynya, however, several questions remain which need to be addressed before leasing should occur. The state recommends that leasing be deferred in the coastal area along the eastern shore of the Chukchi Sea for at least another two years in order to: 1) obtain additional information regarding the effects of industry-related noise and disturbance on subsistence whaling activity and marine mammals, including bowhead whales; 2) allow the oil industry to gain additional experience in operating in multi-year ice conditions; and 3) allow time to determine whether appropriate mitigation measures for protecting the wildlife resources in the Chukchi polynya can be developed.

Proposed Mitigating Measures

The state supports the adoption of all the proposed stipulations and Information to Lessees (ITL) contained in the DEIS and believes that they will contribute to the necessary protection for fish and wildlife resources in the proposed sale area. In addition, we recommend: (1) changes to the language of proposed Stipulation 3 regarding protection of biological resources; (2) the adoption of a stipulation regarding testing of oilspill containment equipment; and (3) modification of ITL No. 2 to include Ledyard Bay and important benthic habitats as areas of special biological sensitivity. Enclosure 1 contains specific language recommended for inclusion in mitigating measures for Sale 109.

Environmental Impact Assessment

The state has four major concerns regarding the Sale 109 DEIS environmental impact analysis, including: (1) the failure to include specific discussions or conclusions on the effects of oilspills and noise disturbance on marine mammals and birds of the Chukchi polynya, (2) the DEIS's apparent underestimation of potential oil and gas development impacts on bowhead whales, (3) failure to acknowledge environmental benefits from the Coastal Deferral Alternative, and (4) deficiencies in the caribou impact discussion. These concerns are discussed in Enclosure 2.

Please call if you have any questions regarding the state's comments.

Sincerely,

Robert L. Grogan
Director

Enclosures

cc: Commissioner Collinsworth, DFG, Juneau
Commissioner Brady, DNR, Juneau
Commissioner Kelso, DEC, Juneau
Mayor Ahmaogak, North Slope Borough, Barrow
Mayor Green, Northwest Borough, Kotzebue
John Katz, Office of the Governor, Washington, DC
Rod Swope, Office of the Governor, Juneau

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ENCLOSURE 1

The state supports the proposed mitigating measures contained in the Draft Environmental Impact Statement (DEIS). The following changes or additional measures are also recommended as necessary to adequately protect the fish and wildlife resources in the Chukchi Sea planning area. These recommendations are predicated on the adoption of the Coastal Deferral Alternative. Should this alternative not be adopted, then the state would recommend a spring seasonal exploratory drilling restriction stipulation for the coastal deferral area, and a stipulation restricting the discharge of produced water, drilling muds, and cuttings in marine waters less than 10 meters deep.

Stipulation 3 - Protection of Biological Resources

STATE-4

The state recommends that the wording of Stipulation 3 be revised as follows:

a. If the Regional Supervisor of Field Operations (RSFO) has reason to believe that biological populations or habitats exist and require protection, the RSFO shall give the lessee notice that the lessor is invoking the provisions of this stipulation and the lessee shall comply with the following requirements. Prior to any drilling activity or the construction or placement of any structure for exploration or well drilling and pipeline and platform placement, hereinafter referred to as "operation," the lessee shall conduct site-specific surveys as approved by the RSFO in accordance with prescribed biological survey requirements to determine the existence of any special biological resource including:

   1. Very unusual, rare or uncommon ecosystems or ecotones; or

   2. A species of limited regional distribution that may be adversely affected by any lease operation.

   If the results of such surveys suggest the existence of a special biological resource that may be adversely affected by any lease operation, the lessee shall: (1) relocate the site of such operation so as not to adversely affect the resources identified; (2) modify operations in such a way as not to adversely affect significant biological populations or habitats deserving protection, or (3) establish to the satisfaction of the RSFO, on the basis of the site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist. The RSFO will review all data submitted and determine, in writing, whether a special biological resource exists and whether it may be significantly affected by the lessee's operation. The lessee may take no action until the RSFO has given the lessee written directions on how to proceed.

b. The lessee agrees that, if any area of biological significance should be discovered during the conduct of any operations on the leased area, the lessee shall immediately report such findings to the RSFO and make every reasonable effort to preserve and protect the biological resources from damage until the RSFO has given the lessee directions with respect to its protection.

The state's recommended revisions would enhance the protection that this stipulation provides to biological resources. The primary advantages are: (1) it would not be confined to only those resources identified in the lease area, (2) the RSFO would be required to determine, in writing, whether a special biological resource exists and whether it may be significantly affected, versus no requirements of written determinations, and (3) the stipulation would be invoked when resources "require protection," versus when resources "may require additional protection." The last point is relevant because the Alaska Minerals Management Service (MMS) could propose that adequate protection is provided through existing mitigating measures.

Recommended Stipulation 5 - Testing of Oilspill Containment Equipment

The state is concerned about industry's capability to clean up oilspills under conditions characteristic of the Chukchi Sea. The stipulation recommended below is designed to improve a lessee's oilspill response capability by requiring semiannual full-scale drills and frequent inspection of response equipment to assure readiness. We believe this stipulation would serve to improve oilspill response capability in the Chukchi Sea. Consequently, we recommend that the Testing of Oilspill Containment Equipment Stipulation, as presented below, be included in the Sale 109 Notice of Sale.

STATE-5

The lessee shall conduct semiannual full-scale drills at the request of the lessor for platforms, drilling structures, and operator-controlled contracted cleanup vessels to test the equipment and the contingency plan. These drills must involve deployment of all primary equipment identified in the oilspill contingency plans as satisfying OCS Order No. 7. At least two of these drills shall include the primary equipment controlled and operated by the appropriate cooperative. These drills will be unannounced and held under realistic environmental conditions in which deployment and operations can be accomplished without endangering safety of personnel. Representatives of the U.S. Coast Guard, MMS and State of Alaska may be present as observers. The lessor's inspectors will frequently inspect oil and gas

facilities where oilspill containment and cleanup equipment are maintained in order to assure readiness.

Information to Lessees (ITL)

The state recommends that ITL No. 2 - Information on Areas of Special Biological and Cultural Sensitively be modified to include Ledyard Bay as an area of special biological sensitivity. The following excerpt from the Barrow Arch Synthesis Report clearly identifies the biological importance of this area.

STATE-6

> Ledyard Bay is a highly productive area of the eastern Chukchi Sea, perhaps the most important in the Barrow Arch for seabirds and waterfowl. Relatively shallow water and annually abundant marine fauna combine to provide rich spring, summer, and fall feeding habitats for many of the region's birds. The bay is especially significant to regional and local populations of seabirds; almost all alcids and larids nesting at Capes Lisburne and Lewis feed there throughout June and July every year, many thousands of them continue to forage there in August in some years, and several thousand subadult glaucous gulls feed and stage there in August of most years. Ledyard Bay is also particularly important to Alaskan and Canadian populations of common and king eiders; tens of thousands, or perhaps hundreds of thousands, of these regionally and locally important sea ducks stage and nest there in July and August.

In addition to Ledyard Bay, reference to macroalgal beds and important walrus benthic feeding habitat should be included as areas of special biological sensitivity in proposed ITL No. 2. To date, these areas are poorly defined, however, ongoing research studies should aid in further delineating these important habitats.

ENCLOSURE 2

The state has a number of concerns regarding the Sale 109 Draft Environmental Impact Statement (DEIS) environmental impact analysis. We have focused our comments on four primary concerns: (1) inadequate impact analysis for the Chukchi polynya, (2) underestimation of potential oil and gas development impacts on bowhead whales, (3) failure to acknowledge environmental benefits from the Coastal Deferral Alternative, and (4) deficiencies in the caribou impact discussion. Each of these concerns are discussed below.

Impact Analysis for Chukchi Polynya

The DEIS does not contain any specific discussion or conclusions on the effects of oilspills or noise disturbance in the Chukchi polynya. This ice lead system is an important spring migration corridor for bowhead and beluga whales and numerous species of waterbirds, particularly eider ducks. The Chukchi polynya acts to concentrate these species both spatially and temporally, which significantly increases their vulnerability to oilspill or disturbance impacts. For example, the entire population of bowhead whales passes through this lead system from mid-April to early June and, in some years, the majority of the migration may occur within a two-week period. It is also believed that the entire eastern Beaufort Sea stock of beluga whales, estimated at 11,500 animals, moves through this nearshore lead system in spring. The open leads provide essential early-season resting, staging, and feeding habitat for large numbers of alcids, larids, waterfowl, and loons during late April to late June, and extremely large concentrations may occur when inclement weather forces migrants to "stop-over." The Barrow Arch Synthesis Report repeatedly acknowledges the importance of the Chukchi polynya as a migration corridor, and it notes the high degree of vulnerability to species using this area from oil development activities. **STATE-7**

The DEIS does provide a general analysis which attempts to discount concerns of oilspill impacts in ice leads on page IV-B-66:

> Perhaps the most serious situation could occur if oil were spilled into a lead from which bowheads could not escape. In this case, whales could die or suffer pulmonary distress from the inhalation of toxic vapors. The probability of such an occurrence is extremely low; generally, only a small fraction of the bowhead population would likely occupy the affected lead at any given time and thus be subject to mortality.

The assessment that only a small fraction of the population may occupy an affected lead at any given time is incorrect. A significant percentage of the bowhead whale population could occupy a portion of the Chukchi polynya anytime from April to June. For example, the 1980 spring bowhead census counts at Point Barrow documented that 70 percent of the observed spring migration passed by within four days.

We recommend that the Final Environmental Impact Statement (FEIS) provide a detailed analysis of the wildlife resources that utilize the Chukchi polynya and the potential impacts that could occur to these species. This discussion should also address the potential impacts from oil tankers using the Chukchi polynya. The DEIS's low and high resource development scenarios predict that 150 and 750 oil tanker trips, respectively, would be made each year. Such a high level of oil tanker activity significantly increases our concerns regarding possible oilspill and noise disturbance impacts, particularly if the Chukchi polynya is used as a transportation corridor.

Underestimation of Potential Impacts to Bowhead Whales

A major shortcoming of the DEIS is that the potential effects of oil and gas exploration are generally underestimated. This is particularly true with respect to marine mammals which are seasonally abundant in the Chukchi Sea planning area. Following are a few specific examples of such underestimation for bowhead whales.

The DEIS overall assessment of minor impacts to bowhead whales appears to be very conservative. In comparison, the Sale 87 (Beaufort Sea) FEIS predicted moderate impacts to bowhead whales. We do not believe reducing the overall impact assessment from that predicted in the Sale 87 FEIS is justified, especially considering the increased vulnerability of bowheads during their spring migration through the Chukchi polynya, which was not included in Sale 87. The Sale 109 FEIS should justify the reduction in impact assessments for bowhead whales between Outer Continental Shelf Sales 87 and 109. **STATE-8**

We do not believe that the scenario used in the worst case analysis for bowhead whales (pages IV-I-1 through IV-I-2) is a "worst case scenario." A 100,000 barrel spill occurring within the Chukchi polynya during the spring migration would generally have a much greater impact to bowhead whales than the fall oilspill scenario presented in the DEIS. The worst case analysis in the FEIS should be modified to address a major spill in the Chukchi polynya during the spring bowhead whale migration. **STATE-9**

We also question the DEIS minor impact prediction for bowhead whales in the worst case analysis. Since there has never been a direct observation of a bowhead whale contacting an oilspill, it is purely speculative to state that "encountering a 100,000 barrel spill . . . would affect whales only slightly" (DEIS page IV-I-2). This prediction is based in part on the assumption that bowhead whales are migrating through without "feeding or milling in any particular area." The data collected on bowhead whales in this region are far from adequate to support this assumption, especially for the fall season. In fact, there are no data to our knowledge with which to evaluate fall feeding in the sale area, although we know that from September to October bowheads feed in the area just west of Point Barrow. **STATE-10**

Underestimation of Benefits from the Coastal Deferral Alternative

The DEIS significantly underestimates the benefits or environmental protection that would be derived from the Coastal Deferral Alternative. We are particularly concerned that the DEIS evaluation concludes that environmental effects and subsistence harvest impacts would be the same regardless of whether the coastal area was deferred. We believe that removing the spring migration corridor used by bowhead and beluga whales; denning and feeding areas for polar bears; the area of highest density of ringed seals along the Alaskan coast; important summer habitats for spotted seals, belugas, and walrus; and primary subsistence harvest areas from consideration must substantially reduce the projected environmental effects of oil and gas development in the Chukchi Sea planning area. The FEIS should more accurately reflect the benefits that would be accrued from adopting the coastal deferral alternative. **STATE-11**

Deficiencies in the Caribou Impact Discussion

The DEIS discussion on potential onshore development impacts to caribou appears to be deficient in three respects. First, the DEIS underestimates potential impacts to caribou from a pipeline between Pt. Belcher and the Trans Alaska Pipeline System (TAPS) Pump Station 2. The pipeline route described in the DEIS would avoid the calving range of the Western Arctic Herd and Teshekpuk Lake Herd thereby minimizing potential caribou impacts. However, the DEIS (page II-8) also states "The pipeline route would vary if production within National Petroleum Reserve-Alaska (NPR-A) or the Beaufort Sea could be facilitated by a different alignment." Given the likelihood of oil discoveries in the western Beaufort Sea, the FEIS should evaluate the potential caribou impacts which might result from an alignment that would facilitate Beaufort Sea production. **STATE-12**

Second, the DEIS provides only a very general discussion on the cumulative effects of oil development in the NPR-A, the Mackenzie delta, and the Arctic National Wildlife Refuge. It does not discuss the possibility of additional oil developments that could be triggered by the presence of a pipeline generated by offshore development in the Sale 109 area. Small onshore oil and gas discoveries that could not independently justify a pipeline, could tie into a major pipeline between the Chukchi Sea and TAPS. The FEIS should evaluate the impacts of satellite developments to caribou in addition to the single transportation corridor by itself. **STATE-13**

Finally, although the caribou narrative in the DEIS is fairly objective, it does contain a few errors. Examples include:

> Page IV-B-82: The DEIS overall conclusion on the potential effects to caribou only identifies potential impacts to the Western Arctic Herd (WAH). Dependent on the actual route of the pipeline corridor, the WAH, Central Arctic Herd (CAH), and the Teshekpuk Lake caribou herd could all be effected. **STATE-14**

Page IV-B-83, third paragraph: The DEIS states that "Some displacement of the Central Arctic caribou herd from a small portion of the calving range near Prudhoe Bay facilities has occurred." Caribou biologists generally agree that there has been almost total cessation of calving in the Prudhoe Bay field, and measurable displacement of calving from the Milne Point road even during periods of very low traffic. The FEIS should revise the first sentence in this paragraph to delete the words "some" and "a small portion of the calving range near".

Page IV-B-83, fourth paragraph: MMS should be aware that the research and conclusions by Carruthers et al. (1984) have been contested by several caribou biologists. Carruthers et al. (1984) concluded that caribou cows and calves avoid the TAPS corridor because it runs primarily along riparian habitat which cows and calves normally avoid. This conclusion conflicts with the findings of Cameron et al. (1984) as well as the 1983 survey results by Carruthers et al. (1984). For all but one year the survey design of Carruthers et al. (1984) did not include a direct comparison between calf percentages in riparian habitat along TAPS, with calf percentages in riparian habitat away from TAPS. However, in the single year (1983) in which this comparison was made, Carruthers et al. (1984) found that calf percentages in TAPS riparian habitats were significantly lower, and bull percentages significantly higher, than in riparian areas way from TAPS. These results are consistent with the findings of Cameron et al. (1984). Cameron et al. (1984) conducted surveys along major river valleys comparing riparian areas away from TAPS with riparian areas along TAPS. They concluded that by comparing comparable habitats, the significantly lower calf percentages observed along TAPS as compared to areas away from TAPS, are most likely due to differences in human disturbance. We believe the DEIS gives undue credence to the conclusions of Carruthers et al. (1984) and that this discussion should be revised in the FEIS. **STATE-15**

Page IV-B-84, line 14: The statement "The mere physical presence of the pipeline and associated facilities probably has no effect . . ." should be qualified. Industry consultants in the Kuparuk oilfield have concluded that under most conditions adequately elevated pipelines without associated vehicular traffic will allow caribou to cross. However, the data concerning large groups of caribou under severe mosquito harassment are not conclusive; large groups deflecting along pipelines have been observed (e.g., Smith and Cameron 1985). In addition, at a recent industry/agency caribou workshop, industry consultants agreed that the question is still unresolved. This issue would have direct relevance to a pipeline across the range of the WAH where group sizes are generally greater than those in the CAH. **STATE-16**

Page IV-B-84, line 21: The statement "Vehicle traffic . . . has the greatest influence on caribou behavior and movement" is somewhat misleading. Traffic levels are a major influence on the ability of caribou to negotiate linear structures; however, other influences such as insect densities, season of the year, and sex and age classes present in the group are also important. **STATE-17**

Page IV-B-84, last paragraph: The DEIS assumes that the majority of the WAH caribou winter south of the Brooks Range. Survey conducted by the Alaska Department of Fish and Game indicate that more WAH caribou have been wintering on the North Slope in recent years. In 1984-85, for example, the majority of the herd wintered in the North Slope. Therefore, a transportation system across the North Slope may affect a greater number of caribou over a larger portion of the year than the DEIS implies. There are relatively few data on the effects of oil development on caribou during winter, thus the conclusion that there will be only minor impacts seems premature at this time. **STATE-18**

Response STATE-1

The MMS continues to support a focused leasing policy and strives to reduce potential environmental concerns associated with OCS lease sales.

To date, two lease sales--Sales 85 and 109--have been proposed for the Chukchi Sea area. Industry has expressed a relatively high level of interest in the entire planning area.

The Barrow Arch Sale 85 Area Identification process was initiated on June 27, 1983. The Call covered the entire Barrow Arch (Chukchi Sea) Planning Area of approximately 29.5 million acres (5,450 blocks). The area of geologic potential included high and moderate potential and was coincident with the Call boundaries.

Respondents to the Call were asked to delineate areas believed to have sufficient oil and gas potential to be offered for lease and to rank them according to priority of interests. Industry indicated interest in the entire Call area. Fourteen companies provided comments; nine submitted indications of interest (the range was from 6 to 9 indications per block).

Based on industry interest, the MMS recommended the entire Call area as the Federal proposal. It included all acreage in which industry indicated any interest (high, medium, or low) and included the area of geologic potential as identified by the MMS.

The Chukchi Sea Sale 109 Area Identification process began on January 28, 1985, with the publication of a Call for Information and Nominations in the Federal Register. The Area of Hydrocarbon Potential covered the entire planning area, and the Call included the entire planning area (5,450 blocks, approximately 29.5 million acres).

Respondents were asked to delineate areas of potential interest within the Call area and to rank those areas. Indications of interest ranged from 7 to 12 per block, with every block receiving at least one high or medium expression of interest.

Based on industry's high level of interest throughout the entire planning area, the MMS recommended that the entire Chukchi Sea Planning Area be selected as the proposed Federal action.

Industry interest remains high in the Sale 109 area. The MMS will carefully examine information gleaned from earlier sales and from MMS' analysis of biological, geophysical, and meteorological information. Measures will be taken to identify and mitigate significant environmental concerns associated with the sale.

Response STATE-2

The Chukchi polynya (or ice-lead area) shown on Graphic No. 2 has been given special attention in this EIS; its importance to bowhead and beluga whales, seals, walruses, and migratory birds is recognized in ITL No. 2 (Information on Areas of Special Biological Sensitivity), and the Chukchi polynya was one of the bases for the Coastal Deferral Alternative. An expanded discussion in Section IV.B.7.a(3) (Effects of Oil Spills and Noise Disturbance in the Spring Lead System) addresses effects on bowhead whales. Risks of oil-spill contact with the Chukchi polynya are shown in Figures IV-20, IV-21, and IV-22 (as contact probabilities for Migration-Corridor Sections A, B, and C) and discussed in Sections IV.B.6.a(3) and IV.B.7.a(1). See also Responses NOAA-4 and NOAA-55.

Note: No Response STATE-3.

Response STATE-4

The MMS believes that Stipulation No. 3 (Protection of Biological Resources) as written provides adequate protection for the biological resources of the Sale 109 area.

The stipulations proposed in the EIS generally apply to the OCS and the leasehold--the area over which the MMS has jurisdiction and enforcement authority. If biological populations or habitats outside of the area of MMS' jurisdiction are identified, they can be noted when exploration and development and production plans are reviewed by Federal and State agencies and the public; at that time, measures can be recommended that would help protect the biological resources.

The RSFO is required to provide a written notice to the lessee if biological surveys are to be conducted based on the identification of biological populations or habitats that may require additional protection. This notice would provide the written determination that special biological resources exist.

Applicable laws, regulations, orders, and stipulations provide the legal foundation for the required protection of the biological resources associated with the sale area. Stipulation No. 3 specifies those identified biological resources or habitats that may require more protection than is provided by the existing legal requirements.

Response STATE-5

The proposed stipulation presented by the State--which would require the lessee to hold a full-scale, semiannual oil-spill exercise--is similar to the present requirements of Alaska OCS Order No. 7, which requires annual drills to test the lessee's response capabilities under realistic environmental conditions. The MMS/USCG planning guidelines go further by requiring 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 and local governments 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, which ensures that response equipment is available and maintained in workable condition and that all personnel receive training required by Alaska OCS Order No. 7.

The proposed stipulation would require deployment of all oil-spill-containment and cleanup equipment identified in the oil-spill-contingency plan (OSCP). Increasing the frequency of deployment and retrieval of some equipment may reduce its useful life and potentially cause a premature failure when used over an extended period of time for an actual spill response.

The MMS believes that the adequacy of spill response can be determined through review of the OSCP and through viewing of oil-spill-response drills in accordance with current MMS rules and guidelines, and that unannounced oil-spill-response exercises are unnecessary. In addition, the MMS believes that unannounced response drills can be unnecessarily burdensome and costly to the lessee, especially during exploratory drilling. Unannounced response drills may require shut-in of operations and possible risk to the well in order to conduct the exercise. The MMS also believes that the periodic inspection of all equipment, coupled with carefully planned drills in realistic conditions using on-site equipment, adequately demonstrates the lessee's ability to conduct a response effort in the unlikely event of a spill.

Response STATE-6

Information on the abundance and distribution of marine and coastal birds portrayed on Graphic No. 1 recognizes Ledyard Bay as part of the primary foraging area of major seabird populations at Capes Lisburne and Thompson; however, marine habitats south of Ledyard Bay are equally important for seabirds. Kasegaluk Lagoon is more important for waterfowl (geese and ducks) and shorebirds than is Ledyard Bay. Marine habitats within 19 kilometers of the Capes Lisburne and Thompson seabird colonies, which include part of Ledyard Bay, have been given special attention by their inclusion in ITL No. 2 (Information on Areas of Special Biological Sensitivity).

Due to the poor definition of macroalgal beds and walrus-feeding habitat in the northern Chukchi Sea, these areas would be better protected under Stipulation No. 3 (Protection of Biological Resources) than under ITL No. 2 (see Sec. II.H.2). Both of these types of areas can potentially be spotted with sidescan sonar, which should make their protection under Stipulation No. 3 quite feasible.

Response STATE-7

The Chukchi polynya is referred to as the Ice-Lead Area in Graphic No. 2 and the Migration Corridor in Figures IV-20, IV-21, and IV-22. The EIS recognizes the great importance of the Chukchi Sea ice-lead system, or polynya; and assessment of the effects on this habitat area are covered in Sections IV.B.6.a(3) and IV.B.7.a(1) for oil-spill effects, and in Sections IV.B.6.b, c, and d for noise and disturbance effects. A new section (IV.B.7.a(3)) has been added to the EIS to give more extensive treatment to effects on bowhead whales in the spring lead system.

The last concern expressed by the commenter was that the EIS is incorrect in assuming that only a small fraction of the bowhead population may occupy an affected lead at any given time. Actually, this is a misinterpretation of the EIS. The EIS stated "Perhaps the most serious situation could occur if oil were spilled into a lead from which bowheads could not escape. . .. The probability of such an occurrence is extremely low; generally, only a small fraction of the bowhead population would likely occupy the affected lead at any given time and thus be subject to mortality." The key phrase in correctly interpreting this section is "a lead from which bowheads could not escape." This refers to a closed lead or open-water pond in which bowheads were detained, such as that discussed by Carroll and Smithhisler (1980); it does not refer to an open lead--through which bowheads would be free to pass in either direction--which we acknowledge could contain many bowheads. Consequently, the MMS maintains that the EIS is correct in stating that only a small fraction of the bowhead population would be expected to occupy "a lead from which bowheads could not escape."

Response STATE-8

The MMS believes that the conclusion of MINOR effects for Sale 109 as opposed to MODERATE effects for Sale 97 is justified, since several studies completed since the Sale 87 FEIS was published have alleviated some concerns about potential effects on bowhead whales (e.g., Richardson, Wells, and Wursig [1985]; Ljungblad et al. [1985b]; Geraci and St. Aubin [1986]). In addition, the bowhead whale population is now estimated to be almost twice as large (7,200 individuals [IWC, 1988, In Press]), as that estimated for the Sale 87 FEIS analysis (4,000 individuals [USDOI, MMS, 1984a]). Consequently, with a larger bowhead population, it is believed that greater effects could occur prior to reaching a MODERATE level of effect on the bowhead population. Also, contrary to information presented by the commenter, the Sale 87 FEIS did analyze the potential effects of oil and gas leasing on bowhead whales migrating through the spring lead system near Barrow (USDOI, MMS, 1984a, Pages IV-96 through IV-101 and IV-208 through IV-211).

Response STATE-9

The text in Section IV.I has been amended to address this concern.

Response STATE-10

A 100,000-barrel oil spill would affect only a very minor portion of the bowhead fall-migration corridor. As a result of this and due to the fact that the bowhead fall migration is spatially more dispersed than the spring migration, it is likely that only a few whales would contact oil. Despite the fact that bowheads have never been observed contacting an oil spill, other large baleen whales have been observed to contact oil without any apparent harm (Goodale et el., 1981; Geraci and St. Aubin, 1982). Consequently, it would be even more "speculative" to assume that brief contact with spilled oil would result in harm to bowheads. There is no evidence to indicate that substantial numbers of bowhead whales aggregate to feed or mill in the Alaskan Chukchi Sea during the fall migration. MMS contractors have flown whale surveys for a considerable number of hours over the Chukchi Sea without observing substantial bowhead aggregations or feeding activity.

Response STATE-11

See Response BIA-1.

Response STATE-12

The development of oil discoveries in the far western part of the Beaufort Sea Planning Area (Sale 97 FEIS [USDOI, MMS, 1987a]) assumes the use of the same onshore-pipeline route from Point Belcher to the TAP as that described for proposed Chukchi Sea Sale 109. Therefore, potential effects on caribou are expected to remain the same as described under the Sale 109 proposal, since the pipeline alignment would remain the same (no pipelines across the Western Arctic calving range) with or without western Beaufort Sea (Sale 97) development. Oil leasing in the NPR-A has so far excluded the Western Arctic herd calving range; thus, an NPR-A/OCS pipeline is not likely to cross the calving range of this herd.

Response STATE-13

The EIS provides a cumulative-effects analysis based on presently available information on other projects. There is no available information on possible small oil discoveries that may occur from State Sales 53 and 58 (which have been deleted from the State's current 5-year schedule but are still analyzed in the EIS because they may be reinstated), let alone on whether the possible discoveries would be economical if a pipeline were built somewhere across the NPR-A. The assumed Sale 109 pipeline route from Sale 109 leases coming ashore at Point Belcher and crossing the NPR-A to the TAP (Graphic No. 3) is about 161 kilometers away from State Sale 53 and 58 areas and existing ASRC onshore leases. Therefore, it is unlikely that the assumed Sale 109 development pipeline would make these possible small oil discoveries economical.

Response STATE-14

The assessment of potential effects on caribou from the proposal assumes that the Sale 109 pipeline corridor shown on Graphic No. 3 would be built. This assumed pipeline route would not cross the Teshekpuk Lake or the Central Arctic caribou-herd calving ranges. The proposed Sale 109 area is not adjacent to the ranges of these two herds; thus, the EIS focuses on the caribou herd that is likely or expected to be affected by the proposal--the Western Arctic herd.

The Prudhoe Bay oil-development area represents 5 percent or less of the total calving range of this herd; thus, the use of the terms "some" displacement and "small" portion of the calving range is appropriate as reflected in Section IV.B.8.a. Use of the terms "some" displacement of caribou and "small" portion of the calving range is further supported by the fact that the Prudhoe Bay oil field was never specifically identified as an important or concentrated calving area of the Central Arctic herd prior to oil development in the area. Measurable displacement of the Central Arctic caribou herd along the Milne Point Road occurred within a few kilometers of the road system. This area also represents a small portion of the Central Arctic herd calving range (less than 1%).

Response STATE-15

The EIS discusses the Carruthers, Jakimchuk, and Ferguson (1984) study on the effect of the TAP on Central Arctic herd distribution in the general discussion of disturbance effects associated with pipelines (Sec. IV.B.8.a). The conclusions of this study are not used in the site-specific effects analysis; thus, the EIS does not give undue credence to the conclusions of this 1984 study. The discussion of this study was included to show the opposing view on whether the TAP has affected the distribution of the Central Arctic herd.

Response STATE-16

The sentence stating that "the mere physical presence of the [TAP] pipeline has no effect" on the behavior, etc., of caribou was qualified by the MMS' recognition that the pipeline must be of sufficient height for the caribou to pass underneath it. There is no evidence to indicate that the TAP acts as a fence for caribou. Smith and Cameron (1985) reported the deflection of large groups of caribou along the Kuparuk pipeline, but this pipeline disturbance was associated with adjacent motor-vehicle traffic--not the pipeline alone.

Response STATE-17

The text in Section IV.B.8 has been amended to address this concern.

Response STATE-18

The EIS recognizes that part of the Western Arctic herd overwinters on the North Slope (Sec. IV.B.8.a), but during most winter seasons the majority of the herd overwinters south of the North Slope. The TAP has not been shown to affect the Central Arctic herd on its winter range, and the proposed pipeline across the NPR-A is not expected to affect the herd on its winter range--regardless of whether the herd overwinters on the North Slope or south of the Brooks Range. Although large numbers of caribou (10-60 thousand) of the Western Arctic herd overwinter on the North Slope, the majority of the herd does not overwinter there (Davis, ADF&G, 1987, oral comm.).

NORTH SLOPE BOROUGH

OFFICE OF THE MAYOR

P.O. Box 69
Barrow, Alaska 99723

Phone: 907-852-2611

George N. Ahmaogak, Sr., Mayor

May 4, 1987

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

Dear Mr. Powers:

Please regard this letter and the accompanying Comments document as the response of the North Slope Borough to your call for comments regarding proposed Chukchi Sea Lease Sale 109. As the area-wide local government for the northernmost region in Alaska, bordering the Chukchi and Beaufort Seas, the Borough speaks to those potential impacts of greatest concern to the people of its member villages who rely upon subsistence resources for their sustenance.

The Borough would support the proposed Chukchi Sea Lease 109 only upon the condition that the 1,630 whole or partial blocks situated along the entire coastline as described in the Draft Environmental Impact Statement (DEIS) as Alternative VI, Coastline Deferral, be deferred from the proposed sale.

The Alternative VI Coastal Deferral area is unique and of particular importance to the residents of the North Slope Borough because of the sea ice dynamics and the presence of many animal species that live in or migrate through the area, and which are relied upon by families for subsistence harvest. During the winter and spring the pack ice is fairly close to land throughout the Coastal Deferral area. It is common knowledge among the coastal villages near the Lease Sale 109 area, that Chukchi Sea ice is much more dynamic than that of the Beaufort Sea. The pack ice is moved by winds and water currents which can create leads of open water within the sheer zone especially in the spring. When the pack ice is pushed close to the landfast ice there is a limited amount of open water in which marine mammals using this area may surface. An oil spill or oil which has been trapped in the ice and released by melting could

cover significant amounts of open water in such an area. We are also obviously concerned that industrial activity in the Coastal Deferral area could displace animals and affect the subsistence hunt.

The North Slope Borough urges selection of Alternative VI, Coastal Deferral for the following additional reasons:

a. Alternative VI is the only alternative which allows exploration and development to occur in the sale area but avoids drilling in most of the spring lead system and associated broken ice areas. By minimizing drilling in or near the lead system, there will be less likelihood of oil spills and a reduced danger to marine animals which use or migrate through the lead system.

b. There is not a major reduction in mean resource estimate if Alternative VI is selected. Table II-2 lists the mean resource estimates for the Proposal and the three deferral alternatives. The mean resource estimates for the Proposal and Alternative VI are 2.68 and 2.24 billion barrels of oil, respectively. The Alternative VI estimate is only 16% less than that of the Proposal. The difference seems to be a reasonable sacrifice in order to reduce drilling-related spills and improve protection of marine life in the lead system and subsistence hunting for marine animals.

c. Alternative VI addressed more concerns expressed during the scoping process than the Proposal or any other deferral alternative (see pages I-17 through I-22).

As noted in more detail in the attached Comments document the North Slope Borough would consider any Final EIS adopted in the same form as this DEIS as inadequate for purposes of agency compliance with the National Environmental Policy Act of 1969. That Act, and applicable regulations, requires not only that the agency preparing a draft EIS must request comments from state and local agencies, and the public, but also requires the agency in preparing a final EIS, to consider and respond to the comments. The comments must be included with the Final EIS. **NSB-1**

Please note that the comments on the attached pages are presented as General Comments (pp. 1 -12) and as Specific Comments (pp. 12 - 52).

Thank you for your attention and anticipated consideration of these comments.

Sincerely,

George Ahmaogak, Sr.

George Ahmaogak, Sr.
Mayor

Attachment: 1

Mr. Alan Powers
May 4, 1987
Page 3

cc: Edward Itta, Director, NSB Planning Department
Warren Matumeak, Deputy Director, Permitting
Harold Curran, NSB Chief Administrative Officer
Ben Nageak, NSB Wildlife Management
Cindy Young, Director, NSB Health & Social Services
Arnold Brower Jr., Alaska Eskimo Whaling Commission
Nate Olemaun Jr., Mayor, City of Barrow
Luke Koonuk, Mayor, City of Pt. Hope
Willard Neakok, Mayor, Pt. Lay IRA
Jacob Kagak, Mayor, City of Wainwright
Eugene Brower, Barrow Whaling Captains Association
Earl Finkler, City of Barrow

Comments on Chukchi Sea Sale 109

Draft Environmental Impact Statement*

Submitted to

Alan D. Powers

Regional Director (Alaska OCS Region)

Minerals Management Service

949 E. 36th Avenue, Room 110

Anchorage, Alaska 99508-4302

Submitted by

George N. Ahmaogak, Sr.

Mayor

North Slope Borough

P.O. Box 69

Barrow, Alaska 99723

May 4, 1987

*Note that the comments on the attached pages are presented as General Comments (pp. 1 - 12) and as Specific Comments (pp. 12 - 52).

V-67

General Comments

It is important that Alternative VI -- the Coastal Deferral Alternative -- be adopted. The Coastal Deferral Zone contains the lead system* through which bowhead whales and many beluga whales migrate in the spring. An oil spill or oil which has frozen into the ice being released by melting could affect much of the open water in such an area.

If Alternative I is adopted, migrating whales would be at risk from Point Hope to near Barrow. It is possible that exploratory activities could be timed to avoid whale migrations and decrease the hazard, but it would be impossible for year-round development and production to occur without creating a situation that would jeopardize the continued existence of the bowhead whale. Noise disturbance and risk of oil spills contacting whales could not be avoided while working in or near the lead system. Since production and development could never be done in the lead system without seriously affecting the migrating whales, leases should not be sold in these areas.

NSB-2

On page IV-B-113 of the DEIS it is stated that under Alternative 1 the effect of Sale 109 on subsistence hunting will be Major in Wainwright and Moderate in other villages. The area which would be deferred by Alternative VI contains hunting areas for the villages of Point Hope, Point Lay, Wainwright, and Barrow. Adopting alternative VI would reduce disturbance to subsistence hunting.

*The term "lead system" is used in these comments to refer to the lead (or leads) and associated broken ice areas through which the spring migrating bowhead whales travel.

If during the spring migration there was oil covering a significant portion of the open water it would surely force whales into contact with the oil. Contact with spilled oil presents a clear danger for bowhead whales, especially regarding ingestion and contact with skin, especially the eroded areas (Albert, 1981a). Oil may adhere to the roughened areas of skin or tactile hairs (Haldiman et al., 1981), and it reduces filtering efficiency of bowhead whale baleen (Braithewaite et al., 1983)

Whales restricted to an oil-covered area of open water within the ice could likely suffer pulmonary distress as a result of breathing petroleum vapor during repeated surfacings. Such a restriction is not out of the question since bowheads have been observed in the Barrow area continually returning to the same small area of open water presumably because there was no more readily available open water where they could surface (Carroll and Smithhisler, 1980). The entire bowhead migration was held up for a period by ice in 1980 (Ljungblad et al., 1985).

NSB-3

The actual inhalation of oil is also possible. Very close range observations (within 5 meters) have been made of bowhead whales and it was seen that water pooled in the closed external nares when the whales surfaced (Carroll et al., In Press). It is assumed that some oil on the surface of the water would also pool in the external nares. There are tactile hairs around the blow hole and folds of skin in the external nares to which oil could adhere. The skin around the top of the blow hole on some whales has been observed to be quite abraded (Carroll et al., 1987). Bowheads sometimes use the top of the blowhole to make breathing holes in ice and presumably this is why that area of skin is abraded (George and Carrolet al., 1987). The abraded skin would provide another surface to which oil could adhere and therefore possibly be inhaled. The bowhead's inhalation is more powerful than the exhalation. Carroll et al. (1987) found that the mean amount of time it takes for an inhalation is about half that of an exhalation (0.71 seconds for an inhalation and 1.45 seconds for an exhalation); therefore, the air must be moving faster during the inhalation. It is quite possible that there could be some oil remaining on the rough skin or tactile hairs after the exhalation that could be inhaled by the more powerful inhalation.

It is stated on page IV-B-66 of the DEIS that only a small fraction of the bowhead population would likely occupy an affected lead at any given time. The fact is that a sizable portion of the population could occupy a section of the lead at a time and this could happen any time from April to June. Bowheads migrate through the Chukchi Sea from early April through June, but often they pass in pulses where a large percentage of the whales pass during a short time period. For instance, in 1985 43% of the whales counted during the spring census **NSB-4**
at Barrow were seen during 3% of the season (George et al., In Press). These pulses generally occur during late April and early May, but there are exceptions such as in 1980 when no whales were seen until 21 May, and 70% of the population passed in 4 days (Krogman et al., 1982). Cows with calves also often pass during a relatively short time period. For example, 38 of 59 calves counted in 1986 were seen from 21 May through 30 May (George et al., In Press). Therefore, an oil spill at the wrong time could have a profound effect on the population.

As a result of recent oil and gas development at Prudhoe Bay and related CIP construction, all North Slope Borough communities have been experiencing increased social problems such as rising rates of alcoholism and drug abuse,

domestic violence, child abuse, homicide and suicide. It is anticipated that similar impacts will be experienced again, though this time the focus of impact will be primarily felt in Wainwright.

It is further anticipated that as a result of sociocultural impacts from Sale 109 development, the existing network of health and social services available to Wainwright will not be adequate to meet the anticipated increased **NSB-5**
social health needs and that additional resources will have to be mobilized.

<u>IMPACT OF U.S. SUPREME COURT DECISION IN AMOCO PRODUCTION v. VILLAGE OF GAMBELL/ OTHER LEGISLATIVE PROTECTIONS AFFORDED SUBSISTENCE USES / ABORIGINAL RIGHTS</u>

On March 24, 1987, the U.S. Supreme Court decided the case of <u>Amoco Production Company, et al. v. Village of Gambell, et al.</u>, No. 85-1239, together with No. 85-1406, <u>Hodel, Secretary of the Interior, et al. v. Village of Gamble, et al.</u> **NSB-6**
also on certiorari to the Supreme Court. Throughout this discussion these cases will be collectively referred to as "<u>Gambell</u>". It is the purpose of this portion of the comments to outline the effect of <u>Gambell</u> on ANILCA § 810, to review the implications of <u>Gambell</u> for aboriginal rights on the OCS, and to point out the protections still afforded endangered species by other environmental laws.

V-69

I. ANILCA

In Gambell, the U.S. Supreme Court ruled that the Alaska National Interest Lands Conservation Act [ANILCA], and in particular § 810, did not apply to the outer continental shelf [OCS]. The Court determined that ANILCA's plain language makes ANILCA applicable only to Federal lands within the State of Alaska's boundaries. Section 102 of ANILCA, 16 U.S.C. § 3102(3) defines "public lands" to mean Federal lands "situated in Alaska", which phrase has a precise geographic/political meaning. The State of Alaska's boundaries extend only to a point three miles from the coastline; from that point the OCS commences. The Outer Continental Shelf Lands Act [OCSLA], rather than ANILCA, governs offshore oil development.

What does this mean for OCS Lease Sale 109? Section 810(a), 16 U.S.C. § 3120(a), provides:

> In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands under any provision of law authorizing such actions, the head of the Federal agency having primary jurisdiction over such lands or his designee shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy, or disposition of such lands which would significantly restrict subsistence uses shall be effected until the head of such Federal agency-
> (1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to section 3115 of this title;
> (2) gives notice of, and holds, a hearing in the vicinity of the area involved; and
> (3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands, (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy or other disposition, and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions. [Emphasis added].

The Supreme Court ruled that by the obvious language of ANILCA § 102 ("in Alaska"), the obligations of § 810 set forth above are imposed upon federal agencies only with respect to decisions affecting the use of federal lands within the boundaries of the State of Alaska. The Court explained:

> The phrase "in Alaska" has a precise geographic/political meaning. The boundaries of the State of Alaska can be determined with exactitude. . . .Under § 4 of the Submerged Lands Act, 43 U.S.C. § 1312, the seaward boundary of a coastal State extends to a line three miles from its coastline. At that line, the OCS commences. OCSLA § 2(a), 43 U.S.C. § 1331(a). By definition, the OCS is not situated in the State of Alaska. . . .We reject the notion that Congress was merely waiving its hand in the general direction of northwest North America when it defined the scope of ANILCA as "federal lands" "situated in Alaska". Gambell Op. pp. 14-15.

Therefore, the hearing procedure, the standards by which decisions are made authorizing actions upon federal lands which might "significantly restrict subsistence uses", and the "reasonable steps" required to be taken to "minimize" adverse impacts upon subsistence, as required by ANILCA § 810 for all federal land actions within the State of Alaska, are not applicable to activities on the OCS, and are not required for processing proposed Lease Sale 109.

However, this does not mean that the hearings which took place were meaningless, or that environmental and subsistence concerns need not be considered by MMS.

Pursuant to NEPA, the Department of Interior, Minerals Management Service, must draft an Environmental Impact Statement on proposed Lease Sale 109. This EIS must still take into account the socio-cultural impact of changes in the availability of subsistence resources, as well as the impact of industrial activities upon endangered species and marine mammals. Therefore, there was every incentive to proceed with the hearings as vigorously as if ANILCA § 810 still applied and to give as much input as possible with regard to potential impacts to subsistence resources.

II. OTHER ENVIRONMENTAL LAWS IN THE OCS

Although ANILCA no longer applies to the OCS, several other environmental statutes do apply to activities on the OCS, and to proposed Lease Sale 109. They are:

1. The Coastal Zone Management Act [CZMA] 16 U.S.C. § 1451 et seq.;
2. The National Environmental Policy Act [NEPA], 42 U.S.C. § 4331 et seq.;
3. The Marine Protection, Research, and Sanctuaries Act, 16 U.S.C. § 1431 et seq.;
4. The Marine Mammal Protection Act [MMPA], 16 U.S.C. § 1361 et seq.;
5. The Fishery Conservation and Management Act, 16 U.S.C. § 1801 et seq.; and
6. The Endangered Species Act [ESA], 16 U.S.C. § 1531 et seq.

The Endangered Species Act, 16 U.S.C. 1531 et seq. and the Marine Mammal Protection Act [MMPA], 16 U.S.C. § 1371 et seq., both recently amended, provide protections to endangered species and marine mammals, and afford protection to the availability of subsistence species such as the Bowhead Whale for adequate subsistence harvest.

Under the pre-amendment ESA, federal agencies had to insure that their actions would not be likely to "jeopardize the continued existence" of any endangered species. The more restrictive pre-amendment MMPA prohibited <u>any</u> taking of marine mammals on the endangered species list, except for scientific purposes. And the MMPA defined taking to include harassment, and in turn defined harassment to include disturbance. This had enabled the Borough to argue that any noise disturbance by exploratory drilling operations would result in an illegal taking by harassment. The oil companies prevailed upon Congress that this argument cut too deeply and would lead to an unreasonable limitation of their drilling activities. Congress accepted that argument and amendments to the MMPA, and conforming amendments to the ESA were made last October. However, even the amended ESA and MMPA provide significant protection to endangered marine mammals upon which the people of the North Slope depend for nutrition.

Under the amended MMPA, the National Marine Fisheries Service [NMFS] can issue a permit to allow incidental takings of endangered marine mammals (such as the Bowhead Whale) if NMFS determines that the takings will have a "negligible impact" on the species. The Conference Report (legislative history) provides a definition of negligible impact as one: "that cannot reasonably be expected to, and is not reasonably likely to, adversely effect the overall population through effects on annual rates of recruitment or survival." 132 <u>Congressional Record</u> S 16305 (daily ed. Oct. 15, 1986). Attorneys for the Alaska Eskimo Whaling Commission, [AEWC] had negotiated for several months and succeeded in getting language added to the MMPA at § 101(a)(5)(A)(i), 16 U.S.C. 1371(a)(5)(A)(i), that would require NMFS, when granting a permit for incidental takings, to make a determination that such takings would not have "an unmitigable adverse effect on the availability of [a] species. . .for subsistence uses." <u>Id.</u>, S 16538.

The accompanying conference report explained that this effect would take place when the activity is likely to cause a reduction in availability of the whale to the point that the subsistence needs could not be met.

In light of the above, it is paramount that NSB staff and the residents of Point Hope, Point Lay, Wainwright and Barrow participate fully throughout the EIS process to make known their concerns for subsistence, in particular how Sale 109 might make animals unavailable for harvest. And it is important that the Borough scrutinize the adequacy of the DEIS in its analysis of impacts upon subsistence uses as well as for impacts upon the continued existence of the species affected.

The Draft EIS for proposed lease sale 109 was prepared in accordance with the requirements of NEPA. Affected parties are afforded the opportunity to seek judicial review of the adequacy of the Final EIS. The comments herein offered by the NSB are an important foundation to lay for challenging the adequacy of the FEIS if those comments are disregarded. Judicial review will also be available to challenge any MMPA permits for incidental takings issued in conjunction with future Sale 109 exploratory activities. The new procedures for permits under MMPA offer greater opportunities for legal issues and public comment than do the procedures for issuance of a biological opinion under the ESA. Under MMPA the public record must include public comments and reasoned agency responses as part of the basis and purpose statement required by the rule making procedures of the Administrative Procedure Act. Mitigating measures which would condition permits must be adopted by regulation.

III. ABORIGINAL RIGHTS - ANCSA

The Gambell decision has serious implications for aboriginal rights on the OCS and could impact Lease Sale 109. At the same time the oil companies appealed the Ninth Circuit's holding that ANILCA applied to the OCS (which holding was then overturned by the Supreme Court), the Native villages cross-appealed the Ninth Circuit's concurrent ruling that the Alaska Native Claims Settlement Act [ANCSA] extinguished aboriginal rights on the OCS. The North Slope Borough submitted an amicus curiae (friend of the court) brief to the U.S. Supreme Court in support of the cross-petition, and argued that ANCSA did not extinguish OCS aboriginal rights. ANCSA § 4(b), 43 U.S.C. § 1603(b) provided:

> All aboriginal titles, if any, and claims of aboriginal title in Alaska based on use and occupancy, including submerged land underneath all water areas, both inland and offshore, and including any aboriginal hunting or fishing rights that may exist, are hereby extinguished. [Emphasis added].

The Ninth Circuit had construed the phrase "in Alaska" to mean the "geographic region, including the contiguous continental shelf and the waters above it, and not merely the area within the strict legal boundaries of the State of Alaska." People of the Village of Gambell v. Clark, 746 F.2d 572, 575 (9th Cir, 1984). The Ninth Circuit then concluded that ANILCA § 810 had the same geographic scope as ANCSA § 4(b). In overruling the Ninth Circuit Court of Appeals and holding that ANILCA does not apply to the OCS, the U.S. Supreme Court observed:

> The similarity between the language of ANILCA and its predecessor statutes, the Statehood Act and ANCSA, also refutes the contention that Congress intended "Alaska" to include the OCS. In the Statehood Act, Congress provided that the State of Alaska could select over 100 million acres from the vacant and unreserved "public lands of the United States in Alaska" within 25 years of its admission. Statehood Act § 6(b), 72 Stat. 340. Similarly, in ANCSA, Congress allowed Native Alaskans to select approximately 40 million acres of "Federal lands and interests therein

located in Alaska," with the exception of federal installations and land selections of the State of Alaska under the Statehood Act. 43 U.S.C. §§ 1602(e), 1610(a), 1611. We agree with the Secretary that "it is inconceivable that Congress intended to allow either the State of Alaska or Native Alaskans to select portions of the OCS - a vital national resource reserve held by the [government] for the public". (43 U.S.C. 1332 (3))." [Citations omitted]. Clearly, the purpose of these provisions was to apportion the land within the boundaries of the State of Alaska. The nearly identical language in ANILCA strongly suggests a similar scope for that statute. [Op. p. 19-20, emphasis added].

The Supreme Court did not rule in Gambell upon the scope of ANCSA § 4(b), the section which extinguished aboriginal rights. Rather, the Court granted the cross petition of the Native villages on that issue, No. 85-1608, vacated the judgment of the Court of Appeals that § 4(b) extinguished aboriginal rights on the OCS, and remanded that question back to the Court of Appeals for its decision "in light of this opinion". However, to be consistent with the Gambell opinion, it seems doubtless that the Ninth Circuit will now rule that ANCSA did not extinguish aboriginal rights on the OCS.

It is only a matter of time until a party raises its claim of OCS aboriginal rights and seeks the stoppage of development activities in the OCS to the extent that such activities interfere or impinge upon those aboriginal rights, unless and until the Natives consent to those activities, or until aboriginal rights in the area are lawfully extinguished. As a home rule municipality and political subdivision of the State of Alaska, the North Slope Borough would not have standing to initiate litigation to enforce aboriginal rights. However, Native villages who feel that their aboriginal rights to hunt various subsistence species, in particular the Bowhead Whale, is being, or is about to be, impinged by development activities, could seek an injunction to stop the activities which are interfering with access to hunt the species or which jeopardize the

continued existence of the species. Previous litigation which asserted aboriginal rights on the OCS, ICAS and UIC v. United States, might be revived.

Specific Comments

1. Page xviii. Paragraph 3 includes the following statement:

"The risk from spills would be mitigated to the extent that weathering of oil occurs and by the success of any oil spill cleanup measures undertaken."

The information on Page IV-A-16 & IV-A-17 states that only 5 to 15 percent of an offshore oil spill in the lease sale area could be cleaned up. Along with this, Table IV-5 shows that up to 75 percent of an oil spill will remain on the water surface after ten days. **NSB-7**

In view of this data, one should conclude that the RISK FROM AN OIL SPILL WILL NOT BE SIGNIFICANTLY MITIGATED BY WEATHERING OR CLEANUP MEASURES. Therefore, the statement cited above downplays the risk associated with oil spills. This point becomes obvious when one recognizes that the Draft Environment Impact Statement (DEIS) does not quantify oil spill cleanup capability for broken ice or sub-surface blowouts from drillship operations.

2. Page I-7. During the April 18, 1985 scoping meeting in Barrow, Alaska, the North Slope Borough recommended that the DEIS for Chukchi Sea Sale 109 include an oil spill risk analysis which addresses the increased risk of using drillships and other floating platforms for offshore exploration.

We are disappointed to see that this DEIS does not discuss oil spill risks associated with drillship activity. Since Minerals Management Service acknowledges that two or more drillships may operate in the proposed lease sale area, it is hereby requested that oil spill and blowout risks for drillship activity in ice-infested water be identified and presented for public comment. **NSB-8**

3. Pages I-7 and I-8. At the April 18, 1985 scoping meeting, for Chukchi Sale 109, the North Slope Borough and the Environmental Protection Agency recommended a seasonal drilling restriction to protect the endangered bowhead whale from oil spills. It was also requested that the DEIS include a stipulation on oil spill cleanup capability for ice-infested water.

It was disappointing to find that: (1) The DEIS does not include any stipulations to protect the bowhead whale, and (2) The DEIS does not include any stipulations on oil spill cleanup capability. **NSB-9**

Since oil spills usually occur during petroleum exploration and development, it is essential that adequate stipulations be in place to protect the bowhead whale and ensure that industry has the capability to clean up oil spills in ice-infested water. These stipulations would be consistent with the level of protection provided for previous lease sales in adjacent

areas. Whereas sufficient information has not been provided to show that the risks are any less for Sale 109, it is imperative that Minerals Management Service take appropriate steps to protect the bowhead whale and ensure that adequate oil spill cleanup capability will be available for this area.

4. Page I-15. Paragraph 1 includes the following statement:

> "An Information to Lessees (ITL) is included in this EIS which should provide endangered whales adequate protection against adverse effects from OCS activities."

ITL No. 3 - Information on Protection of Endangered Whales (Page II-22) gives the Regional Supervisor, Field Operations, the authority to limit or suspend oil and gas drilling activities whenever endangered whales are present and near enough to be subjected to probable oil spill risks or noise disturbance that would be likely to jeopardize the continued existence of these species. This ITL also states that exploratory drilling, testing, and other downhole activities may be prohibited whenever endangered whales are in the vicinity of the drilling operation. **NSB-10**

The North Slope Borough firmly believes that this ITL does not provide sufficient protection for the endangered bowhead whale because:

- The oil spill risk analysis presented in the DEIS is based on an incomplete assessment of existing data. Data which would show a higher probability for oil spills was not included in the DEIS risk analysis.

- The DEIS clearly states that only 15 percent of a major offshore spill could be cleaned up. In view of this, it is difficult to believe that the remaining 85 percent would not pose significant risk to the bowhead whale.

- Due to problems associated with monitoring the bowhead whale migration, it would be difficult to discern if whales in certain areas are threatened by potential oil spills or noise related activities. This is especially true when visibility is reduced by fog (up to 30 percent of the time from May through September).

- The biological opinion prepared by National Marine Fisheries Service for Sale 109 was not included in the DEIS, nor was it present elsewhere for public comment.

As opposed to giving the Regional Supervisor, Field Operations, the discretionary authority to determine when to suspend drilling activities to protect the bowhead whale, it is requested that Minerals Management Service impose a stipulation which would require suspension of drilling activities, testing, and other downhole activities during the spring and fall migration. Once such a stipulation is in place, modifications could be made on a case-by-case basis, in consultation with the North Slope Borough, National Marine Fisheries Service, State of Alaska, and the operator.

V-74

- That a further stipulation be included in each lease which restricts any drilling to above threshold depth prior to the commencement of bowhead whale migration.

5. Pages I-15 and I-16 of the DEIS contains the following statements:

> "The probability of endangered whales contacting spilled oil is low. In addition, a spill would have to occur when and where the whales were present and would have to contact the whales in order to put the whales at risk."

NSB-11

These statements are based on speculation and cannot be supported by facts. As opposed to making a blanket statement such as "The probability of endangered whales contacting spilled oil is low", it is requested that Minerals Management Service (MMS) provide data to show how many whales would contact oil for various size spills which could occur. This information is needed to assess the impact that oil spills could have on the bowhead whale population.

Secondly, the North Slope Borough believes that it is not necessary for a spill to occur when and where the whales are present in order to pose a risk. It should be recognized that both whales and oil spills move. Therefore, it would be appropriate for MMS to acknowledge that wind and currents could cause an oil spill to intersect or enter the bowhead whale migration corridor. If this occurs, contact would be very likely during the migration season. In view of this, MMS has not properly addressed the

NSB-12

risks and potential impacts associated with petroleum activities in the proposed lease sale area.

6. Page I-15, 6th para, 4th sentence. We disagree with predictions about contact between spilled oil and bowhead whales. We disagree on how and when contact could occur, on the likelihood of contact occurring and on the ability of bowhead whales to metabolize ingested oil. Following are five examples:

a. The DEIS states on that "... a spill would have to occur when and where the whales were present and would have to contact the whales in order to put the whales at risk".

A spill would not have to occur when and where the whales were present. It is generally agreed that spilled oil could be trapped in or under the ice and released at breakup. Such release of "trapped" spilled oil could occur during the broken ice period characteristic of the spring migration period.

Contact is not the only way which whales could be put at risk by an oil spill. Scientists (Carroll et al. 1987) and Eskimo hunters have observed bowhead whales feeding during the spring migration. Feeding whales could ingest spilled oil at the surface or in the water column with contaminated prey and/or as a consequence of filtering contaminated water. **NSB-13**

b. We disagree with the DEIS on whether bowhead whales will remain in **NSB-14**

the area of an oil spill. The DEIS states that bowhead whales are not likely to remain in the area of a spill during spring migration (p IV-B-66, 1st para, sentences 1-4). As stated above, bowhead whales have been observed feeding and milling during the spring migration (Carroll et al. 1987). The ability of bowhead whales to detect spilled oil is unknown. Therefore, it is possible that bowhead whales could feed in the area of a spill without detecting or being alarmed by the spilled oil.

c. We disagree with the DEIS on whether whales could ingest enough oil to produce toxic effects. The DEIS states (p IV-B-67, 1st para, lines 1-2) that "... it is unlikely that bowheads would ingest the large quantity of oil needed to produce toxic effects". No one knows what quantity of ingested oil is needed to cause toxicity in bowhead whales or any other large cetacean. There is only speculation based on toxic effects in small cetaceans, other small marine mammals and terrestrial mammals (Geraci and St. Aubin 1982). **NSB-15**

d. We disagree with the accuracy of and impression given by the DEIS about the bowhead whale's ability to metabolize ingested oil. The DEIS states (p IV-B-67, 1st para, lines 3-4) that "... bowheads possess enzymes capable of metabolizing or detoxifying small quantities of ingested oil ...". The review article cited by the DEIS (Hansen 1985) mentions the presence of such enzymes in seals and cetaceans. The article does not specify the number or types of cetacean species in which the enzymes occur, and bowhead whales are not specifically mentioned. One study (Geraci and St. Aubin 1982) referenced by the review involved small cetaceans: five dolphins (of two species) and one porpoise. **NSB-16**

The DEIS statement above also gives the impression that the bowhead whales' ability to metabolize ingested oil is understood to some degree. It is not understood at all.

e. The DEIS states (p I-16, 2nd para, last sentence) that a computer model of spilled oil-bowhead whale interaction overestimated the number of whale contacts with oil because the model assumed (1) spilled oil was neither contained nor cleaned and (2) whales do not avoid surfacing in oil.

NSB-17

The implication was that these two situations were highly unlikely. On the contrary, both situations could easily occur:

(1) weather and/or ice conditions could preclude containment and cleanup, and,

(2) there is no evidence that bowhead whales would avoid surfacing in oil.

7. Page II-3. Paragraph 1 contains the following statement:

> "A drillship generally would be able to drill and test one well per season. Wells not completed in one drilling season could be temporarily abandoned when sea-ice conditions force the drillship to leave the drill sites."

NSB-18

This statement clearly shows that same season relief well capability for blowout control may not exist for drillships in Lease Sale 109. Therefore, it is imperative that MMS impose a seasonal drilling restriction to prevent major oil spills from jeopardizing endangered species in this area.

8. Page II-3, 3rd para, 3rd sentence.

The DEIS refers to the use of drillships , an icebreaker and two ice-strengthened support/supply ships (p II-5, 2nd para) during exploratory activities. Ships would also be used to lay pipelines (p II-9, 1st para). Our concern is that these ships will travel and operate in the spring lead system and associated broken ice areas, interfering with subsistence hunting and increasing the likelihood of an oil spill in the lead system from a damaged ship.

NSB-19

In spring, all ships must stay out of the lead system and associated areas of broken ice until the entire bowhead whale population has passed. This should be a stipulation to any exploratory or development permits.

9. Pages II-22 and II-23. ITL No. 3 - Information on Protection of Endangered Whales gives the Regional Supervisor, Field Operations, the authority to limit or suspend oil and gas drilling activities whenever endangered whales are present or near enough to be subjected to probable oil spill risks or noise disturbances which would be likely to jeopardize the continued existence of these species.

The DEIS states that this ITL could be very effective if OCS petroleum exploration activities are limited or suspended when such activities are determined to pose a substantial risk of jeopardizing endangered whales. Furthermore the DEIS states that this ITL could reduce the effects of OCS activities on endangered whales from minor to negligible.

The North Slope Borough is opposed to using an ITL for protecting an endangered species. The wording used for this ITL is vague and fails to outline the criteria which would be used by the Regional Supervisor to suspend drilling activities. If MMS intends to include this ITL in the Final Environmental Impact Statement for Sale 109, it is requested that additional wording be included to define the following phrases:

o "intends to limit"

o "near enough to be subject to"

o "probable oil spill risk" **NSB-20**

o "vicinity of the drilling operation"

o "zone of probably influence"

o "no longer subject to likely risk of oil spills"

o "operations necessary to prevent a loss of well control"

By defining these phrases, it will be possible for the public to discern whether <u>ITL No. 3 - Information on Protection of Endangered Whales</u> provides adequate protection for an endangered species.

10 . <u>Page II-25, ITL No. 7 - Information on Subsistence Whaling and Other Subsistence Activities</u>, contains the following statement: **NSB-21**

"Lessees are therefore advised that operations should be conducted so as to avoid unnecessary interference with subsistence harvests."

It is requested that additional wording be included to define what would be considered as "unnecessary interference" and what would be considered to be "necessary interference" with subsistence harvests. Without this clarification, ITL No. 7 is vague and meaningless.

11 . <u>Page II-25</u>. <u>ITL No. 7 - Information on Subsistence Whaling and Other Subsistence Activities</u> contains the following statement:

"Lessees are encouraged to consult with local communities and regional organizations including the Alaska Eskimo Whaling Commission and Local Whaling Captains, to develop a program of exploration and development that minimizes disturbance of these critically significant subsistence activities." **NSB-22**

It is suggested that the word "encouraged" be changed to "required".

The information under ITL No. 7 also contains the following statement: "The intent of this ITL is to encourage lessees to conduct themselves in a responsible manner with regard to Native subsistence needs."

It is suggested that additional wording be included to define what is meant by the phrase "...conduct themselves in a responsible manner...."

12. Page II-28, Table II-14. The summary for air quality contains the following statement:

"Accidental emissions from blowouts, spills, or in-situ burning of spills would have negligible effects on air quality. The effects of proposed Sale 109 on air quality are expected to be moderate."

These statements are not true. They show that the author of this DEIS has a very poor understanding of the impacts that petroleum related activities could have on air quality. For example, blowouts could release significant quantities of hydrogen sulfide or other toxic gases which will adversely impact human health and the environment. This point was not addressed anywhere in the DEIS.

NSB-23

In-situ burning is considered by industry and MMS to be the preferred response technique for oil spills in broken ice. However, this technique will create tremendous quantities of suspended particulate matter which could deteriorate ambient air quality. Along with this, by-products of incomplete combustion are known to cause cancer. Burning could also result in the formation of acid rain, which could negatively impact aspects of the environment.

Since these points were not discussed in this DEIS, it is requested that risks associated with air quality deterioration are correctly identified and evaluated. It is our assessment that emissions released by an oil well blowout, oil spill, or in-situ burning could be in violation of federal

standards for ambient air quality at the shore line and present a major risk for North Slope residents as well as wildlife in this region.

The North Slope Borough also requests that air quality impacts associated with the proposed sale be evaluated in consultation with the Environmental Protection Agency and the Alaska State Department of Environmental Conservation.

13. Page II-28, Table II-4. The discussion on water quality failed to identify the impact that drilling discharges or oil spills could have in shallow coastal regions that do not experience high tides or currents. It is conceivable that pollutants which enter these regions might have a long-term significant impact on subsistence resources.

NSB-24

It is suggested that the summary and comparison of effects separate the potential for water quality impacts into two categories, i.e., offshore and near shore. If this is done and given adequate consideration, the potential impact for near shore or coastal waters could be major.

14. Page II-36, Table II-4. The discussion under Endangered and Threatened Species states the following:

NSB-25

"As a result of an oil spill, some bowheads and some gray whales may experience temporary displacement from migrating or feeding areas."

This statement is speculative and underestimates the likely impacts. Statements of this nature give the perception that oil spills will not have a significant impact on endangered species.

It should be noted that very little is known about the behavior of bowhead and gray whales in response to a major oil spill. As a result, all assessments regarding oil spill jeopardy to endangered whales should be conservative. Furthermore, it is wrong for MMS to imply that whales will attempt to avoid contact with spilled oil. Bowhead whales typically follow leads during their northward migration through the sale area. If oil is in the leads, there is no data to suggest that they would take an alternate route in order to avoid contact with it.

15. Page IV-A-3. This page contains the following statements:

"The likelihood that oil spills would occur can be estimated from the assumed volume of oil produced and transported."

The North Slope Borough objects to the methodology used by MMS to assess oil spill probability for Sale 109. The number of spills which have historically occurred per a given volume of petroleum produced and transported does not, necessarily provide a reliable means for predicting the number of spills which could occur in a new lease sale area or from future operations. Furthermore, this approach fails to account for different environmental conditions which would influence oil spill risk in different areas. **NSB-26**

It should also be recognized that the estimated volume of oil produced and transported cannot be used to predict the number of spills which could occur during exploratory drilling. There is simply no relationship between these variables. **NSB-27**

A comprehensive study of oil spill statistics will show that spills are caused by human error, equipment failure, and acts of nature. Therefore, it would be appropriate for MMS to use proven risk evaluation techniques such as "Fault Tree Analysis" to examine the possibility for spills occurring from each of these events, i.e., human error, equipment failure, and acts of nature. Doing so would yield a more reliable determination of the oil spill risk associated with exploration activities in the proposed sale area. **NSB-28**

16. Page IV-A-3 contains the statement:

"Because no resource estimates are available for state lease sales, no oil spill risk estimates can be made for these areas. Therefore, they are not included in the cumulative risk analysis."

The North Slope Borough believes that it is a mistake for MMS to perform a risk analysis for the proposed sale area and exclude oil spill risk estimates for adjacent State sales. Inasmuch as endangered species and subsistence/ cultural activities could be threatened by oil spills from either location, it is unfortunate that resource estimates were not available for State of Alaska Sale areas so that a proper oil spill risk could be estimated. **NSB-29**

In reality, it is impossible to identify the true oil spill risk without performing a cumulative analysis which includes spills from adjacent lease sale areas and tanker traffic. The North Slope Borough requests that an analysis be performed which will assess the cumulative impact of oil spills from adjacent State leases.

17. Page IV-A-5. Paragraph 1 contains the following statement:

> "At a similar rate for the proposal, during the drilling of 43 exploration and delineation wells over eight years, on the order of 67 such spills could occur; but the total spilled would be only about 18 barrels."

It is naive to believe that only 18 barrels of oil would be spilled during eight years of exploration in the proposed sale area. MMS has failed to acknowledge that Sohio spilled 36 barrels of fuel in one year at Challenge Island during the early 1980s. MMS also failed to consider that over 100,000 gallons of oil were spilled as a result of North Slope oil and gas activities during 1985 and 1986. **NSB-30**

The data provided in the DEIS also ignores that spills could occur from support vessels and equipment failure during fuel transfer or storage. Additionally, it overlooks the fact that major spills could occur as a result of oil well blowouts. **NSB-31**

In every respect, MMS is misleading the public by stating that only 18 barrels of petroleum product would be spilled during eight years of exploration in the proposed lease sale area. Statements of this nature hide the real risk associated with petroleum activities in ice-infested water and the oil related jeopardy to endangered species in the proposed sale area. Such statements create a false sense of security and can lead to increased risk by contributing to the removal of stipulations which are needed to protect endangered species and subsistence resources. **NSB-32**

18. Page IV-A-6 - The North Slope Borough was surprised to find that this DEIS does not discuss blowout probability for exploration or development wells. It also fails to discuss relief well timing and the environmental impacts which could result from oil well blowouts. Without including this information, the risk analysis is inadequate and falls far short of accomplishing its intended purpose.

The North Slope Borough requests that the risk analysis be revised to address the potential for oil spill blowouts and the steps which could be taken to bring blowouts under control. **NSB-33**

19. Page IV-A-10 - The information on this page contains the following statement:

> "The conditional probabilities show that if a spill occurred, the likelihood of contact to land would be very low in summer. The risk to land is among the lowest calculated for any previous or proposed

NSB-34

Alaska OCS region oil and gas lease sales. There is a less than 0.5 percent chance that a spill of 1,000 barrels or greater would occur and contact land within ten days in the summer."

Since spills in the proposed lease sale area could occur within ten miles of shore, it is difficult to believe that major spills during the summer months would have a less than 0.5 percent chance of contacting land.

It is important for MMS to realize that 20 to 30-knot winds from the north could cause a major oil spill in the lease sale area to contact the Alaskan coast line within eight hours. Another point that must be recognized is that oil spill trajectory analyses are not very accurate. This point was highlighted by the National Oceanic and Atmospheric Administration's (NOAA) comment to the Associated Press during the 1984 Alvenus spill off the Louisiana coast. Mr. Gary Galt (NOAA oceanographer) stated that the ability to predict spill movement is just not very accurate. The reason for this is that most trajectory analyses are based on simple formulas which cannot account for all of the environmental factors, such as changing winds and currents, which influence spill movement.

20. Page IV-A-10. Paragraph 3 contains the following statement:

"There is a 70-percent chance that a spill of 1,000 barrels or greater could occur in winter and contact land sometime during the winter." NSB-35

Since the Chukchi Sea is covered with ice during the winter season (see Page III-6 of DEIS), we question how it would be likely for a spill to contact land during this season.

21. Page IV-A-14. Paragraph 2 contains the following statement:

"To date, more than a dozen oil spill contingency plans have been submitted and approved for exploration of existing leases in the neighboring Beaufort Sea Planning Area."

Most of these contingency plans have been reviewed by the North Slope Borough. Since many of them were prepared by private consultants who were contracted by the operator, we question whether the operators' personnel fully understand these plans and the steps necessary for responding to major oil spills in the Arctic waters. Additionally, these plans fail to demonstrate that sufficient capability exists to clean up oil spills in moving broken ice. NSB-36

Perhaps one of the most important points to be aware of is that none of the previous oil spill contingency plans for the Beaufort Sea have been tested. Therefore, it is difficult to say with any degree of certainty whether any of these plans would be effective.

22. Page IV-A-14. Paragraph 3 contains the following statement:

V-82

"The first line of defense is always offshore containment. For large, continuous spills, containment devices, such as booms, are often integrated into skimming or other recovery systems."

Due to the presence of moving broken ice and winds, it is unlikely that containment booms would be effective in the proposed lease sale area during most of the year. **NSB-37**

23. Page IV-A-14. Paragraph 4 contains the following statement:

"For a blowout, well ignition is a drastic but potentially effective contingency measure."

In our opinion well ignition will not be effective for sub-surface blowouts created by drillship activity. As demonstrated by the 1979 Ixtoc oil well blowout in the Gulf of Mexico, oil released from a sub-surface blowout would likely be emulsified as it escaped the wellhead and rises through the water column. If the oil is emulsified, it will not burn. **NSB-38**

24. Page IV-A-14. Paragraph 4 contains the following statement:

"It may be appropriate to use chemical agents to disperse the slick if permission for their use can be obtained from the U.S. Coast Guard On-Scene Coordinator." **NSB-39**

It should be recognized that dispersants, if they were permitted and proved to be effective, would put oil in the water column where it can also adversely impact the endangered bowhead whale and other marine wildlife. This point should be included in the risk analysis.

As a point of interest, the U.S. Coast Guard On-Scene Coordinator would have the authority to approve dispersant use only if the spill presented an immediate threat to human life. Since this would not likely be the case for oil spills in the Chukchi Sea, approval authority for dispersant use would rest with the EPA and State representatives on the Regional Response Team. It is suggested that Paragraph 4 on Page IV-A-14 be revised to reflect this point.

25. Page IV-A-14. Paragraph 5 concludes with the following sentence:

"Other CPAs or cooperatives in Alaska have locally stockpiled considerably more equipment than the minimum required by federal regulations, thereby providing additional protection."

Although this equipment exists, there is no evidence to verify whether it would be effective under the environmental conditions that exist in the Beaufort or Chukchi Seas. It is also questionable whether sufficient personnel are trained to operate this equipment in Arctic waters. **NSB-40**

It should be noted that the equipment stockpiled by the ABSORB CPA does not meet federal requirements for oil spill cleanup. For example, these requirements stipulate that the equipment should be deployable in 5 to

6-foot seas and operable in 8 to 10-foot seas, and up to 20-knot winds. None of the ABSORB CPA meets these criteria.

26. Page IV-A-14 - The DEIS failed to acknowledge whether any of industry's contingency plans include sufficient information to show that planning and forethought have been directed towards cleaning up oil spills in pack ice, or beyond the land fast ice zone. Since it is unlikely that industry can clean up oil spills in these regions during spring, freeze-up, or winter, the North Slope Borough urges MMS to implement drilling restrictions during these seasons until adequate oil spill cleanup technology is demonstrated. **NSB-41**

27. Page IV-A-14. Figure IV-14 - Applicability of Oil Spill Response Techniques in the Proposed Sale 109 Area, appears to be taken from documents published by Alaska Clean Seas. The information in this figure was developed for state waters in the Prudhoe Bay region. It was not intended for Chukchi Sea Sale 109. No data exists to show that the response techniques cited in this figure would be applicable or effective in the Sale 109 area. **NSB-42**

28. Page IV-A-16. Paragraph 1 contains the following statement:

> ".....Prudhoe Bay crude oil would..... quickly weather and form an emulsion in about four hours in the open water....."

Additional wording should be included to point out that Prudhoe Bay crude oil would weather in broken ice and form an emulsion just as quickly as it would in open water. Wording should also be added to inform the public that once weathering and emulsification occurs, it would be impossible to disperse the oil with chemical agents or remove the oil by in-situ burning. Additionally, removing emulsified oil by mechanical cleanup would be extremely difficult. Therefore, existing oil spill cleanup technology would not be effective for the Chukchi Sea four hours after a spill occurred. **NSB-43**

29. Page IV-A-16. Paragraph 2 contains the following statement:

> "Dispersants are also more effective on less viscous oils and lose all effectiveness when oil reaches 2,000 centistokes, or about eight hours after spillage."

This statement should include additional information on the probability of dispersant effectiveness in the proposed lease sale area. Also, the time frame within which dispersants must be applied, eight hours or less, makes it unlikely that industry will be able to obtain approval or manifest the capability to deliver sufficient dispersants before the oil weathers to a point where dispersants will no longer be effective. **NSB-44**

V-84

30. Page IV-A-16. Paragraph 3 contains the following statement:

"Oil slicks in the open ocean are seldom traceable for more than about ten days before the oil becomes too dispersed to locate or identify as a slick."

This statement is contradicted by the information provided in Table IV-5 on Page IV-A-10. Here the DEIS states that up to 75 percent of an oil spill will remain on the water surface ten days after the release occurs. This oil, as indicated by the information in Table IV-5, would have a film thickness ranging from 0.6 to 1.3 mm. Consequently, if this quantity of oil was present, it would be easy to identify as an oil slick.

Furthermore, data provided by the 1979 Ixtoc blowout in the Gulf of Mexico revealed that oil slicks were observable on the water surface over 30 days after the spill occurred. These slicks traveled several hundred miles and contaminated more than 50 miles of the Texas shoreline.

NSB-45

31. Page IV-A-16. Paragraph 4 discusses well ignition as a means for minimizing the amount of oil released by a blowout. It cites the West Cameron 1080 blowout in 1971, and says that, "Thousands of barrels of oil were consumed by combustion and only 450 barrels of oil were released to the sea during a 55-day blowout."

This information excludes other pertinent data on ignited blowouts and is therefore misleading. For example, the 1979 Ixtoc blowout in the Gulf of

NSB-46

Mexico released 3 million barrels of oil to the sea, although the well was ignited. Additionally, burning blowouts in the Persian Gulf have released thousands of barrels of oil to the water surface.

Based on a comprehensive analysis of burning blowouts, experts concluded that only 30 to 70 percent of the oil may be consumed by combustion if the discharge occurs above the water surface. On the other hand, if the blowout occurs below the water surface, as would be the case for a drillship blowout, none of the oil may be consumed by combustion, if the oil emulsifies while rising through the water column. Hence, well ignition may not significantly reduce the amount of oil released by a blowout.

In view of the limitations associated with well ignition as an oil spill countermeasure, the public should be aware that MMS has not performed an adequate oil spill risk analysis for Sale 109.

32. Page IV-A-16. The final paragraph on this page contains the following statement:

"Recovery of oil using mechanical equipment usually ranges between 5 and 15 percent of that spilled."

NSB-47

It is suggested that this statement be revised to show that the cleanup percentages stated in the DEIS are for oil spill cleanup operations in temperate waters. This is important in order to avoid giving the public the impression that industry is capable of cleaning up oil in the proposed lease sale area. To date, there is no data which would support that industry's cleanup capability would be effective for ice-infested waters in the Chukchi Sea.

33. Page IV-B-4. Paragraph 3 contains the following statement:

> "If a gas blowout occurred, it would be very unlikely to persist more than one day, and it would very likely release less than two metric tons of gaseous hydrocarbons."

The North Slope Borough hereby requests Minerals Management Service to provide data to substantiate this point. The North Slope Borough firmly believes that the inclusion of this statement is an attempt to minimize, or downplay, the risk associated with blowouts in the proposed lease sale area. This becomes evident when one recognizes that there was a gas blowout in Cook Inlet during 1985 which lasted for several weeks. Also the North Slope Borough wishes to point out that there is absolutely no way of estimating the volume of gaseous hydrocarbons which would be released from a gas blowout. **NSB-48**

34. Page IV-B-5. Paragraph 1 reads as follows:

> "Burning affects air quality in two important ways. For a gas blowout, burning would reduce emissions of gaseous hydrocarbons by 99.98 percent and very slightly increase emissions—relative to quantities in other oil and gas industry emissions—of other pollutants."

NSB-49

The North Slope Borough requests that MMS provide data to support this point. During the April 2, 1987 workshop sponsored by the Alaska Department of Environmental Conservation, industry experts acknowledged that reduction of gaseous emissions could be less than 60 percent from an industrial flare. This provides sufficient reason to question if a burning blowout releases fewer gaseous emissions to the environment.

35. Page IV-B-5. Paragraphs 2 through 5 provide an inadequate assessment of air quality impacts created by in-situ burning. This discussion includes the following assumptions:

- Incomplete combustion injects oily soot and minor quantities of other pollutants into the air.
- Oily residue in smoke plumes from crude oil is mutagenic, but not highly so.
- The soot produced from burning oil spills tends to both clump and wash off vegetation in subsequent rains. Once deposited, it would not be easily resuspended in the air, limiting any health risks to a very short term.
- Accidental emissions would have a negligible effect on onshore air quality.

NSB-50

Careful examination of these assumptions by personnel who have a strong understanding of combustion chemistry will reveal that they are insufficient and misleading.

Based on a review of combustion chemistry and a comprehensive literature search, the following statements can be made regarding the environmental impacts associated with in-situ burning:

- o Laboratory experiments show that hydrocarbons produced by in-situ burning can cause cancer in laboratory test animals.
- o Laboratory tests suggest that hydrocarbons in the smoke plume produced by in-situ burning are 73 times more mutagenic than fresh Prudhoe Bay crude oil.
- o Soot produced by in-situ burning can cause an increase in Arctic haze and increase atmospheric temperatures. This can have a negative impact on global weather.
- o Fallout from the smoke plume created by in-situ burning is toxic and can contaminate fresh water lakes which provide drinking water for Arctic residents. This fallout can also enter the Arctic food web and adversely impact those who rely on subsistence.
- o The fallout from in-situ burning will contain heavy metals if they were present in the crude oil.

- o In-situ burning can significantly contribute to the formation of acid rain which, in turn, can impact the Arctic ecosystem.
- o The air pollution created by in-situ burning can present a significant threat to public health and safety. This threat may increase by an order of magnitude in Arctic regions where frequent atmospheric inversions would keep the pollution close to the ground.

Inasmuch as in-situ burning could violate ambient air quality standards established by the Clean Air Act and present a significant health risk to Arctic residents, it is requested that adequate information be brought forth by Minerals Management Services to clearly identify the true impact that drilling activity and oil spill cleanup operations could have on the Arctic environment.

36. Page IV-B-16 through IV-B-116. References should be noted in the text far more often. The Biological Resources section (section B, pp III-25 through III-37) is generally much better referenced than the discussion of consequences to the biological resources and subsistence harvest patterns. **NSB-51**

An example of a statement requiring referencing is found on page IV-B-103 (2nd para, 1st sentence): "Seals are not susceptible to noise disturbance and vessel presence as has been observed with other marine mammals, but seals are susceptible to noise and disturbance from aircraft." both phases in this sentence need to be referenced.

The problem of unreferenced statements must have proper attention during preparation of the final EIS. If presence of numerous citations in the text is considered a problem, use of numerical superscripts may be helpful.

37. Page IV-B-17, 1st para, lines 13-14; p IV-B-31, 2nd para, 2nd sentence. The effects of clean-up should be added to the effects of oil spills on marine life and subsistence hunting:

a. The DEIS notes in at least two places that adding dispersants increases toxicity of the spilled oil. This effect should be included wherever the effects of spills are discussed.

b. Effects of oil spills should also include the effects of vessel noise, burning oil, use of mechanical cleanup equipment and other cleanup activities.

NSB-52

38. Page IV-B-26, 3rd para. The DEIS mentions the potential effects of pipelines on kelp beds. Our concern is that pipelines will destroy kelp beds.

Any permits for development should stipulate that pipelines and platforms be kept a specified minimum distance from the kelp beds.

NSB-53

39. Page IV-B-66. Paragraph 1 contains the following statement:

"Bowheads migrating at an average speed (about 3 km per hour) would be expected to pass through the discontinuous oiled area in less than

NSB-54

four hours and of this time, would pass through or under actual oil slicks for less than five minutes."

This statement is highly speculative and cannot be supported by facts. It appears to be an attempt to convince the public that oil spills would not pose a significant threat to the endangered bowhead whale.

It is suggested that statements such as this one, which cannot be supported by facts, be deleted from the Final Environmental Impact Statement. It is also suggested that this DEIS discuss the risk to endangered whales if oil remains in the migration corridor or is trapped in leads used during the spring migration.

40. Page IV-B-66. Paragraph 1 contains the following statement:

"After several days, the spill should have moved out of the whale migration corridor; and weathering should render the oil relatively harmless to the whales."

The North Slope Borough requests MMS to include information which will evaluate the impact to the bowhead whale if the oil does not move out of the migration corridor and the possible consequences if weathering does not remove toxic components from the oil.

NSB-55

41. Page IV-B-66. Paragraph 3 contains the following statement:

"If bowheads contact an oil slick, it is unlikely that they would inhale oil into the blow hole while breathing." NSB-56

It is requested that Minerals Management Services provide data to substantiate this point.

42. Page IV-B-66. Paragraph 3 contains the following statement:

"Vapor concentrations in the spill area that could be harmful to whales would be expected to dissipate within several hours after termination of a spill."

The information provided in this section of the DEIS is not sufficient to allow the public to properly assess the adverse impact that major oil spills could have on the endangered bowhead whale. In the above comment, NSB-57 the author assumes that the toxic vapors would dissipate; however, the DEIS fails to address what would happen: (1) If whales were exposed to toxic vapors during an atmospheric inversion, or (2) During periods when there were no winds to disperse the vapors. Furthermore, the DEIS does not discuss the potential impact that toxic gases, such as hydrogen sulfide, could have on the bowhead whales.

It is clearly understood that hydrogen sulfide could be released by a well blowout and this gas is fatal to humans. Therefore, it is requested that information be provided which will allow the public to evaluate the impact

that this gas could have on bowhead whales, especially during periods when atmospheric inversions exist.

43. Page IV-B-68. Paragraph 1 contains the following statement:

"Bowhead whales are not as likely as ring seals to surface as high and thereby expose their eyes to a surface oil slick."

The DEIS fails to consider that oil slicks can float several inches below NSB-58 the water surface. This occurs if the oil is more dense than the upper layer of the water or if the oil becomes contaminated with silt. Whichever the case, it is entirely possible for the sensitive eye of the bowhead whale to come into contact with oil that is either on the water or floating several inches below the water surface in the water column.

44. Page IV-B-68. Paragraph 3 contains the following statement:

"Therefore, the effects from oil contact on bowhead whales are expected to be minor."

The North Slope Borough strongly opposes this statement. Sufficient NSB-59 evidence has not been provided to show that it is true. Until information is available to clearly define the impact that oil spills would have on the bowhead whale, it would be prudent for MMS and other agencies responsible for the protection of this endangered species to take a conservative approach and thereby implement stipulations which would guarantee protection of the bowhead whale.

45. Page IV-B-68, 3rd para, Table S-1; Page IV-B-72, 2nd para. The DEIS underestimates the potential impact to bowhead whales. The DEIS lists potential impacts to bowhead whales as MINOR. Even the worst-case analysis predicts a MINOR effect (pp IV-I-1 and IV-I-2). The potential effects are at least MODERATE and more likely MAJOR. The worst-case analysis predicts effects such as "lower fecundity rate" and "slower population growth rate". There is too little known about bowhead whale reproduction to determine (1) that the effect of decreasing population growth rate would not result in lowered population size or (2) that the population could recover from a decline within one generation. Therefore, the worst-case must assume that lower fecundity rate and slower population growth rate result in a population decline which lasts longer than one generation - a MAJOR effect. Furthermore, it is easy to imagine, based on present knowledge, that loss of sexually mature females due to an oil spill could cause a population decline which would last longer than one generation. (The Sale 97 DEIS also underestimated the potential impact to bowhead whales.) **NSB-60**

Note also that the scenario in the worst-case analysis was not the worst case. In the scenario, bowhead whales encounter an oil spill "... during their high-use fall period (September- November)...". This is not a worst-case scenario. In a true worst-cast scenario, bowhead whales would contact a spill during the spring migration. It is during spring migration that the whales are most concentrated and weather/ice conditions are most likely to hinder or prevent oil cleanup. Thus, it is during the spring migration that an oil spill is likely to contact the most whales for the longest period of time. **NSB-61**

Regarding potential oil spill impacts to the eyes of bowhead whales, the sentence on page IV-B-68 (lines 6-7) is misleading. The possibility that bowhead whale eyes may not reach the water surface during breathing does not rule out potential for serious impact to eyes. Since various oil fractions are dispersed in the water column beneath an oil slick (especially after a recent spill), contact to the eyes is likely. **NSB-62**

46. Page IV-B-97, 1st para, lines 9-12. The DEIS underestimates the potential impact to subsistence hunting of bowhead whales. The DEIS suggests the potential impact to subsistence whaling is MODERATE and would only affect Point Hope and Wainwright. The potential impact is MAJOR and would affect all whaling villages. Following are three examples of the underestimated effects:

a. The DEIS states that "... if an oil spill were to occur when bowhead whales were migrating through the Sale 109 area, it is unlikely that enough whales would be affected for the I.W.C. to suspend bowhead whaling". The DEIS itself presents predictions which support our disagreement with the above statement. **NSB-63**

In two simulated oil spill-bowhead whale interactions (p I- 16, 2nd para, 2nd sentence), 0.6% and 1.5% of the bowhead whale population were affected. Based on the last estimate of the bowhead whale population of 4417, the numbers of affected whales would be 26 and 66, respectively.

The DEIS predicts (p IV-B-66, 2nd half of 1st para) that, in a short-duration spill, not more than several hundred bowhead whales would be exposed to lightly-weathered oil; in a prolonged spill such as an uncontrolled blowout, most of the population could be exposed.

The present bowhead whale quota for Eskimo hunters, imposed by the International Whaling Commission, is 32 per year. These include nonlethal strikes.

It is unreasonable to expect the International Whaling Commission to overlook oil exposure of even 26 or 66 whales when the hunt quota is only 32 and a nonlethal strike counts against the quota.

It is also unreasonable to predict that the I.W.C. would impose a ban for only one year if whales were exposed to oil. Such a prediction is even more unreasonable since most of the DEIS-predicted numbers of exposed whales are multiples of the quota. The potential affect on the subsistence hunt is therefore MAJOR. Furthermore, a ban on subsistence whaling would affect all whaling villages - Gambell, Kivalina, Wales, Savoonga, Point Hope, Wainwright, Barrow, Nuiqsut and Kaktovik. (The Sale 97 DEIS also underestimated the potential effect on subsistence whaling and did not consider the possibility of a ban on the hunt by the I.W.C.)

The EIS should also address the potential effects of oil exploration and development activities on bowhead whale censusing. Effects on the census could be manifested as changes in the subsistence harvest quota because the census-based population estimate is a major factor in quota determination. The census could be adversely affected by any industrial **NSB-64**

activity in the coastal deferral area during the spring migration. The census could also be impacted by oil spills occurring any time of the year and by cleanup activities during the spring whale migration. Interference with and/or disruption of the migration could cause whales to move farther offshore than normal. Fewer whales would be seen and the estimated population size would decline. The ultimate effect would be a decrease in the I.W.C.- imposed quota of whales for the subsistence hunt, a MAJOR effect on all whaling villages. Adoption of Alternative VI and its prevention of industrial activities during whale migration would markedly reduce the effects on censusing.

b. The DEIS does not mention the effect of oil spills on use of bowhead whales for food. The statement (p IV-B-98, 4th para, 3rd sentence) about beluga whales from a spill area being inedible or perceived as such is a good point. A similar statement should be made for bowhead whales which could come in contact with spilled oil. Such an effect on the subsistence harvest pattern would be at least MODERATE. If the inedibility or the perception of inedibility lasted more than one year, the effect would be MAJOR. **NSB-65**

c. The DEIS states (p IV-B-97, 3rd para) that a combination of industrial noise and poor weather/ice conditions could cause migrating bowhead whales to move offshore, out of hunting range. There is no evidence that a combination of the two situations is necessary to push whales offshore. There is no evidence that industrial noise alone could not cause whales to move offshore. If industrial noise had this effect for two or more years, a MAJOR impact to subsistence whaling would occur. **NSB-66**

Table S-1 (Summary of Effects) shows no decrease in potential effects from the Proposal to any of the Deferral Alternatives (IV, V, VI). We think this is unreasonable because the deferral alternatives were developed in response to environmental concerns posed during the scoping process. Appropriate effects under the deferral alternatives should therefore be rated lower than under the Proposal. (Similarly, Table S-1 in the Sale 97 DEIS had very few decreases in effect with deferral alternatives.) NSB-67

The DEIS appears to be written with a bias toward exploration and development at the expense of inadequate treatment of potential impacts to the environment. Items 3 through 6 of Table S-1 are examples. Furthermore, these problems occurred in the Sale 97 DEIS as well (see North Slope Borough written comments and Barrow public meeting oral comments on the Sale 97 DEIS). The bias is therefore common to both documents. Note that not all Environmental Impact Statements have such bias; the LEIS for the 1002 area of the Arctic National Wildlife Refuge had much more realistic predictions of potential impacts. The bias seen in the Sale 97 and 109 documents must be corrected if subsequent environmental impact statements are to properly assess environmental impacts. NSB-68

47. Page IV-B-98, 4th para, 3rd sentence. The statement about beluga whales from a spill area being inedible or perceived as such is a good point. A similar statement should be made for all other edible species (such as bowhead whales) which could come in contact with spilled oil. NSB-69

48. Page IV-I-2. Paragraph 3 contains the following statement:

> "Effects from encountering a 100,000-barrel spill would affect whales only slightly, because they are migrating through the area and not feeding or milling in any particular area. There may be some transient skin damage or slight baleen fouling. Bio-accumulation could occur through absorption/inhalation or maybe through ingestion. In conclusion, massive acute reactions are unlikely to occur."

Sufficient data does not exist to support this statement. As a result, we believe that it is misleading to include information unless it can be adequately supported by facts or assumptions based on field research or laboratory studies. NSB-70

The data included in the report edited by Albert (1981b) are incorrectly cited in several instances. The DEIS seems to ignore the fact that this large report although edited by Albert contains 21 data chapters and there are several different contributors. The proper way to cite the data from a specific section of the report is to cite the appropriate chapter title and the appropriate author or authors. This "common courtesy" and technically correct approach is used elsewhere in the DEIS in numerous instances such as the following: NSB-71

- On page 30 of the Bibliography section of the DEIS there are 3 separate references by Phillips. In each instance these are chapters in an edited report.

- On pages 31 and 32 of the Bibliography section of the DEIS there are 2 separate references by Richardson which are chapters in edited reports.

- On page 33 of the Bibliography section of the DEIS there are 2 separate references by Schell which are chapters in edited reports.

In the interest of accuracy, chapters from the report edited by Albert (1981b) should be properly cited:

- The citation on page IV-B-66, next to last line and the citation on page IV-B-67, 6th line from the bottom are both correct regarding speculation as to potential impacts (Albert, 1986a).

- The citation on page IV-B-68, line 9 to Albert (1981) is incorrect. The laboratory "oil/skin contact" data are properly cited as follows. Please note the citation is to a specific chapter in an edited report.

Haldiman, J., Y. Abdelbaki, R. Albagdadi, D. Duffield, W. Henk, and R. Henry. 1981. Determination of the gross and microscopic structure of the lung, kidney, brain and skin of the bowhead whale, Balaena mysticetus. In: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea, T.F. Albert (ed.), pp. 305-662. Report to the Bureau of Land Management Anchorage, Alaska from the Department of Veterinary Science, University of Maryland, College Park, MD, 20742. 953 pp.

- The citation on page IV-B-68 line 11-12 to "Albert" is incorrect in that it misquotes a reference. It is incorrect to state "that only two out of the six whales examined had these roughened skin areas (skin lesions)". Please note that the data pertaining to the statement were incorrectly interpreted from a specific chapter in an edited report noted below. The misinterpretation may have arisen because skin samples were not taken from some whales and only "normal" skin was taken from others.

Albert, T. 1981. Listing of collected bowhead whale specimens with observations made during initial examination. In: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea, T.F. Albert (ed.), pp. 845-916. Report to the Bureau of Land Management, Anchorage, Alaska from the Department of Veterinary Science, University of Maryland, College Park, MD, 20742. 953 pp.

49. Following are two typographical errors:

a. Potential mitigating measures (p I-13, 3rd para, line 5) are in Section II.H.2.a., not II.B.1.c. **NSB-72**

b. The text (p I-16, 5th para, line 4) describing Figure I- 3 (facing page) appears inconsistent with the Figure itself. The text describes the Eastern Deferral Alternative as extending from 39 km NE of Peard Bay to 5 km south of Kasegaluk Lagoon. According to the map in Figure I-3, southern limit of the deferral area appears to be approximately 50 km south of Kasegaluk Lagoon. It appears that either there is a misprint in the text or Kasegaluk Lagoon is not clearly and accurately labelled. **NSB-73**

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Haldiman, J., Y. Abdelbaki, R. Albagdadi, D. Duffield, W. Henk, and R. Henry. 1981. Determination of the gross and microscopic structure of the lung, kidney, brain and skin of the bowhead whale, Balaena mysticetus. In: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea, T.F. Albert (ed.), pp. 305-662. Report to the Bureau of Land Management, Anchorage, Alaska from the Department of Veterinary Science, University of Maryland, College Park, MD, 20742. 953 pp.

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Krogman, B.D., Sonntag, R., Rugh, D., Zeh, J., and Grotefendt R. 1982. Ice based census results from 1979-81 on the western arctic stock of the bowhead whale. Int. Whal. Comm. SC/34/PS 6, 42 pp.

Ljungblad, D.K., Moore, S.E. Clarke, J.T., Van Schoik, B.K. and Bennett, J.C. 1985. Aerial Surveys of Endangered Whales In the Northern Bering, Eastern Chukchi and Alaska Beaufort Seas, 1984: With A Six Year Review, 1979-1984. Technical Report 1046. Prepared for USDOI, MMS. San Diego, CA: Naval Ocean Systems Center.

Response NSB-1

The commenter is referred to Section V (Review and Analysis of Comments Received).

Response NSB-2

See Responses EPA-11 and NOAA-4.

Response NSB-3

As indicated by the commenter and discussed in the EIS, bowhead whales that contact oil undergo the potential for harm. Repeated or prolonged contact probably would increase the potential for harm; however, as discussed in Response NOAA-55, the spring leads are transitory and oil would not be likely to cover the entire surface area of a major lead or pool. The MMS does not believe that brief contact with oil would result in serious harm, since other whale species have been observed surfacing and feeding within an oil slick without apparent harm (Goodale et al., 1981).

Response NSB-4

See Response STATE-7.

Response NSB-5

We agree that the sociocultural effects from proposed Sale 109 development will place stresses on the health and social services available to Wainwright. This is one of the factors that contributed to our assessment of a MAJOR effect on Wainwright's sociocultural system. Additional information has been inserted in the text in Section IV.B.11.b(3) to clarify this point.

Response NSB-6

As a result of the March 24, 1987, U.S. Supreme Court decision in the case of Amoco Production Company et al. v. Village of Gambell et al., 107 S. Ct. 1396 (U.S. March 24, 1987) reversed in part, vacated in part, and remanded 774 F.2d 1414 (9th Cir. 1985), that the ANILCA does not apply to the OCS, the MMS will no longer prepare ANILCA Section 810 evaluations for OCS program activities on the Alaska OCS. However, the subsistence issue will continue to be actively addressed in the NEPA process, as it has been in the past.

In addition to the decision on the ANILCA, the U.S. Supreme Court vacated the judgment of the United States Court of Appeals for the Ninth Circuit that Section 4(b) of the ANCSA extinguishes aboriginal rights on the OCS. The issue was remanded back to that Court for reconsideration in light of the opinion issued on the ANILCA. However, on September 4, 1987, the U.S. Court of Appeals for the Ninth Circuit denied the Inupiat's motion (Inupiat Community of the Arctic Slope et al. v. the United States of America, 746 F.2d 570 (9th Cir. 1984), cert. denied (U.S. Oct. 7, 1985)) to vacate judgment, recall mandate, and consolidate with Amoco Production Company v. Village of Gambell, Nos. 83-3735, 83-3781, and 85-3877. The court stated that the Inupiat's remedy must be sought in the U.S. Supreme Court, as that court denied their petition for writ of certiorari. As of September 11, 1987, the United States Court of Appeals for the Ninth Curcuit has not issued a decision based on this reconsideration regarding the aboriginal-rights issue in the Norton Basin.

Response NSB-7

The criticized quote in the EIS Summary (Page viii) has been deleted.

As stated in Section IV.A.2.e, response efforts in landfast ice in the sale area could be considerably more effective because of the presence of ice and the good potential of in situ-burning techniques. Effectiveness of cleanup in various environmental conditions, including subsurface spills and broken ice, is quantified in Section IV.A.2.e as low--5 to 15 percent in open water and less in the presence of ice--and is discussed in further detail in incorporations by reference therein.

Response NSB-8

Floating-platform spills are incorporated into the OSRA at the rate they have historically been found to occur on the OCS. Neither the Canadian Arctic-oil-spill record, the Alaskan oil-industry-spill record, nor the historical OCS-spill record justify any assumption of higher spillage rates for drillships or other floating platforms for the category of concern--spills of 1,000 barrels or greater. In Alaskan and Canadian waters, the only platform spill of 1,000 barrels or greater was an exploration-fuel spill from a gravel island in the Canadian Beaufort Sea. No spills of such magnitude have occurred from drillships or other floating platforms. Only one of 12 platform spills in the historical OCS-spill record occurred from a floating platform--also an exploration fuel spill (see Sec. IV.A.1.b).

Response NSB-9

A seasonal drilling restriction is included for evaluation in the FEIS (see Sec. II.H.2, Stipulation No. 5). If selected by the Secretary for inclusion as a stipulation for the lease sale, this measure would restrict exploratory drilling within leased blocks in the area depicted as the Coastal Deferral Alternative (Fig. II-1) during the bowhead whale spring migration (April 1-May 31). MMS has also included in the FEIS a stipulation regarding industry bowhead whale-monitoring programs (Sec. II.H.2, Stipulation No. 6) and an ITL on Endangered Whales and MMS Monitoring Program (Sec. II.H.2, ITL No. 5). These measures would require industry to monitor the bowhead migration in the vicinity of any exploratorydrilling activity taking place in the spring migration area during the spring migration. If, as a result of the monitoring program, it appears that bowheads are subject to a threat of serious, irreparable, or immediate harm from the drilling operation, the RSFO will require the lessee to suspend operations causing such a threat.

A stipulation regarding oil-spill-cleanup capability in broken-ice conditions for Beaufort Sea Sale 87 has not resulted in additional cleanup capabilities being required beyond those already required by MMS guidelines; therefore, such a stipulation was not included in this EIS. As a stipulation in the earlier Beaufort Sea sales, it required that the lessee demonstrate to the RSFO the theoretical and physical capability to detect, contain, clean up, and dispose of spilled oil in broken-ice conditions prior to exploratory drilling below threshold depth. The RSFO has generally determined that the oil industry has such capability and has approved all exploration plans submitted by lessees for broken-ice conditions. See also Response STATE-5.

Response NSB-10

The basic principle of ITL No. 3 (Information on Protection of Endangered Whales), although slightly amended in the FEIS, remains the same as in the DEIS. The commenter's concern regarding the OSRA is addressed in Responses NSB-8, NSB-26, and NSB-30. The analysis of effects on the bowhead whale assumes no oil-spill cleanup; consequently, a 15-percent cleanup efficiency would not increase the effects as discussed in the EIS. Regarding monitoring for the presence of bowhead whales, whatever monitoring system is proposed would need to be approved by the MMS. A combination of visual and acoustic monitoring, such as used by the NSB for the spring bowhead surveys, probably could be used to monitor endangered whales in the vicinity of OCS operations. The MMS did not receive the NMFS Biological Opinion for Sale 109 in time for inclusion in the DEIS; however, the opinion is included in Appendix B of the FEIS and is factored into the analysis of effects in the EIS. The MMS has included a seasonal drilling restriction in the FEIS that would restrict drilling operations during the bowhead spring migration in the area depicted as the Coastal Deferral Alternative in Figure II-2. The fall season was not included in the seasonal drilling restriction because the bowhead migration appears widely dispersed across the sale area during that period, and any drilling operation is likely to affect only a small portion of the population. Other measures evaluated in the FEIS that would provide protection to bowhead whales from oil spills include Stipulation No. 6 (Industry Site-Specific Bowhead-Whale Monitoring Program) and ITL No. 5 (Information on Endangered Whales and MMS Monitoring Program) discussed in Section II.H.2 and Response NSB-9.

Response NSB-11

The text that appeared in Section I.D.3.h of the DEIS has been deleted to reflect the fact that a seasonal drilling restriction to protect bowhead whales is evaluated in the FEIS.

The MMS has contracted for a study to provide the type of information the commenter has requested. The final report, entitled "Computer Simulation of the Probability That Endangered Whales Will Interact With Oil Spills," was recently completed (Reed et al., 1987); and a copy was sent to the NSB. This report includes estimates of the percentage of the bowhead whale population that could contact spilled oil within a 10-day period following a simulated 10,000-barrel spill during the spring and fall migrations. For bowhead whales, spring spills near Cape Lisburne resulted in approximately 0.5 percent of the population contacting oil; near Point Belcher, approximately 0.1 percent of the population would be contacted. For fall spills, approximately 0.6 percent of the bowhead population could be contacted by a spill near Point Belcher, 0.1 percent by a spill near Point Lay, and 0.1 percent by a spill in the central Chukchi Sea west of Icy Cape (168°55'W. longitude, 70°30'N. latitude). The final report contains contact probabilities from several simulated 10,000-barrel spills; however, another major product of the study will be a computer model that can generate contact probabilities for simulated

spills of whatever size and time of year the user specifies at any user-designated spill point throughout the sale area. This model should provide much more detailed oil-spill-contact information for future lease sales.

Response NSB-12

See Response NSB-11, first paragraph. The MMS did not mean to imply that whales would need to interact with a spill in progress to be affected, but rather that whales would need to contact spilled oil in order to be affected.

Response NSB-13

See Responses NSB-11 (first paragraph) and NSB-12. Ingestion of spilled oil or oil-contaminated prey implies contact.

Response NSB-14

See Response NSB-11, first paragraph. The EIS clearly states that prolonged contact with oil could result if whales chose to feed in the area of a spill or were trapped in an ice lead into which oil was spilled.

Response NSB-15

See Response NSB-11, first paragraph. The MMS based its premise on the fact that other large whales have been observed swimming through (Geraci and St. Aubin, 1982) and even feeding in (Goodale et al., 1981) spilled oil without apparent harm. See also Response STATE-10.

Response NSB-16

See Responses NOAA-22 and NSB-11, first paragraph. The text in Section IV.B.7.a(1) has been amended to remove the impression that the bowhead's ability to metabolize ingested oil is understood.

Response NSB-17

See Response NSB-11, first paragraph. In simply stating the model's assumptions and the fact that oil might be contained or cleaned up, or that whales might avoid spilled oil, the MMS did not mean to imply a probability of these events.

Response NSB-18

A seasonal drilling restriction to protect bowhead whales is evaluated in Section II.H.2 (see Stipulation No. 5).

Drilling more than one well each season may not be possible in every year. Excessive ice cover during a drilling season, a late start in the drilling program, or the drilling of multiple wells from one drillship may preclude the completion of a well during any one season. The ability to complete a relief well from a drillship also would be subject to environmental constraints. Given these constraints, options other than drilling a relief well probably would be more viable for controlling a blowout, should one occur. For example, direct underwater control has been used recently as a faster method of killing offshore blowouts (OGJ, 1987b). However, a stipulation providing for a seasonal drilling restriction has been added for consideration.

Response NSB-19

Given current technology, it is unlikely that drillships or lay barges would be used in the spring lead system. These activities would take place during open-water periods. However, this concern would be better addressed at the time when exploration or development plans are proposed, since there will then be opportunities to ensure that operations will not adversely affect the bowhead migration. Also, the NSB will have the opportunity to ensure that subsistence activities and marine mammal populations are adequately protected through the State review process ensuring consistency with the Alaska Coastal Management Program.

See Response NSB-18, first paragraph.

Response NSB-20

Conditions within the sale area and whale behavior can vary considerably from site to site and during different times of the year. By defining these phrases specifically, we may establish a set of conditions that would trigger the suspension of oil and gas drilling activities and would be appropriate for some conditions; however, under other conditions, protection may be inadequate; and under still other conditions, operations would be suspended unnecessarily. Consequently, it would seem best to fit the level of protection needed to the type of operation and the local conditions. Under ITL No. 3 (Information on Protection of Endangered Whales), the MMS RSFO intends to monitor endangered whale migrations and behavior in the area of the drill site and would--with the assistance of the NMFS--determine when endangered whales are present and near enough to be subject to the threat of serious, irreparable, or immediate harm from oil spills or noise disturbance. Once such a determination is made, the RSFO would limit or suspend those activities that pose a risk to the whales. Other measures evaluated in the FEIS that provide protection for endangered whales include Stipulation No. 5 (Seasonal Drilling Restriction for Protection of Bowhead Whales from Potential Effects of Oil Spills), Stipulation No. 6 (Industry Site-Specific Bowhead Whale-Monitoring Program), ITL No. 4 (Information on Endangered Whales), ITL No. 5 (Information on Endangered Whales and MMS Monitoring Program), and ITL No. 6 (Information on Development- and Production-Phase Consultation With NMFS to Avoid Jeopardy to Bowhead Whales). Please refer to Section II.H.2 for further information on these measures.

Response NSB-21

The intent of ITL No. 9 (Information on Subsistence Whaling and Other Subsistence Activities) is not to absolutely define the information provided but rather to inform the lessees that local residents are subsistence hunters and the lessees should be considerate of subsistence activities and conduct themselves and their operations in a manner that would not interfere with subsistence hunting.

Response NSB-22

The MMS has no legal authority to require the lessee to consult with local communities; the MMS can only encourage a cooperative atmosphere. That is why this mitigating measure has been evaluated as an ITL, which is advisory in nature. Neither does the MMS find it necessary to further define the phrase "conduct themselves in a responsible manner. . . ."

Response NSB-23

Effects definitions (Table S-1) for air quality have been revised. The effect of accidental emissions on air quality has been reanalyzed as MINOR. Section IV.B.1.b has been amended to address the concern regarding hydrogen-sulfide emissions.

Emissions from in situ burning of spills, including acids, suspended-particulate matter, and mutagenic compounds are described and discussed in Section IV.B.1.b and in incorporations by reference therein. Additional citations have been added to support the analysis. Note that emissions resulting from burning all of a spill of 1,000 barrels or greater are low compared to amounts of emitted--as permitted--discharges; for example, such in situ-burning emissions would not exceed distance-exemption criteria (Sec. IV.B.1.a) even if the burn were at the minimum distance of the sale area from shore (5 kilometers [3 miles]).

The air-quality standards cited in the EIS apply to permitted emissions--not to accidental emissions. In addition, the averaging-times standards can legally be exceeded once a year. Accidental spills and blowouts would be considered "upsets;" and, technically, the standards would not apply. Because some environmental effects could still occur, two parallel sets of effect definitions--one based on standards and the other on environmental effects--have been used in the FEIS. Air-quality effects of accidents are evaluated on the basis of their environmental effects, as done in Section IV.B.1, and not on whether air-quality standards would be affected.

Chukchi Sea winds are generally offshore. If a spill were very close to shore and atypical onshore winds posed even a perceived threat to local communities, in situ-burning plans could be delayed until offshore winds returned.

The USEPA and the State of Alaska both reviewed the air-quality analysis in Section IV.A.1, and their comments have been incorporated. Neither agency expressed a need for further consultation.

Response NSB-24

Section IV.B.2.a discusses the incorporation of spilled oil that would occur in sediments for both nearshore spills and offshore spills; the Baffin Island Oil-Spill project findings on the persistence of hydrocarbon concentrations in calm, relatively restricted Arctic waters; and the retention of toxic components for several years from a spill within a completely isolated water body for several years. Because OCS spills would occur outside any even relatively isolated lagoon system, a long-term effect on water quality could not occur from a spill. Drilling discharges would have to be at least 5 kilometers (3 miles) offshore of any lagoon system, a distance greater than mud-and-cutting discharges would be detectable from in the water column. No other "shallow coastal regions" other than lagoons have the potential to be low-current regimes in the study area. Separation of nearshore waters into a separate category for analysis of effects would likely result in a lower--not higher--estimated effect level. The MODERATE effect level assessed for water quality in the proposal is caused by the potential for large-scale dispersal of spilled oil by winter pack ice. Such dispersal could not occur in a nearshore, landfast-ice zone. Note that effects on food-chain biota from spills in nearshore, restricted waters are discussed in Section IV.B.3.

Response NSB-25

The commenter takes this statement from the EIS out of context. Temporary displacement is only one of the effects mentioned in a list of six potential effects that may result from oil spills. The MMS has not implied that whales would necessarily avoid spilled oil; four of the other five potential effects discussed imply contact with spilled oil.

Response NSB-26

The text of Section IV.A.1.a quoted by the commenter has been clarified to indicate that exploration-spill risk is included in the overall spill estimate. Concerns as to the exploration-spill-rate calculations, exploration-spill frequencies, and effects of environmental conditions on spill rates are addressed in Section IV.A.1.b and incorporations by reference therein. See also Response NSB-8.

Response NSB-27

This concern is addressed in Responses NSB-8 and NSB-26.

Response NSB-28

The rationale for the MMS approach in estimating risk of oil spillage and a discussion of the causes of spillage are included in Section IV.A.1.b and in incorporations by reference therein. A study conducted for the MMS 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 oil spills from specific causes. Fault-Tree Analyses are highly controversial and statistically unreliable. Generally, Fault-Tree Analyses are used only when there is a complete absence of historical data, i.e., in calculating the probability of a nuclear-power-plant accident worse than has ever occurred. Where historical data exist, probability estimates based on that data are always considered more reliable, i.e., the insurance industry uses historical data to construct survival tables--not Fault-Tree Analyses. The commenter should remember that each additional branch added to a Fault-Tree Analysis (the number of wells to be drilled, the number of blowout-preventer failures, the experience and alertness of the drilling crews, etc.) increases--not decreases--the variance about the final estimate because of the propagation of statistical error. See also Response NSB-26.

Response NSB-29

The text in Section IV.A.1.a has been amended to address this concern.

Response NSB-30

The small-spill statistics are based on spill data obtained from the oil industry, as discussed in the incorporations by reference in Section IV.A.1. Although the MMS has not completed compilation of its own Alaska Region statistics for spills of less than 1,000 barrels from the raw-data reports submitted to the MMS, the numbers in the EIS would appear to be consistent with at least recent Alaska OCS history. Within the last few years of exploration, the largest spill was 2.5 barrels in Norton Sound in 1985 (Cotton, 1986). The Challenge Island spill was a State on-land spill that resulted from the burning of oily wastes in leaky oil drums--an unlikely event on a floating exploration vessel. Most of the spillage on the North Slope in 1985 and 1986 was not attributable to the oil exploration and production industry. Most of this volume was contributed by spills from community storage tanks and during local transport of petroleum products, i.e., the 15,000-gallon Kiayuh Energy, Inc., pipeline spill in Nulato in 1985. Note also that the North Slope produces about 1.3 billion barrels of oil every 2 years--equivalent to almost half the resource estimated for Sale 109. Using the spillage rate of 2,381 barrels (=100,000 gallons) per 1.3 billion barrels found, produced, and transported off the North Slope, the 100,000 barrels spilled on the North Slope would imply a total spillage for Sale 109 of 4,900 barrels from all sizes of spills--less than half the assumed volume of one of the seven major spills assumed in the Sale 109 EIS. The MMS does not agree with the commenter that the EIS should base estimates in the EIS on a lower estimate based on total oil industry plus nonoil industry spillage on the North Slope.

Response NSB-31

All such spills are considered, based on their historical rates of occurrence. Possibilities of major spills that could occur during both exploration and production are discussed in Section IV.A.1.b.

Response NSB-32

The 18-barrel spillage projected to occur during exploration is for small spills only. There is also a small, but real, chance that a major spill of 1,000 barrels or greater could occur during exploration. See also Response NSB-8.

Response NSB-33

Blowouts and other types of spills are included in both the OSRA and in discussions of the fate and behavior of spilled oil, shoreline oiling, and oil-spill response. The commenter is referred to Sections IV.A.1 and IV.A.2 and the respective incorporations by reference therein.

Response NSB-34

The questioned statement is based on the OSRA, which incorporates both the oceanographic and the wind conditions found in the sale area. Effects of spills on nearshore and shoreline resources are discussed in Section IV.B of the EIS, regardless of the low likelihood of oil movement toward the shoreline; however, the bottomline is based on what is likely or expected to occur. The 20- to 30-knot north winds blowing for 8 hours are entered into the oil-spill-trajectory model at their frequency of occurrence and, thus, are taken into account in the OSRA. Winds in the sale area are almost always offshore (Brower, Diaz, and Prechtel, 1977) and currents along or offshore (Lewbel and Gallaway, 1984). The modeled trajectories also agree with observed ice motions and other oil-spill-trajectory models and predictions for the Chukchi Sea (see Colony, 1986). The commenter should not confuse a simple deterministic spill-response model of few equations with the complex stochastic models used by the MMS in oil-spill-trajectory analysis (see Sec. IV.A.1.c). The two types of models are designed to answer different types of questions. Imagine a whaling captain trying to predict where a specific bowhead in the Bering Strait on April 1, 1988, would be on May 1, 1988. Now imagine the different problem of a whaling captain figuring the best location to set up a hunting camp that could be used to hunt whales over the next several years, rather than trying to locate a specific whale on a specific day. The difference in these two whaling problems illustrates the difference between the deterministic (where a specific whale would be at what time) and the stochastic model (where whales are more likely to be).

Response NSB-35

This concern is addressed in Section IV.A.2.b.

Response NSB-36

See Response STATE-5. The MMS tests the operator's personnel on their understanding of contingency plans through required drills. The concern of the commenter regarding cleanup in broken-ice conditions is addressed in Response NSB-9.

Response NSB-37

The commenter and the EIS (Sec. IV.A.2.e) are in agreement on this concern.

Response NSB-38

An undersea blowout from any sort of floating platform may be more difficult to set afire than a surface blowout on a bottom-founded structure because of emulsification. Section IV.A.2.e and incorporations by reference therein address the effect of emulsification on in situ burning as a response technique. Note that in the Ixtoc blowout, although emulsification at the wellhead initially occurred, emulsification at the wellhead ceased in the latter stages of the blowout (Payne and Phillips, 1985). Also, the Ixtoc blowout was successfully set on fire; and 30 to 58 percent of the oil released was burned (NRC, 1981).

Response NSB-39

Guidelines for the use of chemical dispersants in oil-spill response in the Arctic call for their use only when they produce a net environmental benefit; i.e., keeping oil out of a lead system. The EIS, conservatively, does not assume in its effects analysis that oil-spill damage would be mitigated by dispersant use. The concern regarding the line of authority for dispersant use is addressed in Section IV.A.2.e and in incorporations by reference therein.

Response NSB-40

Part of the requirement for approval of an exploration plan is that an oil-spill-contingency plan (OSCP) be written for the time and location when drilling activities will occur. The MMS will thoroughly review the document to see if the equipment and cleanup techniques are adequate for the conditions that may be encountered. The USCG, State, and other Federal and public agencies also review the OSCP. The lessee is required by OCS Order No. 7 to conduct an oil-spill-response drill under realistic conditions. At this time, the initial response-personnel and equipment deployment is witnessed by the MMS for compliance with OCS Orders. Throughout the drilling of the well, the MMS inspects the on-site equipment and the training records of response personnel.

The OSCP will identify equipment that is kept on location as well as equipment that is stored by Cost Participating Areas (CPA's). The MMS is familiar with the equipment currently maintained by various CPA's and has access to the documentation that describes the equipment and its effectiveness under various environmental conditions. In 1984, the oil industry sponsored a task group that formulated a document entitled "Oil-Spill Response in the Arctic, Part 3: Technical Documentation." This document fully describes the spill-response techniques and equipment that industry has adopted for the Arctic and that the MMS expects also will be pertinent to the Chukchi Sea. The document describes various response techniques, assesses the applicability of each technique to varying environmental conditions, and provides the physical parameters and limitations of the equipment. This is a good reference for the best available techniques for the containment and cleanup of oil in the Arctic and for the operating limitations of the equipment. The oceanographic data collected in the Chukchi Sea indicate that waves with heights of less than 1 meter and periods of less than 6 seconds are the most frequently observed sea-state characteristics (Brower, Diaz, and Prechtel, 1977).

The MMS, therefore, feels that the equipment currently available from the CPA's can provide additional response capabilities for operations in the Sale 109 area. See also Response STATE-5.

Response NSB-41

This concern is addressed in Response NSB-9.

Response NSB-42

Figure IV-14 is based, in part, on information provided by Alaska Clean Seas (1984) that was modified by EIS analysts to account for the differing environmental conditions and response considerations that exist in and for the Sale 109 area. The environmental conditions and the portions of the Sale 109 area for which response capabilities are rated are provided in Figure IV-14.

Response NSB-43

This concern is addressed in Section IV.A.2 and in incorporations by reference therein.

Response NSB-44

The text of Section IV.A.2.e has been amended to address these concerns. Further details regarding these concerns are addressed in Section IV.A.2 through incorporations by reference therein.

Response NSB-45

The oil would be present on the surface of the water but would be widely dispersed over the ocean and would seldom be identifiable as a slick. The weathering model used to calculate slick size and thickness in Table IV-5 does not take into account the horizontal dispersion of the slick on the water surface. The commenter is also confusing the persistence of a slick once it is formed with the time period over which oil spills. The Ixtoc spill was the world's largest offshore oil spill; it was not a typical spill of 1,000 barrels or greater or 100,000 barrels or greater. Section IV.A.2 and incorporations by reference therein provide several examples of the persistence of spills in the size range projected to occur in the Sale 109 area.

Response NSB-46

The text in question in Section IV.A.2.e cites the West Cameron 180 blowout as a successful example of ignition. There is no inference in the text that ignition would always be, or would on the average be, that successful. Limitations of the in situ-burning techniques are discussed in Section IV.A.2.e and in incorporations by reference therein, and the conclusions reached as to the effectiveness of this technique are consistent with the data cited by the commenter. The OSRA does not assume that cleanup occurs. The discussion of the OSRA in Section IV.A.1.c does note use of the 10-day (after spillage) timeframe in the EIS as the period after which standard cleanup measures would most likely have lost whatever effectiveness they initially would have had.

Response NSB-47

The quotation from Section IV.A.2.e by the commenter refers only to cleanup in open water. The effectiveness of oil-spill response in other environmental conditions is summarized elsewhere in Section IV.A.2.e and discussed in detail in the incorporations by reference therein.

Response NSB-48

The requested data are summarized in Section IV.B.1 and discussed in detail in the incorporations by reference therein.

Response NSB-49

The requested data are summarized in Section IV.B.1 with greater detail provided in the incorporations by reference therein. Note that (1) Section IV.B.1 includes estimates of emissions for both burned and unburned emissions from gas blowouts, and (2) the data provided by the commenter on reduction of gaseous emissions in industrial flares contradicts the commenter's premise that the burning of blowouts does not reduce emissions to the environment.

Response NSB-50

The cited "assumptions" in Section IV.B.1 are not assumptions but rather are summaries of the findings of scientific literature reviewed in the incorporations by reference therein. The concerns about cancer are addressed in Section IV.B.1. Note that the seventy-threefold increase in mutagenicity of residue in the smoke plume is less than threefold when corrected for loss of mass. Soot emissions would be insufficient to affect the local--much less the global--climate; estimated emissions would not even exceed MMS exemption levels at the shoreline. Emissions from burning spills offshore (1) would be unlikely to reach shore because of the predominance of offshore winds and (2) would, if they reached shore, have a MINOR effect because of the infrequent and short-term occurrence of any spill-burning events and relatively low levels of pollutant emission when compared to other sources, such as local power generation in villages, existing North Slope industry, and emissions from Eurasia. See also Response NSB-23.

Response NSB-51

The text quoted by the commenter in Section IV.B.10.b(4) has been deleted to address this concern.

Response NSB-52

a. Based on past experience, the use of dispersants is unlikely. Dispersants would be used only where effects would be expected to be lessened rather than increased. Use of dispersants in the Arctic would be the mutual decision of the spiller, the USCG, the EPA, and the State of Alaska. In the Baffin Island Oil-Spill experiments, dispersants increased the short-term toxicity of spilled oil but lessened the long-term effects caused by continued re-release of oil from sediments (Manen, 1987, oral comm.). A statement to this effect has been added to the text in Section IV.B.4. See also Response NSB-39.

b. The effects of cleanup activities are not expected to significantly affect most marine organisms. Burning oil would affect only the uppermost layer of water; hence, planktonic and pelagic organisms would not be directly affected if they are below and stay below the surface. Mechanical cleanup activities could affect any organisms on beaches; however, this effect would be minimal in an environment that is seasonally scoured by ice.

The effect of mechanical cleanup activities on subsistence-harvest patterns would be the same as effects from noise and traffic disturbance. Burning oil could cause short-term, localized disruptions to subsistence activities. The intensity of a cleanup effort would not increase the MAJOR effects already expected on subsistence-harvest patterns. The text in Section IV.B.10 has been amended to address this concern.

Response NSB-53

Stipulation No. 3 (Protection of Biological Resources) allows the RSFO to require the lessee to conduct biological surveys prior to operations to identify biological populations that may need additional protection. Based on information gained from the surveys, the RSFO may require the lessee to modify operations in some manner to ensure that special biological resources, such as kelp beds, are protected. See Section II.H.2 for further details.

Response NSB-54

The MMS believes that this example tends to put into perspective the relative size of an oil spill in relation to the bowhead migration. A new subsection (Sec. IV.B.7.a(3)) has been added to the FEIS to discuss the effects of an oil spill in the spring lead system.

Response NSB-55

This information was mentioned in Section IV.B.7.a(1) of the DEIS but is more fully covered in a new subsection (Sec. IV.B.7.a(3)), which discusses oil spills in the spring lead system. (See also the revised worst-case analysis on the bowhead whale [Sec. IV.I].)

Response NSB-56

The reference cited for this information is Geraci and St. Aubin (1980), authors who are noted experts on oil-spill effects on cetaceans.

Response NSB-57

This concern regarding hydrogen sulfide is addressed in Response NSB-23. In addition, the noise associated with a blowout probably would result in whales avoiding the area and, thus, the potential for inhaling toxic concentrations of hydrogen sulfide. The MMS has no evidence to indicate that toxic vapors from an oil spill would present a prolonged hazard under conditions of atmospheric inversion or no winds. Consequently, the MMS continues to maintain that vapor concentrations in the localized spill area sufficient to harm whales would be of short duration and would dissipate within several hours after termination of a spill (Geraci and St. Aubin, 1982).

Response NSB-58

Payne et al. (1984) indicate that oil spilled in the Chukchi Sea is not expected to sink. Furthermore, Section III.A.6 states that sediment concentrations offshore in the sale area are low; consequently, spilled oil in the sale area would not become contaminated with silt. Geraci and St. Aubin (1986) state that, except for aerial behaviors or feeding maneuvers, bowheads generally do not expose their eyes while breathing at the surface. A cetacean's eye may be further protected by a highly viscous, transparent film secreted from glands around the conjunctival sac (Yablokov et al., 1972) that covers the cornea with a protective layer 1 millimeter or more thick (Dawson, 1980). Considering these potentially protective features, we recognize nonetheless that contact with low-molecular-weight, volatile hydrocarbon fractions associated with a fresh spill would be damaging to the eyes.

Response NSB-59

This concern is addressed in STATE-8.

Response NSB-60

The worst-case analysis does not predict effects, such as a lower fecundity rate and a slower population-growth rate. These effects are discussed as possibilities but are not necessarily suggested as the likely case. The MMS believes that the likely case would result in MINOR effects.

Response NSB-61

The text in Section IV.I has been amended to address this concern.

Response NSB-62

This concern is addressed in Response NSB-58. However, it should also be noted that the area of dispersed hydrocarbons beneath a slick would be rather small and that these hydrocarbons would be quickly diluted; so the probability of injury to bowhead eyes resulting from hydrocarbons in the water column would be very low.

Response NSB-63

The text in Section IV.B.10.b(1) (Effects on Subsistence-Bowhead Whales) has been amended to address this concern. In the event of an oil spill occurring and contacting the bowhead whale migration, it is possible that the Native bowhead whale hunt could be suspended not only by the IWC, but also by the NOAA or, less likely, the AEWC. Since this is a hypothetical situation, what may happen is merely a matter of opinion--not a "scientific fact." However, a number of individuals closely involved with the bowhead whaling issue were contacted to ascertain what would most likely occur. There are primarily two situations in which the NOAA or the IWC could suspend whaling: (1) in response to public pressure because of perceived effects on the bowhead whale--prior to any scientific evidence of effects being produced; or (2) scientific evidence demonstrates that there is an effect on the whales including some mortality (no one mentioned how much mortality would have to occur before whaling would be suspended, and opinions on this subject varied).

It is possible that in response to public pressure of perceived oil-spill effects on the bowhead, the NOAA or the IWC might suspend bowhead whaling without waiting for scientific evidence of effects on the region (Brownell, 1987, oral comm.; Crichton, 1987, oral comm.; Braund, 1987, oral comm.; Lefevre, 1987, oral comm.). Such an event occurred in 1969 after the Santa Barbara oil spill off the coast of California. Prior to the 1969 spill, there had been a limited scientific catch of gray whales permitted. During the oil spill, a few dead whales were found on the beach. Without waiting for scientific evidence to prove that the whales were dead as a result of the oil spill, the Bureau of Commercial Fisheries (which had jurisdiction over endangered whales at the time but was later absorbed into the NOAA) ceased permitting a scientific catch of gray whales strictly because of public pressure and perceived fears of what the oil spill could do to the gray whale (Brownell, 1971). However, despite these concerns, the subsistence harvest of gray whales in Alaska was not suspended or terminated. No scientific evidence was ever documented to demonstrate that these whales died because of the oil spill. In fact, it was later revealed that there were no more whales found dead on the beach in 1969 than had been found annually over the previous 20 years (Brownell, 1971). Although a precedent was set for curtailing a scientific catch of gray whales without evidence of oil-spill effects, there is no evidence that in 10 years or more (28 years since the Santa Barbara spill) the NOAA would suspend the Native harvest of bowheads in the event of an oil spill. The reasons why the NOAA might not suspend bowhead whaling without scientific evidence of effects on bowheads are as follows: (1) there is currently much more information known about the effects of oil spills on whales than in 1969 (see Sec. IV.B.7); (2) the bowhead whale population has increased considerably each year since 1969; (3) the NOAA has learned to look for scientific evidence of effects before responding to public perceptions and fears as a result of experiences with the 1969 spill; and 4) the Native subsistence harvest of gray whales was not previously suspended.

If evidence were produced which indicated that the bowhead whale population was affected by an oil spill, it is probable that the NOAA or the IWC would at least consider the possibility of either suspending the bowhead hunt or decreasing the quota (Montanio, 1987, oral comm.; Roots, 1987, oral comm.). However, such effects are not expected (see Sec. IV.B.7). Rather, MINOR effects from oil spills are expected as a result of activities associated with Sale 109. In addition, a suspension would be less likely in the future since the whale-population count has been increasing (and should continue to increase during the 30-year life of the Sale 109 field). Thus, while a suspension of the bowhead whale hunt certainly might be considered by the NOAA or the IWC, or possibly the AEWC, in the event of an oil spill occurring during the whale migration, it is expected that no agency would react out of perceived fears but rather would wait until scientific evidence indicated a level of effect that would warrant a suspension (Montanio, 1987, oral comm.; Roots, 1987, oral comm.).

Response NSB-64

See Response NSB-63. It is not likely that the IWC would reduce the bowhead whaling quota as a result of oil and gas exploration, development, and production activities (except if an oil spill occurred), unless the census figures showed a trend toward a decreasing population. An interference in the census for one year would not be sufficient for a reduction in the quota. There have been years when poor weather conditions have reduced the ability to make an accurate whale census and lowered the census, and this has not affected the quota. It also should be noted that there is a rather large margin of error in the whale census; in 1987, the IWC approved a population count of 7,200 ±2,400 (Braund, 1987, oral comm.).

Response NSB-65

The text in Sections IV.B.10.b(1), (4), (5), and (6) (Effects on Subsistence-Bowhead Whales, Fishes, Seals, and Walruses) has been amended to indicate that oil spills could render bowhead whales, fishes, seals, and walruses inedible or perceived as such. The effects of oil spills on the bowhead whale harvests of bowhead whaling communities are expected to be MAJOR.

Response NSB-66

The text in Section IV.B.10.b(1) (Effects on Subsistence--Bowhead Whales) has been amended to address this concern. An assessment of a MODERATE--rather

than a MAJOR--effect on bowhead whaling due to noise and disturbance was determined because it is unlikely that industrial noise would occur in 2 consecutive years to such an extent that no bowhead whales would be harvested.

Response NSB-67

See Response BIA-1.

Response NSB-68

See Response BIA-1.

Response NSB-69

See Response NSB-65.

Response NSB-70

Given the hypothetical scenario on which this EIS is based, the MMS believes that the conclusions reached are entirely reasonable and supported by the best currently available scientific data.

Response NSB-71

The text in Section IV.B.7.a(1) and citations therein have been amended to address this concern. We regret our misinterpretation of information in the first paragraph on Page 196 of the report by Migaki (1981).

Response NSB-72

The text in Section I.D.3 has been amended to address this concern.

Response NSB-73

According to the Dictionary of Alaska Place Names (Orth, 1967), Kasegaluk Lagoon extends southwest 120 miles (193 km) on the Chukchi Sea coast from its northernmost point at 16 miles (26 km) southwest of Wainwright. The blocks to be deferred by the Eastern Deferral Alternative extend approximately 5 kilometers (3 miles) beyond the southernmost tip of Kasegaluk Lagoon.

P.O. BOX 9
WAINWRIGHT, ALASKA
763-2815

April 27, 1987

THE MMS
Alaska OCS Region
949 East 36th Avenue
Anchorage, Alaska 99508-4302

ATTN: Ray Emerson
Laura Yoesting

Enclosed are the comments of the Mayor of Wainwright, Jacob Kagak. Though, it could be considered crude written (English) testimony by scholarly people, I am submitting as it is written.

Thank you, and I hope that it is accepted as is. Any questions, I am available at above number.

Sincerely,

Jacob Kagak, Mayor
City of Wainwright

cc: Mayor Ahmoagak Sr., NSB
Warren Matumeak, NSB Planning
Wainwright City Council
Files

P.O. BOX 9
WAINWRIGHT, ALASKA
763-2815

April 27, 1987

COMMENTS ON OCS LEASE SALE (Chukchi Sea Lease Sale 109)

First, My name is Jacob Kagak, I am the Mayor of the City of Wainwright. I would like to extend my appreciation for allowing our people to raise comments on the above Draft Environmental Impact Statement. This appreciation is extended to Minerals Management Service people. My apologizes should also be noted for not being at the meeting, illness forced me not to attend this very important meeeting.

From our previous meeting in December or January, (Beaufort Lease Sales) I have strongly indicated that the notices of any such meetings be routed through our City Office and handled through our office. I like to point out that MMS did abide by this request. However, though it is likely that it was pointed out at this meeting, that Wednesday night meetings are not the best of the meeting nights, I still have to point out, that setting up the meetings be carried out accordingly to village population, and the involvement of Whaling (subsistence) activities. What I'm saying is, that the Village of Pt. Lay had this meeting the night before, though, they may have the best interest of the village people for having this meeting, but Wainwright being the second largest village in Arctic Slope, and more actively involved with whaling subsistence than Pt. Lay, it should be very desirous for the Minerals Management Service people to start these meetings from Barrow and go either way, (South or East) to conduct these very important meetings. On my part, I would still, stress that this is very important part of this Chukchi Lease Sales. **WAIN-1**

I know this area is only being considered for leasing certain areas. But if the City of Wainwright can participate in planning of easing the impact that this commitment of Federal Government have in our area. It would be best interest of our livelihood. **WAIN-2**

Comments on lease Sales (Chukchi Sea 109)

City of Wainwright, Page 2

Involvement in Planning. When I indicate that I like to see our City get involve with planning. In this area, what I mean is:

1. Community leaders involved in deciding what role the village should have a stand on. Leasing or Corporation land is number one priority, if it so happens that oil and gas is discovered in our immediate area or in close proximity of our Village.

2. Planning a Hub base. Our village can with co-operation of exploration companies grow with development if done properly, that is if the commitment can be acheived from both sides. **WAIN-3**

3. In reference to #1 above, at the beginning of the explorations, our corporation is willing to sit down and negotiate with parties involved, with Minerals Management Services overseeing the process. Commitment would be achieved to the betterment of both parties involved in this development. **WAIN-4**

4. Employment opportunities for my people, either on the drill rigs, or on land base. Especially, consultant types on our weather, land and sea ice conditions. Wildlife protection. **WAIN-5**

5. Creation of commitee(s), selecting members from both sides, native and non-natives. This commitee(s) would oversee the relations and interactions of both sides, to assist in making our lives better and making our guest feel welcome in our community. This would promote self-reliance on our part. It would help our guest to appreciate our way of life. I know that working against time restraints would hinder any leisure time on the exploratory people, but I would like our people to sure our culture and heritage with our fellow Americans. Life up here is harsh, helping each other would have an tremendous impact on both sides.

6. The Village of Wainwright is friendly, warm, and hospitable people. Willing to assist and comfort outside people, but only one catch is, do not take advantage of my people, we may be naive in alot of areas in Western World, but I also like to point out, the western people are naive to our Arctic enviroment.

7. I believe, if planning is done properly with commitment from both sides, the exploration of minerals will be done in expedious manner, along with protection of our land and sea.

8. We have an Hotel/restuarant in Village that could be utilized to certain extend by the exploratory people. As both sides settled, I can foresee an gradual growth of our community. The only thing that really concerns me alot is our whaling season. If there is no exploration activities or minimize the activities during that time, it would be greatly appreciated **WAIN-6**

Comments on Lease Sales (Chukchi Sea 109)

City of Wainwright, Page 3

by my people. I know there are strict regulations set out by Federal Management Service people, but due to restriants of unforeseeable nature, the enforcement of such regulations will be minimal. In these cases, it would be more cost effective, if the MMS would trained local people to be enforcers of such Federal regulations. These local people could be sworn in and compensated to do their jobs diligently.

9. As our federal government is aware of, that our subsistence life come first. However, over the time, as Prudhoe Bay matures, we have become mature in area of accepting the Western way of life. Though, we haven't foresaken our heritage, like our land have not foresaken us. It's always there, especially, after all the explorations is completed. It may seem like, no man country, but we know we have the riches up here, and again, I stress co-operation between the two worlds.

10. I know there are studies our our environment. I know there are safe guards against all unforeseen expectations. However, year to year experiences with our environment, nature can do alot of changes in matter of minutes. Especially, within the Ocean Ice and Wind. As possible that it may have already happen in our region, the storm can kill anyone in matter of minutes, this is looking at the Winter Blizards. People may be few hundred feet away from shelter, but it can cost havoc and bury anyone deep in the snow and won't find them till next spring. These are the expectations, that the exploration people should be aware of.

11. I know, our environment can contribute alot to our American life, but it should be also noted that living up here, as we become more accustomed to western living, we pay the highest fuel bill and electricity bill and the food cost is ourtrageous. Yet, our own Federal Government allows us to be taken advantage of. People from out side are imported to do all kinds of work in the camps, and drill rigs, expressing technicalities of job opportunities within the exploration adventures and expeditiousness of time restraints. I know, my people, especially, the young adults, that are willing to learn and do as well as these imported workers. They (our people) can do it. Because of skin relevancy, we are treated that way. However, not to dwell on this area, the residents of Wainwright are harmonious and are expertise in living with our environment with our environment accordingly. More than majority of our leaders are experience in public relations, because of our dealing with anthropologist in the past. Federal Research Contractors, have help us alot in dealing with our outside counterparts. Educating us in dealing with naive researchers. **WAIN-7**

12. The most important aspect, or the reality that the exploration people would have to realize is that unwanted nature of criminal element that may come with the exploration people. For example, the importation of Narcotics and alcohol would have to be overseen closely. Otherwise, this element will be used to indicate to the western world, that all the natives want to do is smoke "tokie" or drink booze, which is not true, when these are not made available to my people, my people leave them alone. This is one of the advantage of exploration people will have and

Comments on Lease Sales (Chukchi Sea 109)

City of Wainwright, Page 4

use these elements to downgrade my people. Which is sad. I would stress, that some sort of elimination process be taken to weed out the potential bad breed of imigrants to our Arctic environment as things become more settled. This is reality, we have to work together if we want safe environment in this kind of demanding work.

13. Professionally, speaking, I look at the local invovlement in development of our natural resources an opportunity for our younger generation to get involve with. Presently, we rely on our Borough for job opportunities, mostly, what temporary jobs can offer. Relying on any kind of assistance from governments do have an greatest impact, because of short lived opportunities that may be available at the time of need to liven up the local economy.

14. In overall review of the economic situation in our area and the State wide, the City of Wainwright is anticipating the natural resources development in our region. Wainwright is progressive toward better controlled development with participation of our local people, we should be allowed to take part in our betterment of our society, even if it meant that people down in lower 48 will fare better. We accept harsh Arctic thousand of years ago, so we are only asking that our modern society accept us and have faith is us to be part of our American dream in the Arctic. In finality, "HAPPY HUNTING". (Especially, in our stomping and hunting grounds).

15. Thank you.

Response WAIN-1

Public hearings on the Sale 109 DEIS were arranged through the North Slope Borough and were carefully scheduled because of the bowhead whaling season to be held prior to the whales being in the hunting range of the whaling communities. This called for holding the first hearing in Point Hope, moving northward to Point Lay, and then to Wainwright, since this is the route the whales would be taking. However, because the ice leads often form close to Barrow earlier than at the other communities, thus providing the opportunity for whaling, the North Slope Borough preferred to hold the Barrow hearing prior to the hearings in the other three communities. The MMS agreed to this request.

Response WAIN-2

The Sale 109 scenario identifies the City of Wainwright as a potential support site for offshore exploration that also would be proximate to facilities used to support development and production. As noted in Section II.A, this scenario is hypothetical. As evidenced by Gulf of Alaska exploration off Yakutat, different companies pursue different options for support. The Federal Government has no authority to require that a particular option be pursued or that a planning process involving local government and Native corporations be followed. Potential ITL No. 10 (Information on Coastal Zone Management; Sec. II.H.2) would inform lessees of the State's Coastal Management Program. The ACMP cannot force cooperative planning in advance; but through its consistency-review process, the State provides a means through which local concerns can be expressed. The purpose of the ITL is to alert lessees to this potential and to encourage them to consult and coordinate early in the process with those involved in coastal management review.

Response WAIN-3

Although cooperative planning usually results in a more satisfactory resolution of development problems and although the MMS encourages this cooperation, the MMS has no authority to require lessees to participate in a cooperative planning effort. See also Response WAIN-2.

Response WAIN-4

Cooperation and coordination between the village and regional corporations and the City of Wainwright to develop a local position is the responsibility of community leaders. The MMS, which has no authority to require that lessees cooperate with community leaders, nevertheless encourages lessees to consult and coordinate early in the process with those involved in coastal management review (ITL No. 10). See also Response WAIN-2.

Response WAIN-5

Employment opportunities for local residents with the petroleum industry will have to be discussed directly with industry. See also Response BIA-2.

Response WAIN-6

This concern is addressed in Response NSB-19.

Response WAIN-7

See Response WAIN-5.

Alaska Oil and Gas Association

121 W. Fireweed Lane, Suite 207
Anchorage, Alaska 99503-2035
(907) 272-1481

May 5, 1987

Regional Director, Alaska OCS Region
Minerals Management Service
Attention: Laura Yoesting
949 East 36th Avenue, Room 110
Anchorage, Alaska 99508-4302

Chukchi Sea Sale 109 DEIS

Gentlemen:

The Alaska Oil and Gas Association (AOGA) is a trade association whose member companies account for the majority of the oil and gas exploration, production and transportation activities in Alaska and the OCS offshore Alaska. Members of our organization have reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Chukchi Sea Sale 109 (May, 1988) and AOGA is pleased to have this opportunity to comment.

AOGA supports Alternative I, making available for leasing 29.5 million acres in May, 1988. Alternatives II-VI would cancel, delay or delete acreage from the proposed sale area, actions we believe would not be in the best interest of the nation. Operations in adjacent sale areas have proven industry's capability to operate safely in the Chukchi Sea.

In general, the Minerals Management Service (MMS) has taken a very objective approach to evaluating the potential effects of industry operations in the Sale 109 area on the living resources of the region. For the most part, "effects" are summarized as MINOR or MODERATE, with only two effects identified as MAJOR. These appraisals are fundamentally sound and we are in general agreement. The descriptions, discussions and assessments of possible or probable effects on living resources from a variety of influences (oil spills, construction, noise, boats, aircraft, etc.) appear to be objective in most cases.

AOGA strongly endorses the exclusion of seasonal drilling restrictions from the proposed stipulations in the DEIS. We believe there are adequate experience and scientific study that show such

restrictions are not justified and should not be imposed as a blanket condition. Existing laws provide necessary environmental safeguards.

We are concerned that the DEIS predicts "MAJOR" effects on Wainwright's subsistence harvest patterns. It has been demonstrated that North Slope petroleum development has not had significant impact on subsistence resources or activities for the villages proximate to the North Slope oil production areas. This fact, if taken to its logical conclusion, can be applied to the similarity of the Wainwright subsistence harvesting techniques and those found in Barrow and Kaktovik. **AOGA-1**

Any potential MAJOR impact for the Wainwright area would be mitigated by existing federal and state laws and industry practices which would preclude a significant impact to a village's subsistence rights.

Page IV-B-65 of the DEIS states that a Biological Opinion with regard to endangered whales in the Chukchi Sea as related to oil and gas exploration is expected prior to publication of the FEIS. We request an opportunity to review and comment on this opinion before it appears in the Final EIS. **AOGA-2**

Attached are our detailed comments on the DEIS. If you have any questions on the attached material, please contact us.

Sincerely,

WILLIAM W. HOPKINS
Executive Director

WWH:MC6:683
Attachments

COMMENTS OF THE
ALASKA OIL AND GAS ASSOCIATION
DEIS FOR CHUKCHI SEA 109
MAY 5, 1987

Page II-2 Exploration Drilling Units, First Paragraph

In the seventh line, change "25 to 30 meters" to "16 to 20 meters" in order to match the rig owners published water depth ranges. **AOGA-3**

Page II-3 Floating Drilling Units, First Paragraph

In the first sentence, change "25 meters" to "roughly 16 meters" to reflect current rig owners estimates. **AOGA-4**

Page II-3 Floating Drilling Units, Second Paragraph

In the second line, change "34 meters" to "16 meters" to reflect the lower operating range predicted by the Kulluk operators. **AOGA-5**

Page II-3 Bottom-Founded Drilling Units, First Paragraph

In the third line, change "7.5" to "10.5" for the lower operating depth of the Concrete Island Drilling Structure (CIDS) and in the fifth line change "18 meters" to "23 meters" for the operating depth of the single steel drilling caisson (SSDC). **AOGA-6**

Page II-7, (5) Support for Production Activities, First Paragraph

"This site (Pt. Belcher) was identified by the National Petroleum Council as a likely site for a pipeline landfall (NPC, 1981)."

The length of the offshore pipeline and environmental factors will be factors which determine the selection of a pipeline landfall. The cost of an offshore pipeline is so expensive and the design/construction so dominated by the ice environment that practical consideration suggests a line should come ashore via the shortest route which could be different from Pt. Belcher. The line would then travel on land to the location of an originating pump station for a trunk system to the Trans-Alaska Pipeline System (TAPS). **AOGA-7**

Page II-7, (5) Support for Production Activities, Third Paragraph

The statement is made that "Because dredging in areas of permafrost may lead to subsidence, dredging of the channel (in Peard Bay) would be possible only if the area to be dredged were free of permafrost." This is peculiar. If the object of dredging is to deepen a channel by lowering the sea floor, it would appear that nothing could be more ideal than having subsidence assist in deepening the channel. **AOGA-8**

Page II-9, Second Paragraph

The second sentence describes the permafrost layer as typically deep. We are not aware of any evidence suggesting the existence of offshore permafrost in the Chukchi except in shallow water, nearshore areas. **AOGA-9**

Page II-10, Section D.2. (Also applicable to Table II-7.)

The statement is made that the conditional resource estimate remains the same for the Eastern Deferral Alternative as for the proposal. This implies that there are no reserves in the Eastern Deferral Area, which encompasses some 993,028 hectares. There is insufficient evidence to support this statement. **AOGA-10**

Page II-11, Section E.2., Alternative V - Southern Deferral Alternative

The statement is made in this section that removing this acreage would not change the scenario for the proposal inasmuch as the conditional mean resource estimate and marginal probability of discovering economically recoverable oil would remain the same for the Southern Deferral Alternative. This implies that the 624,291 hectares contain no oil at all. It is premature to make such a statement because there is insufficient evidence to support such a conclusion. **AOGA-11**

Page II-11, Section F., Alternative VI - Coastal Deferral Alternative

This alternative would remove from the Sale 109 area about 3,485,131 hectares comprising some 29.1% of the total offered sale area. However, as shown on Table II-9, the implied loss of ultimate production is 440 MM Bbls of oil, which amounts to a reduction in reserves of only 16.4 per cent. Insufficient evidence is available to support this conclusion. **AOGA-12**

Page II-12, Section F.2., Activities Associated with Alternative VI, First Paragraph

A statement should be added to this paragraph which states that Pt. Belcher would remain the pipeline landfall as indicated in Alternative IV, page II-10, last paragraph. **AOGA-13**

Page II-12, Section G.2.(a) - Low Resource Case, First Paragraph

A pipeline to TAPS or direct offshore loading may be feasible. **AOGA-14**

Page II-13, Section G.2.(b) - High Resource Case, Line 11

In the eleventh line a statement is made about a landfall being near Cape Beaufort. See the comment given for Page II-7, (5) "Support for Production Activities". **AOGA-15**

Page II-13, Section G.2.(b) - High Resource Case, 4 lines from the bottom

Reference is made to using 75,000-DWT tankers requiring about 760 tanker trips per year during the years of peak production (2000-2005). We suggest that this sentence be deleted completely since Table II-12 for the high resource case shows 150,000-DWT tankers as the model. The use of a uniquely small size tends to increase the number of tankers used for transporting oil.

AOGA-16

Page II-15, Stipulation No. 1, Protection of Archaeological Resources

Due to the very low probability of encountering any archaeological sites we consider the requirement to determine the potential existence of any archaeological resource for submerged lands in the Arctic is unnecessary and recommend that it be deleted (see discussion on page III-64, Paragraph 4.a.).

AOGA-17

Page II-17, Stipulation No. 3, Protection of Biological Resources, Second Paragraph

Change "significant adverse effect" to "significant permanent adverse effect". Also change "adversely affect" to "permanently adversely affect" and "adversely affected" to "permanently adversely affected".

This change recognizes the fact that short term temporary effects on biological resource are distinctly different than a permanent or long lasting effect.

AOGA-18

Page II-21, Effectiveness of ITL Number 1, Second Paragraph

Add "Minor to negligible" to the beginning of the last sentence in order to read "Minor to negligible effects on whales, walrus...". This would correspond with the expected effects of Alternative 1 found in Table S-1.

AOGA-19

Page III-2, First Full Paragraph

The term "bedrock" is used in the second line and in numerous other places in this section. We think the term "bedrock" as used is a geological term and it might be misinterpreted in terms of the ease of foundation installation and foundation behavior for offshore structures. We believe that the term "bedrock" should be changed to hard soils and be defined as:

> "interbedded, very dense granular soils and very stiff to hard cohesive soils; commonly cemented."

AOGA-20

Page III-6, Fourth Complete Paragraph

This paragraph discussed the maximum sea ice retreat. We believe the seventh sentence would be better stated as:

> "Seventy-two degrees N latitude is the median latitude of the maximum annual retreat of the ice, and the 75 degree N line is the absolute maximum retreat observed. (LaBelle, et. al. 1983 Alaska Marine Ice Atlas)"

AOGA-21

Page III-9, Sixth Complete Paragraph

The terms "not very frequent" and "relatively infrequent" are confusing. Perhaps "infrequent" and "rare" would be better.

AOGA-22

Page IV-A-5, First Incomplete Paragraph and First Full Paragraph

This discussion of common small oil spills in northern Alaska gives the impression that these spills are shrugged off and lost to the environment. Virtually every last one of these spills is completely cleaned up with zero impact to the environment. This should be noted.

AOGA-23

Page IV-A-20, Fourth Complete Paragraph

The sentence "Because of differences... Sale 109 area." is unclear and should be rewritten.

AOGA-24

Page IV-A-21, Fourth Complete Paragraph

Amoco's spray ice island at the MARS location (OCS-Y-0302) proved the reliability of this technique.

AOGA-25

Page IV-A-22, First Complete Paragraph, Last Sentence

Please add the following after "(Alaska Report, 1985)": "Two additional exploratory wells were drilled in this area in a similar fashion in 1986."

AOGA-26

Page IV-B-2, Exploration, Second Paragraph

The conclusion that exploration would have a MODERATE effect on air quality is based on the supposition that nitrogen oxides emissions from the activity would approach the Federal ambient air standard. The DEIS states that there is a predominance of offshore wind in the area (see top of page, IV-B-4). This predominant offshore wind, in conjunction with the fact that the nitrogen oxides Standard is an annual average, makes it extremely unlikely that emissions from exploration activity would impact the shore in sufficient quantity, over a year's time, to approach the Standard. Therefore, we recommend the nitrogen oxides impact from exploration should be classified at most as MINOR. This change should also be made to other areas of the document that address this issue.

AOGA-27

Page IV-B-3, Production, First Paragraph

AOGA-28

As in the case of exploration, the DEIS concludes that a MODERATE effect on air quality would arise from the production activity that might follow Lease Sale 109. Nitrogen oxides (NOx) and Volatile Organic Compounds (VOC) are predicted to approach limiting air quality standards and emission rates, respectively. With regard to NOx levels, the same point can be made for production that was made for exploration emission impact, that is, that the predominant offshore wind will prevent NOx levels on the adjacent shore from approaching the ambient air quality standard, which is an annual average. Any concern for VOC levels is questioned. There is no ambient air quality standard for VOC. They only become a concern if there is a threat to the ozone (photochemical oxidants) standard. Ozone is not present on the sparsely populated, well-ventilated shorelines of the Chukchi Sea and is not likely to become present as a result of the emissions that would be contributed by production. Therefore, the effect of VOC as well as NOx should be changed to MINOR.

Page IV-B-6, Conclusion (Effect on Air Quality)

AOGA-29

Because of our preceding discussions relating to changing the effect of NOx and VOC from MODERATE to MINOR, the Conclusion for the project's effect on air quality should also be changed to show that the effect on air quality is expected to be MINOR.

Page IV-B-6, Cumulative Effects, Conclusion

AOGA-30

Likewise, the effect for Cumulative Effects would be expected to be MINOR.

Page IV-B-6 to IV-B-9, Effect of Oil Spills

AOGA-31

The conclusion that the projected oil spills for the project would have a MODERATE effect on water quality is based on the determination that there would be short-term, regional degradation of water quality. The proposition that the oil spills would have regional effect seems to be derived from the scenario that winter spills would be encapsulated in ice and travel hundreds of kilometers before the spring thaw released the oil. The areal extent of the spill's impact would not be increased by virtue of this travel. As stated in the DEIS, the oil would remain "intact and unweathered"; in other words, it would degrade no water until it was released in the spring and summer. At that time it would have no more impact than had the spill occurred in open water.

An open water spill of 100,000 barrels would cover only 0.4% of the total sales area in a discontinuous slick after 10 days. When consideration is given to the volume of water affected, the impact would be in an order of magnitude less than 0.1%. As there is no area within the lease sale offering that is identified as having

greater biological importance than any other area, the entire body of water within the lease sale offering should be considered a region; and the individual spills, even as large as 100,000 barrels, should be considered as "local" incidents. This would be the case whether they occur in the open water season or in the ice forming season. It follows then that short term local degradation of water quality from oil spills would have a NEGLIGIBLE effect.

Pages IV-B-14 and IV-B-16, Effects on Water Quality

AOGA-32

Conclusion - Based on the above stated reasons for changing the impact of oil spills from MODERATE to NEGLIGIBLE, the Conclusion for the project's effect and cumulative effects on water quality can be expected to be NEGLIGIBLE.

Page IV-B-16, Cumulative Effects of Construction Activities - Conclusion

AOGA-33

The effect on water quality would be expected to be NEGLIGIBLE.

Pages IV-B-16 through B-38, Effect on Lower Trophic-Level Organisms and Fishes

AOGA-34

We note that discussions of potential effects of oil on fish and shellfish often identify the magnitude of oil/fish interactions as MINOR or NEGLIGIBLE. Data from the National Marine Fisheries Service (NMFS, 1985) need to be incorporated into the rationale which leads to the determination of MINOR effects. A statement summarizing the NMFS data is appended.

Page IV-B-29, Conclusion

AOGA-35

Clarify the point that the level of kelp-bed effects are only when the activities cited occur within a given community(ies), not as a generalized statement of effect for the entire region.

Page IV-B-84, First Complete Paragraph

AOGA-36

Curatolo has since relabeled his disturbance categories. What previously was called "severe" is now called "strong" to more accurately describe the level of reactions (Curatolo & Reges 1986 - The Pipeline Separation Report).

Also add - "Providing a separation distance of 400 feet between the pipeline and the road eliminates the inhibition that occurs when they are adjacent. (Curatolo & Reges 1986)."

Page IV-B-88, Second Paragraph

AOGA-37

Since the geographic ranges of the Alaskan Arctic Herds are relatively distinct and separate, the influence of this project on other (non-Western Arctic) herds is zero. Thus, there is no reason to elevate a cumulative effect to MODERATE. We recommend the cumulative effect be placed at NEGLIGIBLE.

Page IV-B-88, Fifth Paragraph

Since this project will not impact the calving of the Western Arctic Herd, and existing oil fields (Prudhoe Bay/Kuparuk) have not impacted the Central Arctic Herd (it has tripled in size from 1975 to 1986), a prediction of a MODERATE effect is illogical. Even if there were major changes in calving locations (which has not occurred where they now exist with petroleum development) there is sufficient alternative habitat to render the impact to the population NEGLIGIBLE. **AOGA-38**

Page IV-B-89, First Complete Paragraph

MODERATE impacts have not been noted thus far. The impacts noted, if any, have been minor. There is no reason to expect anything greater than that which has been experienced. **AOGA-39**

Page IV-B-89, Third Complete Paragraph

For the reasons stated above, the cumulative effect would be MINOR. **AOGA-40**

Pages IV-B-95, Next to Last Paragraph

This paragraph states that pipelines may limit hunter access to certain active hunting sites. Subsistence access would not be limited by facilities; however, there would be restrictions on the use of firearms near facilities for safety reasons. **AOGA-41**

Page IV-B-100, First Complete Paragraph

This section discusses the effect of oil spills on caribou and confuses the chance of spills reaching shore with the chance of spills reaching subsistence-resource areas, which include offshore areas several kilometers wide along a stretch of coastline in the vicinity of villages. The probability values in summer for Wainwright and Point Lay are less than 0.5 percent chance (See Page IV-A-10, fourth paragraph, Combined Probabilities, and Figure IV-8). The probability values (76 and 24 percent, respectively) for Wainwright and Pt. Lay are inconsistent with the values indicated above. We have also found this inconsistency in other sections of the report and we recommend they should be made consistent. Finally, the associated effects should also be adjusted accordingly. **AOGA-42**

Page IV-B-107, Last Paragraph

We cannot agree with the assessment that construction activity near Pt. Belcher would cause MAJOR effects on Wainwright **AOGA-43**

V-109

subsistence by disrupting harvest activities. Development activities can be coordinated to ensure only negligible effects on subsistence activity for all subsistence use areas.

Page IV-B-109, Conclusion Effect on Wainwright

A series of disclaimers and qualifiers on the speculative and tentative nature of the Alternatives used to describe the Activities Associated with the Proposed Actions appear at the top of page II-2. The difficulty with this statement occurring at this very early point in the DEIS is that it tends to be forgotten by the time the reader reaches IV-B-109 and finds that: "Conclusion (Effect on Wainwright): The effect of proposed Sale 109 on Wainwright's subsistence is expected to be MAJOR." And that MAJOR, as defined in Table S-2, means "One or more important subsistence resources would become locally unavailable for a period of time exceeding one year". **AOGA-44**

A statement as strong as that needs proper qualification in the immediate text. The fact that the shoreline connection point with the "possible" OCS production was arbitrarily chosen to be in the vicinity of Wainwright should be pointed out.

Also, this subject is addressed by Federal and State laws which would prevent an impact that significant to a Village's subsistence hunt.

Pages IV-B-139 and 140, Summary-Effect on Land Use Plans and ACMP

We are concerned that on these pages the DEIS indicates potentially serious conflict with subsistence standards of the ACMP and NSB plans, and ACMP air and water quality standards. The ACMP standard 6 AAC 80.130 on subsistence allows districts to identify subsistence use areas and provides that studies be conducted and appropriate safeguards be taken to assure subsistence usage. Any oil and gas development will more than adequately comply with that standard.

The ACMP air and water quality standards incorporate the statutes, regulations and procedures of the Alaska Department of Environmental Conservation (ADEC). Notwithstanding the referenced analysis in Section IV-B-1 concerning air quality, extensive air monitoring studies of the producing fields on the North Slope have shown that all state and federal standards have been and are continuing to be met. Further, discharges associated with onshore and offshore oil and gas activities near Prudhoe Bay have been in compliance with state and federal water quality standards. **AOGA-45**

We believe the analyses in the DEIS do not substantiate a conclusion of MAJOR conflicts with the NSB plans and ACMP. We recommend the conclusion be modified to MINOR conflicts.

Page IV-C-1 and IV-G-1

The disturbing aspect of the discussions of effects on living resources and their utilization in the Sale 109 DEIS focuses on the MAJOR and MODERATE levels of impact indicated for the subsistence-harvest patterns for the six native communities. No time-frame is suggested within which these effects might occur (5-15 years from now) nor is any relief from these assessments suggested that relate to the fact that exploratory drilling sites may be widely separated and few in number.

We believe that these assessments are extreme. AOGA-46

Page IV-K-1, Sixth Paragraph

This paragraph states "A short-term, offshore regional decrease in water quality may be considered to be a tradeoff for obtaining hydrocarbon resources." Perhaps this is true, but we strongly disagree with the insinuation that a decrease in offshore water quality is likely. We would only cite the evidence from such heavily produced offshore regions as the Gulf of Mexico, Southern California, and the North Sea, where the fisheries have not only been unaffected, but have never been better. With the current regulatory safeguards in force, there is no reason to expect lowered water quality, regional or otherwise, in the Chukchi Sea, except for minor local turbidity from drilling mud discharges. These discharges have never been demonstrated to be measurably harmful to marine life. AOGA-47

Page IV-K-2, First Paragraph

We find it difficult to believe that the establishment of a shore facility of a few acres and a pipeline would cause a reduction in subsistence resources sufficient to "threaten the regional economy."

Also, the first paragraph states that "Land use changes would be dramatic at the shorebase site and along the pipeline route." This is certainly true, but the acreage of the shorebase and of the pipeline is extremely small compared to the huge expanses of the region--hardly enough to significantly affect subsistence patterns anywhere but very locally. AOGA-48

Page IV-L-1, Third Paragraph, Endangered and Threatened Species

This paragraph states "it is possible that endangered whales could be subjected to long-term effects from oil spills, noise disturbances, or loss of habitat due to facility developments." We would emphasize that a significant oil spill, besides being very rare, is extremely short-term, so it's hard to understand the linking of oil spills to "long-term" effects. Noise disturbances are as long-term as exploration and production may continue, but there is AOGA-49

no evidence of significant alteration of bowhead whale behavior in the vicinity of either Canadian or Alaskan Beaufort Sea drilling activities, and there should be no difference in the Chukchi Sea. Loss of whale habitat would potentially amount to about an acre per platform. With 20 platforms, that would amount to .0000006% of the proposed sale 109 area.

We seriously doubt that the potential level of spills, noise, and habitat loss could ever cause the loss of any individual whale.

Page IV-L-1, Fifth Paragraph

The indication that oil spills or offshore noise and pollution may permanently disrupt the harvesting of bowhead whales is unwarranted conjecture at best. See our comments relative to DEIS page IV-L-1. Similarly unwarranted is the inference that the proposed lease sale may tip the scales leading to the "irretrievable loss of the Inupiat language and other cultural behaviors". AOGA-50

Page G-4, First Incomplete Paragraph, Last Sentence

The statement is made that "Recoverable reserves are estimated at 9.6 billion barrels." We believe that this statement is incorrect with respect to Milne Point. Rather this seems to refer to Prudhoe Bay. AOGA-51

dw12:23

APPENDIX TO AOGA COMMENTS
MAY 5, 1987

SUPPLEMENTAL NMFS "EFFECTS OF OIL" DATA

Excerpts from the National Marine Fisheries Service report "Evaluation of the Effects of Oil Development on the Commercial Fisheries in the Eastern Bering Sea" are quoted here: (NMFS, 1985).

"Some past oil spills from grounded tankers have caused extensive damage to beaches and have damaged local inter- and subtidal marine ecosystems. These coastal spills have received considerable attention in the news media and from the scientific community. However, no evidence has been found documenting noticeable detrimental effects of past oil developments on fishery resources (excluding minor local impacts), despite many Draconian forecasts of the possible impacts of oil developments on marine fisheries and ecosystems. Many of these sinister forecasts appear to have resulted from incorrect extrapolations of selective laboratory observations on the effects of hydrocarbons on the physiology, genetics, and mortality of fish.'

'To clarify the possible effects of offshore oil development on fisheries, it (was) necessary to investigate this complex of problems quantitatively (numerically) using all available pertinent knowledge. A contract... was given from Mineral Management Service via National Ocean Service to the Northwest and Alaska Fisheries Center.'

'The (present) study addressed three major areas of possible impacts of oil on fisheries:

1) Effects of oil (from accidents) on fish and shellfish eggs and larvae, and the projection of these effects over subsequent years.

2) Possible effects of oil on adult fish (including crabs and migrating salmon), and the possible uptake of hydrocarbons by fish.

3) Possible effects of weathered oil on the bottom on the benthic ecosystem (including demersal fish).'

'The numerical study was carried out with hypothetical well blowouts and tanker accidents with the objective of achieving Maximum Effect Conditions (MEC), which was defined as follows (See Table 1):'

'1) Either the largest plausible well blowouts... releasing 20,000 bbl/day of Prudhoe Bay crude oil for 15 days, or a tanker accident releasing 240,000 bbl. automotive diesel (refined) at a rate of 10,000 bbl./hr.

2) The spreading of oil in the water occurred in conditions of winds, tides, mixed layer depth, and temperature which produced the largest possible area of highest possible concentration (greater than 1 ppm) of water soluble fraction (WSF) of oil in the water.

3) The blowout/accident occurred during the most unfavorable time with respect to the fishery resources (peak spawning time with maximum aggregation of fish per unit area, and/or peak migration time of anadromous fish).'

Table 1...Hypothetical oil-spill scenarios.

Scenario	Oil Type	Volume	Duration	Computation grid size (mesh 2 km)
Blowout	Prudhoe Bay crude	20,000 bbl/day	15 days	50 x 50
Accident	Automotive diesel (refined)	240,000 bbl (10,000 bbl/hr)	10 days	32 x 34

'The presence and distribution of oil on the surface in offshore areas has no consequences to fish or fisheries... obviously in some conditions oil on the surface could be beached, where it will be of local concern.'

'The maximum concentrations of oil in water (WSF, including soluble and emulsified oil) was less then 0.34 ppm from the blowout scenarios. These low concentrations correspond well to observed concentrations from IXTOC blowout. Grahl-Neilsen, et al (1976) also observed low concentrations of oil under the oil slick (0.450 ppm 1 m under oil slick after 8 to 9 hours; 0.01 ppm after 24 hours).'

'The maximum concentrations from the "tanker accident" were higher than (ca 9 ppm), mainly because refined diesel oil was considered to be involved. The areas covered by different concentrations are reported by Pola-Swan, Miyahara, and Gallagher 1985.'

Possible effects on eggs and larvae

'Eggs and larvae of marine animals are most sensitive to dissolved and emulsified oil (WSF) in the water. The mortalities and serious sublethal effects start at concentration of ca 100 ppb.'

'The areas covered with WSF greater than a part per billion are relatively small in case of a substantial blowout lasting 15 days (less than 150 km^2). Even in case of such an unlikely event as 200,000 barrel tanker accident with diesel fuel (released almost instantaneously), the area covered by this concentration is less than 1200 km^2.'

'Of the species studies, the spawning of yellowfin sole and its eggs and larvae were found most affected by the simulated blowout and tanker accidents in Bristol Bay. If all yellowfin sole would spawn within two weeks and this spawning would coincide with the very unlikely tanker accident, only 1.2 percent of yellowfin eggs and larvae would be killed. However, the yellowfin sole spawning period is about five times longer than that used for the simulated accident--thus, less than 0.3 percent of yellowfin eggs and larvae would be affected. The fraction of eggs and larvae of other fish species that would be killed is less than this fraction.'

'The natural mortality of fish eggs and larvae is very large (the reduction in numbers from eggs to spawning adults is in general from between 2,000,000 to 2, to 50,000 to 2). Furthermore, if considerable mortality would occur due to extensive oil spill, this would not affect the fishery resources, as the exploitable stocks are "buffered" by the presence of several year classes (Honkalehto 1985). Consequently, the possible oil developments in Bristol Bay would have minimal effects on fishery resources in this area via effects on eggs and larvae (emphasis added). Similar conclusion was reached by Jarvela, Thorsteinson, and Pelto (1984) in respect to Navarin Basin.'

Exposure and contamination of fish by hydrocarbons

'The lethal effects of WSF of oil on fish commence in the 1 to 10 ppm range. The lower value (1 ppm) (was used) to achieve MEC (Maximum Effect Condition). In evaluating the effects (lethal and serious sublethal) (it was) also assumed that concentrations of weathered oil on the bottom (tars) in excess of 5 ppm affect the juvenile adult fish. This assumption is somewhat excessive according to available literature, but would given an absolute MEC.'

'Of the species considered in this study, yellowfin sole and king crab were found to be most affected by the hypothetical oil spill. The extensive well blowout would kill and/or seriously affect only 0.03 percent of yellowfin (and crab) population in the eastern Bering sea, which is nearly three orders of magnitude less than the accuracy of resource estimates. Thus an extensive blowout would not have a measurable effect on offshore fishery resources in the eastern Bering Sea (emphasis added)'.

'An unreasonably large tanker accident (refined product) as used in (the) scenarios might kill or otherwise seriously affect 0.15 percent of the adult yellowfin population. This amount is about two orders of magnitude less than the accuracy of resource estimates, and at present less than 2 percent of the catch--i.e.

about an order of magnitude less than the error in the estimation of catch. However, a 0.15 percent fluctuation of resource would have no effect on catch whatsoever. Thus, even an unreasonably large tanker accident would have no quantifiable effect on the offshore fishery resources in the eastern Bering Sea (emphasis added) (NMFS, 1985)."

dw12:24

V-113

Response AOGA-1

The effects of proposed offshore Sale 109 on subsistence harvests cannot be compared with current onshore exploration, development, and production activities on the North Slope. Effects on the environment from onshore and offshore oil exploration, development, and production activities differ because (1) characteristics of the subsistence resources vary, (2) oil spills are more easily contained onshore, (3) operating technology varies, and (4) the problems associated with a species swimming through an oil spill are quite different from a species walking over an oil spill. An example of how an offshore subsistence resource can be more susceptible to a harvest disruption than an onshore resource is seen in the bowhead whale harvest--from one to three bowheads are annually harvested in most communities except Barrow. Unlike harvest disruptions of other species, such as caribou, fishes, or birds--which are harvested in the tens and hundreds, disruption of the bowhead whale harvest could eliminate the harvest. That is, if a community harvests only two whales, a harvest decline of two whales can reduce the harvest to zero--resulting in a MODERATE effect on an affected community. A zero harvest in 2 consecutive years would result in a MAJOR effect. Such an effect is expected only in Wainwright.

Although subsistence-harvest techniques are similar among these communities, the EIS analysis is not based on those similarities. Rather, the level of effects is determined by causal agents: number and likelihood of oil spills occurring and contacting a particular area; noise and traffic disturbance; and construction activities. These causal agents vary according to each community and its proximity to oil exploration, development, and production activities.

Existing State or Federal laws and industry practices, while providing broad protection to subsistence activities and harvests, do not absolutely mitigate potential effects. For instance, they do not remove the possibility that a spill and subsequent effects could occur. See also Reponse AOGA-44.

Response AOGA-2

The MMS received the NMFS Biological Opinion on endangered whales on September 1, 1987; it is included in Appendix B. In order to keep the FEIS on schedule, there was no time to make a separate mailing of the Biological Opinion once it was received. In any event, the Biological Opinion is not subject to the public-review and comment process.

Response AOGA-3

The text of Section II.A.2 has been amended to address this concern.

Response AOGA-4

The text of Section II.A.2 has been amended to address this concern.

Response AOGA-5

The text of Section II.A.2 has been amended to address this concern.

Response AOGA-6

The text of Section II.A.2 has been amended to address this concern.

Response AOGA-7

Given the challenges of the ice environment in the Chukchi Sea, the nearest landfall may not be the most desirable. The selection of Point Belcher as a landfall is representative only of the fact that a landfall is a necessary component of constructing an offshore pipeline to shore. The National Petroleum Council's identification of Point Belcher was one factor that was considered when a representative landfall site was selected. Other factors included Point Belcher's proximity to assumed resources and the ease of converting from support for exploration to support for development and production. While the selection of a shorebase site is not arbitrary, any scenario for developing Chukchi Sea petroleum resources is highly speculative. As noted in the introduction to Section II, the scenario identifies characteristic activities and areas where these activities may occur, but does not represent a recommendation or endorsement by the USDOI.

Response AOGA-8

Section II.A.2.b(5) has been clarified to indicate that the subsidence of concern is subsidence that might eventually affect the shoreline.

Response AOGA-9

The text in Section II.A.2 has been amended to address this concern.

Response AOGA-10

The term "reserves," as used by this commenter, is assumed to mean resources, since there are no discovered oil and gas fields in the area. The statement that the conditional-resource estimate remains the same for the Eastern Deferral Alternative as for the proposal means that either the probability of hydrocarbons or the expected volume of hydrocarbons is very small in the deferral area. Based on available data, the MMS has estimated the marginal probability of hydrocarbons in the Eastern Deferral Alternative to be very small and, therefore, the change in resource estimate for this alternative to be negligible.

Response AOGA-11

For the same reasons stated in Response AOGA-10 and based on the available information, the MMS has estimated the marginal probability of hydrocarbons to be very small and the change in resource estimate for the Southern Deferral Alternative to be negligible.

Response AOGA-12

Based on the available information, the MMS' resource estimates do not distribute the oil resources equally throughout the area. The oil potential for the Coastal Deferral Area is estimated to be less per hectare than for the proposal.

Response AOGA-13

Section II.F.2 has been revised to identify Point Belcher as the landfall site for the Coastal Deferral Alternative.

Response AOGA-14

The scenarios proposed in the Sale 109 EIS are hypothetical. The selection of one scenario over another does not mean that the one selected is the only one that is feasible. (See Responses AOGA-7, NOAA-27, and NOAA-28.)

Response AOGA-15

As noted in Response AOGA-7, the landfall site selected for the scenario reflects development representative of that associated with production so that the effects of oil development can be assessed. The scenario is not a blueprint for development and in no way is a recommendation of the USDOI. Moreover, the nearest point of land to a producing field may not be the preferable site for a landfall.

Response AOGA-16

The text of Section II.G.2(b) includes both tonnage and trip figures to provide readers with an idea of the range of tanker trips that may be generated. The text has been revised to clarify this point.

Response AOGA-17

The MMS has already determined that the probability of finding an archaeological resource in the Sale 109 area is extremely low. Nevertheless, it has been MMS procedure that Stipulation No. 1 (Protection of Archaeological Resources) be considered in all EIS's. A decision to invoke the stipulation for Sale 109 has not yet been made. If the stipulation is not invoked, it would eliminate the requirement for the lessee to do a survey report, relocate operations, or provide other protection to archaeological resources if they were found or believed to exist. The potential stipulation applies to this possibility, however remote. Shipwrecks also are protected under this stipulation; even though the sea bottom may have been disturbed by ice gouging for thousands of years, the historic remains of shipwrecks may still be present and detectable.

Response AOGA-18

The purpose of Stipulation No. 3 (Protection of Biological Resources) is to mitigate significant adverse effects on biological resources. An effect that lasts over the life of the field (30 years) would be significant but not necessarily permanent. While effects or changes may be long-term, there is no evidence to suggest that any change would be permanent--especially within the dynamics of living systems. "Nothing endures but change" (Heraclitus, 540-480 B.C.).

Response AOGA-19

The text of Section II.H.2 (Effectiveness of ITL No. 1) has been amended to address this concern.

Response AOGA-20

"Bedrock" is the term used in the reference(s) cited in Section III.A.1.

Response AOGA-21

No revision of the text in Section III.A.3 is considered necessary.

Response AOGA-22

The terms used to describe the events in Section III.A.4.a(1) are those used in the references cited therein.

Response AOGA-23

The MMS is not aware of a quantitative analysis of cleanup activities and recovery effectiveness for past large or small spills offshore of Alaska. Some of the examples of cleanup to date--i.e., the Challenge Island-spill cleanup--could not have occurred on the ocean.

Response AOGA-24

The noted sentence in Section IV.A.3.a(1) has been revised to address this concern.

Response AOGA-25

The noted paragraph in Section IV.A.3.a(1) has been revised to address this concern.

Response AOGA-26

The noted paragraph in Section IV.A.3.a(1) has been revised to address this concern.

Response AOGA-27

The text in Section IV.B.1 has been amended to address this concern.

Response AOGA-28

The text discussing nitrogen-oxide emissions has been amended to address this concern. The USDOI regulates OCS emissions of VOC through Nationwide emission standards. Local differences in the ability of emitted pollutants to form ozone are not addressed by the USDOI regulations. The MINOR effect levels reached because of potential VOC emissions are based on comparison with USDOI standards and regulations and not directly on effects of VOC or likely ozone formation on the Arctic ecosystem. The USDOI regulations are discussed in Section IV.A.1.

Response AOGA-29

This concern is addressed in Responses AOGA-27 and AOGA-28.

Response AOGA-30

This concern is addressed in Responses AOGA-27 and AOGA-28.

Response AOGA-31

The EIS distinguishes between effects on water quality and effects that polluted water would have on biological resources. Ice is frozen water; thus, the pack ice is part of the water resource of the Chukchi Sea. The horizontal extent--the spread--of an oil spill is a more important parameter than spill thickness. The EIS uses "local" and "regional" as standard areal meanings rather than as synonyms for small and large volumes. Thus, a MODERATE effect is the appropriate conclusion. The concern regarding the EIS treatment of greater effect on water quality from a winter spill than from a summer spill is addressed in Sections IV.A.2.a and IV.B.2 and the respective incorporations by reference therein.

Response AOGA-32

This concern is addressed in Response AOGA-31.

Response AOGA-33

The rationale for a MINOR cumulative effect on water quality from construction activities is explained in Section IV.B.2.c.

Response AOGA-34

The material appended to AOGA's comments is directed mainly at Bering Sea fishes and effects on fisheries. Since no commercial fisheries exist in the marine waters of the northeastern Chukchi Sea and data pertinent to the analysis of effects on fishes in this region have been cited or incorporated by reference, the data in the appendix have not been included in this EIS.

Response AOGA-35

The conclusion in Section IV.B.3 has been amended to address this concern.

Response AOGA-36

The statement made in Section IV.B.8.a about caribou reaction to traffic and pipelines is based on Curatolo (1984) and will remain in the EIS. The terms "severe" or "strong" reaction, as used in this sentence, are the same since no distinction is made to lesser disturbance reactions. In the context of this paragraph, the word "adjacent" is used to encompass the area within 400 meters of either side of the pipeline.

Response AOGA-37

Section IV.B.8 includes overall discussion of cumulative disturbance effects of oil development on caribou in general--whether it be the Western Arctic, Teshekpuk Lake, Central Arctic, or Porcupine caribou herd. One of the main development projects, such as the NPR-A or the ANWR oil development, could affect at least two of these herds.

MINOR effects on caribou distribution, as defined in Table S-2 (Definitions of Effect Levels on Biological Resources), have been documented (Cameron, Whitten, and Smith, 1983; Curatolo, 1984; Curatolo and Murphy, 1986; and Dau and Cameron, 1986); thus, cumulative effects on caribou would definitely be greater than NEGLIGIBLE. The addition of several MINOR effects on caribou distribution (i.e., incremental displacement of a portion of the Central Arctic herd from additional calving range on the Canning River Delta as a result of ANWR oil development, as well as displacement near other future oil-field facilities east of Prudhoe Bay) could produce a MODERATE effect that is likely to persist over the life of the oil fields (more than one generation). This would represent a long-term change in Central Arctic herd distribution, therefore equaling a MODERATE effect on caribou distribution--even though the herd's abundance may not be affected.

Response AOGA-38

Although it is assumed that the proposed Sale 109 onshore pipeline would not cross the Western Arctic caribou-herd calving grounds, NPR-A oil development in the future may include part of these calving grounds. Thus, cumulative oil development on the NPR-A could have MODERATE effects on the distribution (probably no effect on abundance) of the Western Arctic herd through the displacement of a portion of the herd from the calving grounds over the life of the field or for more than one generation. (See Table S-2 for the definition of a MODERATE effect on biological resources.) MINOR effects on the distribution (but not the abundance) of individuals of the Central Arctic caribou herd have been documented (see Response AOGA-37).

Response AOGA-39

MODERATE effects on caribou distribution have been noted in Section IV.B.8 (Cumulative Effects of Disturbance and Overall Cumulative Effects). The expansion of oil-development facilities over more of the calving ranges of Arctic caribou herds can be expected to result in changes in the distribution of portions of one or more of the caribou herds on their calving ranges that would last over the life of the oil fields (more than one generation of caribou). Thus, MODERATE effects can be expected.

Response AOGA-40

See Response AOGA-39.

Response AOGA-41

The text in Section IV.B.10.a (Effects on Subsistence-Harvest Patterns) quoted by the commenter has been amended to indicate that subsistence access would not be limited by facilities but that there would be restrictions on the use of firearms near facilities.

Response AOGA-42

The text in Section IV.B.10.b(3) has been amended to reflect the correct combined probabilities of an oil spill contacting shore.

Response AOGA-43

The MAJOR effect expected in Wainwright due to construction activities is a result of MAJOR effects expected on bowhead whale harvests--not on all subsistence-resource harvests. A MAJOR effect on any one subsistence-resource harvest determines an overall MAJOR effect. The commenter is correct in stating that development activities can be coordinated to lessen the effects on subsistence harvests. Mitigating measures, such as Stipulation Nos. 5 and 6 and ITL Nos. 3, 4, 5, and 9, would decrease the level of effects over a 30-year period, although they would not alter the MAJOR effect determined in the subsistence analysis. (See Response NSB-63; see also Response CHEVRON-1 for a discussion of the MAJOR effect.) The EIS analysis does not assume that potential mitigating measures are in place; see Section II.H.2 for evaluation of the effectiveness of mitigating measures.

Response AOGA-44

The text in Section IV.B.10.a has been amended to emphasize that the analysis is based on a hypothetical scenario. Assumptions provide the foundation for the EIS; therefore, all of the conclusions are based on analyses that are based on a hypothetical scenario. This need not be reiterated for every conclusion. (See also Response AOGA-7.) In addition, it should be noted that some State and Federal laws such as the OCS Lands Act and the CZMA--as well as State policies, such as the Habitat Policy--have provisions stating that a decision made in the National interest prevails over laws and policies that protect subsistence activities. Although such laws may require that certain procedures be followed (e.g., public notice, public hearings), the Secretary of the Interior has the authority to make decisions on actions that are in the best interest of the Nation.

Response AOGA-45

Information in the Section IV.B.13 summary is based on a more detailed analysis in the text. As noted by the commenter, subsistence usage is assured under the Alaska Coastal Management Program. The analysis in Section IV.B.10 indicates that effects on subsistence are expected to be MAJOR. This conclusion is particularly applicable to the City of Wainwright, which could be affected by effects on several subsistence resources. Mitigating measures undoubtedly would ameliorate some of the potential problems; however, the EIS cannot assume that this will occur. Activities considered to be in the National interest may be permitted in spite of the potential for adverse effects.

Conclusions regarding individual resources are derived from a thorough examination of potential effects. As a result, they provide an excellent basis for the analysis in Section IV.B.13; for example, Section IV.B.1 (Effects on Air

Quality) is the only logical and consistent basis for the assessment of air-quality policies in Section IV.B.13. Please note that the analysis in Section IV.B.1 has been modified (see Responses AOGA-27 and AOGA-28), and the text in Section IV.B.13 has been modified accordingly.

The conclusion for land use and coastal management is based on the definition provided in Table S-2 and includes elements of land use and land use policies. First, MAJOR effects can result if the activities assumed in the scenario would (1) displace existing or proposed land uses, for which no reasonable alternative is possible, or (2) be highly incompatible with existing or proposed land uses. Second, MAJOR effects can result if activities assumed in the scenario could lead to conflicts with four or more policies of local, State, or Federal coastal management programs or land use plans. Potential conflict with State standards is only a portion of the picture that leads to a conclusion of MAJOR. The NSB Land Management Regulations also have provisions that were identified as policies with which activities in the scenario could conflict. Two of these policies address subsistence, one addresses cultural concerns, and several relate to habitat changes and disturbance. In past actions, the NSB has established special conditions to ensure that the intent of the policies is met; that practice probably would continue, but mitigation--which is not specifically mandated--cannot be assumed to occur.

Finally, the hypothetical development would occur in an area where it would be highly incompatible with existing land use. This incompatibility is evident in the restrictions that the oil and gas industry has placed in the past on subsistence activities conducted in proximity to oil and gas facilities. Given the special importance of the Point Belcher area for bowhead whale hunting, the loss of that area for that purpose also is cause for the conclusion of MAJOR effects on land use and coastal management.

Response AOGA-46

The MMS does not see the connection between this comment and the DEIS pages referenced. Please see Responses AOGA-1 and NSB-63.

Response AOGA-47

The greatest effect on water quality analyzed in the EIS (Sec. IV.B.2) would be caused by the interaction of winter pack ice and oil spills. Neither the Gulf of Mexico nor the Pacific Ocean offshore of California have pack ice.

Response AOGA-48

The text in Section IV.K has been amended to address this concern.

Response AOGA-49

Oil spills could be linked to long-term effects if whales ingested oil or oil-contaminated prey and bioaccumulation of petroleum hydrocarbons occurred. This potential effect is discussed in the last paragraph of Section IV.B.7.a(1). As indicated by the commenter, noise effects would last throughout exploration and development and production. Studies have indicated that bowheads may avoid approaching within several kilometers or more of petroleum-industry noise sources, so although the area of habitat from which whales might be excluded would be larger--as indicated by the commenter--only a MINOR disturbance to the bowhead population is expected to occur.

Response AOGA-50

The text in Section IV.L has been amended to address this concern.

Response AOGA-51

The amount of recoverable resources estimated for Milne Point has been corrected in Appendix G (Project No. 8).

ARCO Alaska, Inc.
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James M. Posey
Manager
Issue Advocacy

May 4, 1987

Regional Director
Alaska OCS Region
Minerals Management Service
949 E. 36th Ave., Room 110
Anchorage, AK 99508-4302

ATTN: Laura Yoesting

RE: Draft Environmental Impact Statement
Chukchi Sea Sale 109

ARCO Alaska, Inc. has reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Chukchi Sea Sale 109 (May 1988) and would now like to take this opportunity to comment on this document.

ARCO supports Alternative I which would make available for leasing 29.5 million acres in May of 1988. The other alternatives outlined (II through VI) would either cancel, delay, or delete acreage from the proposed sale area; we believe those actions would not be in the best interest of the nation. Operations in adjacent sale areas have thus far proven that industry has the capability to operate in the climates of the northern most areas of the U.S. Outer Continental Shelf. We would like to applaud the Minerals Management Service for the objective approach that has been taken in the evaluation of the potential effects of industry operations in the Sale 109 area on the living resources of the region. The appraisals that were done are fundamentally sound and, in general, we are in agreement. The descriptions, discussions, and assessments of possible or probably effects on living resources from a variety of influences appear to be objective in most cases.

It is essential that the proposed Chukchi Sea Sale 109 proceed on schedule if the congressionally mandated energy objectives are to be achieved. The DEIS recognizes that economic, political, and social benefits will accrue from the availability of domestic offshore petroleum production. It also describes the impact of the cancellation of the sale as follows: "The cancellation of the proposed lease sale could reduce future OCS oil production, prolong the need for imported oil, and add to a national need to develop alternative energy sources." Additionally, a failure at this time

to evaluate the hydrocarbon potential of the Chukchi Sea would be a significant setback to the effort in evaluating this nation's remaining resource potential. A discovery here of commercial reserves could help to insure an uninterrupted energy supply for the nation at a future time when it may be most needed.

Finally, environmental conditions in the Sea will be demanding. However, industry has the proven ability to operate safely in the OCS in general, and in the Bering Sea and adjacent Beaufort Sea OCS areas in particular. All OCS activities are carefully regulated, both prior to and after a lease sale, by various federal and state agencies under several statutory and regulatory programs. Industry has the technology and equipment available now to safely explore the Chukchi Sea and is confident that it can do so without significant adverse environmental effects.

ARCO Alaska, Inc. has assisted in the Alaska Oil and Gas Association (AOGA) written submittal and strongly supports the AOGA position. If you would require further information or if you have any questions, please feel free to call me at 265-6123.

J. M. Posey

J. M. Posey

JMP/RO710:sm

Chevron U.S.A. Inc.
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Mail Address: P.O. Box 5050, San Ramon, CA 94583-0905

May 5, 1987

J.J. Anders
Manager, Alaska Division
Land Department, Western Region

OCS #109 DEIS

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

Attention: Ms. Laura Yoesting

Gentlemen:

Chevron U.S.A. Inc. appreciates the opportunity to make written comments (see attachment) on the OCS Sale #109 DEIS issued in March, 1987. Chevron believes that on the whole the Minerals Management Service has produced a balanced evaluation.

Chevron supports Alternative I as the most logical response to meeting the nation's energy requirements in the 21st century. The oil industry has proven that under present laws and regulations it can operate in the Arctic while helping preserve both its unique wildlife and culture of the native peoples.

No substantial scientific evidence has been offered in the DEIS to indicate it is in the national interest to adopt Alternatives II-VI. Vast amounts of oil reserves may be lost and our future balance of payments harmed by the elimination of those large potentially productive areas.

In our attached comments we disagree with the predicted magnitude and frequency of oil spills as predicted for the OCS Sale #109 area. We also urge that evidence for whale and caribou disruption due to exploration and development activity be reexamined in the light of experience and recent scientific studies.

Due to the long time span required for complete oil development and the vast area of the Chukchi Sea, the impact on the subsistence hunting culture of the Inupiat peoples will be negligible. The past cooperation of the oil industry with both the local and national government agencies on the North Slope is a matter of record and will continue. Chevron believes that this spirit will allow both the timely development of our nation's resources while preserving the splendor of the American Arctic for future generations. CHEV-1

Very truly yours,

JJ Anders /ZT

JJA/WEM:blp:pac
Attachments

CHEVRON U.S.A. INC.

COMMENTS
DEIS FOR CHUKCHI SEA OCS #109
MAY, 1987

(Attachment to Letter Dated May 5, 1987)

Page II-7, Support for Production Activities
The DEIS assumes that Pt. Belcher will be the primary site for onshore facilities and pipeline landfall. Due to the high cost inherent in a remote environment, the pipeline landfall may well have to be located at another location for reasons of economy. Given the size and geologic complexity of the proposed sale area, no one knows where the maximum production will be found. CHEV-2

Page II-9, Alternative II — No Sale
The loss of energy resources is assumed to be limited to only the 2.68 billion barrels calculated as the conditional-mean economically recoverable reserve. However, this estimate may be several times lower than the actual producible reserves. Therefore, the true loss to the nation's economic health and security may be much more serious if no sale is held. Because the scientific community has little direct knowledge of the Chukchi's subsurface, many of the assumptions that produced the 2.68 billion barrel figure may be incorrect and grossly underestimate the Chukchi's potential. CHEV-3

Chevron urges that Table II-6 also include a comparison of the amount of equivalent energy necessary to replace the loss of oil if the estimate of Chukchi oil reserves is several times too low. At the very least, Table II-6 should reflect the effect of losing the high-resource case of 4.88 billion barrels. CHEV-4

Page II-10, Alternative IV — Eastern Deferral Alternative
Chevron opposes the elimination of this large area along the eastern margin of the Chukchi Sea based solely on a fear that subsistence activities will be harmed. Exploration activities in the Arctic have not significantly affected subsistence hunting. Development activities can be mitigated to avoid major adverse effects on subsistence. Before large areas of the Chukchi Sea are closed to leasing, there should be actual evidence of harm in current areas of Arctic exploration and production. CHEV-5

Page II-11, Alternative V — Southern Deferral Alternative
Chevron also opposes the elimination of this portion of the proposed sale area. The same Chevron comments concerning Alternative IV apply to Alternative V. CHEV-6

Page II-11, Alternative VI — Coastal Deferral Alternative
Again, Chevron must strongly oppose this large removal of land from the sale area. Huge oil reserves may be lost by an action based on assumptions, not scientific evidence. The OCS Study, MMS 85-0019, Report No. 5851 on the effects of underwater noise from the petroleum industry activities on Humpback Whale behavior conclude that: "No clear evidence of whale avoidance of the area near the active sound source was obtained." Chevron urges that this and similar scientific studies be included as references in the FEIS. CHEV-7

Page II-10 and 11, Sections D.2, E.2, and F

No evidence is offered as to why the oil reserves do not decrease if the area in Alternative IV is removed from OCS Sale #109. The same observation is made for Alternative V. At this point there is very little reason to automatically write off oil reserves in these vast areas (approximately 6300 square miles) as nonexistent. This DEIS assumes that only 440 million barrels of oil would be lost if Alternative VI was adopted. Since the area is 29.1% of the proposed sale, a more reasonable estimate would be 780 million barrels. In either case no scientific justification is offered for these conclusions. CHEV-8

Page II-22, ITL No. 3
It should be noted that putting a drillship on operational standby while waiting for a whale to leave the "vicinity" is extremely expensive. This would increase the time spent drilling and reduce the value of attractiveness of the Chukchi leases. This ITL seems to ignore evidence that drill-rig noise has little or no influence on the "continued existence of these species." At a minimum the term "vicinity" should be legally defined. Decisions to shutdown operations should be based on sound judgment following well defined guidelines derived from scientific studies. CHEV-9

Page II-23, ITL No. 4
If danger to whales exists from noise then critical distances and amount of noise should be defined from scientific studies. The same comments also apply to the ITL No. 3 as they affect noise resulting from drilling operations. CHEV-10

Page III-42, Community Subsistence - Harvest Patterns
The DEIS states: "The caribou-hunting areas of Barrow, Wainwright, Atkasook, and Nuiqsut would be most directly affected by pipelines and other onshore facilities associated with the proposal." Included in this section should also be the observation that the population of the Central Arctic herd has been unaffected by the facilities associated with TAPS. The only limiting factor to subsistence hunting for caribou would be restrictions on firing firearms within the immediate vicinity of the facilities. The subsistence effect on the caribou harvest may be NEGLIGIBLE. CHEV-11

Page III-44, Bowhead Whales
This section points out the importance of the Bowhead to the Barrow, Wainwright, and Pt. Hope communities. However, it should also be part of the record that the effect of OCS exploratory activity in 1986 on subsistence Bowhead Whale hunting in the Beaufort Sea by the Kaktovik and Nuiqsut villages was negligible. In spite of marine seismic and exploratory drilling being carried out during the annual hunt, the 1986 whaling season was highly successful. CHEV-12

Page IV-A-3, Probability of Oil-Spill Occurrence
Based on probabilities calculated from "Poisson's statistical distributions governing the occurrences of rare, random events," Table IV-3 was constructed. This EIS therefore estimates that there will be one oil spill in excess of 1,000 barrels for every one billion barrels produced. In addition, on page IV-A-5 the DEIS flatly CHEV-13

Chevron's Comments on DEIS for Chukchi Sea OCS #109
May, 1987

states that there is a 99.5 percent chance that this event will occur. Chevron urges that a cautionary note be added that this may be a very artificial set of statistics (even though this analysis may have been used in previous EIS's).

Page IV-B-6, CONCLUSION (Effect on Air Quality)
The conclusion that development will have a MODERATE effect on air quality is difficult to understand. Because the predominant wind direction is onshore to offshore (IV-B-4) and most facilities are located offshore, the impact on onshore air quality will be MINIMAL. CHEV-14

Page IV-B-14, Cumulative Effects of Oil Spills
Chevron objects to the conclusion that activities associated with leasing in the OCS #109 area will result in MODERATE impact on water quality. The DEIS assumes that there will be frequent (seven) spills of 1,000 barrels or greater during the lifetime of production in the Chukchi Sea. Even if that number of spills occurred, the area affected over a 30-year period would be so tiny that the real effect on water quality should be restated as MINOR. CHEV-15

Page IV-B-82, OVERALL CONCLUSION
Based on the lack of scientific evidence and the contents of this DEIS, Chevron suggests that the effect of OCS Sale #109 on the Bowhead and Gray Whales be changed from MODERATE to MINOR. CHEV-16

Page IV-B-88, Cumulative Effects of Disturbance
Chevron fails to see how possible activities at Prudhoe, ANWR or in Canada have anything to do with the Western Arctic caribou herd near OCS Sale #109. Because herds are separate, we suggest the cumulative impact due to OCS Sale #109 be changed from MODERATE to MINIMAL. CHEV-17

Page IV-L-1, Irreversible and Irretrievable Commitment of Resources
With proper safeguards under Federal regulations, there is no reason that the Inupiat culture will be threatened by OCS Sale #109. Bowhead hunting has not been significantly disturbed along the Beaufort Sea even though activities similar to that proposed for OCS Sale #109 are currently taking place. Cooperation between the oil industry and the Inupiat people in the Beaufort Sea area is close and continuing and is helping preserve the Inupiat culture. CHEV-18

Response CHEVRON-1

According to the definition of NEGLIGIBLE used in Section IV.B.10 (Effects on Subsistence-Harvest Patterns), a NEGLIGIBLE effect is: "Subsistence resources could be affected but with no apparent effects on subsistence harvests" (Table S-1). The analysis conducted in this EIS has determined that MAJOR effects could occur as a result of proposed Sale 109. A MAJOR effect is determined when: "One or more important subsistence resources would become locally unavailable for a period of time exceeding one year." A MAJOR overall effect on subsistence harvests is expected because of effects on the bowhead whale harvest in Wainwright. If noise and traffic disturbance occurred during the whale hunt and caused zero bowheads to be harvested for 2 consecutive years, it would cause a MAJOR effect. A MAJOR effect on the bowhead whale harvest can occur more easily than on other subsistence harvests primarily because the bowhead harvest is so low--one to three whales are taken annually in most communities, except Barrow. However, such an effect is only expected in Wainwright due to noise and traffic disturbance during construction of the pipeline and the onshore facilities at Point Belcher.

Response CHEVRON-2

See Response AOGA-7.

Response CHEVRON-3

The amount of oil assumed is based on the best information available at this time and forms the basis for all analyses in the EIS. See also Response AOGA-10.

Response CHEVRON-4

The analyses of both positive and negative effects in the EIS concentrate on the more likely mean case. Summary tables in the EIS, such as Table S-2 (the effects summary) or Table II-6 reflect only the mean case. The MMS believes that greater emphasis on both the high and low cases for positive and negative effects would cause unnecessary complexity in the EIS and detract from its usefulness as a decisionmaking document.

Response CHEVRON-5

It is correct that, to date, there have been insignificant effects on subsistence harvests as a result of exploration activities in the Beaufort Sea. In addition, the oil companies and whalers should be commended for their cooperative spirit that resulted in the Oil/Whalers Cooperative Agreement in 1986. Section 10.B.10.b(1) has been amended to include a discussion about the cooperative agreement. This agreement successfully mitigated problems and aided in a very successful 1986 bowhead whaling season in Kaktovik and Nuiqsut. However, the EIS analysis cannot assume that such agreements or mitigation will be placed on the lessees.

Response CHEVRON-6

See Response CHEVRON-5.

Response CHEVRON-7

The MMS believes that pertinent references to scientific studies, including the study cited by the commenter, have been included in the FEIS.

Response CHEVRON-8

See Responses AOGA-10, -11, and -12.

Response CHEVRON-9

It is not anticipated that drilling would be suspended each time a whale appears in the vicinity of a drilling operation. Rather, activities would be suspended only in the case where endangered whales are present and near enough to be subject to probable oil-spill risks or noise disturbance that would be likely to result in a threat of serious, irreparable, or immediate harm to these species. Should the lessee so desire, he can request a permit from the NMFS for the incidental take of endangered whales resulting from an OCS activity. The NMFS would evaluate the incidental-take permit request to ensure that the requested incidental takes would have a negligible effect on the endangered-species population. Negligible effect is defined as ". . . an impact that cannot reasonably be expected to, and is not reasonably likely to, adversely affect the overall population through effects on annual rates of recruitment or survival." An example of a negligible effect might be minor course changes for a low number of whales. The term "vicinity" would be defined at a later date during discussions between the NMFS and the MMS and might vary depending upon the type of activity, season, and locality.

Response CHEVRON-10

Prior to Sale 109, the MMS intends to issue a Notice to Lessees (NTL) similar to NTL No. 86-2 for the Beaufort Sea, specifying performance standards for preliminary activities in the Chukchi Sea. This NTL will specify--based on results from scientific studies--the specific distances to maintain from endangered whales, which should result in avoidance of taking endangered whales. Noise from drilling operations--except perhaps for support vessels--generally is not thought to be as great a problem as, for example, noise from seismic operations. Consequently, it probably would be a rather unusual circumstance for drilling operations to be shut down due to noise disturbance. The RSFO would evaluate situations on a case-by-case basis prior to determining when operations would need to be suspended.

Response CHEVRON-11

Section III of the EIS describes--but does not analyze--the environment. The analysis of effects on the caribou-subsistence harvest is found in Section IV.B.10.b(3). Section IV.B.8.a (Effects on Caribou) contains more detailed information on the effects of the pipeline, noise and traffic disturbance, and other onshore facilities on caribou. Noise- and traffic-disturbance effects on caribou are most likely to occur as a result of construction of the projected pipeline and the traffic along the support road. Disturbances are likely to be short-term delays of caribou movements across the pipeline corridor that could temporarily disrupt the caribou and the harvest, with possible short-term reductions of the season's harvest; but the caribou would not become locally unavailable, and effects on the subsistence-caribou harvest are expected to be only MINOR.

Response CHEVRON-12

See Response CHEVRON-5.

Response CHEVRON-13

The commenter is in error; the EIS projects a most likely number of seven spills--not one--for the proposal, as shown in Figure IV-3. Table IV-3 presents spill-rate constants, not numbers of spills. These spill-rate constants are calculated from historical rates of oil spillage, corrected for statistically demonstrated trends. These constants are not calculated from the probability estimates but rather are used to calculate the probabilities using the Poisson distribution. Further explanation of this calculation is provided in Section IV.A.1.b through incorporation by reference. The probability of 99.5 percent cited by the commenter is the probability that at least one spill of 1,000 barrels or greater would occur when seven such spills are expected. A discussion of the validity of such probability estimates is included in Section IV.A.1.b and in the incorporations by reference therein.

Response CHEVRON-14

This concern is addressed in Responses AOGA-27 and AOGA-28.

Response CHEVRON-15

The conclusion of a MODERATE effect of oil spills on water quality is based on the analysis that the most likely number of seven spills of 1,000 barrels or greater in the Chukchi Sea would result in short-term regional degradation of water quality, which is the definition of a MODERATE effect on water quality (see Table S-1). Why such spills in the Chukchi Sea could be regional in scale is discussed in Section IV.B.2.a.

Response CHEVRON-16

The conclusion of MODERATE for bowhead and gray whales (Sec. IV.B.7, Cumulative Effects) pertains to the cumulative case, which includes expected effects from all anticipated activities--including Sale 109--within the range of these species north of Unimak Pass. The effect of the Sale 109 proposal alone on bowhead and gray whales is expected to be MINOR.

Response CHEVRON-17

See Response AOGA-37.

Response CHEVRON-18

See Response CHEVRON-5.

B. D. Tilley
Manager of Exploration
Northern Divisions
North American Exploration

Conoco Inc.
P.O. Box 2197
Houston, TX 77252

April 30, 1987

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

Attention: Ms. Laura Yoesting

Gentlemen:

DRAFT ENVIRONMENTAL IMPACT STATEMENT
PROPOSED OIL AND GAS LEASE SALE 109
CHUKCHI SEA

Conoco appreciates this opportunity to comment on the above captioned Draft Environmental Impact Statement (EIS). We support the proposal for oil and gas leasing premised under the EIS and believe that only Alternative I meets the criteria which we hope to see used for the Chukchi Sea.

Industry has shown again and again its ability to operate in hostile areas in an environmentally safe manner. We believe that there is reason to believe that the Chukchi Sea could hold important reserves of oil for the national petroleum inventory. Early exploration of this area is in the best interests of the nation and of the depressed oil industry.

Should you desire further information about our general support of Alternative I, please contact Mr. Raymond L. LaGarde at (713) 293-2291.

Very truly yours,

B. D. Tilley

B. D. Tilley

dw43400docpm

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R.A. Straub
Vice President
External Affairs

STANDARD
ALASKA PRODUCTION

May 1, 1987
7322U

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

Re: Chukchi Sea Sale 109
Draft Environmental Impact Statement (DEIS)

Dear Mr. Powers,

Standard Alaska Production Company (SAPC) is pleased to offer these comments on the Chukchi Sea Sale 109 DEIS. We support this important lease sale and Alternative I. The excellent environmental record of the industry in the Arctic along with the regulatory safequards discussed in the DEIS clearly indicate that large area deferrals (Alternatives IV, V, VI) are not warranted for additional environmental protection.

SAPC is particularly pleased to note that seasonal drilling stipulations are not proposed for Sale 109 recognizing (as discussed in the Notice to Lessees) that the existing regulatory authorities and framework are adequate to protect endangered whales. This is clearly preferable to an inflexible stipulation requiring automatic cessation of exploration drilling. We have attached some specific comments on the Information to Lessees and marine mammal sections.

Should you have any questions please contact Mr. Steve Taylor, Manager, Environmental and Regulatory Affairs at (907) 564-4037.

Sincerely,

R. A. Straub
V.P. External Affairs

RAS:PTH:dld

SPECIFIC COMMENTS

Information to Lessees

ITL No. 1:

This ITL is a useful summary of the major wildlife protection laws relevant to offshore exploration. We believe that it is a positive step that MMS has not imposed a seasonal drilling restriction with regard to bowheads and other endangered whale species, but has instead put the onus on the oil industry to obey the relevant laws, along with other wildlife protection laws.

ITL No. 2:

This ITL is a useful identification of areas that require special attention because of their biological importance. This is adequate notice to ensure that operational and oil spill plans recognize the particular importance of the areas identified.

ITL No. 3 and 4:

We understand that the mere presence of some individuals belonging to an endangered whale species near a drilling operation will not be cause for suspending operations. Operations would be suspended only under circumstances where large numbers of whales might be affected.

ITL No. 7:

With the development of the Oil/Whalers Working Group in 1986, a precedent was set for establishing working procedures to allow both whaling and oil industry operations to take place with minimal interference. ITL No. 7 recognizes the ability of whalers and the oil industry to negotiate a mutually satisfactory arrangement between themselves.

SPECIFIC COMMENTS

Environmental Consequences - Marine Mammals

p. IV-B-51, ¶ 1

Given the small area of sea bottom that could be affected by an oil spill and the currents that would transport and dilute contaminated water, indirect effects of an oilspill would be NEGLIGIBLE. **SAPC-1**

p. IV-B-52, ¶ 2

It is not likely that the effects described would produce a detectable impact. Thus the effects would be NEGLIGIBLE. **SAPC-2**

p. IV-B-52, ¶ 2

The death of a few highly stressed walrus would not likely produce a detectable impact. Thus, the effects would be NEGLIGIBLE. **SAPC-3**

p. IV-B-57, ¶ 2

Overflights are not likely to produce detectable effects, and thus the impact would be NEGLIGIBLE. **SAPC-4**

p. IV-B-58, ¶ 1

There is not evidence that marine seismic has had more than a very temporary (hours) effect on marine mammals. Any effects would clearly be NEGLIGIBLE. **SAPC-5**

p. IV-B-58, ¶ 4

Any sounds emanating from a buried pipeline would be constant, and in that sense similar to other stationary operations, such as drilling. The likely effects would be no more than NEGLIGIBLE. **SAPC-6**

p. IV-B-59

The overall effects on marine mammals are not likely to be more than NEGLIGIBLE. **SAPC-7**

p. IV-B-60, ¶ 2

It is likely that both ringed and spotted seals will habituate to marine activities and that the local effects will be no more than NEGLIGIBLE. **SAPC-8**

p. IV-B-61, ¶ 1

None of the likely impacts on marine mammals should be anticipated to produce effects that exceed NEGLIGIBLE. **SAPC-9**

p. IV-B-62, ¶ 1

Ice breaker activity would no likely cause more than local changes in distribution for very brief periods. Any effects would not exceed NEGLIGIBLE. **SAPC-10**

p. IV-B-64, ¶ 2, 3

The level activity described is not likely to produce detectable effects on any of the populations of marine mammals in the area. The effects should be NEGLIGIBLE. **SAPC-11**

p. IV-B-65, ¶ 3

Overall effects are not likely to be detectable, and thus would be NEGLIGIBLE. **SAPC-12**

p. IV-B-73, ¶ 6

Cumulative effects as described would not result in more than MINOR impact. **SAPC-13**

p. IV-B-76, ¶ 1

An oil spill would affect such a small are and currents would remove and dilute the spill so that the effects would not likely exceed NEGLIGIBLE. **SAPC-14**

p. IV-B-78, ¶ 1

Particularly given the tolerance that gray whales have shown to human activities off the West Coast of North America (including feeding areas off Vancouver Island), OCS activities in the Sale 109 area are not likely to cause whales to leave an important area. Effects are not likely to exceed NEGLIGIBLE. **SAPC-15**

p. IV-B-79, ¶ 2, 3

Although the total level of activity may seem large, the area involved is large as well. The cumulative effects would not exceed MINOR.

SAPC-16

Response SAPC-1

Brief, less than one-season changes in the local availability of any prey species of ringed seal are discussed in Section IV.B.6.a(2) (Indirect Effects of Oil) and represent a MINOR effect. (See Table S-2, Definitions of Effect Levels on Biological Resources.)

Response SAPC-2

Adverse effects on the physiology of groups of ringed seals, walruses, or other marine mammals due to contact with oil and contributing to the death of some individuals, and/or causing brief displacement (for one season or less) of these animals from contaminated habitats, represent a MINOR effect. (See Table S-2, definition of MINOR effect on biological resources.)

Response SAPC-3

Although the death of a few highly stressed walruses would not be likely to produce a statistically significant change in the abundance or reproductive rate of the Pacific walrus population, the effect of oil contact on a specific group of walruses is measurable; and the death of highly stressed individuals in this group due to oil-spill contact would represent a MINOR effect on walruses (see Table S-2).

Response SAPC-4

The death of a small number of walrus calves due to disturbance by aircraft and/or the brief displacement of hauled-out seals and walruses due to aircraft disturbance represent a MINOR--not a NEGLIGIBLE--effect because the detectability or measurability of a MINOR effect is a specific group of individual seals, walruses, etc. (not the entire population) being statistically affected, and because the duration of the effect is short--one generation or less.

Response SAPC-5

Very temporary disturbance/displacement effects (hours) on marine mammals due to marine seismic-boat activities represent a MINOR effect (see Table S-2).

Response SAPC-6

The analysis in Section IV.B.6.d does not consider sounds emanating from a buried pipeline to have any effect on marine mammals but does consider that pipelaying and trenching activities using boats and dredges could have temporary (one season or less) disturbance/displacement effects on some marine mammals within a few kilometers of the pipeline route and near the nine production platforms. Such an effect is expected to be MINOR (see Table S-2).

Response SAPC-7

This concern is addressed in Responses SAPC-1, -2, -3, -4, -5, and -6.

Response SAPC-8

Regardless of whether seals habituate to marine support activities, the disturbance and temporary displacement of some ringed and spotted seals near shorebase facilities and offshore platforms during construction activities for one season or less (less than one generation) represents a MINOR effect--not a NEGLIGIBLE effect. (See Table S-2, definition of MINOR effect on biological resources.)

Response SAPC-9

This concern is addressed in Response SAPC-8.

Response SAPC-10

Local changes in beluga whale, seal, or walrus distribution that last for brief periods of time (discussed in Sec. IV.B.6, Cumulative Effects) represent a MINOR--not a NEGLIGIBLE--effect. (See Table S-2, definitions of MINOR and NEGLIGIBLE effects on biological resources.)

Response SAPC-11

The assessment of MINOR effects on pinnipeds, polar bears, and beluga whales as a result of cumulative development projects in the Chukchi Sea, as discussed in Section IV.B.6 (Cumulative Effects) does not represent detectable effects on the abundance of any of the populations of marine mammals occurring in the proposed sale area. A MINOR effect includes brief effects (less than one generation) on the abundance and/or distribution of groups of individuals but no effect on the population of any marine mammal. In other words, MINOR effects are not population-level effects (see Table S-2).

Response SAPC-12

This concern is addressed in Response SAPC-11.

Response SAPC-13

The MMS expects the cumulative effects on bowhead whales to be MODERATE (see Sec. IV.B.7).

Response SAPC-14

The MMS believes that oil-spill effects on gray whales would be MINOR. In addition to the listed effects, oil-spill-cleanup operations could temporarily displace a low number of feeding gray whales.

Response SAPC-15

The MMS believes that, as a result of the lease sale and associated activities, gray whales might undergo temporarily localized changes in distribution that are defined in this EIS as a MINOR effect on the population.

Response SAPC-16

The MMS believes that cumulative effects in a number of OCS sale areas within the range of the gray whale could result in MODERATE effects on the species (see Table S-2).

Texaco

May 1, 1987

Comments On DEIS OCS Sale 109
Chukchi Sea - Alaska

Regional Director, Alaska OCS Region
Minerals Management Service
949 East 36th Ave, Room 110
Anchorage, Alaska 99508-4302
Attention: Ms. Laura Yoesting

Gentlemen:

Texaco is pleased to have this opportunity to submit comments on the DEIS for Chukchi Sea OCS Sale 109. Texaco supports Alternative I which proposes that the sale be held as scheduled in May 1988 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.

Alternative II (No Sale) is not acceptable to Texaco. Industry must prepare many years in advance for a sale of the magnitude of Sale 109 and its cancellation would cause a financial hardship on industry and would discourage the proper preparation for future sales.

Alternatives IV, V and VI are area deferrals ranging from 288 to 1630 blocks located near the coastline. Offshore petroleum exploration and marine harvesting operations have proven to be compatible in the past; however, even if there were a conflict, the areas designated for deferral are much larger than could be justified for the "protection" of the subsistence areas. An example of this is Alternative VI which defers 43% of the sale area. A deferral of this magnitude has a high probability of excluding prospective acreage and includes areas which are favorable for exploration because of shallow water depths and the longest exploratory season. 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 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,

J. N. [signature]

SRL:hs

Alaska Eskimo Whaling Commission
P.O. Box 570
Barrow, Alaska 99723
Phone: (907) 852-2392

April 29, 1987

Regional Director, Alaska OCS Program
Minerals Management Service
949 E. 36th Avenue Rm. 110
Anchorage, Alaska 99508-4302

REF: CHUKCHI SEA LEASE SALE 109

The Alaska Eskimo Whaling Commission has in place an cooperative agreement with the federal government to manage the subsistence bowhead hunt for the nine (9) member whaling villages. The AEWC is seeking to increase its quota allocations to sustain the nutritional needs of its people as well as ensuring our cultural and traditional existence.

We are in the midst of exploring through our local ministers what portion of foods are cared for by the church deacons for the families that unable to subsist for themselves. We Eskimo's are struggling for existence in the midst of industrial activity while the Federal Government gets wealthier. While the Eskimo's struggle physically for subsistence and trying to offset the the cost of doing so by laboring from dwindling jobs, we allocate just enough to sustain our comfort such as payment for the rent and heat, no indication of concern are demonstrated by the Federal Government.

The Eskimo's have unwritten laws that we live by to conserve the animals that we depend on for our livelihood, and we are concerned with the animals habitat, and the food chain that is a part of the ecosystem and also for their overall health.

In taking a review of the statements given in the previous sentences, it is a grave concern for us and we ask that you address the situation and take positive steps to relieve AEWC of the burden, and do not hold any further sales in the waters of the bowhead whale an endangered species, any infringeement of the habitat waters of the bowhead defeats the purpose of the AEWC in its responsible management.
(1) any alterations of bowheads from their migration patterns will interupt their reproductive process.
(2) offshore activities will diminish the endangered bowheads calves and impact its growth and productivity and effect pregnant bowhead cows.
(3) oil spills in the habitat of the whale will contaminate the food source and would mean eventual starvation for newborn calves and malnutrition for young whales.
(4) infringement of a subsistence resource by altering the normal migration may have disastorious effects to the native communities who are members of AEWC.
(5) with the whale being listed on the endangered species list, the mortality rate may increase due to the increasing activities of oil and gas developement and thus creating even another burden for the AEWC to bear. **AEWC-1**

When the United States represents the AEWC at the next IWC, the U.S. will try to secure us a new quota for us to secure our nutritional and cultural needs for the villages. The AEWC remains strongly opposed in any offshore leasing such as the lease sale 109 in the Chukchi Sea, we feel that any industrial activity will impact the health and productivity of the bowhead. The United States must take its trust responsibilities for the Eskimo's and not take any further steps to lease in the Chukchi Sea.

The industrial activities in ther Beaufort Sea must cease before activity can commence in the migration corridors of the Chukchi Sea.

The Alaska Eskimo Whaling Commission thanks you for the opportunity to comment on this important issue.

Sincerely,

Thomas Napageak
Thomas Napageak
VICE-CHAIRMAN, AEWC

Response AEWC-1

The MMS has an obligation under the Endangered Species Act of 1973, as amended, and the Marine Mammal Protection Act to ensure that activities undertaken or authorized by the agency are not likely to jeopardize the continued existence of the bowhead whale. In fact, if bowheads display more than negligible adverse effects as a result of OCS activities, those activities will be suspended. Consequently, the MMS believes that petroleum exploration on the OCS can proceed carefully without harming the bowhead whale population. In regard to the specific points raised by the commenter, the MMS provides the following responses:

1. To our knowledge, it has not been shown scientifically that any alterations of bowheads from their migration patterns will interrupt their reproductive process. To date, despite the presence of OCS exploratory activities, bowhead whales have not significantly changed their migration paths (Ljungblad et al., 1986).

2. The NMFS, in consultation with the MMS, has determined that OCS activities associated with leasing and exploration would not jeopardize the bowhead whale population.

3. Studies have shown that an oil spill would have little effect on bowhead food sources (Fishman, Caldwell, and Vogel, 1985).

4. The MMS agrees that proposed Sale 109 could have effects on the subsistence resources harvested by the Inupiat in the sale area. The EIS analysis determined that MAJOR effects are expected on subsistence harvests in Wainwright and Nuiqsut. MODERATE effects are expected to occur on bowhead harvests in Point Hope; on beluga harvests in Wainwright and Point Lay; on fish harvests in Atqasuk and Barrow; and on walrus harvests in Barrow, Atqasuk, Wainwright, and Point Lay. The overall effect on subsistence harvests in the proposed sale area is expected to be MAJOR.

5. Because the bowhead whale is listed as an endangered species, it is the responsibility of the MMS, in consultation with the NMFS, to ensure that there is no likelihood of jeopardy to this species--which includes no reduction in the likelihood of survival and recovery of the species. Consequently, the MMS will not authorize any activity that it believes would increase the mortality rate of the species.

Natural Resources Defense Council

122 East 42nd Street
New York, New York 10168
212 949-0049

COMMENTS OF THE
NATURAL RESOURCES DEFENSE COUNCIL
AND
TRUSTEES FOR ALASKA
ON THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
OCS LEASE SALE NO. 109
CHUKCHI SEA, ALASKA

May 4, 1987

Prepared by:

Lisa Speer
Senior Project Scientist
Natural Resources
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The Natural Resources Defense Council, Inc. and Trustees for Alaska, (hereafter, "NRDC"), submit the following comments on the Department of the Interior's Draft Environmental Impact Statement (DEIS) for Outer Continental Shelf (OCS) Lease Sale 109 tentatively scheduled for May of 1988 in the Chukchi Sea of Alaska. NRDC and Trustees have had a long standing interest in OCS leasing activities in Alaska, and we welcome the opportunity to comment on the DEIS. Our major comments are:

1) The lease sale process for Sale 109 should be delayed for at least five years to allow time to fill data gaps identified by the Minerals Management Service (MMS), the North Slope Borough (NSB), the State of Alaska, and the National Marine Fisheries Service (NMFS).

2) If and when the Sale process proceeds, serious flaws in the DEIS must be corrected. These include:

a. the practice of averaging impacts over space and time;

b. failure to include state lease sales in the cumulative impact analysis; and

c. deficiencies in the oil spill risk analysis.

3) The Coastal Deferral Alternative should be expanded and adopted as the preferred alternative.

4) Strict mitigating measures, including seasonal restrictions on oil operations, should be adopted for this lease sale.

A. Sale 109 Should Be Delayed for 5 years.

The Chukchi Sea supports tremendous array of coastal and marine wildlife. Several million birds representing 150 species occur in and adjacent to the Sale area. DEIS at III-27. Included among these are the major portion of the world's population of Ross' gulls and huge colonies of sea birds. Id. Roughly half of the world population of walrus-- including nearly all of the females with dependent young -- summer in the Chukchi Sea. Id. at III-32. The entire western arctic stock of the endangered bowhead whale is believed to pass through the Sale 109 area during spring and fall migrations. Id. at III-35. Many of these species are important subsistence resources for the people whyo live along the coast. Id. at III-42.

The bird and mammal species that inhabit the Chukchi region are extremely vulnerable to impacts resulting from oil development activities. For example, the Department projects 6-7 major oil spills to occur as the result of leasing in the Chukchi Sea (DEIS at Table IV-4). Over 90% of the 500,000 seabirds that nest at Capes Thompson, Lisburne and Lewis have been rated high in vulnerability and sensitivity to oil spills. Id. at III-28. Should one of these spills occur in a lead from which bowhead whales could not escape, death of these highly endangered animals could occur. DEIS at IV-B-66. Disturbance of endangered whales, bird nesting colonies, denning polar bears, and walrus by aircraft, boats and other human activities is also of very serious concern. Id. at IV-B-41, 54-58.

The extreme climate and oceanographic regime of the Chukchi Sea create serious hazards to offshore oil development. Rapidly moving sea ice poses threats to drill ships, production platforms, pipelines (from gouging the ocean floor), tankers, marine terminals, and offshore storage and loading terminals. DEIS at IV-A-24. Fog, darkness, and extreme weather conditions all enhance the possibility of an oil spill and severely restrict the ability of containment and cleanup crews to work effectively.

The extraordinary biological resources of the Chukchi, their vulnerability to impacts related to oil development, and the hazards posed to oil operations by the extreme environmental conditions in the Chuckchi Sea argue compellingly for caution in subjecting this area to oil exploration and development activities. NRDC believes that all further preparation for Sale 109 should be halted for at least five years so that information essential to an informed choice regarding whether or not and how to proceed with oil activities in this very sensitive area can be developed. Critical data gaps which must be filled and incorporated into the environmental analysis before further steps in the leasing process are taken include the following.

1. Sea ice.

NRDC-1

The Department cites the experience of the oil industry in the Beaufort Sea as evidence that operations can be conducted safely under heavy sea ice conditions. However, because the current velocities in the Chukchi are substantially greater than those of the Beaufort, technologies for coping with sea ice in the Beaufort may not be workable in the Chukchi. For example, in the Beaufort Sea, nearshore currents range from 2 - 15 centimeters/second (cm/s), with locally strong currents reaching up to 100 cm/s. Sale 97 DEIS at III-4. In contrast, current speeds of 20-30 cm/s are characteristic of the Eastern Chuckchi Sea, and velocities of up to 200 cm/s have been reported. Sale 109 DEIS at III-8. Thus, current velocities in the Chukchi are 2 to 10 times greater than those in the Beaufort. The DEIS presents no evidence that drilling, production and transportation technology developed for the sea ice and current velocities of the Beaufort Sea will be able to function safely in the Chukchi Sea.

The Natural Marine Fisheries Service has recommended that leasing beyond the shore-fast ice zone be subject to the demonstration of safe operational capabilities. We concur with this recommendation, and urge the Department to investigate means of demonstrating that offshore operations can be conducted safely under the conditions that exist in the Chukchi Sea.

2. The use of the Sale 109 area by bowhead whales.

NRDC-2

The precise location of the fall bowhead migration is not known. DEIS at I-18-19. Given the fact that this species is one of the most endangered of the endangered whales (there are only ome 4,000 individuals remaining in the western arctic stock), the fact the entire population uses the area, and the fact that

impacts on bowheads are potentially very severe, (DEIS at IV-B-65-72), more information about their fall migration patterns is necessary to draft appropriate alternatives and mitigating measures.

3. Marine mammal seasonal habitat use and requirements.

NRDC-3

The National Marine Fisheries Service and the North Slope Borough have recommended that further studies be conducted to define marine mammal seasonal habitat use and requirements as well as the overall effects of oil and gas activities on marine mammals and their habitats. DEIS at I-8. We concur that more information is necessary in both areas to allow a reasoned choice among alternatives and mitigating measures.

4. Oil estimates for state sales.

NRDC-4

Although three lease sales are planned by the State of Alaska for state waters of the Chukchi Sea, the Department has not included oil from these sales in the cumulative oil spill risk analysis because MMS claims the State has not provided oil resource information. This information is essential to gauge the cumulative impacts of oil development on the Chuckchi Sea environment, and must be collected prior to allow the Department to make a reasoned and informed decision about proceeding with lease Sale 109.

5. Completion of the MMS studies.

MMS identifies 43 studies that are or may be conducted during a 2 year delay of the sale. DEIS at Table 14-16. While we recognize that studies can be carried on ad infinitum, many of the studies listed by MMS involve issues critical to an informed choice regarding alternatives and mitigating measures, such as buoy research, coastline and surf-zone oil spill smear modeling, and the probable effects of oil and gas exploration and development of major haulout concentrations of Bering Sea pinnipeds.

These and other significant gaps in information and data lead NRDC to conclude that there is insufficient information available to 1) adequately assess the impacts of OCS leasing the Chukchi Sea environment; 2) make a reasoned choice among alternatives; 3) develop adequate mitigating measures to protect vulnerable resources, and 4) properly balance the environmental risks versus the benefits to be accrued from leasing specific tracts. We believe it is incumbent upon MMS to delay the lease sale process for a minimum of 5 years to allow it to collect information to fill the critical information gaps and include the information in a revised DEIS.

NRDC-5

B. The Analysis of Impacts is Flawed

The National Environmental Policy Act (NEPA) requires that environmental impact statements evaluate direct and indirect effects of the proposed action on the environment. This

assessment is to be used choosing among alternative actions and in the development and selection of appropriate mitigating measures (40 CFR, Sections 1502.14 and 1502.16). The impact analysis in the Sale 92 DEIS contains a number of serious deficiencies in addition to the date gaps identified above which render its assumptions incomplete and its conclusions of doubtful validity. These deficiencies are outlined below.

1. Averaging Impacts

The intent of the alternatives presented in the DEIS is to provide leasing options that offer better protection to important biological resources. For example, "(t)he Southern Deferral Alternative was developed to protect the Cape Lisburne area, which is important to the residents of Point Hope for the subsistence harvest of bowhead whales; ringed, spotted and bearded seals; polar bears; walruses;...." DEIS at I-17. As another example, the Coastal Deferral Alternative was developed "to protect important coastal habitats such as the Peard Bay area, Kaseglaluk Lagoon and the barrier island system, the Cape Lisburne bird rookery and the Kuk River estuary. Id. Yet the DEIS indicates identical impacts for all alternatives. (See e.g., id. at Table S-1).

NRDC-6

The fact that all alternatives entail the same impacts clearly indicates that the Department has failed to give adequate weight to the benefits of deferring sensitive areas from leasing.

This results in part from the practice of averaging impacts over a wide area. For example, under the Coastal Deferral Alternative, the probability of an oil spill occurring and contacting subsistence harvest areas in Wainwright would be significantly reduced over that of the Proposed Action, but the DEIS concludes that "the changes would not be significant enough to change the overall affects from oil spills in the sale area." DEIS at IV-M-8. MMS must develop an impacts assessment scheme that more accurately reflects the benefits of deferring areas so that a reasoned choice among alternatives can be made. To do this, MMS must drop its practice of averaging impacts. See comment 3 (f) below.

2. The Cumulative Impacts analysis is inadequate.

Cumulative effects are those that result from the incremental impact of a proposed action when added to other past, present and reasonably foreseeable future actions (40 C.F.R. Section 1508.7). as noted above, although 3 lease sales are planned by the State of Alaska for State waters of the Chukchi Sea, the Department has not included oil from these sales in the cumulative risk analysis because the State has not provided MMS with oil resource information. We recommend that MMS develop its own projection of oil resources for the State sales so that a reasonable assessment of cumulative impacts may be performed. This is important because even without the any lease sales in State waters factored in, 7.5 spills of 1,000 barrels or more are projected to occur as a result of offshore leasing in the arctic. DEIS at Table IV-4. **NRDC-7**

3. The Oil Spill Risk Analysis (OSRA)

The OSRA forms the basis for much of the impact assessment contained in the DEIS. However, due to the problems outlined below, the OSRA contained in the Sale 109 DEIS seriously underestimates the potential oil spill impacts of the sale.

a. Launch points J-9 and J-38 appear to be the closest launch points to shore, but it is difficult to tell exactly how far from shore they are. Launch points closer in should be included to represent a worst case situation. The feasibility of doing this is demonstrated by the location of launch point No. 24, outside the sale area, which appears to be directly on the shoreline. **NRDC-8**

b. The claim that spills of less than 1,000 barrels are not of major concern (DEIS at IV-A-4) is totally without basis. The environmental effect of a spill is not solely dependent on its size, but also the characteristics of the oil and the sensitivity of the resources affected. This section should be re-written to include a discussion of the cumulative impacts of frequent small spills. This is particularly important given that the volume of oil projected to be introduced into the Chukchi Sea via small spills (3,140 barrels), is the equivalent of 3 major oil spills of 1,000 barrels. Id. at IV-A-5. **NRDC-9**

c. We note that the most likely number of spills for Alternative VI is closer to 6, not 5, if Table IV-4 is correct. Page IV-A-5 should be changed to reflect this. **NRDC-10**

d. Given that offshore oil spill recovery in the Gulf of Mexico averages only 5-10% recovery of spilled oil (DEIS at IV-A-16-17), the idea that cleanup operations in the Chukchi "could be a mitigating factor" (DEIS at IV-A-8) is not credible. **NRDC-11**

e. Since winter spills are really summer spills in terms of effects (DEIS at IV-A-7), the conclusion that summer spills are more "relevant" to Chukchi Sea shorelines (id. at IV-A-10) is not correct. Shoreline contact of winter spills that hit shore when the ice melts should be incorporated in the discussion of probabilities on page IV-A-10-11 and shoreline oiling on pages IV-A-11-12. **NRDC-12**

f. It appears from a reviewing of the OSRA that the trajectory-target analysis is not sensitive to the fact that spills occurring during different seasons will have different effects. It appears as if trajectory results and probabilities were averaged, as they do not identify vulnerable locations during peak use periods. They also average out the importance of seasonal weather conditions that could result in especially critical oil spill transport patterns. This practice of averaging probabilities, trajectories, and weather conditions leads to a very serious underestimation of impacts and must be abandoned. **NRDC-13**

g. Another major problem with the OSRA is that the size of the area assumed to be affected by a major spill is seriously understated. The DEIS assumes the maximum area that could be covered by a spill is 500 km^2. DEIS at Table IV-5. In fact, a much larger portion of the sale area could be affected. The underestimation of spill size means that the entire impact analysis is flawed; in fact far more resources would be affected.

An analysis of actual offshore oil spills shows that they affect much larger areas. For example, the Bravo spill of approximately 70,000 barrels, somewhat smaller than the hypothetical worst-case 100,000 barrel spill considered by the DEIS, spread to cover approximately 4,000 km^2 (Audunson 1977; Teal and Howarth 1984). A slightly larger spill, the Argo Merchant (163,000 barrels), affected an area greater than 20,000 km^2 (Gross and Mattson 1977; Howarth 1985). The area covered and therefore the potential effects from oil spills are much less localized than the DEIS concludes.

h. The same comment applies to the Department's conclusion that only 30-90 kilometers of shoreline may be oiled as a result of a spill. After the Amoco Cadiz spill, over 300 km of coastline were affected by the oil. **NRDC-14**

i. Is the distribution of oil in the Sale area factored into the oil spill risk analysis? We recommend that more launch points be concentrated in those areas where MMS believes the oil is, and not spread randomly over the sale area. This will allow **NRDC-15** a more accurate comparison of the spill risks associated with each alternative to be made.

k. In developing the combined probabilities of oil contacting particular points, does MMS calculate and factor in the amount of oil expected to underlie each launch point? In other words, does MMS calculate the probability of a spill occurring from a particular point based on the amount of oil thought to underlie that point, and then factor it into the combined probabilities? **NRDC-16**

l. Please identify the conditional and combined risk to each target from each launch point and state how MMS calculated those risks. **NRDC-17**

C. The Deferral Alternatives

The Coastal Deferral Alternative should be adopted as the preferred alternative after modification to include a buffer of at least 20 miles extending westward of the 40 meter isobath. The flaw-lead zone generally occurs in waters of 15-40 meters (DEIS at I-19). A 20-mile buffer extending westward from the 40 meter isobath would ensure that the Coastal Deferral Alternative includes the western endges of the flaw-lead zone, which has been recomended for deferral by EPA and others. Id. at I-8. This is important because the relative location of shore-fast and pack ice, and therefore the flaw-lead zone, vary seasonally, yearly and geographically. Id. at I-21. **NRDC-18**

D. Mitigating Measures

The Chukchi Sea is an area of high environmental sensitivity that also poses very serious hazards to offshore development. The region supports numerous species of wildlife, major commercial fisheries, and several species of endangered whales and birds. The potential for conflict with these vast resources and OCS oil operations is enormous, particularly in light of the extreme environmental conditions that characterize the area. **NRDC-19** Mitigating measures are necessary to minimize these conflicts to the maximum extent possible. NRDC recommends that the following mitigating measures be included as part of the proposed action in the EIS for Sale 109.

1. Seasonal restrictions on oil operations. Seasonal restrictions on oil operations to protect migrating bowhead whales was recommended by EPA and NSB and is critical to protect this highly endangered whale from the adverse impacts of oil spills. We strongly recommend that such a restriction be incorporated into the FEIS and the PNOS. This restriction should prohibit drilling, seismic, production, workover and transportation activities whenever bowhead whales are present in the area. Similar stipulations should be developed to protect gray, fin and humpback whales, and other marine mammals. **NRDC-20**

2. Vessel and Aircraft Restrictions.

The Biological Opinion prepared by NMFS for Sale 70 included a set of guidelines which must be followed to prevent **NRDC-21** harrassment of endangered whales. These guidelines should be adopted for Sale 109.

3. Protection of Biological Resources

The Final Notice of Sale (FNOS) for Sale 80 in Southern California issued September 17, 1984, contains a stipulation (No. 1) for the protection of biological resources. This stipulation should be modified to allow state and local participation in biological resource protection decisions and be adopted for Sale 109. A modified version of the Sale 80 stipulation is reproduced below.

(a) If the Regional Manager (RM), or the State or local government, has reason to believe that biological populations or habitats exist and require protection, the RM shall give the lessee notice that the lessor is invoking the provisions of this stipulation and the lessee shall comply with the following requirements. Prior to any drilling activity or the construction or placement of any structure for exploration or development on lease areas including, but not limited to , well drilling and pipeline and platform placement, hereinafter referred to as "operation," the lessee shall conduct site specific surveys as approved by the RM and in accordance with prescribed biological resource including, but not limited to:

(1) Very unusual, rare, or uncommon ecosystems or ecotones;

(2) A species of limited regional distribution that may be adversely affected by any lease operation.

If the results of such surveys suggest the existence of a special biological resource that may be adversely affected by any lease operation, the lessee shall: 1) relocate the site of such operation so as not to adversely affect the resources identified; 2) modify operations in such a way as not to adversely affect the significant biological populations or habitats deserving protection; or 3) establish to the satisfaction of the RM and state and local government

NRDC-22

V-136

representatives on the basis of the site specific information, either that such operation will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist. The RM and state and local government representatives will review all data submitted and determine, in writing, whether they may be significantly affected by the lessee's operations. The lessee may take no action until the RM has given the lessee written directions on how to proceed.

(b) The lessee agrees that, if any area of biological significance should be discovered during the conduct of any operations on the leased area, the lessee shall report immediately such findings to the RM and to state and local government representatives and make every reasonable effort to preserve and protect the biological resources from damage until the RM, in consultation with state and local government representatives, has given the lessee directions with respect to its protection.

4. Wells and Pipelines

NRDC proposes the following stipulation to minimize conflicts with fishing operations. A slightly different version of this stipulation has been included in many recent lease sales.

(a) Wells Subsea wellheads and temporary abandonments, orsuspended operations that leave protrusions above the sea floor, shall be protected in such a manner as to allow trawl gear to pass over the structure without snagging or otherwise damaging the structure or the fishing gear. Latitude and longitude coordinates of these structures, along with water depths, shall be submitted to the Regional Manager. The coordinates of such structures will be determined by the lessee utilizing state-of-the-art navigation systems with the accuracy of at least 50 feet at 200 miles.

(b) Pipelines. All pipelines, unless buried, including gathering lines, shall have a smooth-surface design. In the event that an irregular pipe surface is unavoidable due to the need of valves, anodes, or other structures, those irregular surfaces shall be protected in such a manner as to allow trawl gear to pass over the object without snagging or otherwise damaging the structure or the fishing gear.

NRDC-23

5. <u>Oil Spill Response</u>

The Sale 80 FNOS contains an oil spill response stipulation (No. 9) that will apply to blocks adjacent to important biological resources. MMS should include the same stipulation on all blocks in Sale 109. Modified applicable sections of the Sale 80 stipulation are reproduced below.

(a) The lessee shall be required to maintain state-of-the-art oil spill containment and cleanup equipment... onsite and in the vicinity of exploratory drilling and development and production operations. In addition, suitable means of deployment and personnel trained in deployment and use of this equipment must be available. Such deployment for exploration, development and production operations shall have the capability of immediate initiation of oil spill containment and cleanup.

(b) In the case of spills larger than can be contained byequipment on exploration vessels or production platforms, the lessee shall maintain state-of-the-art equipment on the vessels which, based on the proximity to sensitive areas are capable of responding to a request for assistance and being on the scene within 2 to 4 hours of the request. The lessee shall install on exploration vessels and production platforms real-time monitoring capability to assist the USCG in acquiring meteorological and oceanographic data necessary to make accurate predictions of the trajectory of oil spills. This information shall support oil spill containment and cleanup operations. When a spill greater than 1 barrel occurs, the lessee shall notify appropriate state agencies within 24 hours of such a spill.

(c) Development and production operations will be required to include the capability to automatically detect the loss of oil and gas at any time.

NRDC understands that this oil spill detection device is an instrument attached at frequent intervals to a pipeline that detects pressure changes indicative of a loss of oil and gas.

NRDC-24

6. <u>Testing of oil containment equipment</u>

The Sale 80 FNOS requires that oil spill containment and cleanup drills and equipment tests be periodically conducted. A modified version of this stipulation (No. 10) should apply to all leases in the Chukchi Sea.

The lessee shall conduct semi-annual full-scale drills at the request of the lessor for platforms and operator-controlled contracted cleanup vessels for deploying equipment in open water to test the equipment and the oil spill contingency plan. These drills must involve all primary equipment identified in the oil spill contingency plans as satisfying Outer Continental Shelf Operating Order No. 7. At least two of these drills shall include the primary equipment controlled and operated by the appropriate cooperative. These drills will be unannounced and held under realistic environmental conditions in which deployment and operations can be accomplished without endangering safety of personnel. Representatives of the U.S. Coast Guard, Minerals Management Service, the state and local governments may be present as observers. The lessor's inspectors will frequently inspect oil and gas facilities where oil spill containment and cleanup equipment are maintained in order to assure readiness.

NRDC-25

7. <u>Protection of Subsistence Hunting and Fishing</u>

The Sale 80 FNOS contains a fishery stipulation (No. 12). A modified version should apply to leases in the Sale 109 area.

(a) The lessee, operator(s), subcontractor(s), and all personnel involved in exploration, development, and production operations shall endeavor to minimize conflicts between the oil and gas industry and representatives of the subsistence hunting and fishing community.

Prior to submitting a plan of exploration or development to the lessor, appropriate oil and gas personnel shall contact potentially affected subsistence hunting and fishing or their representatives to discuss potential conflicts with the siting, timing, and methods proposed. Through this consultation the lessee shall assure that, whenever feasible, exploratory and development activities are

NRDC-26

compatible with seasonal hunting and fishing operations and will not result in permanently barring hunting and fishing from important hunting and fishing grounds.

A discussion of the resolutions reached during this consultation process and a discussion of any unresolved conflicts shall be included in the Plan of Exploration or Development/Production.

In accordance with 30 CFR 250.34-1 (b) (1), copies of such plans are sent to appropriate State agencies...

(b) In particular, the lessee shall show in the Plan of Exploration or Development/Production crew and supply boat operation routes which will be used to minimize impacts to subsistence hunting and fishing, marine mammals, and endangered and threatened species. Conflicts foreseen in the planning stages or that develop later shall be resolved whenever feasible and as quickly as possible.

(c) The lessee also shall include in the Plan of Development/Production analyses of the effects of its operations on the allocation and use of local dock space by hunting and fishing boats and crew and supply boats. These analyses shall include present (baseline) uses, predicted oil and gas uses which increase the level of demand, and an assessment of individual and cumulative impacts. Conflicts foreseen in the planning stages or that develop later shall be resolved whenever feasible and as quickly as possible.

(d) All activities associated with exploration and development operations shall be conducted to avoid the creation of obstacles to subsistence hunting and fishing operations. If the RM has reason to believe that the site has not been adequately cleared, additional surveys shall be required to detect the location of any obstacles to fishing and hunting.

8. Drilling and Production Waste

MMS should adopt a stipulation requiring no discharge of produced water or drilling muds and associated cuttings to protect the sale area from the adverse impacts of these materials.

NRDC-27

Thank you for considering these comments.

Response NRDC-1

The oceanographic and sea-ice regimes of the Chukchi Sea are briefly described in Sections III.A.3 and III.A.4. The types and some of the operational characteristics of drilling units and vessels used in the Beaufort Sea are described in Section IV.A.3. As noted in Section IV.A.3, fixed structures are designed to withstand the maximum force--the design load--associated with an event that is not expected to occur during the intended life of the structure. The structures are actually designed to withstand forces greater than the design load; this provides a safety factor to account for the uncertainties in ice-load predictions. If sea-ice forecasts (Sec. IV.A.3.a(1)) indicate that ice may threaten a bottom-founded drilling unit, the well or wells drilled from the unit can be quickly and safely shut in until the threat passes. If ice threatens a floating drilling unit, the well can be shut in and the vessel moved off location until the threat passes.

Development of the technology to drill and produce the petroleum resources of the Chukchi Sea, or any other area, has been and will be an evolutionary process that builds upon a variety of empirical experiences and research investigations in many engineering and scientific disciplines. Operating prototypes--not "test" structures--have been used to prove the capability of offshore as well as many other engineering structures. Prototypes can be instrumented and studied to prove and improve the technology. Examples of this concept are the caisson-retained islands in the Canadian Beaufort Sea and the mobile bottom-founded drilling units, such as the CIDS and the SSDC, used in the Alaskan Beaufort. Furthermore, the requirement for "test" structures (1) may hinder the development of new concepts in offshore arctic technology if every new type of structure has to be "tested" and (2) may lead to erroneous conclusions about structural safety.

If a "test" structure were designed for a 100-year ice load, the probability of getting the design ice load in 2 years of exposure would be about 2 percent, given the spatial and temporal variability of the sea-ice zones. Such a plan demonstrates only that the structures can withstand the sea-ice conditions at the sites they occupy during specific time intervals.

The Alaska OCS Orders governing oil and gas lease operations on the Alaska OCS implement the safety and antipollution measures that the lease operators are required by law to follow. It is through these OCS Orders that standards are set for (1) the design, fabrication, and installation of platforms or other structures and (2) all activities associated with drilling and producing operations. Order No. 2 requires that the lease operator submit evidence that the drilling unit is capable of withstanding the oceanographic, meteorologic, and ice conditions for the proposed area of operations. Order No. 8 states that all new bottom-founded platforms or other structures shall be subject to review under the Platform Verification Program. Hence, the design, fabrication, and installation of these units must be reviewed by an independent third party, a Certified Verification Agent, who has the technical expertise to make the necessary evaluations and judgments.

Response NRDC-2

Information gathered through the MMS Environmental Studies Program and other sources indicates that in the fall, bowheads migrate in a broad front across

the Chukchi Sea from Point Barrow to the northern coast of the Chukotsk Peninsula. This information is sufficient to allow the MMS to develop appropriate alternatives and mitigating measures. As a result of this dispersed migration pattern and the fact that fall-migrating bowheads are generally not confined by ice in the Chukchi Sea, OCS activities located in the Chukchi Sea are likely to affect a smaller portion of the bowhead population than OCS activities located in the migration corridor east of Point Barrow. Contrary to the commenter's assertions, our analysis indicates that the effects of Sale 109 on bowhead whales are expected to be MINOR.

Response NRDC-3

The MMS is proposing an FY-1989 marine mammal seasonal-habitat-use study of the Kasegaluk Lagoon area that is adjacent to the proposed Sale 109 area. Such a study will help define the importance of this habitat for marine mammals; however, sufficient information on the importance of the proposed Sale 109 area for marine mammals is already available for making a reasoned choice among alternatives and mitigating measures. (See Appendix D for a list of MMS Alaska OCS Region studies that have been or are being conducted.) Sufficient information also exists on the potential effects of oil and gas exploration and development to adequately assess the effects of the proposal on marine mammals (see Sec. IV.B.6).

Response NRDC-4

In 1987, the State of Alaska removed all State lease sales along the Chukchi Sea coast from its 5-year lease-sale schedule. However, the State sales remain in the list of cumulative projects because they may be added at some future time to the State's lease-sale schedule. It would be inappropriate to build a major case in the Sale 109 EIS on the basis of sales that are no longer in the State lease-sale schedule.

The State has not provided resource estimates for its Chukchi Sea sale areas. Based on available information, the MMS estimates the probability of hydrocarbons in the State sale areas to be very small and the economically recoverable resources to be negligible. It should also be noted that, when the probabilities of events occurring are small, a reasonable assessment of cumulative effects cannot be accomplished unless the number of events is statistically large.

Response NRDC-5

The MMS does not consider the issues listed in the comment by the NRDC to be critical to the decisionmaking process. Although additional buoy data would have value, the oceanographic and meteorologic database used by the OSRA is already large enough that insertion of new data would not result in detectable changes in modeled trajectory analyses. Estimation of the extent of shoreline oiling can be done without access to the incomplete oil-spill-smear model. How the extent of shoreline oiling is estimated in this EIS is discussed in Section IV.A.2.c. There also is sufficient information on the probable effects of oil and gas exploration and development on pinnipeds and other marine mammals to adequately assess the effects of OCS leasing as reflected in the analysis in Section IV.B.6. The study on pinnipeds referred to by the NRDC is a literature review that, while adding to the ease of using the existing data, really will not add to the database itself.

It is still the judgment of the MMS that the information base currently available is adequate for environmental assessment, for the Secretary of the Interior to make a reasoned choice among alternatives, for developing adequate mitigating measures, and for balancing environmental risks and benefits. Ongoing and future environmental studies will facilitate the decisionmaking process for future offshore oil and gas leasing activities in the Chukchi Sea but are not needed for the Secretary to make an informed decision regarding this proposed lease sale.

Response NRDC-6

See Response BIA-1. The text in Sections IV.E, IV.F, and IV.G has been amended to show more clearly any distinctions between the proposal and the alternatives. The NEPA process requires that the EIS distinguish between effects and their probability of occurrence. Effect levels for the proposal and Alternatives IV and V are based, in part, on the assumption that seven spills of 1,000 barrels or greater would occur; and effect levels for Alternative VI include the assumption that five or six such spills would occur (Table II-1). The effects analysis for an individual resource considers what effect level would be reached if at least one spill of 1,000 barrels or greater contacted the habitat of that resource. (More spill contacts are assumed if the OSRA indicates that more contacts should be anticipated.) The bottomline-effect levels include the assumption of habitat contact with spill(s) only if spill contact is likely.

In the example discussed by the commenter, the analysis found that the effects levels of the proposal and Alternative VI would be similar if spills contacted the resource area, but that the probability of such spill contact and effects levels being reached was less likely for Alternative VI than for the proposal. However, oil spills are not the only effect-causing agent. A review of Section IV.B.10 (Subsistence-Harvest Patterns) clearly demonstrates how the analysis is conducted--and that it does not average effects. The analysis is presented in terms of three effect-causing agents: oil spills, noise and traffic disturbance, and construction activities. To clarify the effects on individual communities and on individual subsistence resources, the effects of causal agents are analyzed by subsistence resource as well as by community; and conclusions are drawn for each subsistence resource as well as for each community--rather than drawing one conclusion for all the communities in the sale area. If there is a MAJOR effect on any subsistence resource in a community from one of these effect-causing agents, the overall effect on the subsistence harvest in that community would be MAJOR. In Section IV.B.10, the analysis concludes that a MAJOR effect is expected on Wainwright and Nuiqsut because of effects from noise and traffic disturbance on Wainwright's bowhead whale harvest and because of effects from onshore-oil-pipeline spills on Nuiqsut's fish harvest. If the MMS averaged effects and drew a single conclusion for all the communities in the sale area, that conclusion most likely would be MODERATE or MINOR--not MAJOR.

A reduction in the oil-spill risk cannot reduce the overall level of effects unless oil spills cause the highest effect level. Although the overall levels of effects on subsistence harvests assessed under Alternatives IV, V, and VI are the same as for the proposal, the text of Sections IV.E., IV.F, and IV.G has been amended to further discuss the degrees of differences in effect levels assessed for the deferral alternatives.

Section IV.M (cited by the commenter) has been deleted from the FEIS (see Response NSB-6).

Response NRDC-7

See Response NRDC-4.

Response NRDC-8

Launch Point J9 is 15 kilometers offshore, J17 is 14 kilometers offshore, and J38 is 12 kilometers offshore. The purpose of the OSRA is to evaluate the risk of oil-spill contact. Risk cannot be evaluated if choice of launch points is biased by deliberate placement of the launch points in worst-case locations. Also, a worst-case analysis neither requires nor uses an OSRA; the worst case assumes both spills and spill contacts. Trajectories for launch points on the shoreline cannot be modeled; the model would automatically count the point as a land contact at the launch-point position. A similar conclusion about location of spill contact can be reached for a shoreline-spill location without running a trajectory model. Note that Launch Point J24 is 300 kilometers offshore and not on the shoreline, as stated by the commenter (perhaps the commenter mistook Land Segment 24 in Fig. IV-8 for a launch point).

Response NRDC-9

The commenter has misinterpreted the EIS. Section IV.A.1.b states that, based on the findings of the NRC (1985), small spills of 50 barrels or less--not 1,000 barrels or less--are not usually a major concern. Frequency and volume of such small spills are estimated in the EIS (see Table II-1), and their effects are analyzed throughout the EIS. Note that in this EIS, a spill volume of 10,000 barrels--not 1,000 barrels--is assumed for the typical spill of 1,000 barrels or greater (Sec. IV.A.1.b). Thus, small spills would introduce 3,140 barrels of oil out of a total of 73,140 barrels for the proposal, or 4 percent of total spillage--in agreement with NRC (1985) conclusions. The commenter requests that effects of small spills be analyzed in Section IV.A.1; this section is a description of how the OSRA works--not an effects analysis. The effects of small spills are discussed in the environmental-effects portion of the EIS (Secs. IV.B through IV.H).

Response NRDC-10

Table IV-4 provides estimates of the statistical quantity of the "expected number" of spills, including 5.8 spills of at least 1,000 barrels for Alternative VI. Because of the difficult statistical concept of fractional spills, the "most likely number" of spills has been used in the EIS text. (The OSRA probabilities in the EIS, however, are still based on the more precise expected numbers.) The "most likely number" of spills is the number of spills with the greatest likelihood of occurrence, i.e., the mode of distribution. Mathematically, the most likely number of such spills for Alternative VI is five, with a 16.6-percent probability of occurrence, as can be seen in Figure IV-5. However, to address the concern, the FEIS text in Section IV.A.1.b and elsewhere has been changed to state "a most likely number of five to six spills" (with a consequent reduction in effectiveness of Alternative VI in reducing spill risk).

Response NRDC-11

The likely effectiveness of oil-spill cleanup in the Chukchi Sea is discussed in Section IV.A.2.e. In analyzing oil-spill effects, the EIS does not assume that oil spills would be cleaned up at sea. Note, however, that although at-sea cleanup is usually not effective, exceptions do occur--particularly for blowouts from offshore-oil platforms. For example, Chevron's "C" Platform in the Gulf of Mexico blew out and caught fire in February 1970. Pollution of the Gulf did not pose a threat until the fire was extinguished 1 month after the blowout occurred. During the 30 days between the blowout and putting out the fire, Chevron stockpiled equipment and supplies to handle the anticipated 5,000 barrels of oil per day that would be released into the water. Overall, Chevron was able to recover somewhere between 23 and 56 percent of the 30,500 barrels of oil spilled into the Gulf. (The uncertainty in recovery is based on an assumed 50- to 80-percent water content of 34,377 barrels of recovered oil emulsion.)

Response NRDC-12

Although Section IV.A.2.b states that summer-spill contacts with land are of greater environmental concern, the section describes and discusses both summer and winter contacts.

Response NRDC-13

The OSRA provides separate spill-risk estimates for the two oceanographic seasons that exist in the Chukchi Sea--a long winter and a short summer. Winter and summer estimates of risk are discussed separately in the EIS; they are not averaged. Within seasons, trajectory contacts are totaled, not averaged. Some significant changes in oceanographic conditions do occur over the 7.5-month-long winter, but these changes are incorporated in the trajectory model discussed in Section IV.A.1.c. See also Response EPA-15.

Response NRDC-14

The areal extents of the two spills cited by the NRDC have been recalculated by Ford (1985) based on information in original sources and maps. The area of the Bravo slick cited by the NRDC is overestimated by 33 percent, and the area of the Argo Merchant spill is overestimated by 222 percent. In addition, the area of discontinuous coverage of a slick given in Section IV.A.2.a and criticized by the NRDC is the average size through 10 days--not a maximum possible size. The size estimate is based an empirical model of spill area and statistical analysis by Ford (1985) of a multitude of spills, including both Bravo and Argo Merchant spills, taking into account size of the spill, age of the spill, windspeed, wave height, and temperature.

The rationale for the estimate of the extent of shoreline oiling used in the EIS is provided in Section IV.A.2.c and in incorporations by reference therein. The 30- and 90-kilometer estimates are derived from an empirical model of shoreline oiling based on statistical analysis of a multitude of spills, including the datum of 300 kilometers of coastline oiled in the Amoco Cadiz spill.

Response NRDC-15

The assignment of oil resources to individual platform launch points is not random but rather is based on the resource distribution information provided in the EIS. The only resource information in the EIS, however, is that (1) the proposal contains 2.68 billion barrels of oil, (2) removing the Alternatives IV and V deferral areas from the analysis does not decrease the amount of oil left in the residual area, and (3) removing the Alternative VI deferral area from the analysis removes 0.44 billion barrels from that alternative. The only way to partition oil among platform launch points consistent with this information is to (1) divide the 2.24 billion barrels under Alternative VI equally among all platform launch points within that alternative; (2) assign zero oil production to platform launch points within the areas deferred in Alternatives IV and V (because deferring these areas does not reduce the resource estimates); and (3) divide 0.44 billion barrels evenly among those launch points that lie both (a) within the deferral area excluded from Alternative VI but (b) outside of the smaller deferral areas excluded from Alternatives IV and V.

Response NRDC-16

Combined probabilities are not calculated for individual launch points but rather combine probability information from all launch points. The procedure takes into account the likelihood of platform spills occurring at platform launch points, the likelihood of transportation spills occurring along transportation routes, and the conditional probabilities that--if spills occurred from individual launch points--specific targets would be contacted. The numbers of platform spills associated with individual platform launch points are the products of the oil resources assumed at individual launch points (see Response NRDC-15) multiplied by the platform-spill-rate constant (Table IV-3). Numbers of transportation spills resulting from the volumes of oil transported from each platform site are the products of oil volumes of individual platform launch points multiplied by the appropriate transportation-spill-rate constant. The resulting numbers of transportation spills attributable to oil produced at a specific launch point are distributed evenly among all launch points, representing the transportation route for oil produced from that platform launch point.

Response NRDC-17

Conditional probabilities for each launch point and target are listed in Appendix A, Tables A-3 through A-14. Combined probabilities for each target are also in Appendix A, Tables A-15 through A-22. See also Response NRDC-16. Further details of calculations involved in the OSRA are provided in Smith et al. (1982).

Response NRDC-18

The MMS used information from sea-ice zonation; bowhead whale-migration corridors; important habitat areas for pinnipeds, polar bears, gray and beluga whales, and marine and coastal birds; and subsistence-harvest areas to develop the Coastal Deferral Alternative. As shown in Figure I-3, the deferral area extends along the Alaskan Chukchi Sea coast from Point Hope to an area north of Peard Bay and from the Federal/State 3-geographical-mile (about 5 km) line seaward at distances that range from about 5 to 115 kilometers.

Along the Chukchi Sea coast, there is often a band of open water just offshore of the landfast-ice zone (see Fig. III-9 or Graphic No. 2 for the landfast-ice zone). This band of open water is at times a well-defined lead and at other times a series of openings or polynyas. The width and persistence of this open-water band is quite variable (Stringer, Zender-Romick, and Groves, 1982): (1) between February and May, the average polynya width is about 1 kilometer, but extreme widths may range from a few to about 20 kilometers--about 50 percent of the time there is open water somewhere in the area; (2) during May and June, the average polynya width at the northern end is about 4 kilometers, at the southern end about 58 kilometers, and in the center about 75 kilometers; extreme widths range from about 28 kilometers in the north to 370 kilometers in the south; and (3) through July and August, the average width increases dramatically--extreme widths of several hundred kilometers can occur.

The stamukhi, or flaw-lead zone, lies within this area of recurring open water. The stamukhi zone is the region of dynamic interaction between the relatively stable ice of the landfast-ice zone and the mobile ice of the pack-ice zone that results in the formation of ridges, leads, and polynyas. As noted in Section I.D.4.g, the zone of most intense ridging in the Chukchi Sea occurs in water depths that range from 15 to 40 meters. As shown in Figure III-1, the distance between the 15- and 40-meter depths is much narrower in the northern part of the sale area than in the southern part, particularly in the Ledyard Bay area; off Point Belcher, the seafloor between the 15- and 40-meter isobaths is about 10 kilometers wide, whereas in the Ledyard Bay area the width is about 80 kilometers. However, as noted above, the width of the open-water area is quite variable and, beginning in May and June, may be several hundred kilometers wide. Thus, extending the boundary of the Coastal Deferral Alternative another 20 miles (about 32 km) seaward of the 40-meter isobath would not ensure that the Coastal Deferral Alternative includes the western edge of the open-water area.

Rather than rely on a single variable parameter related to sea-ice zonation to develop a deferral area, the MMS also considered biological-resource and subsistence-harvest information to formulate the Coastal Deferral Alternative. This alternative was developed to (1) protect the biological resources and their migration corridors and habitats and (2) provide a protective buffer for the subsistence-harvest areas and resources of the Chukchi Sea coastal communities. A summary of the biological-resource and subsistence-harvest information is shown in the following graphics and figures: (1) important marine and coastal bird habitats are shown in Graphic No. 1; (2) important habitats of pinnipeds, polar bears, and beluga whales in Graphic No. 2; (3) generalized bowhead whale-migration corridors in Figure III-16; (4) gray whale-concentration areas in Figure III-17; and (5) subsistence-harvest areas

for bowhead and beluga whales in Figures III-22 and III-23 and for seals, walruses, fishes, and birds in Figures III-24B, III-25, III-26, and III-27, respectively. As shown by these graphics and figures, most of the areas associated with biological resources or subsistence activities are included in the area of the proposed Coastal Deferral Alternative (Fig. I-3). Thus, the MMS does not believe it is necessary to extend the seaward boundary of this deferral alternative in order to protect the biological resources and subsistence activities of the Chukchi Sea coastal area.

Response NRDC-19

The northern Chukchi Sea does not support any commercial marine fisheries.

Response NRDC-20

The MMS has included and evaluated a seasonal drilling restriction (potential Stipulation No. 5) in the FEIS. This restriction pertains to the bowhead spring-migration period in the vicinity of the Chukchi Sea nearshore lead system used by migrating bowheads. Alternative approaches to the seasonal drilling restriction evaluated in the FEIS include ITL No. 3 (Information on the Protection of Endangered Whales), Stipulation No. 6 (Industry Site-Specific Bowhead Whale Monitoring Program), and ITL No. 5 (Information on Endangered Whales and MMS Monitoring Program). Additional information on these measures can be found in Section II.H.2. The MMS also intends to issue a Notice to Lessees (NTL) for the Chukchi Sea area similar to NTL No. 86-2 for the Beaufort Sea, which provides guidance for lessees regarding how to conduct preliminary activities (such as seismic surveys) and aircraft and vessel operations without disturbing endangered whales. The NTL would protect all endangered whales, not just bowheads. The MMS is convinced that endangered whales would receive adequate protection from Sale 109 activities, since the NMFS concluded in its Endangered Species Act Section 7 Biological Opinion that leasing and exploration activities associated with Sale 109 would not jeopardize any marine-cetacean species. Should development and production be proposed as a result of Sale 109, the MMS would consult with the NMFS to ensure that such proposed activities would not jeopardize any listed species.

Response NRDC-21

Guidelines similar to those contained in the NMFS Biological Opinion for Sale 70 have been incorporated in ITL Nos. 1 and 4 for Sale 109.

Response NRDC-22

See Response STATE-4.

Response NRDC-23

The stipulation proposed by the NRDC relating to wells and pipelines is not pertinent since there are no commercial marine fisheries in the northern Chukchi Sea.

Response NRDC-24

The proposed stipulation is redundant to the current provisions for requiring state-of-the-art oil-spill-containment and cleanup equipment, included in OCS Order No. 7 and in the MMS planning guidelines for approval of oil-spill-contingency plans (OSCP's). Information on oil-spill equipment and techniques is identified in the OSCP--submitted with an exploration plan and development and production plan--which is reviewed by the USCG and the State prior to approval. Annual oil-spill-response exercises are held to ensure that personnel are adequately trained in response equipment and techniques. See also Response STATE-5.

The MMS planning guidelines for an OSCP require the lessee to respond to a spill within 6 to 12 hours, geography permitting. If the risk analysis included in the OSCP indicates that an oil spill from the proposed activity will contact a shoreline or biological community in sooner than 6 to 12 hours, the response time will be reduced accordingly in order to protect the resource. The MMS does not believe that it is appropriate to mandate a specific response criterion without consideration of location, timing, and potential spill size, trajectory, and risk.

Through OCS Order No. 2, the MMS currently requires the lessee to record oceanographic and meteorologic data at the site. This information will be readily available for input into a trajectory analysis of an oil spill, if needed.

OCS Order No. 7, Part 2.3.1, requires the lessee to notify the MMS of an oil spill within 12 hours if the spill volume is 6.3 billion barrels or less, and immediately if the spill is more than 6.3 billion barrels. Most spills on the OCS are small in size and are unlikely to reach State waters. The MMS does not consider it necessary to require lessees to notify the State of a spill through a stipulation. It is our understanding that current State law requires reporting of spills that enter State waters. In the event of a large spill that could affect the State, the RRT would be activated; and the State representative would be informed of a spill through the RRT. In the past, it has been standard practice for industry to notify the State of all spills; the MMS expects this practice to continue.

The MMS has stringent requirements for pressure-detection and safety devices for production operation under OCS Order No. 5. This order requires pressure vessels to be adequately protected by appropriate sensors that will detect losses and gains in the system that may indicate potential leaks. All flowlines will be equipped with high- and low-pressure sensors that are designed to shut in the well if the pressure varies beyond a predetermined amount. In addition, all platforms will be equipped with a manually operated emergency-shutdown system that will completely shut down production operation from key locations on the platform if all automatic systems fail, which is unlikely. The MMS, therefore, believes that the safety aspects of development and production operations are adequately covered in the OCS Orders.

Response NRDC-25

See Response STATE-5.

Response NRDC-26

The stipulation that the commenter suggests modifying is a commercial-fishing stipulation for a sale outside of Alaska. Part C of this stipulation refers to conflicts between hunters and fishermen and supply boats on the allocation and use of local dock space. Native hunters in the Arctic do not use docks; consequently, this part of the suggested stipulation does not apply to the specific needs and concerns of Alaska subsistence uses. Other portions of this stipulation apply to subsistence hunting and fishing; however, the MMS believes that ITL No. 9 (Information on Subsistence Whaling and Other Subsistence Activities [Sec. II.H.2]) appropriately addresses subsistence activities. In addition, during the review of site-specific exploration plans or development and production plans, local communities will have the opportunity to identify concerns regarding possible conflicts with subsistence activities. See also Response NSB-22.

Response NRDC-27

The effects levels estimated in this EIS do not justify the requirement for a stipulation prohibiting discharge of muds, cuttings, and/or produced waters. Exploration discharges estimated in this EIS have been evaluated as having a negligible effect on water quality by both the MMS (Sec. IV.B.2.b) and the USEPA (Appendix I). Production discharges have been evaluated by the MMS as having only a MINOR effect on water quality (Sec. IV.B.2.b). The MMS would reevaluate the effects estimates in preparing any developmental EIS, and the USEPA would regulate production discharges to ensure that no significant degradation of water quality could occur.

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Regional Director, Alaska OCS Region
Minerals Management Service
Attention: Laura Yoesting
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Anchorage, Alaska 99503-4302

COMMENT ON DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED OIL AND GAS LEASE SALE 109 IN THE CHUKCHI SEA.

1. Identity and background: John L. Mohr, Ph. D., Zoölogy, University of California; Professor emeritus, biological sciences, University of Southern California. Principal investigator: marine biological investigations, subcontractor of Arctic Institute of North America, 1952-55; Research Drifting Stations (Ice Island, T-3), 1952-56; USAF Arctic Aeromedical Laboratory; (T-3, Arlis I, Arlis II), Office of Naval Research, 1959-1971; Zoological program, U. S. Antarctic Research Vessel ELTANIN, 1962-64, Office of Antarctic Programs, NSF.
   Investigation of technological information and mythology of offshore oil and gas industry effects, especially of drilling drilling discharges and of dispersants, 1978--- (analysis particularly of gray literature, participation in hearings, workshops, information transfer meetings and legal proceedings).

2. Submitted:
   A. Written comment directly on EIS proposed Sale 109.
   B. reprint: (portion) J. L. Mohr, D. J. Reish, J. L. Barnard, R. W. Lewis, and S. R. Geiger 1961 Arctic 14(4):210-223, The marine nature of Nuwuk Lake and small ponds of the peninsula of Point Barrow Alaska.
   C. reprint: J. L. Mohr, N. J. Wilimovsky, and E. Y. Dawson 1957 An Arctic Alaskan kelp bed. Arctic 10(1):45-52.
   D. reprint: J. L. Mohr and S. R. Geiger 1968 Arctic Basin Faunal Precis--animals taken mainly from Arctic drifting stations and their significance for biogeography and water-mass recognition. pp. 297-313 in J. E. Sater, ed. ARCTIC DRIFTING STATIONS: a report on activities supported by the Office of Naval Research. Arctic Institute of North America, Washington, D.C.
   E. reprint: J. L. Mohr Marine biology Arctic 22(3):265-282.
   F. critique asked for by Washington office, Ecological Society of America, of NAS/NRC 1983 Drilling Discharges in the Marine Environment, prepared Jan. 1984.
   G. references: Naval Research Reviews, 1984, 36(4):27

3. Conclusion/ recommendation:
   the draft Environmental Impact Statement for proposed Sale 109 is poorly done, showing signs of carelessness, incompetence, reckless generalization from miniscule data or none and other major defects; in all the many areas I have had time to examine closely, IT IS UNTRUSTWORTHY. There is evidence that significant vulnerabilities exist (the draft

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EIS ignores them or stonewalls!
ON THE EVIDENCE ALTERNATIVE TWO, NO SALE, IS THE CORRECT ONE.

WRITTEN COMMENT:

A

Because my principal work in the arctic (Alaska and the Arctic Basin plus a run of T-3 north and east of Greenland by a member of my group) much of my comment is directed to the biological work, but if I were simply an administrator or an editor, I should cite enough matters of work patterns clearly perceptible that render this document UNTRUSTWORTHY. First, there is plain lack of care. One of the supervisors had a laboratory for some years in the Allan Hancock Foundation, about 30 yards from considerable Arctic collections, less than that from a laboratory in which work on arctic biology was centered, and just a little farther from a library with notable holdings on polar biology and geography. The EIS spells it not Allan but Allen and the report in general evinces no awareness of such research resources. **MOHR-1**

Of United States' work on arctic science certainly the programs supported by the Office of Naval Research with millions of dollars working out of the Arctic Research Laboratory, Barrow, Alaska is not negligible. Nor is that carried by the Air Force through the Arctic Aeromedical Laboratory and other agencies. Together these involved such institutions and people (some rightly dubbed eminences) as California Institution of Technology: George and Nettie MacGinitie; Columbia University-Lamont Geological Laboratory (subsequently Lamont-Dougherty): Ken Hunkins; Hokkaido Univ.: Kou Kusunoki; McGill Univ.: Max Dunbar; Northwestern University: Max Britton; Stanford University: botanical work under William Steere and Ira Wiggins, fish under N. J. Wilimovsky; Univ. of Alaska: Victor Hessler; Univ. of California, Berkeley: F. A. Pitelka and teams; Univ. of Iowa: Edgar Folk; University of Southern California: W.V. Mayer, J. L. Mohr, H. Fernandez; Univ. of Washington: Cliff. Barnes, Phil Church, Tom English, Norbert Wiener; Univ. of Wisconsin: Ned Ostenso. **MOHR-2**

The EIS lists many agencies and other impersonal entities as having been consulted---but it obviously did not seek out knowledgeable individuals like Max Britton, who for years worked in the Arctic Office of the Office of Naval Research, nor Sid Galler, who was chief of the biology branch, offering not just support, but helpful ideas for the arctic work. Similarly, I have found no evidence that the appropriate people in the Arctic Institute of North America were "tapped". I think I recognize one name from the old NARL staff, but I can not detect signs of transfer of ideas. **MOHR-3**

One may raise the question whether the ARL work was in the Sale 109 area. Significant portions were. Wilimovsky and Mohr (see Mohr et al. 1957) in the 1954 cruise of the LCM William E. Ripley worked as far south and west as Kuk Inlet discovering geological and biological facts not properly presented in the draft EIS. F. E. Durham, originally as part of the USC project, but **MOHR-4** subsequently independently funded (AINA), working out of Barrow, worked on the bowhead whale along the entire coast involved. Check on an ARL monthly report finds investigators going to Wainwright, Icy Cape, Point Lay, Beaufort, Point Hope and Cape Thompson, and beyond to Noatak, Kotzebue and Nome. The scene is the right one.

Another aspect of resources ignored (avoided?) is the main-stream science literature. How is it that the anthropological portion of the EIS does not use a journal called Arctic Anthropology (I find it cited in Science, a journal of high repute)--or have I glossed over such references? In the biological portion it is certainly damaging to have noone with competence in the Russian language; the facing coast of the eastern Soviet Union has a formidable literature. It is not properly used though the readily available Lev Zenkevitch 1963 Biology of the Seas of the U.S.S.R. (transl. by S. Botcharskaya) London, Allen & Unwin, Ltd. provides requisite leads. There are other indefensible omissions: I note among those I have found most thought-provoking in arctic and offshore work, the Medelelser om Gronland (with, a. o., the classical studies of Thorson) and the Journal of the Marine Biological Association of the United Kingdom (especially important in our matters in coverage of metals in marine organisms, e.g. the work of Simkiss).

MOHR-5

Among other glaring omissions: in the Dames & Moore Lower Cook Inlet study for ARCO there are quite significant revelations (though they are not stressed). A number of the tests were ruined, seemingly by failure to allow for rough seas. Kill of all Eogammarus (amphipod) by drilling discharge within the period of the ritualistic LC_{50} 96hr. Indication that the surface component of a discharge went beyond 13 km (as far as it was followed by injection of just 1.5kg of rhodamine B, 20% aqu. = Dupont rhodamine WT) from source, Rig Ocean Ranger. Similarly, while the Lake Buena Vista, Florida, Symposium of January 1980 is cited a number of times (and referenced in different ways), the most important revelations, usually emerging in the discussion sections, are ignored.

MOHR-6

I opened on the theme of carelessness. The Lake Buena Vista citations in the reference lists are examples of this--references 445, 449 and I-15, p. 54, quartile c, item 4, are in in the proceedings of that symposium, but someone unfamiliar with the publication would not recognize that because of the great differences in the reference, that is they are not recognizable as parts of the same publication.

MOHR-7

A kindred fault of the reference section (particularly the principal one; that of Appendix I tends to follow established practice) is inconsistency, lack of identification of people who prepared documents (therefore, no opportunity of running them down in Am. Men & Women of Sci. Diss. Abstracts, etc. for germane background), and assorted incompletenesses, such as source, number of pages (is it substantial enough to be worth the often great effort required to run it down?), and availability (where may it be found other than at MMS, Anchorage; are copies supplied or purchasable?).

MOHR-8

On the references the text most often gives no clue as to the extent and reliability of the work cited. Indeed, the handling

MOHR-9

throughout suggests that the MMS compilers lack the competence, alertness, and encouragement from superiors to produce a document fulfilling statutory requirements. This is a matter needing Congressional attention.

The reduction of Appendices B, D and I, all of which require the reviewer's attention, to a pale 6-point size, makes examination notably more difficult.

MOHR-10

As with all BLM-POCSO and MMS EISs I have reviewed, the draft for proposed Sale 109 is heavily, in this case overwhelmingly, resting on the furtive (=gray) literature. In this case I found the furtiveness more striking than ever, for having worked on an OCSEAP study at Allan Hancock Foundation, I tried to make an appointment to discuss contents with an author/editor at the Boulder Headquarters. The phone information person told me that some of the materials were probably in Seattle and some in the D.C. area; the people likewise. She could not tell me whether those I named were at one, the other, or neither.

MOHR-11

What is very clear about arctic Alaskan work is that time is required to reach an effective literature background (what has been done; what needs to be done; how have investigators gone about the jobs; what tools are available, etc.) and then it takes considerable time in the field to get the hang of working in arctic conditions. The most impressive peformance to date, I hold, is that of George and Nettie MacGinitie, who worked continuously for much of two years out of ARL, Barrow. Their accomplishment was possible only because of decades of intense field work and thoughtful analysis at lower latitudes. In contrast, the studies of the Environmental Studies Program are excessively broad for the number of people involved and defeatingly shallow for any useful guidance for the draft EIS. As a taxpayer I find it outrageous on the one hand that the basic work out of Barrow is so little used [George MacGinitie, the general analysis of marine biology, esp. invertebrates; Nettie MacGinitie, molluscs; Marion Pettibone, polychaetes; Clarence Shoemaker, amphipods] and on the other that work that is clearly not done by people competent in areas in question (and which could easily be spotted by examiners of competence) is used as basis for important decisions. One example--one who does not know that kelp are brown algae (separate designations in the draft EIS) is too ignorant to be analyzing marine biological results. In a similar way Petrazzuolo 1981 (among a host of indications of marine biological ignorance) holds that drifting plants (phytoplankton) are an animal group; NAS/NRC 1983 Drilling Discharges similarly mistakes a soft coral, Eunephthya (misspelled Eunephyta) for a plant, again, along with a great amount of mistaken and presumably some falsified matter. These are treated somewhat in my Item F, appended. These indicators of **UNTRUSTWORTHINESS** are ignored by MMS compilers and decision makers. The result is a wholly **UNTRUSTWORTHY DRAFT EIS.**

MOHR-12

MOHR-13

When scientific, or economic, or other writing has been published in what the University of Chicago Press calls "not just established, (but) respected" publications, it has been examined by at least a couple of people known to be able to weigh the quality of the manuscript and been found worthy of publication. Then it has been exposed to the professionals of the field who may raise

MOHR-14

questions about parts of contents. Most of the raw materials of the draft EIS have not had such exposure. Further, from some familiarity with the fields in question, I have the strong impression that most of the workers herein (where there is indication who did the work) have never worked at such acceptable-quality levels.

This is to say that the draft EIS lacks almost totally work by proven investigators like Rhoads (cited once) or, to note another striking omission, the physiologists, Laurence Irving and Per Scholander, and it badly needs them. In essence it means that MMS consistently ignores the superior investigators and investigations and embraces the incompetent and the shoddy. My unfavorable evaluation is supported in a number of ways, any of the clear faults being fatal to trustworthy policy-making. To begin with MMS does NOT take a look good enough to be useful to know pre-start conditions; therefore it will be impossible to document, if drilling, etc. occur, what changes take place. Among the matters that need to be determined are the occurrences of energy-base organisms, macroscopic algae, phytoplankton, eel-grasses, and possibly in some situations, certain microbes. In any case, the microbes are a critical force in the water masses and especially in benthic situations. MMS adduces no information on such. Even in the Gulf of Mexico situations, where it is obvious from gross conditions that massive microbial shifts (esp. sulfur-related kinds) have taken place, there is still no considerable research program on such. **MOHR-15**

A major factor ignored (neglected) in the draft EIS is the influence of latitude in Chukchi Sea physiologies: temperature, light, Coriolis' force interacting with fluctuating populations and other variables result in exceedingly complex events and relationships. An example of the unwisdom of the compilers is the use of J.M. Neff team work (cited several places) without noting that they have done careless work stating that a study of oil effects done at Vancouver, B.C., on British Columbia animals was done on Prudhoe Bay intertidal forms. Neff has assumed in other studies that organisms of different latitudes are interchangeable for toxic effects studies. So have some of the EISs other reference-workers. MMS should consult the work of John Vernberg, U. of South Carolina; Paul Dehnel, U. of British Columbia, and Earl Segal, Calif. State Univ., Northridge, for evidence that physiological differences with latitude are to be expected. **MOHR-16**

Associated in part with latitude is the gradient of numbers of kinds of organisms from the Canadian high arctic islands generally southward and westward along the coasts to Point Barrow, then more consistently southward and westward to boreal latitudes. Such information as we have from studies from T-3 (Univ. So. Calif. projects), Cruise of the Red, Nortec's (SOHIO) Reindeer Island effort, ONR and AINA studies about Barrow, and the Cruise of the Ripley are consistent with this view and, I think, so far Soviet Pacific records. **MOHR-17**

The draft EIS "finds" a much less varied biota both inshore and farther out through the proposed Sale 109 area. Should one accept this? Not at all! The work was not done by "arctic old hands", well educated and experienced at the work; one may properly question the value of the work on that score. However, that is relatively a

negligible (if potentially still fatal) fault compared with the worthlessness of the sampling programs. According to Fig. III-13, a if not the major benthic community study has 11 (possibly 12, the chart is not well done) quantitative stations and 2 qualitative stations. This represents nearly 12 million hectares (20,000 mi²?). I began by comparing this with my back yard of ~.1 hectare-- in which an OPB dropped from the cloud height sample a banana clump, a Pittosporum row, a grassy patch, an avocado clump, etc. depending on slight shifts. Closer to the Chukchi, sampling from a boat on Nuwuk Lake (right at Point Barrow), less than 700 feet in greatest length, one might get gravel bottom, sandy bottom or sulfide mud bottom within a 30 foot range. This is about equal to the whole bottom range charted for the whole draft EIS sea area (Fig. III-4). On that chart is Hanna Shoal, which may be named for geologist G. Dallas Hanna (see Mohr et al. 1957 p. 46) who characterized the bottom at the Skull Cliff kelp bed as "rocky with a minor amount of sand". No rocky area is indicated anywhere in the EIS area (Fig. III-4) despite this published account. Examination of Chart III-13 and those of the Cruise of the Red and the Cruise of the Ripley show that the cruise stations are much closer together and give much better coverage of the coastal areas, but the crew of the Red (including Wilimovsky and C. Horvath, of the USC team) missed kelp beds in the Prudhoe Bay area now reasonably well charted while the Ripley (with Wilimovsky, Hanna and Mohr) turned up the Skull Cliff kelp bed which would not be known from the MMS work even though it is in the designated area. **MOHR-18**

The MMS benthic analysis (see esp. Fig. III-14) may be compared reasonably with a descriptive analysis of the Boston and Cambridge area, physical and biological, based on sampling from a blimp with grab or dredge at a single locus. Obviously there is no possibility of knowing reliably (or even vaguely) what is present in a considerable area (Boston-Cambridge or some thousands of square miles of Chukchi Sea) from one or two samplings of surfaces that are not seen. One set of samplings to more than a million acres. The work is so grossly lacking in significance one is hard put to see how it could have been produced by a team in which there obviously at least two individuals I know to have more awareness than goes with all this. The sampling base insures that whatever is derived must be GROSSLY UNTRUSTWORTHY. Moreover, it is difficult to attribute integrity to Department, agency or participants. **MOHR-19**

If there were from the aspect of space (we have seen that there is not) an adequate sampling, the program would still be inadequate because of lack of repetition over adequate time. Annual patterns are especially variable in far northern seas. Thus in 1952 strandings of gammaridean amphipods were heavy at Barrow and not in 1953 and 1954. In 1953 there were stranded thousands of large medusae; in 1954 we had neither. In none of these years did we find there the myriad hyperiid amphipods the MacGinities found a couple of summers earlier. (It should be noted that there is negligible information on winter (under-ice populations) events and draft EIS does not help (MacGinitie work from Barrow is our best, though exceedingly limited source). **MOHR-20**

The collected statistics on catches of fishes, birds and mammals (there was a big walrus take in only one of our three **MOHR-21** summers at Barrow) indicate clearly large, but irregular, and under our present knowledge, unpredictable swings. Various information, however incomplete, indicate local large changes in the sea bottom from ice or bottom currents. In sum, restricted programs are of limited use for "inventory" of kinds present, but for knowing "what's in the store" and what may happen, it is necessary to have close spacing of samples (closeness depending on the complexity of an area and how sure one hopes to be, but in any case 3-5 orders, at least, closer than used in the draft EIS) and repeated through a number of years. One notes that the ability to distinguish between significant trends and local disruptions reached by United Kingdom oceanographic biologists in parts of the North Atlantic is based on frequent well-spaced tows of the Hardy sampler over 30 (and in some phases 50) years. In the draft EIS UNTRUSTWORTHY RESULTS are combined with indefensible extrapolations to achieve policy decisions the agency apparently wants. The groundwork, the decisions and the justifications are UNTRUSTWORTHY.

It may be useful to note that poor mesoscale information has been used to reach microscale results or interpretations. This, of course, is not science and not tolerable in academic research.

MOHR-22

In trying to carry out the intent of the Congress under the enabling legislation, a major concern should be determination of various vulnerabilities. I lack time and document-access to do a comprehensive job on such, but note, II-43 reference to a "relatively plentiful supply of fishes". This recalled Prof. Wilimovsky's seminar account (ARL, about summer 1954) after several seasons of the Stanford University's fish project. Particularly the salmonids were at vulnerable population levels, and it would be unwise to permit any commercial exploitation of fishes in northern Alaskan waters.

MOHR-23

In this situation one must take into account the fact that Inupiat folkways (traditions) developed 1) with notably smaller populations, 2) before firearms, explosive harpoon darts, modern bird and fish nets, outboard motors, etc. were available: capacity for major killing was lacking, 3) characteristically it was such a challenge to survive each winter that long-term considerations about subsistence-base was not part of the tradition. There is not a well-established conservation tradition. Accordingly, to take care of the public lands and waters, it is necessary that our steward agencies do their jobs with continous vigilance.

MOHR-24

Of other vulnerabilities, that of the kelp-beds is obvious. Wherever standing stocks are small and discontinuous to the extent apparent with the northern/northwestern Alaskan kelp-beds, restocking following serious disturbances is limited at best; mechanical disturbances (such as anchor cable rubbings, pipe laying, movement of sand or gravel), turbidity with light loss, or/and chemical disturbance are threats despite the draft EIS effort to play down their vulnerability. There is compelling need to know where all the kelp-beds are and to see that they are not exposed to disturbances.

MOHR-25

It is significant and disturbing that the case made that damage will not be done is based mostly on non-arctic (lower latitude) work and that much of it is questionable even for the areas in which the work was done. In general there is little attention paid to critical times such as those of mate finding, mating, spawning, settling and these are especially critical in the special conditions of the arctic.

MOHR-26

It is instructive to examine something of the development of the rather off-beat (that is, not trained in the standard way) marine toxicologists at work. In the late 1940's Univ. of Southern California marine biologists (Mohr, principal investigator) studied borer and fouler populations in heavily polluted Los Angeles-Long Beach Harbors. In 1950 the State of California through the then Division of Fish and Game, acting for a new State Water Pollution Control Board, enlisted our group to do pollution base-line studies in several Californian harbors. Late in this work Dr. D. J. Reish became involved in this work and in 1959 we submitted together a paper (not accepted) noting that a range of harbor invertebrates representing all the major invertebrate phyla were so tough they could be shipped to inland laboratories and used for living laboratory teaching examples. As another USC zoologist, Dr. K. Fauchald (for some years now of the Smithsonian Institution) observed some of these thriving without attention in a 10-gallon tank in Prof. Reish's laboratory, he remarked "they are resilient!" Prof. Reish began using especially four (one of these turned out to be two different species) bristle worms, real "toughies", as test animals for marine toxic exposures and he has been a leader in such work for years. Dr. Jack Anderson, now heading the So. Calif. Coastal Waters Research Project (aka Skwirp), apprenticed with Reish. While he was at Texas A. & M. Univ., J. M. Neff, a recent Duke Univ. Ph. D., apprenticed with Anderson. Thus these are respectively academic nephew (Reish worked with me in some of the harbor activities and was part of my ARL, Barrow team, summer, 1953, but I was not his Ph. D. guidance chairman, only a committee member, thus not "academic dad"), grand nephew and great grand nephew. Reish and Anderson have noted that test organisms need to be appropriate to latitude; Neff is oblivious on this as on other points. *Neff is notable in the draft EIS' references.*

MOHR-27

None of the marine toxic testers has shown how any one of the test organisms related to any "real world" marine situation; the activity is rather marine applied technology than science of any degree. The most usual test is the so-called LC_{50} 96hr exposure. This means that batches of a given test organism (almost never plants, and if plants, only a variable diatom, Scenedesmus, except perhaps at the EPA Gulf Breeze Laboratory) are exposed to varying concentrations of material in solution (a single substance or a complex mixture-often not analyzed at all--like a drilling discharge) until it is determined what concentration kills half of the individuals in 96 hrs. Marine biologists aware of such goings-on (this is an activity that does not come into main stream science scrutiny) tend to regard them as preposterous. The so-called steward agencies have been asked in hearings and workshops to stop using such obviously unreliable methods. They pay no attention to the objections.

Recently marine scientists of the Marine Science Institute of the University of California, Santa Barbara have presented work showing the agencies' (and industry's' tests to be not just worthless, but grossly misleading. Prof. Daniel Morse has shown that settling stages of an abalone (Haliotus) are much more sensitive than the ciliated larvae which had previously known to be "especially sensitive", using barium salts inter alia. Richard Zimmer-Faust working on the commercially important yellow crab and a spiny lobster in the Santa Barbara Channel demonstrated numbing effects (different in the two crustaceans) by a variety of substances in drilling discharges not earlier examined at all (for example, ammonia) at much lower levels than the agencies have considered significant. Morse's and Zimmer-Faust's work was presented at the Santa Barbara hearing of EPA Region 9 on extension and modification of general NPDES permit CA0110516.

MOHR-28

More recently a Zimmer-Faust research team, using the same commercial crab at various developmental stages, demonstrated more crucial matters. A level of a toxicant that produced no effects they recognized in four days (96 hours) killed all exposed organisms in seven days---thus showing that the LC_{50}96hr test is worthless, as many marine biologists have held for some years. A significant part of MMS case is based on the assumption that discharges have been shown to be relatively harmless by the LC_{50}96hr tests. The critique for the EPA Washington Office of NAS/NRC Drilling Discharges has related information.

MOHR-29

Another defective area of the draft EIS is the handling of accident likelihood if the Sale is held. To begin with much of the experience data on which calculations are based comes from the Gulf of Mexico where very different conditions prevail. It is not demonstrated in any way that such extrapolation is sound. There is no consideration of a series of very prominent mishaps. In the first place there are drilling rig mishaps of which Ocean Ranger and Java Sea, (the first of ODECO and MOBIL Oil, the second of Global Marine and ARCO, all U. S. companies) should be noted. In the Ocean Ranger disaster, as revealed by a Royal Commission and related on Radio Canada, 84 men were lost; with Java Sea, not well covered in the United States, 81 were lost. Particularly disturbing is the report from the captain who left Ocean Ranger some weeks before the disaster that 1) he was not permitted to have life-boat drills; 2) that the U. S. Coast Guard had noted more than 200 safety violations, but had not forced compliance---that is, in still another way (U. S. C. G. was responsible for safety regulation despite the fact that the Ocean Ranger was in Newfoundland waters) United States steward agencies can not be counted on to do their statutarily defined jobs when it involves bucking the oil industry.

MOHR-30

Of oil spill accidents the draft EIS is notable in overlooking the implications of Santa Barbara Channel Platform A and IXTOC I. With IXTOC I, the drilling company was SEDCO, a U. S. firm, so it must not be dismissed simply as Mexico's problem; U. S. expertise was at work. About the Platform A spill, it is significant here that a Department of Interior component's waiver on casing requirements led directly to the blowout. DOI did not, however, contribute largely to the cost of the effects survey; $240,000 of the $250,000 support of the survey (done by USC's Allan Hancock Foundation) came from an industry group, Western Oil and Gas Association.
There are a number of disturbing facts about the survey that DOI has chosen not to notice. The individual chosen to direct the survey, a relatively new Ph. D. from Australia, had no direct experience with the area or its organisms (there was a veteran of the "State" survey, a four year study of southern California waters to serve as a sort of pollution base-line investigation, available and eager to take part, but his services were not used). The survey director accepted travel support to meetings from industry sources and ten days of consulting (on Chevron difficulties in the Gulf of Mexico) during tenure as director according to department members and not contradicted by either project director or Hancock director in interview with me.

MOHR-31

According to the survey director's summary, there were not persistent significant effects of the Platform A spill. To the contrary the botanists who checked on macrophytic algae noted very significant losses since an earlier local survey by Dr. E. Y. Dawson (one of the authors of the Skull Cliff kelp-bed paper) and they stated that the survey was too limited to determine either that the spill itself was or was not responsible. Similarly Dr. K. Fauchald (now of the Smithsonian Institution) noted that certain worms were dramatically less abundant than shown by Hartman and Barnard during the "State Survey" ; he also said that the spill survey was inadequate to determine whether the spill was or was not responsible for any or much of the loss. Nearly a decade later Ralph Hazard, a commercial fisherman and fisheries consultant, testified in the original general NPDES permit (CA0110516) hearing in Santa Barbara that a large batch of spill oil deliberately sunken off Anacapa Island had smothered a worm-bed and eliminated what had been a major flatfish commercial fishing area. It had been without activity, but in the tenth year since the smothering, worms were just beginning to come back. It is thus clear that a steward agency was part of the cause of the spill and that there was specific long-term damage by the spill despite agency positions that there was none.

MOHR-32

With the IXTOC I spill it is known that oil reached Texas waters. Industry publications seek to minimize the matter. Dr. Richard Casey, a specialist on marine protozoans, the radiolarians, who took his doctorate with me, was on the faculty of Rice University (a full professor) at the time. Now director of the marine science program at the University of San Diego, he told me during last year's MMS Information Transfer Meeting at Culver City, that he had tried to make studies of the spill effects in Texas waters, that he could get neither support nor access, and that he believed there was more damage than was reported or admitted.

MOHR-33

Of tanker matters Secretary Hodel likes to emphasize that holding up off-shore drilling will make tanker spills more common. It is desirable to examine the analyses esp. Tiburon Laboratory's of the events. The central fact is that what has been promised by industry and steward agencies in the way of responses was not delivered. The clean-up boat was to be on the scene within six hours. According to Calif. Coastal Commission staffer's report before the Commission's meeting at which I was present, the clean-up boat was battered by the rough ocean and had to return to port. The substitute boat arrived after 24 hours. It was less effective at scooping up oil than was supposed to be the case. In the clean-up activities the response team used a wrong current data base moving the wreck in a direction that made the damage worse. There was considerable damage.

MOHR-34

In all of the above there are aspects that are contrary to draft EIS's claims or implications. None is properly covered.

Other areas that I have too little time to cover are tied up with worst case analyses of which I found only two in the draft EIS. MMS people and their contractors seem not to hear or see the things I do. There was a terrific storm about Barrow on October 3 of 1963. Inupiat friends, Pete Sovalik and Chester Lampe, told me of extreme sea-ice thrusts onto the land within memories. I have a huge treatise on an impressive Anchorage earthquake in 1964 and there was a tsunami the killed in Crescent City, California, some miles away. SCIENCE in an april issue this year has an article called Earthquake Hazards on the Cascadia Subduction Zone with references and notes that should be taken into account by the agency. Occurrence of tsunamis of Asiatic origin must be considered.

MOHR-35

Office of Naval Research's European Scientific Notes has items that bear on the problems of Alaskan oil operations. One such examines the level of alcohol use by rig and platform workers during their on-shore breaks; there is no inquiry into illicit use of alcohol on the job. The investigator found much heavy use of alcohol by the workers ashore. In view of the alcohol problems of the Inupiat, this certainly requires considera-tion in the draft EIS.

MOHR-36

Another problem raised in ESN for the North Sea installations is problems of removal of damaged or no-longer-needed platforms. It noted that the matter is rarely considered ahead of time and that the costs are notably greater than is generally anticipated. Observation in probably analogous situations in which a national corporation "sells" an embarrassing property to a small local firm that subsequently goes into bankruptcy without appreciable assets--leaving clean-up as a governmental problem (local government in the case I have most in mind) should be considered in a proper EIS.

MOHR-37

Use of dispersants in possible Chukchi oil spills is not handled forthrightly or adequately. I note that there is not examination of the arctic habitat portion of the recently approved Dispersant Use Guidelines of the American Society for

MOHR-38

Tests and Materials. Head of the task force that developed the guidelines is Dr Lindstedt, an ARCO biologist who took her doctorate on feeding of coelenterates at USC. The arctic portion (although this is not made clear in the published version which is anonymous) was prepared by Dr D. Chamberlain, an ichthyologist who studied at USC and who was at one time laboratory assistant in my invertebrate zoology course. He has not carried out research in the arctic and in preliminary drafts showed little knowledge of arctic biological literature, but he has visited arctic Alaska. None of the DUG sections covers specifics of chemical composition, physiological effects on any organisms, or how one may meet special conditions such as whiteouts, communication failures, change in dispersants stocked, or a lot of other problems. In fact secrecy prevails in the dispersants meetings I have * attended---for example in a "workshop" arranged by EPA IX and USCG, Clayton McAuliffe, of Chevron, reported on what was claimed to be an excellent dispersing experiment off California. A listener asked, "Clayt, did you say what the dispersant was?" Dr McAuliffe responded, "I didn't and I'm not going to". In the current state of operations people confronted with a serious oil spill may not know which dispersant is available, certainly will not know either the precise chemistry of what is delivered or just how it should act based on that chemistry, and not what it may be expected to do with the particular oil or oils in the spill. In view of the formidable circumstances that may be involved in arctic Alaska, the problems need to be examined much more critically than does the draft EIS. It has been claimed that for a period in which the IXTOC I spill was absorbing available supplies of dispersant, none was available for other areas. This should be examined for all OCS EISs.

The incorrect claims about drilling discharges present in draft EIS particularly in Appendix I are treated in the appended critique of Drilling Discharges. I have a more detailed examination with more specifics on the mistakes and what I regard as deliberate manipulations, should MMS want to go further. The recent findings of the Santa Barbara Marine Science Institute investigators should be kept in mind. Not mentioned above was the discovery that levels of Fe and Mn that occur in discharge areas are toxic to some stages of invertebrates. These have been accepted as harmless. They have not been studied at all for offshore oil activity effects. If hematite, a standard weighting agent, should be used in any of the drilling slurries, levels far above those the Zimmer-Faust team found disruptive, would occur.

MOHR-39

* on grounds of proprietary rights, ostensibly.

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Draft EIS coverage of Alternative Energy Sources (Appendix H) is grossly inadequate. To begin with it is the administration of which Secretary Hodel is a part that has sabotaged energy conservation by ditching auto performance requirements (which Chrysler Corp. had met). Not to have mentioned that is UNTRUSTWORTHY.

A second matter is the dropping of research on making kerogen available from oil shale. Colleagues at USC directed a project that succeeded in using bacteria to release kerogen from the limestone portion of the shale and sought support for further work to get release from the silicon portion. I represented Prof. M. D. Appleman in an interview with an official of EPA in its SW Washington offices. He told me that kerogen could not be separated from shale, that had been shown in Montana 20 years earlier. This was after my late colleague's project had succeeded with one side of the task. The present administration's neglect exposes the United States to the perils the Secretary airs and to economic exploitation by the oil companies.

MOHR-40

A further area of dropped support is the use of solar energy. I recall particularly that the late Farrington Daniels (under whom I worked as member of the national board of the Society of the Sigma Xi) had made significant advances with photovoltaics-- a field the federal government no longer presses. Similarly there were tax incentives for installation of solar heating, no longer operative. There is room for significant advances in at least several aspects of solar energy generation. The federal government has copped out.

Wind energy can make some isolated areas nearly energy-self-sufficient Stimulation of that industry by government has stopped. If there is really a situation in which intense offshore drilling must be contemplated, a critical examination of current technology is an absolute necessity and there should be both encouragement to develop more wind-energy fields and research for improving the technology. One must doubt the truth of DOI claims about drilling need when official position does so little to advance the alternatives--indeed, its role has been to fold much of the activity. This makes the oil companies more profitable.

The administration of the old Naval Petroleum Reserves has not suggested that the federal government is deeply concerned about the future.

A closing paragraph: draft EIS shows neither an awareness that unfortunate happenings can occur together, that disruptions can combine synergistically to do worse damage (e.g. carelessness and a storm = 84 dead in Ocean Ranger) or that there may be a last straw, the one that breaks the camel's back as the use of the wrong data base in the Puerto Rican debacle.

MOHR-41

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Submitted 2 May 1987
via Express Mail

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Response MOHR-1

The Allan Hancock Foundation (AHF) at the University of Southern California had--at the time in question--an extensive and current collection of several important marine phyllogenetic groups, most notably polychaetous annelids, crustaceans, echinoderms, bryozoans, and some hydroid groups. The literature in the AHF library also was extensive regarding most marine topics, with particular emphasis on earlier works on biogeography, species distributions, species descriptions, and natural-history observations. These topics characterized most of the marine literature in the 1950's and 1960's. No excuse is made for the misspelling of any word, name, or place--especially the Allan Hancock Foundation--in this EIS; however, this should not detract from the scientific content or the intent of this document.

Response MOHR-2

These distinguished marine scientists have, in their time, indeed made important contributions to our understanding of marine ecosystems and processes; and, while it is not the intent in this EIS to ignore these contributions, it is the intent to tier from these major works to the more recent literature. It should be recognized that most of the more recent works are heavily dependent on the findings of these earlier researchers.

Response MOHR-3

The Council on Environmental Quality regulations governing the NEPA require that the MMS contact other Federal, State, and local agencies concerned with the area under discussion (40 CFR 1503.1(a)(1) and (2)). Agencies are, of course, made up of knowledgeable individuals whose expertise is sought. Although Dr. Max E. Britton has been consulted on an informal basis, his formal responses have not been sought since his retirement. Dr. Galler also is retired. The Arctic Institute of North America (AINA), now located in Calgary, Alberta, Canada, has no scientists on its staff. The pertinent offshore research funded by the AINA in the 1950's and 1960's forms the basis for many of the reports referenced in the EIS. Where appropriate, the original reports are referenced.

Response MOHR-4

Pertinent published studies of NARL research are cited, where appropriate, as is the commenter's article (Mohr, Wilimovsky, and Dawson, 1957; cited in Sec. III.B.1.c).

Response MOHR-5

The author of the EIS sections on Sociocultural Systems and Subsistence-Harvest Patterns is familiar with Arctic Anthropology both as a reader of the journal and as a former student of, and a journal-editorial assistant to, Dr. Catherine McClellan--a past editor of the journal.

Pertinent Russian literature on the biology of the Chukchi Sea has been properly used in Section III of the EIS. Section III.B.3 (Marine and Coastal Birds) uses Portenko, 1981, Birds of the Chukchi Peninsula and Wrangel Island; Section III.B.4 (Pinnipeds, Polar Bears, and Beluga Whales) uses Uspenski and

Belikov, 1974, "Research on the Polar Bear in the U.S.S.R.," and Uspenski and Kistchinski, 1972, "Polar Bear Research and Conservation Measures in the U.S.S.R. in 1970-1971"; and Section III.B.5 (Endangered and Threatened Species) uses Berzin, 1984, "Soviet Studies of the Distribution and Numbers of the Gray Whale in the Bering and Chukchi Seas, 1968-1982," and Tomilin, 1957, "Mammals of the U.S.S.R. and Adjacent Countries," Vol. 9, Cetacea. See the EIS Bibliography for complete citations of the above-mentioned Russian literature.

Mainstream scientific literature is used and cited in the EIS (note references to Science and other journals in the Bibliography). Although the Russian literature may be useful for broad comparisons, the differences in physical regimes of the eastern and western Chukchi Sea (see Zenkevitch, 1963) as well as possible differences in bottom type (Ushakov, 1952, as cited by Zenkevitch, 1963), make it difficult to generalize from much of that literature to the Sale 109 area. Under the USDOI policy of summarizing and incorporating information by reference, three of Thorson's articles are included indirectly. (They were originally cited in the Norton Basin Sale 100 FEIS [USDOI, MMS, 1985c]; also see Sec. IV.B.3 of this EIS.)

The Arctic Anthropology journal is not cited in the EIS because it contained no articles pertinent to the Sale 109 area.

Response MOHR-6

The Dames and Moore study was incorporated in Section IV.B.3.c by reference to the Norton Basin Sale 100 FEIS (USDOI, MMS, 1985c). The amphipod studied by Dames and Moore was not Eogammarus, but Anisogammarus. The sensitivity of amphipods was similar to that of other crustaceans unless the amphipods contacted the mud layer (mostly barite) on the bottom of the test containers. If they contacted the mud, they couldn't maintain themselves on its surface, became partially buried, and died.

Even if the surface component of the discharge went beyond 13 kilometers, the dilution factors reported suggest that effects on pelagic organisms are not likely except in the immediate vicinity of the discharge point.

The importance of the discussion sessions is duly noted regarding a paper by Dr. Reish (academic lineage; see Response MOHR-26) that attempted to establish that hydrocarbons being discharged into a marine-harbor ecosystem were increasing the species diversity of the area. The ensuing discussion session was able to determine that the control station was located outside the harbor and subject to extreme salinity fluctuations. This paper was not published in the proceedings.

Response MOHR-7

The Bibliography has been amended to address this concern.

Response MOHR-8

The EIS bibliographies are prepared under the guidelines established by the MMS Technical Publications System. It is the established practice of some governmental agencies and consulting firms to provide only the agency or corporate--not the authors'--names on a document. Of the over 500 references cited in the EIS, approximately 72 (about 14%) fall into this category, which consists primarily of references from the State of Alaska, the USDOI, and the North Slope Borough. The USDOI documents cited are primarily environmental impact statements. The MMS concurs that authors should be credited or held accountable for their contributions to all of these documents and encourages this practice.

Response MOHR-9

In this EIS--as in any applied-research as well as pure-research paper--the documentation and literature cited have been accepted by the author as important, and unless otherwise qualified, representative of the best available information. If a particular research effort needs qualification that would bear significantly on the intent of the EIS, the commenter needs to be more specific.

Response MOHR-10

This EIS was prepared in compliance with Council on Environmental Quality regulations issued in 1979, which specified a reduction in the size and complexity of EIS's published by the Federal Government with no accompanying reduction in the quality of analysis. The MMS prefers to include supporting appendices in a reduced format rather than to reduce the comprehensive Bibliography, which is used more extensively by EIS readers. The MMS regrets any inconvenience that this format may present to EIS readers.

Response MOHR-11

The "furtive gray literature" is, in most cases, the applied aspects of the "pure" or "white literature." A perusal of the literature cited in gray literature usually reveals several basic research citations on which the applied study was based. The scientific merit of a gray-literature document has been considered in this light and thus was the basis for its inclusion in the EIS. The more applied and recent applications of the MMS' scientific database are represented in the gray literature cited. The commenter is encouraged to check the literature cited in these gray documents.

Response MOHR-12

See Response MOHR-2.

Also, please note that the McGinitie, Pettibone, and Shoemaker work was done in the late 1940's and early 1950's and consisted primarily of natural-history observations and taxonomic descriptions that were the state of the art of the research efforts in the remote Arctic environments at that time. These works are important in the initial description of an area and have provided the basis for more recent studies cited in this EIS. The more recent MMS/OCSEAP research effort has been charged with the more difficult task of providing some quantifiable estimates at the population, community, and ecosystem levels to better predict the potential effects of oil and gas exploration and development in these areas.

Response MOHR-13

While, indeed, kelp are brown algae, not all brown algae are kelp. Kelp are those brown algae belonging to the Order Laminariales, only one of the orders of brown algae. Thus, both the terms "kelp" and "brown algae" are used in the EIS, since brown algae other than kelp--for example, Desmarestia viridis (Order Desmarestiales)--are included.

Response MOHR-14

See Responses MOHR-2 and MOHR-9.

All of the contributing authors of this document have either a Master's degree and/or Ph.D. in their respective fields and have published in the "respected" literature. The same can be said for most of those researchers cited.

Response MOHR-15

See Responses MOHR-2 and MOHR-9.

Arctic ecosystems are characterized by a low species diversity and high biomass. The MMS has conducted major ecosystem studies in Peard Bay, Simpson Lagoon, and the eastern Beaufort Sea. There is a distinct similarity in ecosystem structure in these areas. The Simpson Lagoon study was a major 4-year study that defined an Arctic ecosystem at all trophic levels. At present, a multiyear integrated physical/biological study--"Beaufort Sea Mesoscale Circulation", which is regional in scope (Bering Strait to the Canadian Border)--is defining offshore circulation and cross-shelf nutrient dynamics in the Arctic. In conjunction with the NSF-funded ISHTAR Program in the northern Bering and the Central Chukchi Seas, the MMS-funded Bering Strait/Kotzebue Sound studies, and the Chukchi Sea Benthic study, which focus on lower-trophic dynamics and their contributions to the Arctic environment, the MMS has a major program that cannot be faulted for mediocre science.

Response MOHR-16

The MMS is aware of the ongoing disagreement between Dr. J. Neff, presently with Batelle Laboratories, and the commenter. The EIS does not, in any case, state or mean to imply that there is no physiological difference between species or populations at different latitudes. There are, however, some similarities within the physiological, metabolic, and behavioral makeup of all living organisms that can serve as indicators of potential adverse environmental conditions. It is with this understanding that "compilers" have drawn upon the available literature. Differences are recognized, but so are the similarities of living things (Savage, 1963).

Response MOHR-17

See Response MOHR-16.

Response MOHR-18

The EIS remarks in Section III.B.1.c(3) that the offshore benthos in the northeastern Chukchi Sea has not been extensively studied. The study referred to (Stoker, 1981) was not designed as an in-depth study of the infauna of the northeastern Chukchi Sea but rather as a broad survey of infaunal assemblages in the Bering and Chukchi Seas. As can be clearly seen from Figure III-13, sampling was much more intensive in the Bering Sea. The EIS analysts use the best available data. The MMS recognizes that problems with scale occur at multiple levels and are not all resolvable; the comment referring to the lack of depiction of the rocky substratum in Figure III-4 is one such problem.

Additional data on benthic organisms in the northeastern Chukchi Sea will be forthcoming from several studies funded by the MMS. Some of this work was cited in the text in Section III.B.1.c(3) as a personal communication with Phillips (1986). The concern about the intensity of sampling may be ameliorated to some extent by the knowledge that in other areas where much more extensive sampling has occurred, predicted effects on benthic communities from offshore oil and gas activities are not expected to be extensive or major.

Response MOHR-19

See Response MOHR-18.

Response MOHR-20

The MMS recognizes the limitations of the data being used in the analysis and would prefer to have data from multiple years of sampling; however, because the MMS does not yet have this type of data, the EIS analysts use the best available data.

Response MOHR-21

See Responses MOHR-18 and MOHR-20.

Response MOHR-22

Key elements used in analyzing the potential effects of oil and gas activities on various species are the sensitivities and perceived vulnerabilities of the species. There is no Page II-43 in the DEIS, but the MMS assumes that the commenter refers to subsistence activities. There are no commercial marine fisheries in the Chukchi Sea.

Response MOHR-23

Inupiat "folkways" did not develop under much smaller populations. Particularly the coastal whaling communities are thought to have been much larger at one time than they are today. There were 10,000 Natives in Alaska in 1850. By 1900, this number had dropped to 3,000 (Rainey, 1941). The Point Hope population is estimated to have been 1,342 in 1800 (Burch, 1981); in 1984 the population was 580 (State of Alaska, Dept. of Community and Regional Affairs, 1985). Wales, another Inupiat whaling village, had a population of 400 in 1880 (U.S. Bureau of the Census, 1884), while in 1984 the population was only 136 (State of Alaska, Dept. of Community and Regional Affairs, 1985). Disease introduced by the white man caused Native populations all over Alaska to plummet.

It is correct that under the subsistence conditions that existed prior to the advent of modern weapons, conservation was not part of the Inupiat tradition--but only because there was no need for conservation. However, the Inupiat are wise and intelligent people. It would be a mistake (and an insult) to say that they cannot take care of their public lands and waters; indeed, the North Slope Borough has a fine staff that effectively handles these matters. The Alaska Eskimo Whaling Commission also has done well in protecting the bowhead whale from over-harvesting, and the "steward agencies" are doing their jobs with "continuous vigilance." It should be noted that a MAJOR effect is expected on subsistence harvests as a result of activities associated with proposed Sale 109.

Response MOHR-24

The EIS does not downplay the perceived vulnerability of the few known kelp beds; rather, these communities are highlighted in Section IV.B.3 as being particularly vulnerable. The location of as-yet-undiscovered kelp beds may be revealed by site-specific biological surveys that can be required by the RSFO under potential Stipulation No. 3 (Protection of Biological Resources) in Section II.H.2 of the EIS.

Response MOHR-25

See Response MOHR-26. The potential for effects on behavior, reproduction, and recruitment is discussed in Section IV.B.3.a(2). Little specific information on timing of events such as mate-finding, spawning, etc., is given because almost none of this information is known for invertebrates in the Chukchi Sea region or the offshore areas of the lower 48 states, including California.

Response MOHR-26

The position of the commenter is somewhat confusing regarding the importance of test organisms to their locality and their longitudinal environment. While several researchers have promoted the idea of providing laboratory organisms from the marine environment to be used elsewhere, it is important to note that this same concept was extended to provide "standard" bioassay test organisms that could be shipped to laboratories anywhere in the country for use in toxicity tests. These test organisms are usually the less sensitive species that are found in more severely polluted environments. It is of interest that one of the toughest of the "toughies," the polychaetous annelid, Capitella capitata--found primarily in the most polluted of Southern California-harbor environments, also is a dominant species within the benthos of the Chukchi Sea, as reported by Stoker (1981). This species also is reported in the Russian literature as one of the most "usual" for the area (Zenkevitch, 1963). D.J. Reish has used Capitella capitata in numerous bioassay tests. The use of this highly insensitive organism continues to be questionable for bioassay purposes, especially since it thrives in physically disturbed bottom sediments (Grassle and Grassle, 1974) and polluted-harbor environments (Reish, 1961).

Response MOHR-27

The 96-hour bioassay has been the basic toxicity test for years and still is used extensively. The more practical application of this test is to scope the toxicity of a substance to determine the general concentration ranges to use in more sophisticated tests. More recent state-of-the-art toxicity testing includes systems that maintain a constant level of exposure to the test organisms for extended periods of time. These tests are designed to also determine sublethal effects with respect to fecundity, behavior, reproductive activity, growth, early development success, and bioaccumulation.

Even with just the standard 96-hour static toxicity test, comparative differences between species or between geographically different members of the same species can be determined. In some cases, application factors of 0.1 to .001 have been applied to static, short-term and long-term bioassay results to suggest possible "safe" levels. Attempts also have been made to correlate laboratory bioassay results to exposure levels in the field, or "real world." None of these tests is without its faults, and it is not the intent of this EIS to pose the tests as absolute indicators of any potential environmental-contamination problem. The EIS analysts have used the available literature on this subject--as it applies to their respective disciplines--with an understanding of the shortcomings of the results. Bioassays will always be easy subjects for criticism for "mainstream science," but these criticisms will persist unnecessarily if "mainstream science" is reluctant to get involved and provide the best possible tools with which to answer these questions that concern us all.

Response MOHR-28

The MMS is trying to obtain this information and looks forward to incorporating pertinent aspects into the EIS analysis. Please refer to the concern on Page 8 of the MOHR letter regarding generalizing results from lower-latitude test animals to Arctic species.

Response MOHR-29

See Response MOHR-27. In addition, it should be mentioned that in the case where the Zimmer-Faust research team reported that the organisms did not die until the seventh day of a 4.5-day test, one of two conclusions should be made: (1) the concentrations used in the 96-hour test were not appropriate to obtain the toxic response, and/or (2) a toxic response may not occur until some period of increased metabolic activity or developmental change occurs, or an increase in physiological activity occurs. In this case, a knowledge of the life history of the organisms is critical to the design of the experiment. The Zimmer-Faust tests really didn't invalidate or disprove anything.

Response MOHR-30

The MMS considers historical rates of platform spillage in the OCS, corrected for statistically demonstrated trends, to be the most reasonable basis for projecting platform spillage in OCS waters. Inspection procedures, regulations, and safety practices are standardized on the OCS by the USDOI; and accurate spill and production information is readily available and statistically compatible. The historical OCS database includes production- and exploration-spill records for platforms in the Gulf of Mexico and California OCS Regions, and exploration-spill records for the Alaska and Atlantic OCS

Regions. The MMS considers the application of OCS spill statistics to the Alaska OCS to be a reasonable extrapolation. The rationale for and validation of this extrapolation are discussed in incorporations by reference in Section IV.A.1.b.

Contrary to the implication of the commenter, the accident rates for mobile offshore drilling vessels in U.S. and international waters are similar in cause and by activity (NRC, 1981); projections of accident rates would not have been significantly different if non-OCS accidents were considered in the analysis. Note also the NRC's finding that accident rates were poor predictors of oil spillage; although the NRC found that accident rates had increased in more recent years, rates of oil spillage had actually decreased. The EIS does assume that all applicable laws and regulations would be enforced; however, this assumption cannot bias the observed rates of OCS spillage upon which the oil-spill-risk analysis is based.

Response MOHR-31

The U.S. OCS database used to project spillage in the EIS includes the Santa Barbara Channel Platform A spill. The Ixtoc I spill occurred in Mexican waters in the Gulf of Mexico, "an area where very different conditions prevail" (MOHR Comment 30). Data from both these spills are incorporated in the effects analyses in Section IV.B.2 and elsewhere. The commenter's concern regarding a USDOI waiver of casing requirements prior to the Platform A spill is misplaced. This spill is included in the spill statistics used in the EIS, regardless of factors contributing to the occurrence of the spill. That is the advantage of using historical spill records--contributing factors are explicitly incorporated in the spill rate.

The USDOI evaluates research by its scientific merit--not by a researcher's funding source, be it support from industry, a military research laboratory, the Federal Government, or another source.

Response MOHR-32

The referenced Dawson surveys were conducted 10 years before the Santa Barbara oil spill, and the relationship to the decline in the macrophytic algae population is difficult to assess at best. Dawson established 45 stations at rocky beaches and recorded the populations of seaweeds and marine grasses from 1956 to 1959. Based on the collections made by Setchell and Gardner between 1898 and 1920, Dawson concluded that reductions in the number of algal species had already occurred by 1959. Two of the primary impacts on the macrophytic algal communities in the Southern California area have been increased recreational uses of the beaches, and "educational" field trips and collection of specimens by marine-biology classes. While some long-term damage may be interpreted from the Santa Barbara oil-spill study, the evidence is very inconclusive, especially with the presence of numerous natural oil seeps in the area and with the abnormally high rainfall and flooding that occurred prior to the oil spill. Hartman (1960) reported the extinction of large portions of the benthic community near Ventura following heavy spring rains that changed the sediment composition. As reported by Fauchald (1971), the density reduction in the echiuroid worm, Listriolobus pelodes--concentrated at about 40-meter depths--could be the result of drilling activity, changes in sediment composition, and/or natural population dynamics. Natural population fluctuations are very likely to occur since the density of L. pelodes changed significantly, but distribution and the biomass of other macroinvertebrates associated with the L. pelodes population did not change.

Response MOHR-33

Unsupported hearsay about beliefs of others who also have not conducted research on the subject can be given little credence. Spill-effect studies on Ixtoc I have been published in peer-reviewed literature and support the premise of limited effects (see NRC, 1985).

Response MOHR-34

The USDOI does not claim that proposed Sale 109 would decrease the likelihood of tanker spillage, because any oil discovered would be tankered out of Valdez; thus, Sale 109 production would not replace imported, tankered oil with pipelined OCS oil. The commenter's concern regarding the effectiveness of oil-spill response is addressed in Section IV.A.2.e.

Response MOHR-35

The storm referred to by the commenter is referenced in Section III.A.3. The phenomenon of ice rideup is noted in Section III.A.4.a(1).

As noted by its absence from the proceedings, the physical scientists--geologists, geophysicists, meteorologists, and oceanographers--who participated in the synthesis meetings for the Chukchi Sea Planning Area did not mention tsunamis as a hazard to petroleum-exploitation activities in the Sale 109 area (USDOC, NOAA, 1978; Truett, 1984). Based on this information and the lack of any area-specific data in the comment, tsunamis are not considered in the EIS.

With regard to the descriptive information base of the EIS, regulations for implementing the procedural provisions of the NEPA (43 FR 55978-56007, Nov. 29, 1987) note the following: (1) "agencies shall reduce excessive paperwork by preparing analytic rather than encyclopedic environmental impact statements (1502.2(a)) and reducing emphasis on background material (1502.10) and (2) the environmental impact statement shall succintly describe the environment of the area(s) to be affected or created by the alternatives under consideration (1502.15)."

Response MOHR-36

It is correct to say that there are alcohol and drug problems among the Inupiat. However, it is not the intent of this EIS to analyze the Inupiat drinking problem, except as it relates to proposed Sale 109. Importation of alcohol and drinking is illegal in all of the North Slope communities except Barrow. Thus, when easier access to alcohol and drugs occurs with the influx of additional people, substance-abuse problems are going to increase, as has been the case in Nuiqsut and other Alaskan communities.

Response MOHR-37

Section 22 (Removal of Property on Termination of Lease) of the lease agreement between the United States of America and the lessee (Sires, 1986) states the following:

> Within a period of 1 year after termination of this lease in whole or in part, the lessee shall remove all devices, works, and structures from the premises no longer subject to the lease in accordance with applicable regulations and Orders of the Director.

Furthermore, Section 20 (Transfer of Lease) states:

> The lessee shall file for approval with the appropriate field office of the Minerals Management Service any instrument of assignment or other transfer of this lease, or any interest therein, in accordance with applicable regulations.

Response MOHR-38

The commenter's concerns regarding dispersants, the Dispersant Use Guidelines of the American Society for Testing and Materials (ASTM), and dispersant-effectiveness problems are addressed in summary form in Section IV.A.2.e and in detail in incorporations by reference in Section IV.A.2.e. The commenter should note that the ASTM guidelines were a consensus of many Arctic and oil-spill researchers--all and any who expressed interest in reviewing the draft guidelines. The commenter should not be concerned about the proprietary nature of some dispersant studies limiting the availability of data to industry operators. It is these people who generally are the keepers of the information. For example, the oil-spill-response cooperative, Alaska Clean Seas, has sponsored similar proprietary studies of dispersant effectiveness on Alaskan oils. That dispersant supplies would be insufficient to concurrently treat two spills the size of Ixtoc I is an unrealistic, extremely improbable concern that does not merit consideration in the EIS. Dispersants are just one of many tools available in oil-spill-response arsenals (see Sec. IV.A.2.e), and Ixtoc I was the world's largest spill--orders of magnitude greater than any OCS-oil-related spill in U.S. waters.

Response MOHR-39

The MMS appreciates the critique of the National Research Council's review, Drilling Discharges. The MMS is trying to obtain results of the Santa Barbara investigators and looks forward to incorporating pertinent aspects into its analysis.

Response MOHR-40

Appendix H of this EIS has been revised to reflect current conditions and alternative sources of energy. All the alternatives noted by the commenter are discussed. Economic factors have limited the vitality of several energy programs once funded at the National level; for example, funding of synthetic-fuel production was stopped because it was not an economically viable operation. However, the U.S. Department of Energy continues to fund experimental work in many areas. Current research under the purview of the DOE Office of Fossil Energy is focused on techniques for achieving clean coal and enhanced oil recovery (Haywood, 1987, oral comm.). The DOE, in conjunction with the University of Alaska and the State of Alaska, recently held a workshop to explore options for utilizing Alaskan gas and determine areas in which DOE funding of research would be appropriate.

Response MOHR-41

The historical rate of unfortunate, synergistic happenings that contribute to the frequency of oil-spill accidents is implicitly included in the spill statistics used in this EIS. See also Response MOHR-30.

B. Public Hearing Comments and Responses

Public hearings were held on the Draft Environmental Impact Statement for Chukchi Sea Lease Sale 109 on April 10, 1987, in Barrow; on April 13, 1987, in Point Hope; on April 14, 1987, in Point Lay; on April 15, 1987, in Wainwright; and on April 22, 1987, in Anchorage. A total of 35 persons testified. The oral presentations made by the speakers are not reproduced in their entirety because of the length of the transcripts. Instead, the significant issues discussed by the speakers are excerpted.

Speakers who presented written documentation of their oral testimony are indicated with an asterisk (*). These exhibits or letters are reproduced in their entirety, with MMS responses following each exhibit. The exhibits are located after the respective excerpts from testimony for each hearing. Where letters were received that reiterated oral testimony, the reader is referenced to the preceding Letter Comments and Responses (Sec. V.A). Speakers are listed in the order in which they testified; excerpts from oral testimony appear in the order heard.

1. Barrow Public Hearing:

Speaker	Home/Affiliation
James Savok	North Slope Borough
Earl Finkler	*City of Barrow
Eugene Brower	Barrow Whaling Captains Association
Mike Philo	North Slope Borough
Tom Albert	North Slope Borough
Marie Adams	Barrow, Ak.
Rex Okakok	Barrow, Ak.
Ronald H. Brower, Sr.	Barrow, Ak.
Joash Tukle	Barrow, Ak.
Delbert Rexford	Barrow, Ak.
Arnold Brower, Jr.	Alaska Eskimo Whaling Commission
John Craighead George	Barrow, Ak.
Nate Olemaun, Jr.	Mayor, City of Barrow
Dorcas Maupin	Barrow, Ak.
Robert A. Edwardsen	Barrow, Ak.
Michael I. Jeffery	Barrow, Ak.

Issues Raised

1. Mike Philo: The DEIS, in my opinion, underestimates the potential impact to bowhead whales; this occurs in the section on impact to bowhead whales (Sec. IV.B). You can see it in Table S-1, and also in the worst-case analysis, which is Section IV.B. In all those cases, the predicted impact to bowhead whales is given as minor. In my opinion, those impacts should be rated as at least moderate and, actually, preferably, major--especially if loss of sexually mature females occurs. In the worst-case analysis, the EIS predicts some chronic effects, such as [a] lower fecundity rate and [a] slower population-growth rate. My opinion is that there's so little known about bowhead whale reproduction, we should assume the worst. That is, these chronic effects would cause a decline in the population, and the population may not recover within one generation. According to Table S-2, that's a major effect.

Response: This concern is addressed in Response NSB-60.

2. Mike Philo: I also disagree with the assessment of what will happen when there's contact between bowhead whales and spilled oil. One of these is on Page I-15, in the sixth paragraph, where it says that a spill would have to occur when and where the whales are present and would have to contact the whales in order to put the whales at risk. My disagreement is in two parts: (1) that it [an oil spill] doesn't have to be when and where the whales are and (2) the whales would not only have to contact the spilled oil to be affected by it. My disagreement with the when and where is that a spill could occur during the winter in the ice and would not necessarily be released until breakup; so the oil could be spilled in the winter and not contact the whales until breakup when the whales are in the lead. My disagreement with the restriction to contact is that whales have been seen milling and feeding along the spring-migration route, so that not only would they be likely to contact it [oil], but they may ingest it as well--either on the surface, in the water column, or through contaminated prey.

Response: This concern is addressed in Responses NSB-12 and NSB-13.

3. Mike Philo: The last general area that I have a comment on is the area of [impacts on] subsistence hunting. This is another area in which the impacts are underestimated. The document predicts that the impacts to subsistence whaling would only occur in Point Hope and Wainwright and that the effects would be moderate. I think that all the whaling villages would be affected; and it's likely that the effect would be major, not minor. There are two points that I want to use to support that opinion. One has to do with the statement about the IWC [on] Page IV-B-97, in the first paragraph. At the Sale 97 hearings, I predicted that if there were an oil spill that contacted the bowhead whale population, the IWC might close the subsistence hunt. In the 109 document, it says that if an oil spill were to occur when bowhead whales were migrating through the Sale 109 area, it is unlikely that enough whales would be affected for the IWC to suspend bowhead whaling. My comment is that the document itself gives instances where quite a number of whales could be contacted. On Page I-16, in the second paragraph, it talks about computer simulation of oil spills that are contacted by whales. In one instance, it says 0.6 percent of the population are predicted to [be affected]; and in the second one, it says 1.5 percent of the population would be affected. So, based on the last estimate of the bowhead whale population, which is 4,417, those percentages come out to 26 whales and 66 whales, respectively. Compare that to the quota this year and last year--the IWC-imposed quota for hunting.

Then again, on Page IV-B-66 in the first paragraph, it says that in a short-term spill, no more than a few hundred bowhead whales might be contacted by lightly weathered oil; and it says in a longer spill--something like an uncontrolled blowout--perhaps the whole population could be affected. If the Eskimo whalers were to deliver a nonlethal strike to a whale, that still counts as a whale. If that happened all season without a kill, that's the end of the hunt for the season. Now, it's hard for me to believe that the IWC would accept even 26, let alone 66, or several hundred, or most of the population, without stopping the subsistence hunt. If they did impose a ban on subsistence whaling, there's no reason to believe that it would only last 1 year. That puts it in the category of a major impact; and that would affect not just Point Hope and Wainwright but Barrow, Kaktovik, and Nuiqsut as well.

Response: See Response NSB-63.

4. Mike Philo: The second example I want to use to show that I think it's a major effect on subsistence whaling has to do with some comments that are made in the document, on Page IV-B-97 in the third paragraph. In that part of the document, it states that whales might be pushed offshore and out of hunting range by a combination of industrial noise, poor weather, and ice conditions. There's no reason to think that that combination is what's necessary to push whales offshore out of range. I think that industrial noise alone could do that. If that were a recurring industrial noise every year, the whales could be pushed offshore every year; and that would be a major effect on the subsistence hunt.

Response: See Response NSB-66.

5. Mike Philo: I have one other comment to make on the area of evaluating impacts to the subsistence hunt. Actually, this applies to impacts to the bowhead whales as well. I am referring to a place in the document that begins on Page IV-B-94, the section entitled Causal Agents Affecting Subsistence Patterns. Again, these comments apply to the section on bowhead whales as well. There are two types of effects that I think should be included in discussing effects on [the] subsistence hunt and on bowhead whales. One is the toxic effect of the dispersants. In two places, it [the EIS] talks about the increase in the toxic effect of oil due to the addition of dispersants. That's one thing. The second thing that I think should be discussed is the effects of the actual cleanup operations--the vessel noises, the vessels moving in the area, burning of oil, use of mechanical cleanup equipment, and probably a number of other cleanup activities, which can be added to this list.

Response: Effects from noise and traffic disturbance are discussed in Section IV.B.10.b(1). Whether noise comes from a vessel cleaning up an oil spill or a vessel delivering supplies is not important; it is the noise and presence of any vessel that is the important factor to consider. However, mention of cleanup activities has been added to Section IV.B.10.b(1) to address this concern.

6. Mike Philo: My last comment has to do with the whole document itself. I have a lot of trouble with the tone of the document, as I did with the Sale 97 document. A lot of the comments that I have made here tonight might help to explain the problem I have with it. . . One example was the question of how IWC would respond to a spill. I don't think it was really given as much consideration as it should have. I had the same problems with underestimation of impacts in this document as I did with the Sale 97 document. And Table S-1 in both documents, in my opinion, gives the reader the impression that all of the deferral alternatives, which were supposedly put there to reduce impacts to the environment, actually don't do that, because most of the deferral alternatives have essentially the same impacts as the proposals. These are the kind of problems which lead me to the conclusion that these two draft EIS's were written with a bias toward development at the expense of not [providing] an adequate treatment of the potential effects to the environment.

Response: See Responses NSB-63, NSB-64, and BIA-1.

7. Tom Albert: I was commenting about interference from spilled oil. As you realize, in the spring these animals [bowhead whales] are more or less confined to the lead system and the associated broken ice. As you well know, there's no way to deal with substantial amounts of oil under these conditions. And, as far as we know, almost all of these animals move through this area so that oil spills at this time, without any doubt, could be a catastrophe.

Response: This concern is addressed in Responses STATE-7 and NOAA-55.

8. Tom Albert: Another source of interference, obviously, is noise, and that is noise from icebreakers, tankers, and drilling platforms. A particularly scary thing would be ships in the leads. The idea of ships being in the leads--although some folks may say that if the whales are there, the ships will stay away--I don't believe that because I think the insurance companies will require that all vessels take the path of least resistance, and that means in the lead or in the associated broken ice. And even though these whales are not insured, as far as we know they, too, take the path of least resistance.

Response: This concern is addressed in Response NSB-19.

9. Tom Albert: If industrial activity is allowed in this coastal deferral area during the spring, it could very well interfere with the annual whale-counting efforts off of Barrow. These numbers that are generated here during the censusing time are what the IWC uses as it helps to determine the harvest quotas. So, anything that would negatively impact the counting effort could, then, have an impact at the IWC, which would then have an impact on the subsistence hunt. As far as I know, this is not mentioned in the document; and, as Dr. Philo pointed out, what is mentioned in reference to the IWC is downplayed. I think the document, when it's revised, has got to give due consideration to this IWC thing. This is a very, very real thing and, in my view, not very well treated in your document.

Response: See Response NSB-64.

10. Marie Adams: In your document (it's real hard to read, and the parts that I did read), the treatment of the impact on our resources is minimal; but when you talk about the impacts on the subsistence hunters, you say something like major impact on the subsistence hunters. To me, the two are interrelated. If it does impact our people at a major level, to me that means they've been impacted to a point where it's affecting the whole ecosystem, including the human predators. I'm calling myself a predator; we're part of the cycle up here. We have been up here for hundreds and millions of years and have depended on our resources up here, and continuously depend on them, especially now with the declining revenues. Those resources are going to be much more important that they have been in the last decade up here in the North Slope; and any impact on those resources is going to be devastating for the people who depend on them.

Response: It is often difficult for the reader who is not acquainted with subsistence analysis to understand why the level of effects for subsistence harvests is different from that for biological resources. The biological-resource analysis examines effects on an entire population of a resource, while the subsistence-harvest analysis only examines effects on a potentially small portion of a population--effects that are often localized. If an oil spill occurred in the only place where a resource is harvested and during the primary month when a resource is harvested, then that harvest could not occur for the entire year--which would be a MODERATE effect. If this occurred in two or more consecutive years, the effect would be MAJOR. Thus, even though an oil spill might not have more than a MINOR effect on a biological population, it could have a higher level of effect on the subsistence harvest of a localized portion of that population. Similar logic applies to noise and traffic disturbance, construction activities, and facility sitings. Levels of effects on subsistence harvests also will vary according to whether a harvest occurs during a short timeframe or throughout the year, in few or many places, or in low or high numbers.

11. Rex Okakok: The shoreline of [the] Chukchi Sea has not been adequately marked or researched for topography, geology, and soils. Technologies and strategies considered to explore for petroleum resources are different from the Beaufort Sea; and special studies and research are needed to address adequately the physical and chemical oceanography to test the variability and the dynamics of ice and water masses, including the special role of the seas covering the continental shelf, major boundary currents, and exchange of adjoining seas. There is still insufficient knowledge of ice and oceanographic conditions.

Response: The topics noted in the comment are described in Sections III.A and IV.A.3 of the EIS. These topics are, and have been, the subject of many past and current studies sponsored by the MMS (see Appendix D). Many of the topics also have been studied through research programs sponsored by public and private institutions.

12. Rex Okakok: Further studies are needed in the area of mesoscale interactions between the ice and structures, and between ice and ships from the macroscale of ice/flow distribution, movement, size, and thickness to [the] macroscale of ice dynamics in the Chukchi Sea as opposed to [the] Beaufort Sea.

Response: The mesoscale and macroscale features of the Chukchi Sea ice regime are described in Section III.A.4. Through its Environmental Studies Program (ESP) and the Technology Assessment and Research Program (TARP), the MMS has sponsored, or helped to sponsor, a number of research projects related to the interaction between sea ice and manmade offshore structures. The ESP sea-ice studies are listed in Appendix D. The TARP studies include: structural materials for Arctic operations, mechanical properties of sea ice, ice forces against Arctic structures, development and testing of an ice sensor, ice-stress measurements, modeling of ice-structure interactions, engineering properties of multiyear-ridge sea ice, and measurement of ice stress around a caisson island in the Beaufort Sea (USDOI, MMS, 1987c).

The small- and large-scale interaction between sea ice and offshore manmade structures is also addressed in programs sponsored by individual companies or industry associations that are concerned with the design, construction and installation, and operation of offshore facilities.

See also Response NOAA-13.

13. Rex Okakok: No developments should occur until the area addressed above--and including the atmospheric/ocean/ice interactions, integrated long-term marine-ecosystem studies, marine mammal research, effects of noise and toxicants on marine mammals and their accumulative effects, terrestrial and freshwater biological studies for long-term ecological monitoring of natural responses, and man-induced effects--have [a] substantial database.

Response: Except for freshwater biological studies, the information needs identified in Issue No. 13 (and Issue Nos. 11 and 12) are being acquired along with similar needs in adjacent lease-sale areas (Hope Basin and Beaufort Sea). Several of the data needs are of a generic nature (i.e., toxicant and noise effects on species; atmospheric/ocean/ice interactions) and are not exclusive to the Chukchi Sea. Sea-ice dynamics specific to the Chukchi continue to be analyzed and archived by remote sensing. Extrapolations on sea-ice dynamics from data collected in adjacent lease-sale areas are valid. Ecosystem processes, by necessity, have to be linked to regional (Arctic and global) oceanographic and meteorologic processes. At the present time, there are several ongoing regional studies of this nature that include the Chukchi Sea.

14. Ronald Brower, Sr.: When you consider the dynamic forces which are interplaying in our part of the country--say, if you take a west wind and a west current, the ice forces are much more dynamic than what would be in the Beaufort Sea; and the impact of that would be much greater if you are developing sales which are going to incorporate drillships. In dealing with those ice ships that would be located in there, as identified in the EIS, it would be detrimental to our coast here and [would] have a much greater impact than is identified in your EIS statement.

Response: The operation of floating drilling vessels is described in Section IV.A.3.a(1). This description also includes a brief discussion of sea-ice forecasting and ice-management techniques.

15. Joash Tukle: When the whole ice pack starts piling up, there's nothing to prevent it from going through its course. From that point of view, what would it be like if the Arctic ice can do that to ships with their captains and their crews--what would it be like even for a floating platform, or a tanker, or whatever is used as a drilling rig out in the Arctic ice. Anything--whatever means are used to prevent the Arctic ice from crushing it underneath all this ice pack. And we know for a fact, whether we are Inupiat, or Taniks [Caucasians], that in the years gone by we all may have heard how that people who lived on top the bluff here--once the ice comes up and crushes them all under it. If the Arctic ice pack can do that, what can [it] do to a floating platform or a ship that has this drilling rig in it. If it can do that to solid ground--the bluff, imagine what it can do to a floating platform down on the ice. You may have seen pictures or have gone over to these offshore drilling rigs east of Prudhoe Bay. That is where there is not much

current, and they are safe; nothing drastic has happened there. But the current is different west of Barrow; from that point of view, it would be very difficult--once this ice pack starts piling up--to anything floating on a platform or a ship because the currents are much more forceful west of Barrow than they are where the offshore drilling is going on east of Prudhoe. The currents are different in the Arctic Ocean west of Barrow and east of Barrow.

Response: These concerns are addressed in Response NRDC-2.

16. Joash Tukle: During fall hunting on the bowhead during 1976, we had gone out of Barrow while it was still dark. We had gone by boat, had traveled for about a half-hour; but since it was too dark for us to do anything, we cut the engine off and waited for the other boats, all the while listening [for] where the bowhead was. When the other boats caught up with us and we finally got to where the bowhead[s] were, there were about 150 to 200 whales in one spot. I am not telling you now of what somebody told me; I was there. I saw it with my own eyes, and it is a fact--the one I'm telling you about right now. So, since the offshore drilling started way back over there near Prudhoe or east of there, during fall bowhead hunt it would seem that the bowhead had taken another route on the Arctic Ocean. Because last fall we went whaling starting from September, October, November--in all that length of time, all we saw was 3 bowheads and that was way far away down there at the real far distance. If we can take into consideration what the problem is, where we can put the blame, we would all think--whether we are Inupiat [or] whether we're Tanik--that all this began to change as the offshore drilling started, though it is very far from Barrow. The bowhead, being sensitive to any kind of noise, any kind of activity, has started taking another route since that time, because during fall bowhead hunt it has really changed.

Response: Ljungblad, Moore, and Clark (1986), MMS subcontractors who have flown aerial endangered-whale surveys over the Beaufort Sea for the past 8 years, report that groups of feeding bowheads have been observed near Point Barrow during 4 of the past 10 years. They speculate that waters near Point Barrow may be inconsistent in annual productivity and that this possibly explains why bowheads are intermittently seen feeding there. Even prior to OCS exploration, Durham (1979) reported occasionally sighted groups of bowheads near Point Barrow in the fall.

17. John Craighead George: Little has been said about fish. The conclusion of the EIS was that the effects would be minor; this may be somewhat premature. I suggest you consider the electrophoretic work that's been done on the Arctic shore, [which] suggests that the decaluptics (is that what they are?) may be reproductively tied--unique to the drainages in the Beaufort Sea. You know that each drainage is a separate population. I suggest you contact Benny Galloway of LGL, Limited, because I think he did some similar work with pink salmon, and those, of course, would pertain to the Chukchi rivers. It may be that if these stocks are unique, that an oil spill, or something during out-migration or in-migration, might essentially eliminate a particular stream stock.

Response: The MMS is currently funding the research on Arctic char to which the commenter alludes. This year, the research is being extended into the northeastern Chukchi Sea; but the recent pertinent results of the Beaufort Sea work have been added to the text in Section III.B.2. The analysis in Section IV.B.4 has been amended accordingly.

18. John Craighead George: Finally, I'd like to support what Joash Tukle and Ron Brower said. I'm not an engineer, but I spend a considerable amount of time on the Chukchi side, on the sea ice, and have tracked icebergs going at nearly 5 kilometers an hour at the size of this village. I can't imagine how any structure could withstand the impact of the multiyear ice going by [at] 2, 3, 4 knots.

Response: These concerns are addressed in Response NRDC-2.

19. Nate Olemaun: As you know, the existing pipeline--there's no hunting allowed around it. If you put a pipeline from off Point Franklin over to Pump Station 2, the same thing would happen right in the middle of our hunting area; that would have a major impact, and you address it as minimal. Even though you have put [the pipeline] in the impact statement, you look at it as minimal, hardly any impact. But if you put a pipeline--say from Point Franklin, the way it's indicated, to Pump Station 2--that's going to prevent us from traveling between here and Wainwright or Nuiqsut or to any of our campsites inland. We would have to make quite a bit of detour to cross.

Response: The commenter is correct in stating that there are regulations against hunting near the pipeline. However, there would be no problems associated with crossing the pipeline. According to the approved North Slope Borough Title 19 Land Management Regulations and Barrow Zoning Ordinance (19.80.040.C, Minimization of Negative Impacts):

> When linear structures such as roads and pipelines are located in areas used as corridors by migratory species of wildlife, a means of crossing shall be included for those migratory species. . . Above-ground pipelines shall be elevated a minimum of five feet, except at those points where the pipeline intersects a road, pad or caribou ramp.

CITY OF BARROW

"farthest north incorporated city"
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TO: MINERALS MANAGEMENT SERVICE

CITY STAFF TECHNICAL COMMENTS ON
THE PROPOSED OCS LEASE SALE 109
APRIL 10, 1987

The City Staff have reviewed the Chukchi Sea Sale 109 Draft EIS and have prepared two technical memorandums on environmental and socioeconomic considerations. In summary, it appears from the EIS that the only alternatives that seem to be reasonable from an economic, environmental and subsistence stand point would be Alternatives II (no development) and VI (no development in the coastal area).

Alternative IV (eastern area deferal) would provide some protection to areas important to Barrow subsistence activities. However, the most important marine mammal species for subsistence (bowhead and other whales) would be left vulnerable by development within their spring migration area west and north of the defered area. Although this alternative would be preferable to alternative I to Barrow residents, Alternative VI provides the greatest protection.

The local economic impact from the sale appears fairly minor, since according to the EIS, "the number of jobs to be filled by the regions's permanent residents is not projected to be large." If development is to proceed, maximum local hire and training efforts should start as soon as possible.

Alternative VI does not eliminate all environmental and subsistence risk, but it does reduce them. Alternative II (no development) has no risks to our environmental and subsistence resources, but it remains to be seen whether Department of Interior would ever choose this option.

Finally, the Department of Interior must take steps to protect subsistence resources no matter which option is chosen. At a minimum, Department of Interior should severely restrict development activities during critical migration periods for marine mammals. **BARROW-1**

CITY OF BARROW

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M E M O R A N D U M

TO : Mayor Olemaun & Council

FROM: Earl Finkler, City Manager

Earl Finkler

DATE: April 9, 1987

SUBJ: OCS LEASE SALE 109;
SOCIOECONOMIC CONSIDERATIONS

Attached is a memorandum from Monte Engel covering some environmental concerns with the proposed federal OCS Lease Sale 109 which runs from Point Hope past Wainwright to a point approximately 31.5 miles southwest of Barrow. Monte summarizes the six development alternatives very well and recommends as the only reasonable choices II (no development) and VI (no development in the coastal area). Since, as he notes, it is unlikely the Department of the Interior will choose II (no development), a possibly more realistic alternative might be VI (no development in the coastal area).

Socioeconomic Considerations:

This sale will not have a significant effect on the local Borough economy. With or without the sale, "the unemployment rate for Native residents would still reach 50 percent by 2005," according to the EIS.

"The effect of proposed sale 109 on the economy of the North Slope Borough region would be NEGLIGIBLE," according to the EIS.

So even the full sale itself would have a NEGLIGIBLE effect on jobs and the economy in the North Slope Borough. Alternative VI, (no development in the coastal area) recommended by Monte would have only a slightly less impact on the economy. According to the EIS, under VI, "the number of production platforms installed and operated would be reduced by over 20 percent, and the number of production wells drilled would be reduced by over 15 percent." The reduction would make alternative VI only about 10 percent less economically significant on the North Slope Borough economy, an effect the EIS calls NEGLIGIBLE. Even the No Development Alternative (II) would have only a "MINOR" effect on the North Slope Borough economy, according to the EIS. In addition, "the number of jobs to be filled by the regions permanent residents is not projected to be large."

MAYOR OLEMAUN & COUNCIL
APRIL 9, 1987
PAGE TWO

Increased population associated Sale 109 development could result in somewhat higher North Slope Borough operating revenues and expenditures, according to the EIS, "by allowing collection of additional property-tax-operations revenues that are proportional to the North Slope Borough population."

According to the EIS, Sale 109 is projected to increase North Slope Borough operating expenditures by 10 percent or more between 1997 and 2010. Of course, even the more restricted option VI (no development in the coastal area) would apparently still result in about a nine percent gain in NSB operating expenditures, only one percent lower than projections for the full sale.

CITY OF BARROW

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MEMORANDUM

TO: Mayor Olemaun & Council Members
FROM: Monte Engel, City Attorney
DATE: April 8, 1987
SUBJECT: OCS Lease Sale 109

This memo will address the environmental concerns the staff has with the proposed OCS Lease Sale 109. The Sale 109 area starts at Point Hope, goes straight west approximately 80 km (50 miles) to longitude 169 W, then north to latitude 73 north, then east to longitude 162 W, then south to latitude 71 N, then east to the coast approximately 50 km (31.5 miles) south west of Barrow.

The Draft Environmental Impact Statement prepared by the Minerals Management Service contains six development alternatives. Alternative I is full development of the sale area. Alternative II is no development of the sale area. Alternative III is to simply delay development for two years. Alternative IV is to develop the entire sale area except the costal area from south of Barrow to south of Point Lay. Alternative V is to develop the entire sale area except from Point Hope to Cape Sabine. Finally, Alternative VI would be to develop only that portion that is at least 41 km (25.6 miles) from the shore.

The only alternatives that seem to be reasonable choices are II (no development) and VI (no development in the coastal area). The area identified in Alternative VI for no development is identified as the bowhead whale spring migration corridor, and as the major area for other marine mammal subsistence hunting. Alternative VI does not completely eliminate all risk of impact on subsistence activities by development, but it does reduce them. If development in sale area 109 is going to take place, this is the best alternative for the people of Barrow. Alternative II has no risks, but it is unlikely that the Department of Interior will choose this option.

In addition to supporting Alternative VI the City could recommend that special restrictions be placed on development activities in the sale area during peak periods of marine mammal migration. **BARROW-2**
Similarly, restrictions should be placed on land based pipeline construction during caribou spring migration and calving periods. **BARROW-3**

Response BARROW-1

The Department of the Interior and the MMS are mandated by Federal law to protect marine mammals and endangered species, and the MMS intends to fulfill its responsibilities under this mandate. The MMS has evaluated several mitigating measures included in the FEIS that could be used to minimize adverse effects on marine mammals and endangered species (see Sec. II.H.2).

Response BARROW-2

This concern is addressed in Response BARROW-1.

Response BARROW-3

The MMS does not have the legal authority to restrict onshore construction activities that may be associated with the onshore oil and gas development transportation scenario. However, the BLM and the Alaska DNR and ADF&G may require seasonal restrictions on pipeline and road construction during the caribou-calving and spring-migration periods.

2. Point Hope Public Hearing:

Speaker	Home/Affiliation
James Savok	North Slope Borough
Jack Schaefer	Point Hope, Ak.
Leo Kinneeveauk	Point Hope, Ak.

Issue Raised

1. Jack Schaefer: [In] Section V, Consultation and Coordination [with local governments and Native organizations], there is a lack of the village corporation in Point Hope and also the Native Village of Point Hope, which is an IRA government. Also, I believe a few other IRA governments are not listed here.

Response: The text in Section VI (Sec. V in the DEIS) has been amended to address this concern.

3. Point Lay Public Hearing:

Speaker	Home/Affiliation
Annie Martin	Point Lay, Ak.
Jack Susook	Point Lay, Ak.
Nancy Lampe	Point Lay, Ak.
Allen Attongowruk	Point Lay, Ak.
Willie Tukrook	Point Lay, Ak.
Amos Agnasagga	Point Lay, Ak.

Issue Raised

1. Willie Tukrook: I'd like to see this lease sale postponed or canceled due to the fact that not enough noise-pollution study has been done on the belugas; we have no idea now the noise will affect them. It might change their migratory routes. It might be too much activity around if the lease sale goes through, and it might chase the belugas away. I've seen the same thing happening in Kotzebue. The belugas hardly go into Kotzebue Sound anymore, where they used to be numerous. It might be due to activity or noise pollution. But I think some kind of a study should be made and included in the EIS before this lease sale takes place.

Response: Noise associated with exploration-drilling units, production platforms, marine vessels, and aircraft associated with the proposal is not likely to cause any long-term displacement of beluga whales from the Point Lay subsistence-hunting area. Extensive vessel and air traffic associated with oil and gas activities in the Mackenzie River Delta area in Canada have not displaced beluga whales that occur in that area, nor have they greatly affected beluga whale hunting in the area (see discussion in Sec. IV.B.6.b(2) and (3), Noise and Disturbance Effects). The MMS Alaska OCS Region has proposed a study to investigate the potential effects of icebreaker-vessel noise on the migration and behavior of beluga whales; this study may be funded in the future.

4. Wainwright Public Hearing:

Speaker	Home/Affiliation
Charles Brower	North Slope Borough
Jim Allan Aveoganna, Sr.	Wainwright, Ak.
Lydia Agnasagga	Wainwright, Ak.
Florence Ahmaogak	Wainwright, Ak.
Winfred Ahvakana	Wainwright, Ak.
Luke Kagak	Wainwright, Ak.
Alma Bodfish	Wainwright, Ak.
Jim Allan Aveoganna	Wainwright, Ak.
Mr. Bodfish	Wainwright, Ak.

5. Anchorage Public Hearing:

Speaker	Home/Affiliation
Rich Ogar	*Alaska Oil and Gas Association *Brown & Root U.S.A., Inc.

U.S. DEPARTMENT OF INTERIOR
MINERALS MANAGEMENT SERVICE

HEARING ON PROPOSED
OIL AND GAS LEASE SALE
CHUKCHI SEA SALE 109
MAY, 1988

April [illegible], 1987
Anchorage, Alaska

My name is Rich Ogar. I am employed by ARCO Alaska, Inc., in the Issue Advocacy Department and have been a resident of Alaska since 1981. I am appearing here today on behalf of the Alaska Oil and Gas Association (AOGA). AOGA is a trade association whose members account for the bulk of oil and gas exploration, production and transportation activities in Alaska and on the Alaska OCS. Many of AOGA's members are interested in the proposed Chukchi Sea Lease Sale. In addition to my remarks today, AOGA will be submitting written comments for the record.

At the outset, let me state AOGA's primary recommendations for this Lease Sale:

1. That Alternative I, offering the entire proposed sale area on schedule, be adopted; and

2. That no seasonal drilling limitation be imposed.

It is appropriate to reflect on the purpose of this proposed lease sale. The DEIS states, "In 1978, Congress mandated the DOI 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.'" (DEIS p. I-1)

It is essential that the proposed Chukchi Sea Sale 109 proceed on schedule if the Congressionally-mandated energy objectives are to be achieved. The DEIS recognizes that economic, political and social benefits will accrue from the availability of domestic offshore petroleum production. It also describes the impact of the cancellation of the sale (Alternative II) as follows: "The cancellation of the proposed lease sale could reduce future OCS oil production, prolong the need for imported oil, and add to a national need to develop alternative-energy sources.". (DEIS at p. IV-C-1).

A failure to evaluate the hydrocarbon potential of the Chukchi Sea Lease Sale area at this time would be a significant set-back to the effort to evaluate this nation's remaining resource potential. The mean resource level projected in the DEIS for this lease sale is 2.68 billion barrels. This resource potential is important and must be evaluated. The discovery here of commercial reserves could help to insure uninterrupted energy supplies for the Nation at a time when they may be direly needed.

According to Interior Secretary Donald Hodel, America is facing an avoidable energy crisis. "Avoidable" because many continue to believe that oil will remain abundant on the world market in the foreseeable future despite what OPEC may do. But, unless we prepare for the future emergence of OPEC as the dominant force in the international world market, the Secretary warns that "the chances of a crisis grows greater and the potential consequences become increasingly onerous".

The February, 1987 National Petroleum Council report entitled "Factors Affecting U.S. Oil and Gas Outlook" states that American oil imports will rise from 27% of domestic consumption in 1985 to 50% by the early to mid-1990's.

The report states further that in 1986 domestic oil production dropped by 700,000 barrels a day, oil demand increased by 2.5 percent and oil imports rose 23 percent (to 33 percent of supply). A continued decline in production and exploratory and development drilling will reduce production capability in the future, which, when combined with growing demand, will result in even greater dependence on imports. The nation must address the increased vulnerability that will inevitably result from a continuation of these trends. Certainly, Sale 109 is one of the steps we should take to reverse such trends.

Based on geology and on geophysical data, the United States has substantial undiscovered oil and gas resources. These resources are relatively high cost because they are located either in smaller fields or in remote and hostile environments. Discovery and development of these resources will require significant investment and development of existing and new technology.

Environmental conditions in the Chukchi Sea will be demanding. However, industry has the proven ability to operate safely in the OCS in general, and in the Bering Sea and adjacent Beaufort Sea OCS areas in particular. All OCS activities are carefully regulated, both prior to and after a lease sale, by various federal and state agencies under several statutory and regulatory programs. Industry has the technology and equipment available now to safely explore the Chukchi Sea and is confident that it can do so without significant adverse environmental effects.

With regard to the question of the effect of OCS exploratory activity on subsistence hunting of whales, we believe it is important to note that in 1986 the villages of Kaktovik and Nuiqsut were successful in obtaining 4 whales out of their total limit of 5. These kills were made during a period when marine seismic and exploratory drilling activities were being carried out in the immediate vicinity of the hunting area which was in the eastern portion of the Beaufort Sea Sale 97 area. The fact that the subsistence hunt, seismic operations and drilling operations all came to successful conclusions offers evidence that drilling and seismic activity can occur without interfering with subsistence activities.

Tract deferral alternatives are not justified by the MMS analysis in the DEIS which concludes that there is no change in potential adverse impact by deferrals. According to the DEIS, Table S-1, the Deferral alternatives offer no environmental advantages over proceeding with the proposal, Alternative I. For that reason, and because of our urgent national energy needs, AOGA strongly supports Alternative I, and urges that the entire proposed lease sale area be offered on schedule in May, 1988. Even if the offering is held on schedule and commercial quantities of petroleum are discovered, the DEIS mean resource scenario indicates that it would be at least 1999 before the first barrel of oil would be produced from the Chukchi Sea (DEIS Table II-3). It is unclear what the state of world political relations and energy supply circumstances may be in 1999, but it is clear that if this lease sale does not go forward on schedule, the potential reserves in the Chukchi Sea would not be available in this century to contribute to the Nation's security or energy supply.

As I have discussed, the United States remains vulnerable to energy supply disruptions. That vulnerability is increasing daily at a dramatic rate. No one curative measure will solve the

problem; however, holding the proposed lease sale on schedule, and without seasonal drilling limitations, would be a positive step in the right direction and one that must be taken.

Thank you for this opportunity to comment today.

MC6:618

Brown & Root U.S.A., Inc.

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TESTIMONY OF THE

ALASKA SUPPORT INDUSTRY ALLIANCE

ON THE

CHUKCHI SEA SALE
109
Draft Environmental Impact Statement

by

Chuck Becker

Director
of
Governmental Affairs

Brown & Root USA, Inc.

at a
Public Hearing
of
the
Minerals Management Service
of
the
United States Department of the Interior

April 22, 1987

a Halliburton Company

THE ALLIANCE
MEMBER

I am Chuck Becker, Director of Governmental Affairs for Brown & Root USA in Alaska and am here today representing the Alaska Support Industry Alliance for which I am Vice President of Public Policy.

The Alliance is the concerted voice of over 300 firms throughout Alaska which, directly and indirectly, serve the needs of Alaska's petroleum and mining industries. Our members represent a diverse group of businesses from drilling and construction companies to firms in real estate, finance and transportation, to name but a few. Although hetrogenous in appearance, all members of the Alliance unite under a common understanding that vital and dynamic petroleum and mining industries in Alaska are fundamental to their success and to the jobs of their employees. Members of the Alliance form the backbone of the state's private sector.

The Alliance supports and endorses Alternative #1 as outlined in the Chuckchi Sea Sale #109 draft environmental impact statement (MMS 87-0009). Under the proposed alternative, leasing would occur about one year from now with possible exploratory drilling to commence about one year thereafter. Assuming that the price of oil firms sufficiently to spur exploratory drilling and possible commercial production of a discovery within the sale area, not a drop of oil would be available to the American consumer until the turn of the century. Those assumptions, however, must be underpinned with another set of assumptions among which are the potential delays associated with litigation which will likely be brought forward in opposition to the sale or one of the several developmental initiatives it will trigger. Despite recent rulings by the U.S. Supreme Court, the likelihood of a suit to block the plan as defined in Alternative #1 is great.

Yet the United States can ill afford delays in discoveries of new hydrocarbon resources. Today we are importing more oil than we were when our nation was humiliated and blackmailed by foreign nations which today continue to supply the world's increasing appetite for energy. All indications are that this trend towards greater dependency will continue placing our nation at great and grave risk.

America's domestic petroleum industry has proven itself responsible, responsive, highly innovative and capable of development without insult to our environment or to those fragile cultures with which such development interacts from time to time.

From a more parochial perspective, Alaska's economy is in a tailspin. Many of our members have had to lay off valued employees, have undergone fundamental structural changes and some even have had to declare bankruptcy or have simply dissolved. Careers and families have been greviously disrupted. Those who believed that they were providing for future retirement by investing in real estate in Alaska have had their dreams trashed and their personal finances thrown into shambles. And, as we look around for a glimmer of hope, we see that the political will to make America great by developing its energy potential is either tied up in courts or in the Congress. Tied up because some refuse to accept factual evidence which demonstrates the safety and environmental compatability of petroleum exploration and development, prefering to assume the, "yes, but, what if..." posture - an attitude that now must be balanced by available science and proven track records. Now longer can this nation acquiesce to concerns of well meaning individuals who have not taken the time to study the evidence but who have sufficient money to hire legal talent to give vent to their anxieties.

Time is running out on us. The Japanese, patient observers of global history, are convinced that America's lack of will to excell with its associated social evils is an inexorable path of decline on which all great nations of the world have trod. We must prove them wrong. If not for ourselves, then for our children who will inherit our legacy.

The Alaska Support Industry strongly urges the department to act decisively and affirmatively on Alternative #1.

VI. CONSULTATION AND COORDINATION

A. Development of the Proposal

The proposed Chukchi Sea Sale 109 is one of 37 proposed OCS sales included in the current 5-Year Oil and Gas Leasing Program. Official coordination with other government agencies, industry, and the public regarding this proposal began on June 1, 1984. At that time, the MMS requested resource reports from all Federal agencies with expertise pertinent to the proposal and the proposed sale area. Next, on January 28, 1985, 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 12 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 area selection to the Secretary. On May 28, 1985, the Secretary of the Interior selected the entire Chukchi Sea Planning Area as the Sale 109 area for further environmental study. (See Sec. I.A for more details.)

B. Development of the EIS

During preparation of this EIS, Federal, State, and local agencies; industry; and the public were consulted to obtain descriptive information, to identify significant effects and issues, and to identify effective mitigating measures and reasonable alternatives to the proposal. The information received was considered in preparing the EIS. In addition, scoping meetings were held to more clearly and specifically identify 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 lease stipulations for this proposal (see Sec. II.H.2).

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 EIS for review and comment.

<u>Federal Agencies</u>

Department of Agriculture
Department of Commerce
  National Oceanic and Atmospheric Administration
    National Marine Fisheries Service
    National Marine Mammal Lab, Northwest and Alaska Fisheries Center
  Office of Coastal Zone Management
Department of Defense
Department of Energy

Department of the Interior
  Advisory Council on Historic Preservation
  Alaska Resources Library
  Bureau of Indian Affairs
  Bureau of Land Management
  Bureau of Mines
  Fish and Wildlife Service
  Geological Survey
  National Park Service
Department of State
Department of Transportation
  Office of Pipeline Safety
  U.S. Coast Guard
Environmental Protection Agency
Marine Mammal Commission
Naval Ocean Systems Center
Nuclear Regulatory Commission

<u>State of Alaska</u>
Alaska Power Authority
Department of Community and Regional Affairs
Department of Environmental Conservation
Department of Fish and Game
Department of Natural Resources
Department of Transportation and Public Facilities
Office of the Governor
Office of Management and Budget, Division of Governmental Coordination
State Historic Preservation Office
University of Alaska
  Arctic Environmental Information and Data Center
  Institute of Social and Economic Research

<u>Local Governments and Native Organizations</u>
Alaska Native Foundation
Arctic Slope Regional Corporation
City of Atqasuk
City of Barrow
City of Kaktovik
City of Nuiqsut
City of Point Hope
City of Point Lay
City of Wainwright
Diomede City Council
Kuukpik Corporation
Maniilaq Association
Municipality of Anchorage
NANA Regional Corporation
Native Village of Point Hope
North Slope Borough
Northwest Arctic Borough
Tigara Corporation
Ukpeagvik Inupiat Corporation

Special-Interest Groups

Alaska Eskimo Whaling Commission
Alaska Land Use Council
Alaska Legal Services Corporation
Bering Sea Fisherman's Association
Canadian Department of Indian and Northern Affairs,
  Office of Northern Research and Science Advisory
Defenders of Wildlife
EBASCO/Envirosphere
Friends of Animals, Inc.
Greenpeace New England
National Audubon Society
National Ocean Industries Association
Natural Resources Defense Council, Inc.
North Pacific Fisheries Management Council
Northern Alaska Environmental Center
Northern Southeast Aquaculture Association
Sierra Club
Trustees for Alaska
Whale Center
Yukon Conservation Society

Oil Industry

Alaska Oil and Gas Association
Amerada Hess Corporation
American Petroleum Institute
Amoco Production Company
ARCO Alaska, Inc.
ARCO Exploration and Technology Company
BHP Petroleum (Americas), Inc.
BP Alaska Exploration, Inc.
Champlin Petroleum Company
Chevron U.S.A., Inc.
Cities Service Oil and Gas Company
Conoco, Inc.
Exxon Company U.S.A.
Exxon Production Research Company
Home Petroleum Corporation
Hunt Oil Company
ICI Petroleum, Ltd.
Koch Exploration Company
Marathon Oil Company
Mobil Alaska Exploration Group
Mobil Exploration and Producing Services
Murphy Oil USA
Odeco Oil and Gas Company
Ogle Petroleum, Inc.
Pacific Energy and Minerals, Ltd.
Panarctic Oils, Ltd.
Pancanadian Petroleum Corporation
Pennzoil Producing Company
Petrofina-Delaware, Inc.
Phillips Petroleum Company
Placid Oil Company

Santa Fe Minerals, Inc.
Shell Western E&P, Inc.
Sohio Alaska Petroleum Company
Sun Exploration and Production Company
Tenneco Oil Company
Tennessee Gas Transmission, Reserves
Texaco, Inc.
Texas Eastern Exploration Corporation
Union Oil Company of California
Union Texas Petroleum Corporation

Other Organizations
Alaska Clean Seas
Alaska Geographic Society
Alaska Oil and Gas News
Alaska Oil Field Services
Alaska Public Radio Network
Applied Science Associates, Inc.
Arctic News Record
Arctic Slope Consulting Engineers
Associated Press
Canadian Marine Drilling, Ltd.
Chukchi Community College
Crowley Maritime Corporation
Dames and Moore
Enserch Center
Environmental Management and Engineering
Environmental Sciences and Engineering
ESL Environmental Sciences, Ltd.
Fairbanks Daily News Miner
Fisheries Research Institute
Geophysical Service, Inc.
Global Marine Development, Inc.
Intersea Research
LGL Limited
Oil and Gas Journal
Oil Spill Consultants
Pacific Marine Technology
Petroleum Information Corporation
Prudhoe Bay Journal
Science Applications International
Tetra Tech, Inc.
Tundra Times
Universal Seafoods, Ltd.
University of California
University of Maryland
University of Southern California
University of Southwestern Louisiana
University of Washington
Washington State University
Western Geophysical Company of America

ANILCA Section 805 Regional Councils
Arctic Regional Council
Interior Regional Council
Southcentral Regional Council
Southeast Regional Council
Southwest Regional Council
Western Regional Council

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Table A-2. -- Monte Carlo error as a function of the number of trials and the estimated probability.

NUMBER OF TRIALS

PROB	10	20	40	50	100	200	500	1000	2000
0.02	0.07	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0.01
0.04	0.10	0.07	0.05	0.05	0.03	0.02	0.01	0.01	0.01
0.06	0.12	0.09	0.06	0.06	0.04	0.03	0.02	0.01	0.01
0.08	0.14	0.10	0.07	0.06	0.04	0.03	0.02	0.01	0.01
0.10	0.16	0.11	0.08	0.07	0.05	0.04	0.02	0.02	0.01
0.12	0.17	0.12	0.08	0.08	0.05	0.04	0.02	0.02	0.01
0.14	0.18	0.13	0.09	0.08	0.06	0.04	0.03	0.02	0.01
0.16	0.19	0.14	0.10	0.09	0.06	0.04	0.03	0.02	0.01
0.18	0.20	0.14	0.10	0.09	0.06	0.04	0.03	0.02	0.01
0.20	0.21	0.15	0.10	0.09	0.07	0.05	0.03	0.02	0.01
0.22	0.22	0.16	0.11	0.10	0.07	0.05	0.03	0.02	0.02
0.24	0.22	0.16	0.11	0.10	0.07	0.05	0.03	0.02	0.02
0.26	0.23	0.16	0.11	0.10	0.07	0.05	0.03	0.02	0.02
0.28	0.23	0.17	0.12	0.10	0.07	0.05	0.03	0.02	0.02
0.30	0.24	0.17	0.12	0.11	0.08	0.05	0.03	0.02	0.02
0.32	0.24	0.17	0.12	0.11	0.08	0.05	0.03	0.02	0.02
0.34	0.25	0.17	0.12	0.11	0.08	0.06	0.03	0.02	0.02
0.36	0.25	0.18	0.13	0.11	0.08	0.06	0.04	0.03	0.02
0.38	0.25	0.18	0.13	0.11	0.08	0.06	0.04	0.03	0.02
0.40	0.26	0.18	0.13	0.11	0.08	0.06	0.04	0.03	0.02
0.42	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.44	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.46	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.48	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02
0.50	0.26	0.18	0.13	0.12	0.08	0.06	0.04	0.03	0.02

Level of significance - 90 percent

Table A-3. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a particular location will contact a certain target within 3 days.

Target	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
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
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
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
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
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	n	n	n	n	n	n	7	n	n
Sea Segment 6	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 7	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 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
Sea Segment 9	n	53	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	3	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	20	**	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
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
Migrat. Corridor A	n	**	n	n	n	n	n	n	**	**	n	n	n	n	n	n	10	70	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
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
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
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
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
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
Barrow Subsis. Area	n	47	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	17	n	n	n	n	n	n	**	**	n	n	n	n	n	n	10	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
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
Any Subsis. Area	n	57	n	n	n	n	n	n	**	**	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table A-3. (Continued) -- Conditional probabilities (expressed as percent chance) that during the summer an oil spill starting at a particular location will contact a certain target within 3 days.

Target	Hypothetical Spill Location																				
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41	J42	J43	J44	J45	J46
Land	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	33	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
Sea Segment 3	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
Sea Segment 5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 6	n	n	n	n	n	10	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 7	n	n	n	n	40	n	n	n	n	n	n	n	n	n	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
Sea Segment 9	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	3	27	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
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	27	n	n	n	n	n	n	n
Migrat. Corridor A	n	n	n	**	n	n	n	**	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
Migrat. Corridor C	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
Whale Area B	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	50	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
Barrow Subsis. Area	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
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
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
Any Subsis. Area	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table A-4. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a particular location will contact a certain target within 10 days.

Target	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
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
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
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
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
Sea Segment 4	n	n	n	n	n	n	13	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	n	n	n	n	n	n	23	n	n
Sea Segment 6	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 7	n	n	n	**	n	7	n	n	n	n	n	n	n	n	n	n	n	n	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
Sea Segment 9	n	73	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n
Sea Segment 10	n	10	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	57	**	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
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
Migrat. Corridor A	n	**	n	n	n	n	n	n	**	**	n	n	n	n	n	n	60	93	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	n	n	n	**	**	**	**	**	n	23	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
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
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
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
Peard Bay Area	n	13	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	47	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	40	n	n	n	n	n	n	**	**	n	n	n	n	n	n	90	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	n	n	3	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
Any Subsis. Area	n	70	n	n	n	n	n	n	**	**	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table A-4. (Continued) -- Conditional probabilities (expressed as percent chance) that during the summer an oil spill starting at a particular location will contact a certain target within 10 days.

Target	Hypothetical Spill Location																				
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41	J42	J43	J44	J45	J46
Land	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	80	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
Sea Segment 3	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
Sea Segment 5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 6	n	n	n	n	n	77	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 7	n	n	n	n	40	n	n	n	n	n	n	n	n	n	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
Sea Segment 9	n	n	n	17	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	23	53	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
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	33	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	37	n	n	n	n	n	n	n
Migrat. Corridor A	n	n	17	**	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	13	**	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
Whale Area A	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	33	n	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	83	n	n	n	n	n	n	n
Peard Bay Area	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	3	**	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	3	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
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
Any Subsis. Area	n	n	3	**	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table A-5. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a particular location will contact a certain target within 30 days.

Target	Hypothetical Spill Location J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
Land	n	7	n	n	n	n	n	n	n	3	n	n	7	n	n	n	20	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
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
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
Sea Segment 4	n	n	n	n	n	n	70	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	13	63	n	n	n	n	n	n	n	n	n	n	n	n	n	7	23	n	n
Sea Segment 6	n	n	7	n	**	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n
Sea Segment 7	n	n	7	**	n	97	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 8	3	23	13	n	n	3	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n
Sea Segment 9	n	80	n	n	n	n	n	n	n	n	n	n	n	n	n	n	30	n	n	n	n	n	n	n	n
Sea Segment 10	n	13	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	70	**	n	n	n	n	n	3	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
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
Migrat. Corridor A	n	**	n	n	n	n	n	n	**	**	n	3	n	n	n	n	80	97	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	23	17	n	**	**	**	**	**	3	87	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
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
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	10	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	3	n	n	n	n	n	n
Peard Bay Area	n	30	n	n	n	n	n	n	**	3	n	n	n	n	n	n	**	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	47	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	50	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	3	33	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
Any Subsis. Area	n	73	n	n	n	n	n	n	**	**	n	n	n	n	n	n	**	**	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table A-5. (Continued) -- Conditional probabilities (expressed as percent chance) that during the summer an oil spill starting at a particular location will contact a certain target within 30 days.

Target	Hypothetical Spill Location																				
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41	J42	J43	J44	J45	J46
Land	n	n	7	7	n	n	n	n	n	n	n	n	83	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	**	10	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
Sea Segment 3	n	n	n	n	n	n	3	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
Sea Segment 5	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 6	n	n	n	n	n	97	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 7	n	n	n	n	40	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 8	n	**	n	13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	7	53	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	33	63	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	3	n	13	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	37	n	n	n	n	n
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	37	n	n	n	n	n	n	n
Migrat. Corridor A	n	n	23	**	n	n	n	**	3	n	n	n	n	n	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	63	**	n	**	n	17	n	n	10	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
Whale Area A	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	3	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	90	17	n	n	n	n	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	90	n	n	n	n	n	n	n
Peard Bay Area	n	n	3	7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Barrow Subsis. Area	n	n	10	**	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	23	n	n	n	7	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
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
Any Subsis. Area	n	n	10	**	n	n	n	7	n	n	n	n	n	n	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent.

Table A-6. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a particular location will contact a certain land segment within 3 days.

Land Segment — Hypothetical Spill Location

J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11 J12 J13 J14 J15 J16 J17 J18 J19 J20 J21 J22 J23 J24 J25
J26 J27 J28 J29 J30 J31 J32 J33 J34 J35 J36 J37 J38 J39 J40 J41 J42 J43 J44 J45 J46

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table A-7. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a particular location will contact a certain land segment within 10 days.

Land Segment — Hypothetical Spill Location

J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11 J12 J13 J14 J15 J16 J17 J18 J19 J20 J21 J22 J23 J24 J25
J26 J27 J28 J29 J30 J31 J32 J33 J34 J35 J36 J37 J38 J39 J40 J41 J42 J43 J44 J45 J46

Table A-8. -- Conditional probabilities (expressed as a percentage chance) that during the summer an oil spill starting at a particular location will contact a certain land segment within 30 days.

Land Segment	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
16	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n	n	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
23	n	7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	20	n	n	n	n	n	n	n	n

Land Segment	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41	J42	J43	J44	J45	J46
16	n	n	n	n	n	n	n	n	n	n	n	n	77	n	n	n	n	n	n	n	n
17	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n	n	n	n	n	n
24	n	n	3	7	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
25	n	n	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
57	3	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table A-9. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a particular location will contact a certain target within 3 days.

Target	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
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
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
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
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
Sea Segment 4	n	n	n	n	n	n	16	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	13	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40	n	n
Sea Segment 6	n	n	n	n	**	16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 7	n	n	n	**	n	9	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 8	n	n	4	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	64	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
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	n	73	**	2	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
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
Migrat. Corridor A	n	13	2	n	n	n	n	n	13	13	n	n	n	n	n	n	n	11	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	n	n	n	13	13	13	13	13	n	n	n	n	13	n	n	n	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n	13	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
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
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
Peard Bay Area	n	9	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	33	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	40	n	n	n	n	n	n	**	**	n	n	n	n	n	n	24	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	n	n	22	n	7	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	13	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	53	n	n	n	n	n	n	**	**	n	7	n	n	n	13	**	**	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-9. (Continued) -- Conditional probabilities (expressed as percent chance) that during the winter an oil spill starting at a particular location will contact a certain target within 3 days.

Target	Hypothetical Spill Location															
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41
Land	n	n	n	n	n	n	n	n	n	n	n	n	n	5	n	n
Sea Segment 1	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
Sea Segment 3	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
Sea Segment 5	n	n	n	n	n	4	n	n	n	n	n	n	n	n	n	n
Sea Segment 6	n	n	n	n	n	40	n	n	n	n	n	n	n	n	n	n
Sea Segment 7	n	n	n	n	27	n	n	n	n	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
Sea Segment 9	n	n	n	18	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	7	40	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
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	36
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	64	n	n
Migrat. Corridor A	n	n	n	13	n	n	n	13	2	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	7	13	n	13	n	n	n	n	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	13	13	13
Whale Area A	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
Whale Area C	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
Barrow Subsis. Area	n	n	n	**	n	n	n	n	n	n	n	n	n	n	n	n
Wrght. Subsis. Area	n	n	n	2	n	n	n	9	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	4	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	4
Any Subsis. Area	n	n	n	**	n	n	n	9	n	n	n	n	n	n	n	4

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-10. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a particular location will contact a certain target within 10 days.

Target	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
Land	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	22	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
Sea Segment 2	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	2	n	n	n	n	n
Sea Segment 3	n	n	n	n	n	n	20	7	n	n	11	n	n	n	n	n	n	n	n	2	n	n	n	n	n
Sea Segment 4	n	n	n	n	n	n	58	33	n	n	n	n	n	n	n	n	n	n	n	n	n	7	2	n	n
Sea Segment 5	n	n	2	n	7	9	n	36	n	n	n	n	n	n	n	n	n	n	n	n	n	22	40	n	n
Sea Segment 6	n	n	11	7	**	62	n	n	2	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	n
Sea Segment 7	2	4	2	**	n	24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 8	n	22	4	n	n	2	n	n	4	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	76	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	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
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	20	78	**	4	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
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
Migrat. Corridor A	n	16	2	n	n	n	n	n	18	22	n	n	n	n	n	n	16	16	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	4	2	n	20	24	22	13	13	n	9	n	n	13	n	n	n	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n	13	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
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7	n	n	2	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	9	n	n	n	n	n	n
Peard Bay Area	n	20	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	33	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	47	n	n	n	n	n	n	**	**	n	n	n	n	n	n	78	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	n	n	40	n	9	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	13	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	56	n	n	n	n	n	n	**	**	n	9	n	n	n	13	**	**	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-10. (Continued) -- Conditional probabilities (expressed as percent chance) that during the winter an oil spill starting at a particular location will contact a certain target within 10 days.

Target	Hypothetical Spill Location															
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41
Land	n	n	n	n	n	n	n	n	n	n	n	n	4	54	9	n
Sea Segment 1	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	2	n	n	n	n
Sea Segment 3	n	n	n	n	n	n	11	n	n	7	n	n	n	n	n	n
Sea Segment 4	n	n	n	n	n	7	**	n	n	4	n	n	n	n	n	n
Sea Segment 5	n	n	n	n	n	27	n	2	2	n	n	n	n	n	n	n
Sea Segment 6	n	11	n	n	2	82	n	2	n	n	n	n	n	n	n	n
Sea Segment 7	n	44	n	2	27	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 8	n	**	9	18	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	51	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	13	56	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	4	n	2	n	n	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	69	n	n
Migrat. Corridor A	n	n	n	22	n	n	n	16	2	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	2	n	n	n	13	16	n	13	n	9	n	n	2
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	20	13	24
Whale Area A	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	7	n
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	2
Peard Bay Area	n	n	n	7	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
Wrght. Subsis. Area	n	n	n	13	n	n	n	11	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	4	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	7
Any Subsis. Area	n	n	n	**	n	n	n	11	n	n	n	n	n	n	n	7

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-11. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a particular location will contact a certain target over the entire winter season.

Target	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
Land	n	2	13	5	9	7	29	16	7	20	31	20	11	18	22	31	29	18	73	24	22	18	9	7	3
Sea Segment 1	n	2	n	n	n	n	7	4	n	n	9	2	13	16	13	9	n	n	n	18	n	2	n	n	n
Sea Segment 2	n	4	4	n	n	n	13	2	4	2	36	7	13	13	13	2	n	4	n	27	7	7	n	n	n
Sea Segment 3	n	4	2	n	n	2	40	18	2	4	27	22	9	9	n	n	2	11	n	11	31	4	n	n	n
Sea Segment 4	n	4	16	n	n	4	62	47	13	11	2	16	n	n	n	n	4	20	n	n	16	27	2	n	n
Sea Segment 5	n	16	27	n	7	18	n	38	27	13	n	n	n	n	n	n	16	7	n	n	n	38	40	n	n
Sea Segment 6	n	20	33	7	**	71	n	n	13	n	n	n	n	n	n	n	18	n	n	n	n	9	n	n	n
Sea Segment 7	4	13	4	**	n	24	n	n	2	n	n	n	n	n	n	n	4	n	n	n	n	n	n	n	n
Sea Segment 8	n	29	4	n	n	2	n	n	4	n	n	n	n	n	n	n	7	n	n	n	n	n	n	n	n
Sea Segment 9	n	76	n	n	n	n	n	n	n	n	n	n	n	n	n	n	13	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
Seabird Concent. I	n	n	n	n	n	n	n	n	n	n	n	n	33	78	**	4	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
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n
Migrat. Corridor A	n	16	2	n	n	n	n	n	18	27	n	n	n	n	n	n	29	22	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	n	n	n	n	n	7	13	n	20	27	22	13	13	4	29	n	n	13	n	n	n	n
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	4	n	n	13	n	n	n	n	n	n
Whale Area A	n	n	n	n	n	n	2	n	n	n	7	2	2	9	9	16	n	n	4	9	2	n	n	n	n
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	4	2	n	7	n	n	4	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	9	n	n	n	n	n	n
Peard Bay Area	n	20	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	33	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	47	n	n	n	n	n	n	**	**	n	n	n	n	n	n	89	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	n	n	51	n	9	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	13	n	n	n	n	n	n	n	n	n
Any Subsis. Area	n	56	n	n	n	n	n	n	**	**	n	9	n	n	n	13	**	**	n	n	n	n	n	n	n

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-11. (Continued) -- Conditional probabilities (expressed as percent chance) that during the winter an oil spill starting at a particular location will contact a certain target over the entire winter season.

Target	Hypothetical Spill Location															
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41
Land	n	n	n	n	7	13	22	16	18	24	20	16	62	84	47	40
Sea Segment 1	n	n	n	n	n	n	2	4	4	4	9	22	2	n	n	2
Sea Segment 2	n	n	n	n	n	2	n	2	4	13	18	11	2	n	n	n
Sea Segment 3	n	n	n	4	n	2	11	7	11	40	13	n	4	n	n	n
Sea Segment 4	n	2	n	7	n	16	**	22	29	18	n	n	n	n	n	n
Sea Segment 5	n	4	2	7	n	38	n	18	11	n	n	n	n	n	n	n
Sea Segment 6	n	29	2	16	2	82	n	7	n	n	n	n	n	n	n	n
Sea Segment 7	n	60	16	29	27	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 8	n	**	11	36	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 9	n	n	n	53	n	n	n	n	n	n	n	n	n	n	n	n
Sea Segment 10	n	n	13	56	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	4	n	16	n	n	n
Seabird Concent. II	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	40
Bering Strait Area	n	n	n	n	n	n	n	n	n	n	n	n	n	69	n	n
Migrat. Corridor A	n	n	n	22	n	n	n	16	2	n	n	n	n	n	n	n
Migrat. Corridor B	n	n	n	4	n	n	n	13	16	n	13	n	27	n	n	2
Migrat. Corridor C	n	n	n	n	n	n	n	n	n	n	n	n	n	20	13	24
Whale Area A	n	n	n	n	n	n	n	n	2	2	7	9	2	n	9	16
Whale Area B	n	n	n	n	n	n	n	n	n	n	n	n	n	n	11	20
Whale Area C	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	2
Peard Bay Area	n	n	n	7	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
Wrght. Subsis. Area	n	n	n	16	n	n	n	11	n	n	n	n	n	n	n	n
P. Lay Subsis. Area	n	n	n	n	n	n	n	4	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	7
Any Subsis. Area	n	n	n	**	n	n	n	11	n	n	n	n	n	n	n	7

Note: ** = Greater than 99.5 percent; n = less than 0.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-12. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a particular location will contact a certain land segment within 3 days.

Land Segment	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41									
52	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n									
66	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n									

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table A-13. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a particular location will contact a certain land segment within 10 days.

Land Segment	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n
24	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n
48	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n
49	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	n	n	n	n	n	n
50	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	n	n	n	n	n	n
51	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table A-14. -- Conditional probabilities (expressed as a percentage chance) that during the winter an oil spill starting at a particular location will contact a certain land segment over the entire winter season.

Land Segment	Hypothetical Spill Location																								
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	J25
15	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n
20	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n
21	n	n	n	n	n	n	n	n	n	11	n	n	n	n	n	n	n	4	n	n	n	n	n	n	n
23	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	18	n	n	n	n	n	n	n	n
24	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
27	n	2	9	2	7	2	13	4	4	7	22	11	7	7	n	2	2	7	n	9	16	9	2	2	n
28	n	n	4	2	2	4	13	9	2	n	n	4	n	n	2	n	n	4	n	2	2	7	4	4	2
30	n	n	n	n	n	n	n	2	n	n	4	2	2	n	2	n	n	n	n	2	2	2	2	n	n
39	n	n	n	n	n	n	n	n	n	n	n	n	n	2	4	4	n	n	n	4	n	n	n	n	n
40	n	n	n	n	n	n	2	n	n	n	2	n	n	2	4	13	n	n	2	2	n	n	n	n	n
41	n	n	n	n	n	n	n	n	n	n	n	2	n	2	2	2	n	n	2	2	2	n	n	n	n
42	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	2	n	n	2	2	n	n	n	n	n
43	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n	n	n	n	n
44	n	n	n	n	n	n	n	n	n	n	n	n	2	n	2	2	n	n	2	n	n	n	n	n	n
45	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	2	n	n	n	n	n	n	n	n	n
46	n	n	n	n	n	n	n	n	n	2	n	n	n	2	n	n	n	n	n	n	n	n	n	n	n
47	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	9	n	n	n	n	n	n
48	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	16	n	n	n	n	n	n
49	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	20	n	n	n	n	n	n
50	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	18	n	n	n	n	n	n
51	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	n	n	n	n	n
57	16	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
58	18	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
59	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7
60	2	n	n	2	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	11
61	2	n	n	9	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2	7	4
62	n	2	n	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	4	2

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table A-14. (Continued) -- Conditional probabilities (expressed as percent chance) that during the winter an oil spill starting at a particular location will contact a certain land segment over the entire winter season.

Land Segment	Hypothetical Spill Location															
	J26	J27	J28	J29	J30	J31	J32	J33	J34	J35	J36	J37	J38	J39	J40	J41
14	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
16	n	n	n	n	n	n	n	n	n	n	n	n	11	n	n	n
17	n	n	n	n	n	n	n	n	n	n	n	n	42	n	n	n
27	n	n	n	n	2	9	11	7	13	20	9	2	2	n	n	n
28	n	n	n	n	4	4	9	7	4	2	2	n	n	n	n	n
30	n	n	n	n	n	n	n	2	n	n	n	n	2	n	n	n
39	n	n	n	n	n	n	n	n	n	n	7	2	n	n	n	2
40	n	n	n	n	n	n	2	n	n	n	n	4	2	n	4	n
41	n	n	n	n	n	n	n	n	n	2	n	n	n	n	4	7
42	n	n	n	n	n	n	n	n	n	n	n	7	n	n	2	2
43	n	n	n	n	n	n	n	n	n	n	n	n	2	n	2	2
44	n	n	n	n	n	n	n	n	n	n	2	n	n	2	11	4
45	n	n	n	n	n	n	n	n	n	n	n	n	n	2	n	2
46	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	2
47	n	n	n	n	n	n	n	n	n	n	n	n	n	2	9	2
48	n	n	n	n	n	n	n	n	n	n	n	n	n	n	7	7
49	n	n	n	n	n	n	n	n	n	n	n	n	n	4	7	2
50	n	n	n	n	n	n	n	n	n	n	n	n	n	22	n	2
51	n	n	n	n	n	n	n	n	n	n	n	n	n	36	n	2
52	n	n	n	n	n	n	n	n	n	n	n	n	n	11	n	n
57	2	n	16	n	n	n	n	n	n	n	n	n	n	n	n	n
58	20	n	4	2	n	n	n	n	n	n	n	n	n	n	n	n
59	13	2	n	n	n	n	n	n	n	n	n	n	n	n	n	n
60	2	n	n	4	4	n	n	n	n	n	n	n	n	n	n	n
61	2	9	n	n	4	n	n	n	n	n	n	n	n	n	n	n
62	2	n	n	n	4	n	n	n	n	n	n	n	n	n	n	n
66	n	n	n	n	n	n	n	n	n	n	n	n	n	4	n	n

Notes: ** = Greater than 99.5 percent; n = less than 0.5 percent.
Rows with all values less than 0.5 percent are not shown.

Table A-15. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for summer spills of 1,000 barrels and greater.

Target	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER	
	Prob	Mean	Prob	Mean	Prob	Mean	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	n	0.0	n	0.0	7	0.1	2	0.0	8	0.1
Sea Segment 1	n	0.0	n	0.0	n	0.0	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	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	1	0.0	1	0.0	1	0.0
Sea Segment 4	16	0.2	16	0.2	16	0.2	18	0.2	18	0.2	18	0.2	27	0.3	27	0.3	27	0.3
Sea Segment 5	1	0.0	1	0.0	1	0.0	4	0.0	4	0.0	4	0.0	25	0.3	25	0.3	25	0.3
Sea Segment 6	21	0.2	21	0.2	21	0.2	33	0.4	33	0.4	33	0.4	39	0.5	39	0.5	39	0.5
Sea Segment 7	30	0.4	30	0.4	30	0.4	32	0.4	32	0.4	32	0.4	52	0.7	52	0.7	52	0.7
Sea Segment 8	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	4	0.0	4	0.0	8	0.1
Sea Segment 9	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	5	0.1	n	0.0	n	0.0	7	0.1
Sea Segment 10	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	4	0.0
Seabird Concent. I	1	0.0	n	0.0	4	0.0	3	0.0	n	0.0	6	0.1	6	0.1	n	0.0	9	0.1
Seabird Concent. II	n	0.0	n	0.0	n	0.0	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	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Migrat. Corridor A	86	2.0	79	1.6	89	2.2	87	2.1	80	1.6	90	2.3	88	2.1	80	1.6	90	2.3
Migrat. Corridor B	53	0.7	24	0.3	60	0.9	58	0.9	30	0.4	64	1.0	78	1.5	57	0.8	82	1.7
Migrat. Corridor C	n	0.0	n	0.0	9	0.1	n	0.0	n	0.0	9	0.1	n	0.0	n	0.0	9	0.1
Whale Area A	n	0.0	n	0.0	n	0.0	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	1	0.0	n	0.0	n	0.0	3	0.0
Whale Area C	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	3	0.0
Peard Bay Area	56	0.8	49	0.7	59	0.9	56	0.8	49	0.7	59	0.9	57	0.8	50	0.7	60	0.9
Barrow Subsis. Area	n	0.0	n	0.0	7	0.1	n	0.0	n	0.0	7	0.1	n	0.0	n	0.0	7	0.1
Wrght. Subsis. Area	76	1.4	68	1.1	78	1.5	76	1.4	68	1.2	78	1.5	77	1.5	69	1.2	79	1.6
P. Lay Subsis. Area	23	0.3	13	0.1	23	0.3	24	0.3	14	0.2	24	0.3	38	0.5	27	0.3	38	0.5
P.Hope Subsis. Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Any Subsis. Area	81	1.7	72	1.3	84	1.8	82	1.7	72	1.3	84	1.8	82	1.7	73	1.3	84	1.9

Notes: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table A-16. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for summer spills of 1,000 barrels and greater.

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
16	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	5	0.1	n	0.0	5	0.1
21	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5-percent probability of one or more contacts within 30 days are not shown.

Table A-17. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for winter spills of 1,000 barrels and greater.

Target	------- Within 3 days ---------						------- Within 10 days --------						------- Winter Season --------					
	PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	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	n	0.0	3	0.0	66	1.1	57	0.8	69	1.2
Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	21	0.2	15	0.2	22	0.2
Sea Segment 2	n	0.0	n	0.0	n	0.0	2	0.0	1	0.0	2	0.0	34	0.4	28	0.3	36	0.4
Sea Segment 3	n	0.0	n	0.0	n	0.0	11	0.1	11	0.1	11	0.1	45	0.6	38	0.5	46	0.6
Sea Segment 4	19	0.2	19	0.2	19	0.2	36	0.5	36	0.5	36	0.5	66	1.1	62	1.0	68	1.1
Sea Segment 5	11	0.1	11	0.1	11	0.1	33	0.4	33	0.4	34	0.4	63	1.0	59	0.9	64	1.0
Sea Segment 6	31	0.4	31	0.4	31	0.4	53	0.7	52	0.7	53	0.8	61	0.9	60	0.9	63	1.0
Sea Segment 7	31	0.4	31	0.4	31	0.4	35	0.4	35	0.4	35	0.4	36	0.5	36	0.4	38	0.5
Sea Segment 8	2	0.0	2	0.0	3	0.0	5	0.1	5	0.0	9	0.1	5	0.1	5	0.0	10	0.1
Sea Segment 9	n	0.0	n	0.0	4	0.0	n	0.0	n	0.0	7	0.1	n	0.0	n	0.0	7	0.1
Sea Segment 10	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	3	0.0	n	0.0	n	0.0	3	0.0
Seabird Concent. I	4	0.0	n	0.0	7	0.1	7	0.1	n	0.0	10	0.1	9	0.1	n	0.0	12	0.1
Seabird Concent. II	n	0.0	n	0.0	n	0.0	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	2	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0
Migrat. Corridor A	24	0.3	19	0.2	26	0.3	32	0.4	26	0.3	35	0.4	35	0.4	28	0.3	37	0.5
Migrat. Corridor B	12	0.1	6	0.1	14	0.1	23	0.3	13	0.1	25	0.3	34	0.4	21	0.2	36	0.4
Migrat. Corridor C	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0
Whale Area A	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	9	0.1	6	0.1	11	0.1
Whale Area B	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
Whale Area C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Peard Bay Area	56	0.8	49	0.7	59	0.9	56	0.8	49	0.7	59	0.9	56	0.8	49	0.7	59	0.9
Barrow Subsis. Area	n	0.0	n	0.0	7	0.1	n	0.0	n	0.0	7	0.1	n	0.0	n	0.0	7	0.1
Wrght. Subsis. Area	77	1.5	69	1.2	79	1.5	77	1.5	69	1.2	79	1.6	77	1.5	69	1.2	79	1.6
P. Lay Subsis. Area	34	0.4	23	0.3	35	0.4	41	0.5	29	0.3	42	0.5	45	0.6	33	0.4	45	0.6
P.Hope Subsis. Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Any Subsis. Area	82	1.7	73	1.3	85	1.9	83	1.7	73	1.3	85	1.9	83	1.7	73	1.3	85	1.9

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-18. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for winter spills of 1,000 barrels and greater.

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Winter Season --------					
	PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
16	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
17	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	n	0.0	3	0.0
20	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
21	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	8	0.1	6	0.1	8	0.1
27	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	39	0.5	34	0.4	40	0.5
28	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	23	0.3	21	0.2	24	0.3
30	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	5	0.1	4	0.0	6	0.1
39	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	2	0.0	3	0.0
40	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	2	0.0	4	0.0
41	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	1	0.0	2	0.0
42	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	2	0.0	3	0.0
44	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	1	0.0
46	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
47	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
48	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
49	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
50	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
51	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
59	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
60	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	5	0.0	5	0.0	5	0.0
61	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	6	0.1	6	0.1	6	0.1
62	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	3	0.0	3	0.0	3	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5-percent probability of one or more contacts over the entire winter season are not shown.

Table A-19. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for summer spills of 100,000 barrels and greater.

Target	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER	
	Prob	Mean	Prob	Mean	Prob	Mean	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	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Sea Segment 1	n	0.0	n	0.0	n	0.0	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	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	n	0.0	n	0.0	n	0.0
Sea Segment 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
Sea Segment 5	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
Sea Segment 6	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
Sea Segment 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	3	0.0	3	0.0	3	0.0
Sea Segment 8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Sea Segment 9	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Sea Segment 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0
Seabird Concent. I	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Seabird Concent. II	n	0.0	n	0.0	n	0.0	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	n	0.0	n	0.0	n	0.0
Migrat. Corridor A	8	0.1	6	0.1	10	0.1	8	0.1	6	0.1	11	0.1	8	0.1	6	0.1	11	0.1
Migrat. Corridor B	3	0.0	1	0.0	6	0.1	3	0.0	1	0.0	7	0.1	6	0.1	3	0.0	10	0.1
Migrat. Corridor C	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0	n	0.0	n	0.0	2	0.0
Whale Area A	n	0.0	n	0.0	n	0.0	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	n	0.0	n	0.0	1	0.0
Whale Area C	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Peard Bay Area	3	0.0	3	0.0	4	0.0	3	0.0	3	0.0	4	0.0	3	0.0	3	0.0	4	0.0
Barrow Subsis. Area	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Wrght. Subsis. Area	6	0.1	5	0.0	6	0.1	6	0.1	5	0.0	7	0.1	6	0.1	5	0.0	7	0.1
P. Lay Subsis. Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	2	0.0	1	0.0	2	0.0
P.Hope Subsis. Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Any Subsis. Area	7	0.1	5	0.1	8	0.1	7	0.1	5	0.1	9	0.1	7	0.1	5	0.1	9	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent.

Table A-20. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for summer spills of 100,000 barrels and greater.

Land Segment	------- Within 3 days ---------						------- Within 10 days --------						------- Within 30 days --------					
	PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER		PROPOSAL SUMMER CASE		COASTAL DEF ALT SUMMER		CUMULATV CASE SUMMER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5-percent probability of one or more contacts within 30 days are not shown.

Table A-21. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting targets over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for winter spills of 100,000 barrels and greater.

Target	Within 3 days						Within 10 days						Winter Season					
	PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	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	n	0.0	1	0.0	4	0.0	3	0.0	6	0.1
Sea Segment 1	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0
Sea Segment 2	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	1	0.0	2	0.0
Sea Segment 3	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	3	0.0
Sea Segment 4	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	4	0.0	4	0.0	5	0.0
Sea Segment 5	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0	4	0.0	3	0.0	4	0.0
Sea Segment 6	1	0.0	1	0.0	1	0.0	3	0.0	3	0.0	3	0.0	4	0.0	4	0.0	4	0.0
Sea Segment 7	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
Sea Segment 8	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Sea Segment 9	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Sea Segment 10	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Seabird Concent. I	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Seabird Concent. II	n	0.0	n	0.0	n	0.0	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	n	0.0	n	0.0	n	0.0
Migrat. Corridor A	1	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0
Migrat. Corridor B	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0
Migrat. Corridor C	n	0.0	n	0.0	n	0.0	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	n	0.0	n	0.0	1	0.0
Whale Area B	n	0.0	n	0.0	n	0.0	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	n	0.0	n	0.0	n	0.0
Peard Bay Area	3	0.0	3	0.0	4	0.0	3	0.0	3	0.0	4	0.0	3	0.0	3	0.0	4	0.0
Barrow Subsis. Area	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0	n	0.0	n	0.0	1	0.0
Wrght. Subsis. Area	6	0.1	5	0.0	7	0.1	6	0.1	5	0.0	7	0.1	6	0.1	5	0.0	7	0.1
P. Lay Subsis. Area	2	0.0	1	0.0	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0	2	0.0
P.Hope Subsis. Area	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0
Any Subsis. Area	7	0.1	5	0.1	9	0.1	7	0.1	5	0.1	9	0.1	7	0.1	5	0.1	9	0.1

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Whale Migration Corridor A (Migrat. Corridor A) is a target only between April 15 and June 15. Whale Migration Corridors B and C are targets between April 1 and June 15.

Table A-22. -- Combined probabilities (expressed as a percentage chance) of one or more spills, and the estimated number of spills (mean) occurring and contacting land segments over the expected production life of the lease area, proposal vs. Coastal Deferral Alternative vs. cumulative case. Probabilities are for winter spills of 100,000 barrels and greater.

Land Segment	Within 3 days						Within 10 days						Winter Season					
	PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER		PROPOSAL WINTER CASE		COASTAL DEF ALT WINTER		CUMULATV CASE WINTER	
	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean	Prob	Mean
27	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	2	0.0	2	0.0	2	0.0
28	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	n	0.0	1	0.0	1	0.0	1	0.0

Note: n = less than 0.5 percent; ** = greater than 99.5 percent. Segments with less than 0.5-percent probability of one or more contacts over the entire winter season are not shown.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

In Reply Refer To:
LMS-Mail Stop 644

JUN - 6 1986

Mr. William G. Gordon
Assistant Administrator for Fisheries
National Marine Fisheries Service
Department of Commerce
Washington, D.C. 20235

Dear Mr. Gordon:

This is to confirm that on March 25, 1986, Alaska regional personnel of the Minerals Management Service (MMS) and the National Marine Fisheries Service (NMFS) met in Anchorage to discuss information for an Endangered Species Act (ESA) section 7 formal consultation on leasing and exploration activities associated with proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 109 in the Chukchi Sea offshore Alaska. This lease sale is scheduled for October 1987 and will be the first sale in this planning area of the Arctic OCS subregion. (A previously proposed sale in this planning area (Barrow Arch Sale 85), for which the MMS requested formal consultation with the NMFS on December 2, 1983, was dropped on July 12, 1984, from the 5-year leasing schedule then in effect; the MMS requested that the NMFS terminate the Sale 85 consultation by letter of August 17, 1984.)

The site-specific and quantified information discussed at the March 25 meeting included delineation of the proposed Sale 109 lease area, proposed leasing deferrals (leasing alternatives), potential archaeological and biological stipulations, conditional mean resource estimates, anticipated exploration and development scenarios, and oil spill risk analyses. This is the same information that is being used for the draft environmental impact statement (EIS) now nearing completion.

By mutual agreement between MMS and NMFS personnel in Alaska, the March 25 meeting marked the start of the ESA formal consultation period. Accordingly, this memorandum confirms this agreement and represents the official MMS request for formal consultation.

We believe the Sale 109 formal consultation will be a relatively straightforward one because it is actually a reexamination and updating of the NMFS April 1, 1982, Arctic Region biological opinion. As in the past, MMS policy continues to be to include a copy of each consultation request and attendant biological opinion in the draft or final EIS that is prepared for each lease sale. Specific EIS preparation milestones were discussed with your representatives at the March 25 meeting. Accordingly, we request receipt of the NMFS opinion on Sale 109 at MMS headquarters in as timely a manner as possible, and we look forward to your cooperation in accommodating any deadlines agreed upon at the March 25 meeting.

In addition, should problems arise or your staff consider a potential finding of "jeopardy," we strongly request that our respective staffs discuss the problems or finding, as well as "reasonable and prudent alternatives" and any incidental take "reasonable and prudent measures," terms, and conditions, as early as possible during the consultation to minimize or prevent later confusion or misunderstandings.

As always, it is understood that by providing us with a biological opinion for Sale 109 you will not be foreclosing on opportunities to reconsider that opinion in later phases of the program or as future lease sales are proposed for this area. It is our position that additional lease sale proposals in a region or planning area provide an appropriate occasion for further consultation and that formal consultation may be reinitiated at that time. Furthermore, it is understood that formal consultation should be reinitiated before development and production activities begin in this planning area. These formal proceedings will take place in addition to the ongoing informal consultations presently occurring throughout all phases and regions involved in the OCS leasing program.

If you have any questions regarding this request, please address them to Jackson E. Lewis, Minerals Management Service, Mail Stop 644, 12203 Sunrise Valley Drive, Reston, Virginia 22091 (commercial telephone: 703-648-7771; FTS: 959-7771), or Debby J. Johnston, Minerals Management Service, Alaska Region, P.O. Box 101159, Anchorage, Alaska 99510 (commercial and FTS telephone: 907-261-4686).

Sincerely,

(SGD) WM. D. BETTENBERG

Director

bcc: MMS General
Director's Chron
AS/LM
RD/RS-LE/RS-FO, Alaska Region
Debby Johnston, Alaska Region
Pat Carter, NMFS
Official File (BEO)(Sale 109; ENV 7-1.a, Chukchi) MS 644
AD/OMM
Chief, OEAD
OEAD RF
Chief, BEO
BEE/BES/BEM/Lewis
Offshore Chron
BEO RF

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United States Department of the Interior

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

In Reply Refer To:
LMS-Mail Stop 644

JUN - 6 1986

Memorandum

To: Director, U.S. Fish and Wildlife Service

From: Director, Minerals Management Service (SGD) WM. D. BETTENBERG

Subject: Endangered Species Act Section 7 Formal Consultation for Proposed Chukchi Sea Outer Continental Shelf Oil and Gas Lease Sale 109, Arctic Subregion, Alaska

This is to confirm that on March 25, 1986, Alaska regional personnel of the Minerals Management Service (MMS) and the U.S. Fish and Wildlife Service (FWS) met in Anchorage to discuss information for an Endangered Species Act (ESA) section 7 formal consultation on leasing and exploration activities associated with proposed Outer Continental Shelf (OCS) Oil and Gas Lease Sale 109 in the Chukchi Sea offshore Alaska. This lease sale is scheduled for October 1987 and will be the first sale in this planning area of the Arctic OCS subregion. (A previously proposed sale in this planning area (Barrow Arch Sale 85), for which the MMS requested formal consultation with the FWS on December 2, 1983, was dropped on July 12, 1984, from the 5-year leasing schedule then in effect.)

The site-specific and quantified information discussed at the March 25 meeting included delineation of the proposed Sale 109 lease area, proposed leasing deferrals (leasing alternatives), potential archaeological and biological stipulations, conditional mean resource estimates, anticipated exploration and development scenarios, and oil spill risk analyses. This is the same information that is being used for the draft environmental impact statement (EIS) now nearing completion.

By mutual agreement between MMS and FWS regional personnel, the March 25 meeting marked the start of the ESA formal consultation period. Accordingly, this memorandum confirms this agreement and represents the official MMS request for formal consultation.

We believe the Sale 109 formal consultation will be a relatively straightforward one because it is actually a reexamination and updating of the existing FWS November 9, 1981, Arctic Region biological opinion. As in the past, MMS policy continues to be to include a copy of each consultation request and attendant biological opinion in the draft or final EIS that is prepared for each lease sale. Specific EIS preparation milestones were discussed with your representatives at the March 25 meeting. Accordingly, we request receipt of the FWS opinion on Sale 109 at MMS headquarters in as timely a manner as possible, and we look forward to your cooperation in accommodating any deadlines agreed upon

at the March 25 meeting. So as not to delay unnecessarily the start of the consultation process, we are sending a copy of this request for formal consultation directly to the FWS Alaska Regional Director in Anchorage.

In addition, should problems arise or your staff consider a potential finding of "jeopardy," we strongly request that our respective staffs discuss the problems or finding, as well as "reasonable and prudent alternatives" and any incidental take "reasonable and prudent measures," terms, and conditions, as early as possible during the consultation to minimize or prevent later confusion or misunderstandings.

As always, it is understood that by providing us with a biological opinion for Sale 109 you will not be foreclosing on opportunities to reconsider that opinion in later phases of the program or as future lease sales are proposed for this area. It is our position that additional lease sale proposals in a region or planning area provide an appropriate occasion for further consultation and that formal consultation may be reinitiated at that time. Furthermore, it is understood that formal consultation should be reinitiated before development and production activities begin in this planning area. These formal proceedings will take place in addition to the ongoing informal consultations presently occurring throughout all phases and regions involved in the OCS leasing program.

If you have any questions regarding this request, please address them to Jackson E. Lewis, Minerals Management Service, Mail Stop 644, 12203 Sunrise Valley Drive, Reston, Virginia 22091 (commercial telephone: 703-648-7771; FTS: 959-7771), or Debby J. Johnston, Minerals Management Service, Alaska Region, P.O. Box 101159, Anchorage, Alaska 99510 (commercial and FTS telephone: 907-261-4686).

bcc: MMS General
Director's Chron
AS/LM
Regional Director, FWS, Anchorage
Daniel L. James, FWS
RD/RS-LE/RS-FO, Alaska Region
Debby J. Johnston, Alaska Region
Official File (BEO) (ENV 7-1.a Chukchi Sea; Sale 109) MS 644
AD/OMM/DAD, Leasing/DAD, Operations
Chief, OEAD
OEAD RF
Chief, BEO
BEE/BES/BEM/Lewis
Offshore Chron
BEO RF

LMS:BEO:JELewis:ag:6/02/86:648-7773 Folder EV7; Disk G-L (G-CHUKCHI1)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C. 20235

SEP 1 1987

Mr. William D. Bettenberg
Director
Minerals Management Service
U.S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Bettenberg:

Enclosed is the Biological Opinion prepared by the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA) concerning OCS Lease Sale 109 in the Chukchi Sea.

NMFS concludes that the leasing and exploration phases of Lease Sale 109 are not likely to jeopardize the continued existence of any endangered or threatened marine cetaceans. In formulating this opinion, NMFS used the best available information, including the recent material submitted by the Minerals Management Service (MMS) on the probability of an oil blowout from exploratory drilling and the results of research available and considered relative to the issuance of the recent Biological Opinion for the Beaufort Sea Sale 97 planning area.

Although we have concluded the foreseeable exploration activities are not likely to jeopardize the bowhead or gray whales, NMFS is concerned about the potential effects of oil and noise associated with Lease Sale 109, particularly combined with ongoing and future exploration, production and development activities throughout the range of these two species of endangered whales. We urge MMS to continue studies on the potential effects of OCS activities on endangered species so that the necessary information will be available for future consultations, including those on development and production. Conservation recommendations are provided with the opinion concerning these information needs and concerning actions that MMS can take to minimize potential impacts to whales.

In addition to our opinion on the incremental step (leasing and exploration), NMFS is providing its views on the entire action, including development and production. Under 50 CFR Section 402.14(k) of the Section 7 regulations, there must be a reasonable likelihood that the entire action will not violate Section 7(a)(2) of the ESA for the Federal agency to proceed with the incremental step. Based on currently available information and technology and the absence of effective mitigating measures, we believe that development and production activities in the spring lead systems used by bowhead whales for their migration would be likely to jeopardize the population. This potential for jeopardy should be recognized as early as possible so that the oil companies will be aware of possible future restrictions. We have included reasonable and prudent alternatives to the action to avoid jeopardy. In addition, NMFS will reconsider this conclusion when new information, technology, and/or measures become available or are proposed that would effectively eliminate or otherwise mitigate this potential jeopardy situation.

NMFS has not provided an incidental take statement for endangered whales and any taking of whales is prohibited. Section 7(b)(4)(C) of the ESA specifies that in order to provide an incidental take statement for listed marine mammals, authorization is required under Section 101(a)(5) of the Marine Mammal Protection Act (MMPA). No taking of endangered whales incidental to OCS leasing and exploration activities has been requested or authorized. Requests should be submitted in accordance with 50 CFR Part 228 and the recent amendment to the ESA and MMPA. If you have any questions concerning the incidental take provisions, please contact Patricia Montanio of the Protected Species Management Division (FTS 673-5351).

Sincerely,

William E. Evans
Assistant Administrator
for Fisheries

Enclosure

Endangered Species Act Section 7 Consultation

BIOLOGICAL OPINION

Agency: Minerals Management Service

Activities: Oil and Gas Leasing and Exploration - Chukchi Sea Lease Sale 109

Consultation Conducted By: National Marine Fisheries Service

Date Issued: SEP 1 1987

Background:

On March 25, 1986, the Minerals Management Service (MMS) of the Department of the Interior (DOI) requested the initiation of formal consultation under Section 7(a) of the Endangered Species Act (ESA) concerning a proposed oil and gas Lease Sale 109 in the Chukchi Sea planning area of the Alaska outer continental shelf (OCS). This area encompasses OCS lands in the Chukchi Sea off northwest Alaska. The subject of the consultation was the potential impacts of OCS leasing and exploration on endangered whales that may occur in this proposed lease area.

The proposed Chukchi Sea Lease Sale 109, scheduled for May 1988, is the second proposed offering of submerged federal lands in the Chukchi Sea. An earlier lease offering called the Barrow Arch Sale 85 was scheduled for February 1985, and a Call for Information was issued on June 27, 1983. Formal consultation for this sale was initiated on December 12, 1983. The proposed sale was subsequently cancelled and removed from the leasing schedule in March 1984. Formal consultation was consequently suspended, and no biological opinion was issued for the proposed Barrow Arch Sale.

Earlier leasing has been conducted in federal waters of the adjacent Beaufort Sea. Formal consultations have been conducted and biological opinions have been issued by NMFS concerning these previous sales. These previous biological opinions for OCS lease sales in the Arctic Region of Alaska are listed below:

On June 24, 1980, the NMFS issued a Biological Opinion in the joint Federal/State Sale BF in the Beaufort Sea.

On April 1, 1982, a revised Biological Opinion was issued for the joint Sale BF;

On May 19, 1982, a Biological Opinion was issued for the Diapir Field (Sale 71) area of the Beaufort Sea;

On December 19, 1983, a Biological Opinion was issued for the Diapir Field (Sale 87) area of the Beaufort Sea which was held in August 1984;

On May 27, 1986, a Biological Opinion was issued for a proposed Deep Stratigraphic Test (DST) Well in the Chukchi Sea.

On May 20, 1987, a Biological Opinion was issued for the proposed Beaufort Sea Lease Sale 97, currently scheduled for January 1988.

NMFS issued an area-wide Biological Opinion for five proposed OCS lease offerings in the Arctic Region of Alaska on April 1, 1982. This opinion resulted from a regional consultation for all operations and activities concerning future OCS leasing and exploration for five proposed sales in the Beaufort and Chukchi Seas: Diapir Field Sales 71, 87, and 97; Barrow Arch Sale 85; and Hope Basin Sale 86. The Arctic Region Biological Opinion was generic in nature and primarily served to identify potential impacts, to identify information needs, and to assist in the further planning of individual OCS lease sales. The regional opinion was initiated to complement, but not replace, the consultation for individual lease sales.

This is the Biological Opinion for the Chukchi Sea Lease Sale 109. Additional information on the proposed leasing and exploration activities that will result from this sale has been provided by MMS and reviewed by NMFS. New information on the use of this lease area by endangered whales has been studied and incorporated into our analysis. This opinion updates the Arctic Regional Biological Opinion pertaining to the Chukchi Sea Lease Area, which should be referred to for additional background information.

Proposed Activities:

This is an incremental step consultation covering leasing and exploration activities of OCS Lease Sale 109. The proposed activities considered are an oil and gas lease sale scheduled for May 1988, followed by a period of exploratory drilling, testing, and surveying. A separate consultation for development and production activities will be conducted if oil is discovered and development plans are proposed.

The details of the proposed exploration, development, and production scenarios for this sale are contained in information provided by MMS (1985 and 1987). The mean resource estimate for Sale 109 is 2.68 billion barrels of oil with a 20 percent chance of a discovery of commercially recoverable oil. The activities associated with this sale are foreseen to be similar to the activities associated with the adjacent Beaufort Sea lease sales, with exploration beginning on newly leased tracts the first year following the sale (1989) and continuing for six years (1995). A total of 20 exploration wells and 23 delineation wells are estimated. The probable kinds and levels of exploratory activity that may occur as a result of leasing in the Chukchi Sea have been estimated by MMS (1985, 1987). Exploration would be done by existing ice-strengthened drillships in water depths over 25 m, working in the late summer and fall (August through October) when there is minimal sea ice. Icebreaker assistance would be necessary to extend the drilling season into freeze-up.

In water depths of less than 25 m, gravel islands 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 prevalent in the Chukchi Sea. These units could become the primary type of drilling unit in this area within 4 years. Subsea well completions are unlikely.

Drillship operations could be supported from barges towed into the area from the west coast. Shallow barges could anchor in Peard Bay. Air support activities could be based in Wainwright or Barrow, which have aircraft runways capable of handling C-130 Hercules aircraft. A great deal of effort would be necessary to equip the area with facilities for work boats. 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).

Only shallow-hazards seismic surveys are expected to result from this sale. Deep seismic surveys (using airguns) are primarily a pre-lease activity and few, if any, are projected to occur as a result of Sale 109.

Listed Species and Critical Habitats:

There are six species of endangered whales known to inhabit Arctic waters of Alaska. These species are:

Bowhead Whale	-	*Balaena mysticetus*
Right Whale	-	*Balaena glacialis*
Fin Whale	-	*Balaenoptera physalus*
Sei Whale	-	*Balaenoptera borealis*
Humpback Whale	-	*Megaptera novaeangliae*
Gray Whale	-	*Eschrichtius robustus*

The right whale and the sei whale are rare in Arctic waters. They are represented by isolated records, probably of stray individuals well outside the normal ranges of their populations.

The humpback whale and the fin whale are occasional inhabitants of the Chukchi Sea, usually in low numbers. Both species 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 whale and the gray whale commonly occur in the Chukchi Sea. Recent information on their distributions and habitat use are discussed below.

Gray Whale: The gray whale is a regular summer inhabitant of the Chukchi Sea from June through October. The northern Bering and Chukchi Seas are the main summer feeding grounds for the majority of the population. At least half the population probably summers south of the Bering Strait. The Bering Strait is an important migratory corridor for those individual whales moving north between late May and August and returning to the Bering Sea from September to November on their fall return to southern waters. From July through mid-October, some gray whales are found regularly as far north as Point Barrow, and a few gray whales occasionally travel as far east as the Canadian Beaufort Sea.

Present knowledge of the distribution and abundance of the gray whale in the Chukchi Sea is incomplete. Up to one-fourth of the total gray whale population of about 17,000 (Rugh, 1984) may enter the northern Chukchi Sea to feed during the openwater season (July-October).

Gray whales have been observed feeding off the Chukchi Sea coast of Alaska well into October (Ljungblad et al., 1983). Whether this is a resident feeding population of gray whales throughout the summer is unknown. Many gray whales have been observed feeding in coastal waters of northwest Alaska during summer and fall aerial surveys (Ljungblad et al., 1985). 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., 1985). They avoid heavy ice conditions, remain south of the pack ice edge, and leave northern areas before freeze-up. Other reports of whales feeding farther offshore are known, and feeding appears to be widespread.

Bowhead Whale: The bowhead whale is the northernmost ranging of the great whales. The size of the Western Arctic population of this whale has recently been revised upward to 7,200 (standard error ± 2,400) individuals (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. The path followed through these leads along the edge of the shorefast ice varies in distance from shore with the depth and 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 covers the period mid-April to early June, with a few whales migrating before and after depending on annual variability in ice conditions.

Past Point Barrow the whales follow offshore leads that extend in an easterly direction toward Banks Island in the Canadian Arctic. After feeding during the summer, mainly in the Canadian Arctic, the bowhead whales begin their westwardly migration and return along the Alaskan Beaufort Sea coast in September and October, although a few individuals may migrate into this area in August.

The fall return migration, after passing Point Barrow, is believed to continue in a general westwardly direction along the edge of the pack ice in the northern Chukchi Sea toward Wrangell Island and Herald Shoal off the Siberian coast. Some whales are known to pass close to Pt. Barrow and continue swimming west or southwest in the Chukchi Sea. Other whales apparently pass Point Barrow farther offshore, depending on annual ice conditions and the location of the pack ice edge. In either event, the whales continue migrating westward toward the Siberian Coast or turn southwest along the Alaska Coast. Aerial surveys (Ljungblad et al., 1983; Ljungblad et al., 1985) have found bowhead whales traveling through the Chukchi Sea in October. Numerous bowhead whales are known to move west to Siberia before turning south along the coast of the Chukotsk Peninsula toward the Bering Strait in late fall and early winter (November through December) on their return to the Bering Sea in advance of the winter pack ice.

The fall migration route, after the whales have passed Point Barrow, is inadequately documented, however, and that portion of the bowhead whale population which passes through the Alaska side of the Chukchi Sea is uncertain. In any event, the fall migration through the Chukchi Sea appears to be broad and variable. Bowhead whales appear to be actively migrating at this time and are not known to stop or feed in the Chukchi Sea, although this information in not conclusive.

Assessment of Impacts:

NMFS believes that exploration activities in the Chukchi Sea Sale 109 lease area have the potential to affect adversely endangered whales from oil spills and noise. Because of their low population numbers, their habit of frequenting 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 (Braham, 1984).

Since the issuance of the Arctic Region Biological Opinion in 1982, a number of 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). Noise disturbance of bowhead whales related to industrial activities have been the focus of a 5-year program in the Canadian Beaufort Sea (Richardson and Green, 1983; Richardson et. al., 1985 a-c). Some direct studies have been conducted in Alaskan waters (LGL, 1986; Miles et al., 1986).

Oil Spill Risk: Oil spills from OCS drilling are a major concern. An oil spill occuring during the spring in lead systems used by migrating bowhead whales and coming in contact with the whales might be critical. 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 generally spread out over a period that does not have to coincide with the bowhead migration because their operation is not governed by ice conditions. A blowout from bottom-founded structures in the spring lead system when whales are migrating, would be likely to contact bowhead whales because such structures would be in the shallower waters, coinciding with 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.

Drillships are expected to be used only during exploration, not during development and production. Drillships used during exploration in the Chukchi Sea, have about a 3 to 4-month drilling window overlapping the fall return migration period. An oil spill or blowout from a drillship is likely to enter the water. Drillships operating in the fall may also have to temporarily suspend operations and move off the well because of pack-ice encroachment.

MMS (1985, 1987) estimates a mean of 7 spills of 1,000 barrels or greater in the lease area over the projected 30-year life of any fields discovered and fully developed as a result of this sale. This assumes the full development of the resource estimate of 2.68 billion barrels, including the transportation of produced oil ashore (which accounts for more than 4 of the 7 spills estimated). MMS also estimated mean of 0 spills of 100,000 barrels or greater. Cumulative oil spills resulting from this and previous Chukchi Sea lease sales, including the production and transport of 1.7 billion barrels of Canadian oil, are estimated at 7.5 and 0.36 mean spills of greater than 1,000 and 100,000 barrels, respectively.

Transportation of oil in the cumulative case for spills of 1,000 or more barrels accounts for 4.7 of the 7.5 mean spills estimated. These spill estimates are drawn from all wells drilled, including both exploration and production wells. Historically, oil spills have occurred on production wells and in oil transportation, but MMS statistics are based on the total record (which shows no exploratory drilling spills). As such, the probability for an oil blowout during exploration is exceedingly small, but this can only be estimated from available statistics. To date, there has been no oil spilled as a result of a blowout during exploratory drilling on the U.S. outer continental shelf. However, there have been gas blowouts (which do not spill oil) associated with exploratory drilling in the U.S. OCS and the Canadian Beaufort Sea.

MMS has recently concluded that the probability of an oil spill resulting from a blowout during exploratory drilling is extremely unlikely (Attachment 1 of the Beaufort Sea Sale 97 Biological Opinion). They cite several studies of offshore drilling statistics that indicate the risk of a gas blowout during offshore exploration on the U.S. OCS is around 0.64 percent or about 1 blowout per 156 wells drilled. The upper 95 percent confidence level to the probability of an oil blowout of an exploration well is estimated to be equal to or less than 0.0004 percent, or no more than 1 in 250,000 wells drilled. MMS believes that such a low probability of an oil blowout does not pose a threat to bowhead and gray whales from exploratory drilling.

If an oil spill should occur, however, from either a blowout or an operational discharge, the conditional probabilities (expressed as percent chance) that an oil spill will contact certain whale habitats or migration corridors 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, 1987).

MMS also cites legal authorities that are in place to ensure safe drilling practices on OCS leases, which further assure that an oilspill 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.

Effects of Oil: Assuming an oil spill were to occur and contact whales, the worst case adverse impacts to whales from spilled oil could 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. Albert (1981) speculated that the most likely adverse effects of oil contact to bowhead whales are 1) conjunctivitis and corneal eye inflammation leading to reduced vision and possible 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. Fouling of the baleen plates by oil can decrease their filtering efficiency (Braithwaite et al., 1983) and result in oil ingestion that could, theoretically, 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. Recent experiments, summarized by Geraci and St. Aubin (1982, 1985, 1986), demonstrate that effects of actual oiling of certain marine mammals can be short-term, transient, minor, and reversible.

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. They acknowledge, however, that in heavy ice conditions, the ability of bowhead whales to avoid oil trapped among ice would be limited. Observations from the Regal Sword spill off Cape Cod (Goodale et al., 1982), show 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 and 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) demonstrated 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) suspects 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 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 would appear to be difficult for them to consume enough oil in this manner to be toxic from absorbed hydrocarbons. As in humans, ceteceans could develop lung damage from aspirating regurgitated hydrocarbons (Geraci and St. Aubin, 1986).

Bowhead whales rely on ice leads, cracks and small pools 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 offered 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 reductions in availability of their food supply within localized areas near the spill site and in areas where the oil slick occurred. In addition, 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 abandonment of traditional use areas. Geophysical seismic noise, particularly from airgun arrays used in conducting deep seismic surveys, as well as drilling, construction, icebreaker activity, and other vessel noise in areas where whales are present could cause such impacts. The range or level of noise required to produce these effects depends on 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 relates primarily to the fact that 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 well 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 in the Beaufort Sea. 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 to conduct above threshold drilling during the fall whale migration from the first drillship operation in the Alaskan Beaufort Sea. Although the well location was in the nearshore migration corridor, 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 was permitted to conduct exploratory drilling during the beginning of the fall migration, and Unocal subsequently drilled a well, also during the migration. Each well used a drillship, an icebreaker and icebreaking support vessels, and the well locations were in the nearshore migration path of the bowhead whale. Studies were conducted to determine the effects of noise on the migrating whales (LGL, 1986). Results of these studies are not yet available.

In an MMS-contracted, 2-year study of noise characteristics and propagation, the underwater acoustic environments of six specific drill sites in the Alaskan Beaufort Sea were measured during 1985 and 1986. This information was used to develop preliminary estimates of zones of responsiveness of bowhead whales to these noise sources. Based on preliminary (1985) results, the zones of potential responsiveness (where half of the whales would probably respond at a 30db signal to noise ratio) are estimated through modeling studies to extend 1.5 to 7.4 km from a dredge noise, 2.7 to 13 km for a tug noise, 1.3 to 6.5 km from drillship noise, and 0.02 to 0.7 km from man-made gravel island drilling noise (Miles et al., 1986). A small proportion of whales would probably respond at an estimated 6 to 22 km from a dredge, 11 to 30 km from a tug, 6 to 19 km from a drillship and 0.1 to 1.7 km from gravel island drilling.

Disturbance responses of bowhead whales to industrial activities have been the focus of a 5-year study in the Canadian Beaufort Sea during the summer seasons (Richardson, 1981, 1982, 1983; Richardson et al., 1985a-c). 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 situation such as an approaching boat or aircraft or the startup of noise sources (Richardson et al., 1985 a-c).

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., 1985 a-c). 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. Whether this holds true for migrating whales in Alaska is not certain.

Playback of dredge noise in Canadian waters produced behavioral responses from bowhead whales, including avoidance and changes in orientation, out to 2.25 km. Around active dredges, apparently undisturbed bowhead whales were observed, within 1 to 5 km, and no disturbed behavior was observed beyond 2.8 km. However, there are variations in reactions of these whales to dredge noise. The whales seen near actual dredges may have been less sensitive animals; those that were more sensitive may have moved away earlier or may have avoided the area (Richardson et al., 1985 a-c).

Marine geophysical sounds from seismic surveys are the loudest industrial sounds emitted into the environment. According to MMS, these activities are primarily prelease activities, and few, if any, are expected to occur as a result of Lease Sale 109 and, therefore, the potential impacts are not considered in this opinion. Deep seismic surveys are a pre-lease activity evaluated in previous biological opinions.

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' course, 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 flight altitudes of less than 1,500 feet (Richardson et al., 1985a). Reaction to helicopters may have a similar radius of influence (M. Dahlheim, NMFS, 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.

Significant 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. Because the 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 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 and supply vessels to operate. Marine exploration activities generally occur for about 90 days, in August, September and October.

Additional Impacts: 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 effects from this sale are limited to additional exploratory drilling, to the increase in permitted traffic and support activities, and to the extremely small increased risk of an oil spill occurring prior to or during the migration period. Past drilling has been restricted by lease stipulation to avoid or reduce its coinciding with bowhead whale presence during the fall migration. By limiting OCS exploratory drilling to the times of years and portions of the lease area where whales are not present, MMS has helped to avoid possible impacts from previous lease sales.

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., 1985 a-c). This variation 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. Assumed variation in food availability (zooplankton concentrations) may also have been involved.

OCS exploratory and development activities in the Chukchi Sea, together with similar present and proposed activities in other lease areas (Beaufort Sea, Norton Sound, Navarin Basin), may eventually adversely affect the successful life cycle of this species. At present, we are unable to predict what these tolerance thresholds might be, but do not believe that the combined effects of this sale with ongoing activities and cumulative effects 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 that the combined effects from all OCS activities are not likely to jeopardize the continued existence of the bowhead whale population.

Conclusions:

Based on review of the information on the proposed oil and gas leasing and exploration activities in the Chukchi Sea Sale 109 lease area provided to us by MMS and from information available on endangered whales in the Chukchi Sea, NMFS has reached the following conclusions.

Right, Sei, Fin and Humpback Whales: NMFS concludes that the Chukchi Sea Lease Sale 109 is 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. NMFS believes that impacts to either the humpback or fin whales are also not likely to jeopardize their continued existence. Humpback and fin whales inhabit the Chukchi Sea on occasion, but in relatively low numbers.

Gray Whales: 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 many as one-fourth of the gray whale population may enter the northern Chukchi Sea. Due to the good overall condition of the gray whale population and to its widespread distribution in the Bering and Chukchi Seas, and because available information suggests that the major portion of the population summers south of the Chukchi Sea lease area, we conclude that the continued existence of the gray whale is unlikely to be jeopardized from oil and gas exploration activity in the Chukchi Sea lease area. Although some individuals may suffer disturbances or other impacts from the proposed activities such impacts associated with the exploration phase are not likely to result in jeopardy to the species.

However, the impacts that could result from OCS activities proposed in other Bering and Arctic lease areas, 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 is important to assess whether the combined impacts are affecting the gray whales adversely.

Bowhead Whales: The primary concerns of NMFS in the Chukchi Sea lease area focus on the bowhead whale. The entire population of this whale is susceptible to impacts in this lease area during its spring migration through nearshore leads. In the fall, mainly in September and October, a large portion of the bowhead whale population may again be exposed to oilspills and disturbance from noise when they migrate through the Chukchi Sea lease area both nearshore and offshore with the pack ice.

Based on information provided by MMS (see Attachment 1 of the Sale 97 Biological Opinion), an uncontrolled oil blowout or a major oil spill in the proposed Chukchi Sea lease area 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, and is not likely to jeopardize the continued existence of the bowhead whale.

Large or widespread noise disturbance along the spring migration path in the ice lead system could seriously affect bowhead whales by interfering with successful migration. 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. Noise resulting from activities in other parts of the lease area or at times other than the spring migration are not likely to seriously affect the bowhead whale. We base this conclusion on the generally widespread and diffuse path of the fall migration through the Chukchi Sea lease area. Although some impacts to individuals may occur, we do not believe that the anticipated proposed activities will produce noise levels that would be expected to reduce appreciably the likelihood of survival and recovery of the bowhead whales by reducing the reproduction, numbers, or distribution of the species. Therefore, we conclude the leasing and exploration associated with Lease Sale 109 is not likely to jeopardize the continued existence of the bowhead whale. Our concerns over activities in the Spring Lead Systems are discussed under the subsequent section on "Incremental Step Consultation."

Based on the above discussion of physical impacts, NMFS believes that leasing and exploration activities in Chukchi Sea waters resulting in physical impacts to bowhead whales will be relatively inconsequential and are not likely jeopardize the continued existence of the species.

The bowhead whale potentially is subjected to impacts from oil and gas activities throughout its range. Because of the relatively short history of OCS activities in Alaska waters, we are unable to predict a level of activity that would result in significant adverse impacts to this species. We believe that such effects are more likely to occur during future development and production activities than during the exploration phase, and have yet to materialize on the Alaska OCS. NMFS believes that more attention should be given to these potential impacts to bowhead whales in the future planning and conduct of all OCS oil and gas activities.

Reinitiation of Consultation

During the post-lease exploration phase, MMS should provide NMFS 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 Chukchi Sea. 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 Sale 109. In addition to our opinion on the incremental step (leasing and exploration), NMFS 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, NMFS believes that development and production activities in the spring lead systems used by bowhead whales (in the eastern part of the lease sale area along the Chukchi Sea coast) would likely 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 oilspills and noise disturbance. 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.

Although we believe it is possible for DOI to time exploration activities in such a way as to avoid oilspills and potential impacts to bowhead whales during the spring migration, we cannot at this time specify how such impacts can be avoided at the development and production phases should oil be discovered in the spring migration corridor. We believe that potential year-round development and production activities in those nearshore portions of the lease area containing the ice leads used by bowhead whales for their spring migration could lead to foreseeable circumstances that would be likely to jeopardize the continued existence of the bowhead whale population. NMFS will reconsider this conclusion when new information, technology and/or measures become available or are proposed that would effectively eliminate or otherwise mitigate this potential jeopardy situation.

We believe this potential for jeopardy must be recognized during the leasing stage. Therefore, NMFS 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, which would be met by adopting the Coastal Deferral Alternative VI (MMS, 1987), or, (2) if leasing and exploration activities occur in these areas, development and production activities should not be approved in these blocks 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 taking incidental to the proposed activity has been requested or authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered or threatened marine mammals is provided, and no take is authorized.

CONSERVATION RECOMMENDATIONS

NMFS offers MMS the following recommendations to further promote the conservation of endangered whales in the Chukchi Sea lease area:

1. To minimize potential harassment to bowhead and gray whales from daily activities associated with OCS exploration in the Chukchi Sea, MMS should adopt the Information to Lessees (ITL's) on Bird and Mammal Protection and on Endangered Whales. The ITL should specify 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 that vessels should avoid concentrations of whales and to keep at least a distance of 1 mile from any observed whales. Seismic geophysical vessels should follow the same requirements developed for the Beaufort Sea. 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 NMFS for review.

2. To avoid adverse effects should a major oil spill occur, MMS should use its authorities to keep the areas occupied by these whales free of spilled oil when either bowhead or gray whales are present. Special precautions should be taken to ensure that spilled oil does not persist in areas located in or near lead systems used by bowhead whales during their spring migration (April through June).

3. MMS is encouraged to continue to sponsor research needed to improve knowledge of the seasonal movements and habitat utilization of endangered whales in the Chukchi Sea, and of the effects of oil spills and other OCS activities on these whales. Specific research should continue to a) identify and characterize feeding areas of gray whales, and habitat use of bowhead whales, and determine their importance to the species; b) ascertain the nature and effects of industrial noise in the Chukchi Sea, including geophysical seismic sounds using airguns, drilling noise from both fixed and floating units and their support activities, including icebreakers and dredges, and c) detect cumulative effects.

4. Information on the location of the spring lead system and distribution of whales in this system is partially available from aerial surveys and spring whale census efforts. This information should be thoroughly analyzed 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 in the Chukchi Sea lease area. Certain information gaps remain on the variability in location of these

nearshore leads in the Chukchi Sea, distribution of the whale migration across the lead system, and the integrity of the lead system along the coast.

5. The results of MMS sponsored research on bowhead and gray whales should be made available to NMFS and other parties interested in management of these whales as soon as possible after completion of the research. To provide for greater interdisciplinary coordination among researchers, and between researchers and agencies, annual research coordination and review workshops are helpful to update information and study results on these whales.

6. As proposed in the ITL, the Arctic Biological Task Force should be mandated for this lease offering also, to assist MMS in ensuring 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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JUN 24 1986

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Re: Biological Opinion for the Chukchi Sea Outer Continental Shelf (OCS) Oil and Gas Lease Sale 109

Dear Mr. Bettenberg:

This responds to your June 6, 1986, request for formal consultation pursuant to Section 7(a) of the Endangered Species Act of 1973, as amended, for Outer Continental Shelf (OCS) oil and gas leasing and exploration in the Chukchi Sea, Arctic subregion, Alaska. Previous biological opinions (copies attached) for OCS leasing and exploration in the Chukchi Sea were issued on November 9, 1981, (Arctic OCS region, sales 71, 85, and 86), and on January 26, 1984, (Barrow Arch area, sale 85). A biological assessment report on oil and gas leasing and exploration in the Arctic region was provided to the Fish and Wildlife Service prior to the 1981 biological opinion. Reinitiation of consultation was requested so that changes to the lease sale offering, including new leasing alternatives and other new information, could be taken into consideration.

Sale 109 is currently scheduled for May 1987, and as proposed includes the entire Chukchi Sea Planning Area, although we understand that selected portions of the lease area may be deferred from sale. Projections predict the drilling of 20 exploration wells beginning in 1989 and ending in 1996. Exploration would be accomplished using floating drilling units or bottom-founded drilling units. Past exploration scenarios included the use of rigs supported by artificial islands. Air support for off-shore activities would probably originate from Barrow and Wainwright. Alternative air support sites are Icy Cape, Cape Beaufort and Kotzebue.

The threatened Arctic peregrine falcon (Falco peregrinus tundrius) is the only listed threatened or endangered species considered in this opinion. The Arctic peregrine, which winters as far south as Central and South America, is present on the North Slope of Alaska from late April to September. Peregrines are most vulnerable to disturbance during nesting -late April to about mid-August.

Peregrines typically nest on cliffs and bluffs overlooking rivers and along coastal areas. Although the bluffs along the Chukchi Seacoast in the Sale 109 area are not known to be important nesting habitat for peregrine falcons, a few nests have been reported. Surveys are needed to determine to what extent peregrines use the coastal habitat adjacent to the sale area.

Having reviewed the 1981 biological assessment, the 1981 and 1984 biological opinions, and current information supplied by the Alaska Minerals Management Service staff, we conclude that those portions of the earlier biological opinions pertinent to Sale 109 remain valid. We believe that relatively few peregrine falcon nest sites occur adjacent to the sale area, and that disturbance to peregrines from exploration activities will be minimal. Accordingly, it is my biological opinion that Oil and Gas Lease Sale 109 as proposed, is not likely to jeopardize the continued existence of the Arctic peregrine falcon.

By mutual agreement between our respective regional office staffs, and consistent with previous OCS lease sales in Alaska, this opinion addresses only those activities pertaining to oil and gas leasing and exploration. Our review of preliminary development and production scenarios indicates that both the 325 mile (high case) pipeline alternative, from Cape Beaufort across the DeLong Mountains to Kivalina and the 656 mile (mean case) pipeline alternative, from Point Belcher south, crossing the Colville River to the Trans-Alaska Pipeline System Pump Station 2 at Sagwon, pass within close proximity to numerous Arctic peregrine falcon nesting locations. Consultation on these and other aspects of development and production will require a biological assessment addressing the activities associated with these phases.

Thank you for your continuing efforts to protect threatened and endangered species. Questions regarding this biological opinion may be directed to our endangered species staff in Anchorage at FTS 786-3435.

Sincerely,

Deputy Regional Director

Attachment

cc: J. Lewis, MMS
R. Brock, MMS
D. Johnston, MMS
OES
NAES

IN REPLY REFER TO:
SE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503
(907) 276-3800

1 FEB

William D. Bettenberg
Director
Minerals Management Service
EMS - Mail Stop 644
12203 Sunrise Valley Drive
Reston, Virginia 22091

26 JAN 1984

Dear Mr. Bettenberg:

This ~~responds to your December~~ 2, 1983, request to reinitiate formal consultation pursuant to Section 7 (a) of the Endangered Species Act (ESA), as amended, for Outer Continental Shelf (OCS) oil and gas leasing and exploration in the Barrow Arch (Arctic Region) planning area. As with all OCS consultations, it is understood that consultation will be reinitiated should the project advance beyond the exploration phase.

BACKGROUND

A biological opinion was issued on November 9, 1981, for the Arctic Region (copy attached). Your stated reason for reinitiating consultation is to ensure that conclusions contained in the earlier opinion are still valid in view of newly obtained information relative to this proposed sale. Also, the previous opinion addressed the entire Arctic Region. In accordance with your request, this reassessment will address only the Barrow Arch planning area.

BIOLOGICAL INFORMATION

The Arctic Peregrine falcon (Falco peregrinus tundrius) was the only endangered species considered in the 1981 opinion. Arctic willow (Salix ovalifolia var. glacialis) and fleabane (Erigeron muirii), candidate plant species which occur near the Barrow Arch planning area, were also considered. We find the 1981 opinion for the Arctic Region to be current and entirely appropriate.

As a reminder, we call your attention to the findings of that opinion, and in addition, we have elaborated on and clarified several of the findings in light of new information you supplied:

1. The need to intensively survey, for peregrine falcons, those coastal areas where proposed onshore activities or aircraft traffic may conflict with peregrine nesting. As emphasized in our 1981 opinion, a thorough survey for coastal nesting peregrine falcons has not been accomplished in Alaska. The coastal and riverine areas within the Barrow Arch area have not been surveyed to date. Future development and production sites (currently proposed for Peard Bay) should be extensively surveyed for nesting peregrine falcons prior to initiation of Section 7 consultation.

2. A preference for locating onshore facilities in or near existing villages and away from potential peregrine nesting areas. Your current proposal identifies Wainwright as the support site for exploration. We see no conflict with nesting peregrine falcons at this site.

3. The need to provide all potential lessees with the document "Recommendations to Avoid Peregrine Falcon Conflicts" which is an attachment to the 1981 opinion. As requested by your Anchorage staff, we will review and abbreviate these recommendations where possible.

4. A request that candidate plant species be considered in the planning of all onshore activities that result in ground surface disturbances.

BIOLOGICAL OPINION

It is my biological opinion that OCS leasing and exploration activities in the Barrow Arch Planning Area are not likely to jeopardize the continued existence of the Arctic peregrine falcon.

This opinion does not address oil or gas development or production. Consultation will be required prior to initiation of those phases. New information which could alter this biological opinion, the listing of new species which could be affected by the proposed action, or significant modification of the proposed action will also require reinitiation of consultation.

Thank you for your cooperation and for your concern for endangered species.

Sincerely,

Regional Director

Attachments

cc: MMS, Anchorage
OES, Washington, D. C.
NAES, Region 7
OCS Coordinator, Region 7

In Reply Refer To:
FWS/OES BLM/GS-81-3

NOV 9 1981

Memorandum

To: Director, Bureau of Land Management
Director, U.S. Geological Survey

From: Chief, Office of Endangered Species

Subject: Section 7 Biological Opinion, Proposed OCS Oil and Gas Leasing and Exploration in the Arctic Offshore Area

By memorandum of August 28, 1981, (copy attached) the Bureau of Land Management (BLM), on behalf of themselves and the U.S. Geological Survey (GS), requested joint formal consultation on the proposed leasing and exploration in the Arctic Outer Continental Shelf (OCS) region. The proposed leasing consists of OCS Sale No. 71 in the Beaufort Sea, as well as Sales 85 (Chukchi Sea) and 86 (Hope Basin). The combined Federal/State oil and gas lease sale in the Beaufort Sea area has been the subject of a previous biological opinion (July 27, 1978; copy attached).

Since OCS exploration in the Arctic region is likely to involve the construction of gravel islands, it was agreed that BLM should perform a Biological Assessment, as required by Section 7(c) of the Endangered Species Act of 1973, as amended (ESA). To assist with the Biological Assessment, on May 21, 1981, the Fish and Wildlife Service (FWS) provided BLM with a list of Endangered and Threatened species which are under FWS jurisdiction and which might be present in the area of concern (copy attached). Following receipt of the list BLM completed the Biological Assessment and submitted it to FWS with the request for consultation. The Biological Assessment concluded that the listed Arctic peregrine falcon and three candidate plant species may be affected. It also concluded that the Eskimo curlew should not be considered as being present in the area. The FWS concurs with these findings.

During the course of this consultation, the FWS reviewed a number of reports and publications in addition to the Biological Assessment and contacted various individuals by phone. Copies of pertinent reports and records are maintained in an administrative record at the Office of Endangered Species (OES) and are incorporated by reference in this opinion.

Project Description

BLM acts as the Secretary of the Interior's agent in arranging for the processing of bids on offshore oil and gas lease sales. After the issuance of the leases, GS assumes the authority to administer the lease areas. Among other things, this includes the approval of exploratory and development/production plans

submitted by the lessee. The final Five Year OCS Oil and Gas Leasing Schedule dated June 1980, calls for three proposed sales in the Arctic region between now and June 1985. These three sales include proposed Sale No. 71 in the Beaufort Sea (also called Diapir Field), proposed Sale No. 85 in the Chukchi Sea (also referred to as the Barrow Arch area) and proposed Sale No. 86 in the Hope Basin. An accelerated proposed leasing schedule was published in the Federal Register on July 31, 1981. This new proposed schedule calls for two additional sales, No. 87 and 97, both in the Diapir Field, to be added by June, 1986.

Proposed Sale No. 71 in the Beaufort Sea will be the first of the five areas offered for leasing. At this time, it is the only area in which tracts have been identified for further analysis and possible sale. The 411 tracts identified lie from west of the Canning River to just west of Camp Lonely, with the bulk of the tracts located west of Prudhoe Bay. The tracts range from 3 to 43 miles offshore and in water depths of approximately 67 to 164 feet.

Exploration of the Arctic OCS will almost certainly include the construction of artificial islands built from fill material obtained from sites either offshore or onshore. The average exploratory island will probably be 2 to 3 surface acres and require 0.4 to 1.0 million cubic yards of fill. For tracts in the Chukchi Sea and Hope Basin, ice-strengthened drillships will probably be used. Onshore support facilities, including airports, are expected to be located in Barrow and/or Prudhoe Bay for the Beaufort Sea tracts and in Kotzebue and Cape Lisburne for the Chukchi and Hope Basin tracts.

In any drilling operation there is a possibility of an oilspill. An exploratory well blowout can cause the release of significant amounts of hydrocarbons into the marine environment and may affect listed species. The Campeche, Mexico, oilspill is a dramatic example of an exploration blowout. While the exact causes of the Campeche blowout are likely to remain unknown, it appears that operational procedures, rather than technology, were at the root of the accident. It is thought that this spill could have been avoided had operating procedures used in the United States been employed.

In the United States, OCS Operating Orders require that a number of safety devices and procedures be employed to prevent such an accident. These include the use of blowout preventers, strict drilling procedures, regular testing of safety equipment, training of personnel, regular inspection by GS personnel, and approval by GS of all drilling plans and modifications. According to statistics compiled by GS, the probability of a blowout occurring during exploration in the offshore waters of the United States is remote. These statistics, however, were not generated under Arctic conditions. The Canadians have been drilling in the Beaufort Sea since 1965 and have drilled a total of 33 offshore wells, seven of which have resulted in discoveries. None of these wells have experienced any oilspills. The Canadian experience provides support for the conclusion that a blowout is unlikely to occur during OCS exploration activities.

This biological opinion considers only operations pertaining to oil and gas leasing and exploration in the Beaufort and Chukchi Seas and Hope Basin including proposed OCS Sales 71, 85, 86, 87, and 97. Consultation must be reinitiated

prior to entering the development/production phases of OCS activities. Although this consultation considers the proposed Sales through June 1986, BLM and GS should remain in close contact with OES to insure that new circumstances which may develop do not impact listed species and that agency obligations to conserve listed species are effectively met. OES concurs with BLM's contention that additional sales proposed for this region constitute new information and that formal consultation should be reinitiated at the appropriate time. Should new species be listed which may be affected, this consultation should be reinitiated. In addition, BLM and GS are required to confer with OES if they determine the OCS activities are likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed Critical Habitat.

Arctic Peregrine Falcon (Falco peregrinus tundrius)

The Arctic peregrine falcon was listed as Endangered in 1970, primarily due to population declines associated with chlorinated hydrocarbon contamination. The Alaska Peregrine Falcon Recovery Team has estimated that historically Alaska supported about 150 pairs of Arctic peregines. This population, however, was severely reduced in the late 1960's and early to mid-1970's. Since then, the population has slowly increased. In the 1980 surveys the population was estimated to be 45-50 pairs.

Peregrines are usually present in Alaska from mid-April to mid-September with egg laying on the North Slope beginning in the middle of May. According to the Recovery Team, the primary threat to peregrines during the nesting season is human disturbance.

The physical presence of humans, use of aircraft, or other intrusions near eyries can result in injury or death to peregrines and abandonment of nest sites. Abrupt disturbances can cause adults to flush from an eyrie causing egg breakage, injury to young, or premature fledging which could result in injury or death of young. Even temporary abandonment of eyries can result in overcooling or overheating of eggs or young, malnutrition in young, and predation of eggs or young by other species. Helicopter and fixed-wing aircraft noise and movement may be taken as a threat and may cause a peregrine to flee the eyrie or attack the aircraft. Experience in Alaska and elsewhere has shown that nest sites near sustained human activity are more likely to be abandoned.

These adverse impacts on peregrine falcons are generally avoidable when eyrie locations are known. The Biological Assessment which BLM provided with their request for consultation identifies the locations of the known eyries. The data we currently possess on coastal peregrine nesting is largely information gathered incidental to sea bird survey work. In other words, people were not looking for peregrine falcons so the likelihood of missing nest sites was high. Some authorities believe there could be as many as 6 to 8 undiscovered nesting pairs between Cape Lisburne and Kotzebue. Although no sites are currently known, there is evidence which indicates that coastal nesting may occur along the North Slope. This speculation points out the need to intensively survey coastal Alaska for Arctic peregrine falcons.

The impacts of OCS leasing and exploration on Arctic peregrines can range from little or no effect to severe adverse effects depending upon where activities take place. As stated earlier, the primary threat to nesting peregrine falcons in Alaska is human disturbance. OCS activities can add significantly to this threat. If onshore facilities are limited to Barrow, Prudhoe Bay, Kotezebue, and Cape Lisburne and are not located within the nesting territories of Arctic peregrines, these facilities would have no effect on the falcons. Airplane and helicopter traffic would pose little or no threat if existing facilities are used and a minimum altitude of 1500 feet is observed. Likewise, gravel operations, if conducted offshore, would pose no threat. Unfortunately, none of these conditions can be guaranteed since no one knows where these activities will be required and BLM and GS do not possess the authority to regulate onshore activities (including air traffic). BLM will, however, inform all potential lessees of the protection that Arctic peregrine falcons receive under the ESA and of the possible conflict between exploration activities and peregrine falcons. BLM will also provide a series of four recommendations, concurred in by FWS, which should avoid peregrine falcon conflicts (attached).

Candidate Species

As noted in our memo of May 21, 1981, (attached) there are several candidate plant species which could be impacted by OCS exploration and its associated onshore facilities. While candidate plants are afforded no protection under ESA, we feel that agencies, wherever possible, will be interested in protecting such species and thus reducing the probability that they will need to be listed. In this case, it is recommended that surveys be done prior to any onshore construction or gravel mining to insure that these candidates are not further depleted.

Cumulative Effects

Cumulative effects are considered to be the direct and indirect effects of actions that are interrelated or interdependent with the action under consideration. Indirect effects of the action under consideration are those that are caused by the activity and are later in time or farther removed in distance, such as the progression from leasing OCS tracts, to exploration, and ultimate development/production of the hydrocarbon resources. Other actions will be considered interrelated with the action if they are all part of a larger action, and other actions will be considered interdependent if they do not have significant independent utility apart from the action that is under consideration. Under this definition cumulative effects would include development and production resulting from any of the lease Sales considered. It is impossible at this point to determine if and where any finds of commercial significance are likely to be made. With that in mind, it is the agreed upon practice to require reinitiation of consultation when these tracts enter the development/ production phases of OCS activities. Therefore, any development/production actions will be consulted upon at a later time.

Conclusion

Based on the above discussion and the likelihood that exploratory activities will be limited to Barrow, Prudhoe Bay, Kotzebue, and Cape Lisburne it is my biological opinion that OCS leasing and exploration activities in the Arctic region are not likely to jeopardize the continued existence of the Arctic peregrine falcon. This biological opinion concerns only the leasing and exploration of the Arctic OCS resulting from proposed lease Sales 71, 85, 86, 87, and 97, as described above. This does not include any development or production which could result if oil or gas is discovered by exploratory drilling. As has been previously mentioned, development and production activities will require reinitiation of consultation. Consultation should also be reinitiated if significant, new information is developed which could alter the biological opinion, if new species are listed which could be affected by the proposed action, or if the proposed action is significantly modified.

I would like to express my appreciation to all involved parties for their cooperative efforts during the course of this consultation. I hope that this cooperative attitude can be maintained throughout the period of OCS activities in the Arctic. BLM and GS are aware of their continuing responsibilities under ESA to utilize their authorities to conserve listed species and close cooperation at the field level will greatly increase the effectiveness of efforts to meet those responsibilities.

/s/ Janice F. Hill

Attachments

cc: Ralph Ainger, BLM
Skip Ambrose, FWS
Dennis Money, FWS
Jack Edmundson, OES
Mary Ann Turner, GS
Ray Fritz, FWS
Jerry Reid, FWS

FWS/OES:Edmundson:mbn:draft-10/27/81,final-11/6/81

Analysis of Potential Effects Resulting from the High- and Low-Resource Cases

There is only a 20-percent chance that any commercial quantity of oil resources would be present in the Chukchi Sea Sale 109 area. The environmental effects from proposed Sale 109 are based on the mean case, which represents a middle ground in the range of potentially recoverable oil resources estimated for the proposed sale area. The low and high cases are the extremes of the resource-estimate range. Potentially recoverable oil resources (total production of the field) are estimated to range from 0.96 to 4.88 billion barrels (the mean resource estimate is 2.68 billion barrels of oil). (See Sec. II.A. for estimated schedules of exploration, development, and production.) The low case probably would result in a most-likely number of two oil spills of 1,000 barrels or greater, while the high case probably would result in a most-likely number of 15 oil spills of 1,000 barrels or greater. In the high case, one of these spills also would be greater than 100,000 barrels. The following analyses summarize the possible environmental effects that could occur from the low and high cases based on the development scenarios established for the respective quantities of potentially recoverable resources. The assumption held in the mean case that gas production is not economic applies also to these resource estimates.

A. Low-Resource Case:

If hydrocarbons are present, there is a 95-percent chance that 0.96 billion barrels of economically recoverable oil would be present. (Activity levels and timing of events for this low-case resource estimate are shown in Sec. II.A, Tables II-10 and II-11). Although activity levels are lower in the low case, production is expected to begin in 1999--the same year as for the mean case. The primary difference is that offshore loading would be used to transport the oil to a refinery. It is assumed that the three production platforms would be in proximity, and that one production platform also would serve as a tanker terminal. Using 75,000-deadweight-ton (DWT) tankers, approximately 150 tanker trips per year would be required during the years of peak production (2001-2005), when 81 million barrels would be produced annually. Although a shorebase near Wainwright would still be needed, it would be smaller (approximately 15-20 hectares) than the shorebase for the mean case.

1. Effect on Air Quality: The minimum distance of industry activities from shore and peak emissions per block could be similar to those for the mean case. Further air-quality modeling would be required before exploration and development plans could be approved if such plans indicated similar, but site-specific, exceeding of exemption levels. Any emissions of sulfur dioxide could cause short-term depression in photosynthetic rates of sensitive vegetation, a MINOR effect on air quality. The quantities of acid pollutants that would be emitted by the low case for Sale 109 are insufficient to pose risk of acidification of the tundra ecosystem. Accidental emissions from blowouts, spills, or in situ burning of spills would have a MINOR effect on air quality. There is expected to be MINOR degradation of air quality in regard to standards from normal offshore operations during exploration and production because of volatile-organic-compound and nitrogen-oxide emissions under the low case.

2. Effect on Water Quality: Oil spills of 1,000 barrels or greater would temporarily and locally increase water-column hydrocarbon concentrations. The two spills projected could result in detectable but short-term contamination of pack ice over long distances, for a MODERATE effect on water quality. Construction activities would, at most, increase turbidity over a few square kilometers in the immediate vicinity of the construction and only while that activity persisted, resulting in a NEGLIGIBLE effect on water quality. Deliberate discharges are regulated by the Environmental Protection Agency (EPA) such that any effects must be extremely local: water-quality criteria cannot be exceeded at a greater-than-100-meter distance from the discharge point. In offshore loading, oil is usually stored on the platform between tanker visits. Such storage tanks are often displacement tanks: as oil is pumped into a tanker, seawater enters the storage tank. As more oil is then stored in the tank, the water is displaced and returned to the ocean--contaminated with water-soluble hydrocarbons. Total water-soluble hydrocarbons released in this manner would total on the order of 0.001 to 0.0025 percent of total oil production (Howarth, 1985), or up to 280 metric tons per year and 3,300 metric tons total. These contaminants released in displacement and formation waters under the low case would total close to the amount for formation waters alone under the mean case. The combined discharge under the low case could result in long-term pollution in the vicinity of the oil field, resulting in a MINOR effect on water quality. Under the low case, the overall effect on water quality is expected to be MODERATE, attributable mostly to oil spillage.

3. Effect on Lower-Trophic-Level Organisms: In the low-resource case, activities related to oil exploration, development, and production are projected to be of lesser extent than those associated with the proposal, and the transportation scenario differs. The number of exploration and delineation wells decreases by about one-half (from 43 to 21), the number of platforms by two-thirds (from 9 to 3), and the number of production wells by about two-thirds (from 153 to 55). Because the total number of wells drilled is projected to decrease by approximately 40 percent, the quantities of drilling fluids discharged would similarly decrease. The activities mentioned above all have very localized effects on marine plants and invertebrates, and the levels of activity associated with the low-resource-case estimate would entail a reduction in the extent of these localized effects. However, the level of effect is expected to be MINOR.

The major difference between the low-resource-case scenario and that of the proposal involves transport of oil. Because offshore loading and tankering is projected for the low-resource-case scenario, no pipelines should be constructed (versus 400 km of pipeline for the proposal). Therefore, long-term, localized effects on benthic organisms from pipelines would not occur. This change, like the others associated with this scenario, is not expected to change the level of effect from construction activities associated with the proposal; the most likely effect on marine plants and invertebrates is expected to be MINOR under the low case.

4. Effect on Fishes: In the low-resource case, the lower amount of oil and the change from pipelines to offshore-tanker loading would decrease the number of oil spills. This also would decrease the probability that a spill would occur and contact important nearshore fish habitats, since the oil would not be piped toward shore. The decreased probability of occurrence and

already low probability of oil contacting land make it unlikely that any of the important estuarine areas would be hit. Peard Bay would no longer have a high probability of contact because the pipelines would no longer converge offshore near the bay.

No onshore pipeline would be built; therefore, risk to fishes in freshwater habitats from onshore-pipeline spills would be eliminated. This would have the effect of reducing overall risk to fishes from MODERATE to MINOR.

Drilling discharges would be decreased because of the decrease in numbers of exploration-, delineation-, and production-wells. This would decrease the amount of drilling muds and cuttings and the numbers of discharge points where fish could be harmed by the drilling muds, cuttings, and formation waters. The kilometers of trackline for seismic disturbance would decrease dramatically without the pipelines and with the decrease in platforms and exploration and delineation wells. Airguns would have a localized effect on fish eggs where the airgun is used. Construction activities would change considerably because pipelines would not be laid and fewer bottom-founded drilling units would be placed. This would greatly decrease the number of fish that could be harmed by construction activities.

The low-resource case would have a lesser effect than the proposal on the fishes of the Sale 109 area primarily because of the elimination of onshore-pipeline spills and the decrease in the number of offshore oil spills. The likely effect on fishes would be reduced from MODERATE to MINOR. In the unlikely event that an unweathered oil spill contacted an estuarine environment during the open-water season when pink or chum salmon smolts or concentrations of capelins were present, or during the late winter when rainbow smelts were aggregated at the mouths of spawning rivers, a MODERATE effect could occur.

5. Effect on Marine and Coastal Birds: If the low resource estimate is found, the transportation scenario would include offshore loading of oil from only three production platforms and the tankering of oil through the Bering Strait with about 150 tanker trips per year during years of peak production. This transportation scenario would greatly increase the oil-spill risks to marine and coastal birds, particularly to the over 1,000,000 seabirds--especially least and crested auklets, which nest and forage in the Bering Strait. If a large tanker spill occurred in the Bering Strait during the open-water season, several thousand to several hundred-thousand seabirds--particularly least and crested auklets--could be killed. Oil-spill risk to, and effects on, other seabird populations at Cape Lisburne (over 150,000 birds) and Cape Thompson (about 400,000 birds) would increase with offshore loading and oil tankering under the low-resource case. If a tanker spill occurred near these colonies, tens of thousands to perhaps 100,000 birds--particularly murres and horned puffins--could be killed, representing MODERATE effects. MAJOR effects are possible because of the increased oil-spill risks and potential oil effects associated with tankering and offshore loading.

In conclusion, the low-resource case is expected to have MODERATE effects (versus MINOR effects under the mean case) on marine and coastal birds.

6. Effect on Pinnipeds, Polar Bears, and Beluga Whales: Under the low case, only three production platforms (versus 9 platforms) and a maximum of three exploration drillships or drilling units (versus 4 drilling units) would be present in the offshore habitats of pinnipeds, polar bears, and beluga whales. Noise and disturbance of these marine mammals from vessel traffic during exploration may be reduced slightly with one less drilling unit operating at one time. However, the tanker traffic (150 tankers/year) associated with offshore loading in the low case would increase the amount of vessel traffic into the sale area and increase noise and disturbance of seals, walruses, and beluga whales during their spring and fall migrations along the tanker route. The tanker traffic would temporarily disturb these marine mammals within probably a few kilometers of the vessel as it passes by concentrations of tens to several thousand belugas, seals, and walruses. Disturbance reactions are likely to be brief, with the animals returning to normal behavior and prior distribution within a few hours or no more than a couple of days--representing MINOR effects on pinnipeds, polar bears, and beluga whales.

The offshore-loading and tanker traffic under the low case would increase the risk of oil spills occurring and contacting the marine mammal-migration corridor, especially from Point Hope south to the Bering Strait (Fig. IV-20). However, if a tanker spill of 100,000 barrels or greater occurred, seals, walruses, polar bears, and beluga whales would be likely to suffer low mortalities (see Sec. IV.B.6., Effects of Oil Spills). Thus, oil-spill effects on marine mammals are expected to be MINOR under the low case.

In conclusion, although noise and disturbance of pinnipeds, polar bears, and beluga whales from exploration-vessel traffic may be reduced slightly, the increase in tanker traffic during production (150 trips/year during years of peak production) and the increase in oil-spill risk to the migration corridor are expected to result in about the same level of effects as for the mean case--MINOR.

7. Effect on Endangered and Threatened Species: The overall effect on endangered and threatened species from direct and indirect effects of oil spills or noise disturbances associated with the exploration/production of oil would be different from that described for the proposal. Spill rates and the volume of oil transported would be lower, such that offshore loading rather than construction of a pipeline would occur. Short-term, localized effects would occur in the event of an oil spill, although the low-resource-case scenario has only about 36 percent of the oil projected for the proposal. The number of production platforms would decrease to three from the nine projected for the proposal, and support traffic would decrease accordingly. Industrial activity during the whale migrations and summer-feeding periods in the sale area would still pose spill risks and/or potentially disturb at least local populations of endangered and threatened species, regardless of the absolute level of petroleum-resource estimates. The tanker traffic associated with the low-resource case (150 tankers/year) would increase the amount of vessel traffic into the sale area and thus increase noise and disturbance of endangered whales in the sale area. Tanker traffic would temporarily disturb summering gray whales and spring- and fall-migrating bowhead whales within a few kilometers of the vessel. Disturbance reactions are likely to be brief, with animals returning to normal behavior within a few hours. Offshore loading and tankering under the low-resource case would increase the risk of oil spills occurring and contacting the bowhead-migration corridor, especially

from the sale area south to the central Bering Sea. Should an oil spill occur, MINOR effects are expected on the bowhead population (see Sec. IV.B.7.a(1)). It is expected that a specific group of individuals of a population in a localized area would be affected for less than one breeding cycle by activities associated with the low-case scenario. The level of effects on endangered and threatened species is expected to be MINOR under the low case.

8. Effect on Caribou: If the low-resource estimate is found, the onshore pipeline and support road associated with the proposal would not be built. Although a shorebase near Wainwright (15-20 hectares) would still be built and would have noise effects (probably NEGLIGIBLE) on the caribou range, the 640-kilometer pipeline and road projected for the mean case to cross the summer range of the Western Arctic herd would not be built. Thus, the Western Arctic caribou herd would not be disturbed by road traffic associated with the mean-case onshore pipeline crossing its summer range, nor would 64 square kilometers of summer range be altered by road and pipeline construction. Therefore, effects on caribou under the low case are expected to be NEGLIGIBLE.

9. Effect on the Economy of the North Slope Borough: The effect of the low case on revenue and employment in the North Slope Borough could be about 50 percent as great as the effect of the proposal. Therefore, the effect of the low case on the economy of the North Slope Borough is expected to be NEGLIGIBLE.

10. Effect on Subsistence-Harvest Patterns: Effects associated with the low-case scenario would be lower than those associated with the mean-case scenario. Decreased oil production would reduce the oil-spill risk to subsistence resources, including fishes and marine mammals. This would reduce effects on Barrow's (and Atqasuk's) subsistence walrus harvest. Offshore loading would eliminate the noise and traffic disturbance and construction activities concentrated in the Peard Bay area for the landfall and shorebase at Point Belcher under the proposal. This would decrease the effects on Barrow's, Wainwright's, and Atqasuk's subsistence harvests. However, noise and traffic disturbance from icebreakers would continue to affect the bowhead whale harvests in Wainwright and Point Hope. The beluga whale harvest in Point Lay also would continue to be affected by noise and traffic disturbance. Under the low case, effect levels would be reduced to MODERATE in Wainwright and remain MODERATE in Point Lay and Point Hope. Effect levels for Barrow and Atqasuk (harvested with Barrow) would be reduced to MINOR. The elimination of the pipeline from Point Belcher to the TAP would eliminate effects on Barrow's, Nuiqsut's, and Atqasuk's caribou and fish harvests. Effect levels in Nuiqsut would be reduced to NEGLIGIBLE. Effects on subsistence-harvest patterns in the Sale 109 area are expected to be MODERATE.

11. Effect on Sociocultural Systems: Effects associated with the low-case scenario would be lower than those associated with the mean-case scenario. Offshore loading would eliminate effects from onshore industrial activities and population and employment increases, and would decrease effects on subsistence-harvest patterns in Wainwright from MAJOR to MODERATE. The elimination of onshore industrial activities and increases in direct population and employment increases and decreases in subsistence-harvest-pattern effects would decrease effects on Wainwright's sociocultural system from

MODERATE to MINOR under the low-case scenario. Point Lay's sociocultural system would be affected only by subsistence-harvest effects--these would remain MINOR in the low case; thus, effects on sociocultural systems also would remain MINOR. Effects on subsistence harvests in other communities due to oil spills would be decreased throughout the lease-sale area; however, this would not alter the MINOR effects expected under the proposal on sociocultural systems in Barrow and Atqasuk and the NEGLIGIBLE effects in Point Hope. The elimination of the pipeline from Point Belcher to the TAP also would eliminate effects on Nuiqsut's subsistence-harvest patterns. Overall effects on the sociocultural systems of communities in the Sale 109 area are expected to be reduced to MINOR.

12. Effect on Archaeological Resources: The overall effect on archaeological resources from direct and indirect effects of oil spills or activity associated with development and transport of extracted oil would be less than described for the proposal, since the spill rates and the volume of oil transported would be reduced to two oil spills of 1,000 barrels or greater and zero spills of 100,000 barrels or greater. Short-term, localized effects could occur in the event of an oil spill. Activities associated with cleanup of oil, i.e., bulldozing, digging, transporting contaminated soil out of the area, and building access roads for equipment from airports to oil-spill sites, could disturb onshore archaeological resources. Effects from such activities would be reduced from MINOR under the proposal to NEGLIGIBLE under the low case. The same is true for construction of offshore pipelines to transport oil and the maintenance of these offshore pipelines. The effects of activities associated with offshore and onshore transportation on archaeological resources are expected to be NEGLIGIBLE under the low case.

13. Effect on Land Use Plans and Coastal Management Programs: Lower oil reserves and a different method for moving produced resources to market cause a shift in the land use regulations, coastal management policies, and the levels of effects on other resources relevant for this analysis. Reduced effect levels for fishes, caribou, subsistence-harvest patterns, sociocultural systems, and archaeological resources are primarily attributable to the removal of the pipeline and road system between Point Belcher and the TAP and the reduced number of oil spills. Potential effects on birds would be greater because birds would be more exposed to oil spills from tankers.

With only limited activities occurring within the boundaries of the North Slope Borough, development probably would not conflict with the Mandatory Policies of the NSB Land Management Regulations. A Best-Effort Policy that prohibits development to accommodate petroleum transportation via marine tankers would be relevant. However, loading is hypothesized to occur offshore; and no onshore or nearshore terminal is anticipated with this scenario. As a result, conflict with this regulation is not inherent in the low-case scenario.

Water dependency is a prime criterion for development along the shoreline. This CMP standard for coastal development (6 AAC 80.040[a]) is intended to prevent the displacement of activities dependent upon a shoreline location. Because of the limited upland development associated with the low case, no conflict with this policy is anticipated. The State coastal development standard also requires that the placement of structures and discharge of dredged material into coastal waters comply with the regulations of the U.S. Army Corps of Engineers (COE) (6 AAC 80.040[b]). The placement of a bottom-founded structure offshore would fall under this standard; however, no conflict is anticipated.

Potential hazards would differ from those of the proposal. In the proposal, onshore geological hazards such as aufeis and permafrost are major concerns. With limited onshore activity and offshore loading, offshore hazards assume greater significance. Of greatest concern are hazards associated with ice. Conformance with Alaska OCS Orders would ensure that safety measures are incorporated into the design and installation of offshore platforms; as a result, no conflict with the standard for geological hazards (6 AAC 80.050) is inherent in the scenario.

Standards for energy facilities (6 AAC 80.070), transportation and utilities (6 AAC 80.080), and mineral processing (6 AAC 80.110) would have little bearing on activities in the low case. Energy facilities, as noted above, would be limited. No major transportation or utility corridors would be required and the need for gravel would be reduced considerably. Archaeological resources are less apt to be affected, thereby reducing potential conflict with the standard for historic, prehistoric, and archaeological resources (6 AAC 80.150). And since no development would take place at Point Belcher--a primary site for whaling by residents of Wainwright--and no pipeline and road would be constructed between Point Belcher and the TAP, potential conflict with the standard for subsistence (6 AAC 80.120) also would be reduced.

Under the low case, the limited amount of upland development removes serious concerns associated with the habitat standards for uplands (6 AAC 80.130[a][8]); rivers, lakes, and streams (6 AAC 80.130[c][7]); and wetlands (6 AAC 80.130[c][3]) and the lagoon habitat of Peard Bay. However, effects in Kasegaluk Lagoon would remain the same; planned and accidental activities could lead to a decrease in the use of the lagoon by important coastal species and thereby conflict with the ACMP standard for lagoon habitat (6 AAC 80.130[c][5]). Potential conflict with the habitat standard for seacliffs (6 AAC 80.130[c][4]) is increased in the low case because of the increased potential for oil spills from tanker traffic that would pass Capes Lisburne, Lewis, and Thompson.

Effects on air and water quality would be the same for the low case as for the proposal. The potential for MODERATE degradation of water quality could pose a conflict with the air, land, and water standard (6 AAC 80.140) of the ACMP.

Because of the reduced potential for severe conflicts with the ACMP policies for subsistence, archaeology, and several habitats, potential conflicts of activities in the low case with land use and coastal management are expected to be reduced to MODERATE.

B. High-Resource Case

If hydrocarbons are present, there is a 5-percent probability that 4.88 billion barrels of economically recoverable oil would be found. (Activities associated with discovery of the high-case-resource estimate are shown in Sec. II.A., Tables II-12 and II-13.) Activity levels for the high case are almost double those of the mean case; however, the timing does not vary significantly. Between 1989 and 1996, 33 exploration wells and 40 delineation wells would be drilled. Sixteen platforms would be installed from 1995 to 1998--one in the first year and five in each following year. As many as nine rigs would be used between 1995 and 1999 to drill 279 production wells. Muds and cuttings would increase to a total of 37,927 metric tons (dry weight) of mud and 92,073 metric tons (dry weight) of cuttings during exploration and delineation drilling and 123,876 metric tons (dry weight) of mud and 387,252 metric tons (dry weight) of cuttings during development drilling. Production would begin in 1999 and peak in the following year--the same as for the mean case. Peak production of 410 million barrels per year would continue through 2005. A major difference between the mean and high cases is the method used to transport oil to market. Under the high case, oil would be piped to shore near Cape Beaufort. From there, the oil would be transported via pipeline across the Lisburne Peninsula--following the Kukpowruk River to the Wulik River--to a terminal south of Kivalina. To the extent possible, the route would take advantage of the transportation corridor developed for the Red Dog Mine. Congressional action probably would be required before a pipeline could be installed along the road easement through the Cape Krusenstern National Monument. One pump station and two construction camps would be located along the route. A helicopter pad would be built at each of these sites, and a road would be constructed parallel to the pipeline. A 300-hectare marine terminal would be needed for handling more than 1 million barrels of oil per day. From the terminal, icebreaker tankers or ice-strengthened tankers assisted seasonally by icebreakers would transport the oil to market. Using 75,000-DWT tankers, approximately 760 tanker trips per year would be required during the years of peak production (2000-2005). If 150,000-DWT tankers were developed for transporting oil from the arctic, the number of tanker trips would be halved; approximately 380 trips per year would be required during peak production.

1. Effect on Air Quality: The minimum distance of industry activities from shore and peak emissions per block could be similar to those for the mean case. Peak emissions during exploration and delineation would be 63 percent greater than for the mean case. Peak emissions during development would be slightly greater than for the mean case. Further air-quality modeling would be required before exploration and development plans could be approved, if such plans indicated similar, but site-specific, exceeding of exemption levels. Sulfur-dioxide emissions could cause short-term depression in photosynthetic rates of sensitive vegetation--a MINOR effect on air quality. The quantities of acid pollutants that would be emitted under the high case would be almost twice that for the mean case but would still be insufficient to pose risk of acidification of the tundra ecosystem. Accidental emissions from blowouts, spills, or in situ burning of spills would have a MINOR effect on air quality. MINOR degradation of air quality is expected with regard to standards from normal offshore operations during exploration and production from individual blocks because of volatile organic compounds and nitrogen-oxide emissions under the high case. MINOR degradation of air quality is also expected with regard to other aspects of air quality.

2. Effect on Water Quality: Oil spills of 1,000 barrels or greater would temporarily and locally increase water-column-hydrocarbon concentrations. The one spill of 100,000 barrels or greater could temporarily and locally increase water-column-hydrocarbon concentrations over long distances,

a MODERATE effect on water quality. Most of the 15 spills of 1,000 barrels or greater would be anticipated to occur in winter, resulting in detectable but short-term contamination of pack ice over long distances, for a MODERATE effect on water quality. Construction of slightly more pipeline and nearly twofold-more platforms than for the mean case would still, at most, increase turbidity over a few square kilometers in the immediate vicinity of the construction, and only while that activity persisted, resulting in a NEGLIGIBLE effect on water quality. Deliberate discharges are regulated by the EPA such that any effects must be extremely local: water-quality criteria cannot be exceeded at a greater-than-100-meter distance from the discharge point. Discharge of formation waters--rather than their reinjection into the seafloor--would result in long-term pollution in the vicinity of the oil field, a MINOR effect on water quality. The overall effect on water quality under the high case would be MODERATE.

3. Effect on Lower-Trophic-Level Organisms: Under the high-resource-case scenario, activities related to oil exploration, development, and production are projected to be almost double those associated with the proposal; and the transportation scenario differs. The number of exploration and delineation wells increases by about one-half (from 43 to 73), the number of platforms increases (from 9 to 16), and the number of production wells increases (from 153 to 279). Because the total number of wells drilled is projected to increase by approximately 55 percent, the quantities of drilling fluids discharged would similarly increase. The activities mentioned above would all have very localized effects on marine plants and invertebrates, and the levels of activity associated with the high-resource-case estimate would entail an increase in the extent of these localized effects. However, the level of effect is expected to be MINOR under the high case.

The major difference between the high-resource-case scenario and that of the proposal involves transport of oil. Under the high-resource-case scenario, oil would be piped to shore near Cape Beaufort and transported via pipeline across the Lisburne Peninsula to a terminal near Kivalina. Tankers would load there and transport the oil elsewhere. Under this scenario, there would be an insignificant increase in the amount of offshore pipeline laid (425 km for the high case versus 400 km for the proposal); so effects on benthic organisms from pipeline construction are not expected to change (effects would remain MINOR). Risk to marine plants and invertebrates of concern changes somewhat due to the alteration in the transportation scenario, since more spills are expected from pipelines than from platforms. In particular, kelp beds near Peard Bay, as well as Peard Bay itself, would have less chance of being contacted by oil from pipeline spills. Under the high case, the Cape Lisburne region could have a higher probability of being contacted by oil (although a spill starting at Spill Point J38 has a low [less than 0.5%] probability of contacting Seabird Concentration Area I within 10 days during the open-water season). Under the high-resource-case scenario, new risk from oil spills is created south of the proposed Sale 109 area, near Kivalina. Some risk to marine plants and invertebrates in that region is possible from development associated with the Red Dog Mine. Offshore loading for the mine would entail the siting of a converted crude carrier offshore in water depths of 11 meters. Some oil spills are possible from this carrier, which will have the capacity to store 38 million liters of fuel oil, in addition to zinc and lead concentrates. Effects on marine plants and invertebrates from such spills are expected to be MINOR. Effects from the siting of the offshore-loading carrier are expected to be very limited in extent and, hence, MINOR. Although the littoral biota of the northeastern and southeastern Chukchi Sea apparently changes considerably at Point Hope (Broad et al., 1978), the offshore benthos cannot be easily compared because of the general lack of studies in the northeastern Chukchi Sea. Stoker's study (1981) of the benthic infauna in the Bering and Chukchi Seas shows similar infaunal assemblages in the northeastern and southeastern Chukchi Sea; Jewett and Feder (1981) and Frost and Lowry (1983) both found that echinoderms dominated the biomass of benthic invertebrates in, respectively, the southeastern Chukchi Sea and the offshore northeastern Chukchi and western Beaufort Seas. Based upon what is known of the benthic invertebrates in the southeastern Chukchi Sea and their life histories, oil spills associated with loading of oil near Kivalina is expected to have a MINOR effect on marine plants and invertebrates. Activities associated with the high-resource-case scenario are expected to have a MINOR effect on marine plants and invertebrates.

4. Effect on Fishes: With a little less than twice as much oil found under the high case, the number of oil spills would increase by a measurable amount. The change in the onshore pipeline from Point Belcher to Cape Beaufort greatly reduces the likelihood that Peard Bay would be contacted by an offshore oil spill. With this pipeline alignment, offshore oil spills would have more effect on the Pitmegea River mouth and Ledyard Bay. If an oil spill occurred in the area where the pipelines converge and come onshore, the Pitmegea River area would have a 77-percent probability of being contacted within 30 days during the summer. During the time of highest toxicity (the first 10 days), oil has a less-than-0.5-percent probability of reaching this area. Throughout the entire winter, there is an 11-percent-or-lower probability that an oil spill would contact the Pitmegea River area.

The Pitmegea River has spawning populations of pink and chum salmon that could be affected. The weathered oil would pose less of a threat to the salmon smolts as well as other fishes at the river mouth. Pacific sand lance and arctic cod are found throughout Ledyard Bay. Large schools of Pacific sand lance in Ledyard Bay north of Cape Lisburne would not be greatly affected, since they are multiple-year spawners that spawn on the bottom in fairly deep water. The development near Kivalina could have an adverse effect on the fishes of this region from spills associated with the tanker-loading facility and Red Dog mine. Offshore oil spills may have a greater probability of contacting an estuarine area, thereby producing a MODERATE effect on some fish populations, although the most likely effect of offshore spills is MINOR. Onshore spills associated with the pipeline traversing the Lisburne Peninsula could affect anadromous and freshwater fishes in the Kukpowruk and Wulik Rivers, along which the pipeline runs. An oil spill contacting these rivers is likely to have a MODERATE effect on fishes by affecting overwintering and rearing habitat, sensitive lifestages, or concentrations of fishes. Thus, the overall effect on fish resources from oil spills under the high-resource case is likely to be MODERATE.

During exploration, drilling discharges would increase as the number of wells increase by a factor of 1.7. A total of 37,927 dry metric tons of drilling muds would be used, and 92,073 dry metric tons of cuttings would be produced. With the increased discharges, the area of toxicity might increase but would not change the effect on fish resources. During development, another 123,876 dry metric tons of mud and 387,252 dry metric tons of cuttings would be used.

Seismic exploration also would increase because of the increased number of wells and platforms, increased distance of pipelines, and increased information needed for these activities. The airguns would damage no more than a few eggs near the source of the discharge. Construction activities and associated effects would increase somewhat because of the extra 25 kilometers of pipelines and the increased number of wells and platforms that would be placed throughout the Sale 109 area.

The high-resource case would increase the number of oil spills that could occur, which would subsequently increase the effects on the fishes--but not much more than under the proposal. The new location of the pipeline would increase the likelihood of a spill occurring in Ledyard Bay and contacting the Pitmegea River area and would likewise decrease the probability of a spill contacting Peard Bay. The new routing of the onshore pipeline would cause fish in the Kukpowruk and Wulik Rivers to become vulnerable, and an onshore oil spill contacting these rivers is likely to have a MODERATE effect on these fishes. Thus, the general effects of oil spills on fish resources is likely to remain MODERATE under the high case. Drilling discharges, seismic disturbance, and construction activities would be greater than under the proposal, but the effect would remain MINOR under the high case. The effect of finding a higher resource than expected under the proposal is still likely to have a MODERATE effect on the fish resources of the Sale 109 area.

5. <u>Effect on Marine and Coastal Birds</u>: The nearly double increase in oil resources estimated under the high case would increase the projected number of oil spills of 1,000 barrels or greater to 15 and could significantly increase the chances of oil spills occurring and affecting several thousand or more seabirds, particularly (1) in the Cape Beaufort area where the offshore pipeline is assumed to come ashore, and (2) in the Kivalina area where the oil would be tankered from and pass through the Bering Strait, where over 1 million seabirds would be at risk from potential oil spills associated with tankering in the high-resource case. If an oil spill occurred at or near the pipeline beach-head at Cape Beaufort, over 150,000 seabirds that nest at Cape Lisburne would be at risk; several thousand or more birds--particularly murres and horned puffins--could be killed. If a spill occurred at Kivalina, tanker-terminal-spill trajectories probably would contact the Cape Thompson-seabird-colony complex, where over 400,000 seabirds would be at risk; several thousand to tens of thousands of birds, particularly murres, could be killed by an oil spill. The tankering of oil through the Bering Strait could result in one or more spills occurring in the foraging-concentration area of over 1 million seabirds that nest on Little Diomede Island and Fairway Rock. Such an oil spill could result in the death of several hundred-thousand seabirds, particularly least and crested auklets, and could result in MAJOR effects on these bird populations.

In conclusion, under the high case oil tankering in particular would significantly increase the risk of oil-spill effects on marine and coastal birds. Effects on birds are expected to be MODERATE.

6. <u>Effect on Pinnipeds, Polar Bears, and Beluga Whales</u>: The nearly double increase in oil resources under the high-resource case would increase the maximum number of exploration-drilling units in the sale area from 4 under the mean case to 7, which would result in a substantial increase in vessel

traffic including icebreakers that could increase noise and disturbance of migrating beluga whales, walruses, and seals. However, increases in vessel traffic, particularly tanker traffic through the Bering Strait, are not likely to have more than MINOR noise-and-disturbance effects on marine mammals when the vessels pass nearby. The projected number of oil spills also would increase along with the risk of oil-spill contact to seals, walruses, and polar bears. Even though risk of oil-spill contact to these marine mammals and their habitats would increase, seals, walruses, polar bears, and beluga whales are likely to suffer low mortality rates from oil-spill contact or habitat contamination (see Sec. IV.B.6). Effects of oil spills on marine mammals under the high-resource case are likely to be MINOR. Increases in construction activities, including the installation of 16 versus 9 production platforms in the sale area, and the construction of a tanker terminal at Kivalina could result in more localized changes in distribution and abundance of seals, polar bears, and walruses near the 16 platforms during construction activities (1 or 2 years). However, the overall distribution and abundance of seals, walruses, polar bears, and beluga whales are not likely to be affected (see Sec. IV.B.6).

The high-resource case is expected to have MINOR effects on pinnipeds, polar bears, and beluga whales (the same as for the mean case).

7. Effect on Endangered and Threatened Species: Under the high-case scenario, the resource estimate is 4.88 billion barrels of oil, an increase of 1.8 times the mean-case resource. A maximum of 7 exploration rigs per year would be active (versus 4 rigs/year under the proposal), 16 production platforms (9 for proposal), and 425 kilometers of offshore pipeline (400 km for proposal). In this scenario, oil would be piped to Cape Beaufort and then to a year-round port at Kivalina. Tanker trips would vary, depending on their size, between 760 tanker trips per year to 380 trips per year. Support traffic would increase accordingly. This scenario would represent a significant increase in exposure of endangered cetaceans to OCS activities. The use of a tanker route between Kivalina and the Bering Strait daily or twice daily during the open-water season might preclude bowhead and/or gray whale use of this area during the 5 years that tankering is projected to occur. Bowheads would be most significantly affected during the fall migration near the Bering Strait area, which would be ensonified to levels probably beyond levels tolerated by bowheads. Bowheads strongly react to vessels, and avoidance behaviors often begin at 4 kilometers from the noise source. Displacement of the migration route probably would occur. Gray whales also may abandon this area, responding similarly to increased noise levels as they did in their breeding lagoon (see Sec. IV.B.7). Fin and humpback whales are not as likely to be disturbed by the tankering traffic, because observations have occurred farther away from shore except for the Bering Strait area. Peregrine falcons would benefit from the elimination of the shorebase at Cape Beaufort and movement of the onshore pipeline away from nesting areas along the Colville River. It is expected that a portion of the regional population of gray and bowhead whales would decline in abundance and/or distribution for more than one breeding cycle but less than one generation. Migration routes and habitat use of the area would return to historic-use levels when the tankering ceased. The level of effects is expected to be MODERATE for bowhead and gray whales, MINOR for humpback and fin whales, and MINOR on peregrine falcons.

8. Effect on Caribou: Under the high-resource case, the transportation scenario is assumed to change from the 640-kilometer onshore pipeline from Point Belcher to TAP that would cross the entire summer range of the Western Arctic caribou herd under the mean case to a much shorter onshore pipeline (200 km) crossing the Lisburne Peninsula and intersecting only a small portion of the winter range of this caribou herd. Disturbance of caribou during pipeline and road construction and habitat alteration associated with the pipeline-road corridor would be considerably less than under the mean case since most of this herd would not have to cross any pipeline to and from its primary winter range, which is east of the Lisburne Peninsula; and this pipeline would not cross the calving range either (see Fig. IV-24A).

Under the high-resource case, disturbance and habitat-alteration effects on caribou of the Western Arctic herd may be reduced from MINOR (under the mean case) to NEGLIGIBLE due to no onshore pipeline crossing the NPR-A (summer range of the Western Arctic herd).

9. Effect on the Economies of the North Slope Borough and the Northwest Arctic Borough: Revenue and employment effects on the North Slope Borough under the high case could be about 60 percent greater than the effects of the mean case discussed in Section IV.B.9. However, the economic effects of the high case are expected to be the same as those for the proposal--NEGLIGIBLE.

The facilities and portions of the onshore pipeline located within the Northwest Arctic Borough would be subject to borough property taxes. A small number of borough residents would be directly or indirectly employed by the construction and operation of these facilities. The estimated level of effect on the economy of the Northwest Arctic Borough resulting from the high-resource use is expected to be MINOR.

10. Effect on Subsistence-Harvest Patterns: Effects associated with the high-case scenario would be less than those associated with the mean-case scenario. Increased oil production would increase the oil-spill risk to subsistence resources including birds, fishes, and marine mammals. A pipeline from Cape Beaufort to near Kivalina, rather than from Point Belcher to the TAP under the mean case, would eliminate the noise-and-traffic disturbance and construction activities concentrated in the Peard Bay area for the pipeline at Point Belcher. This would decrease effects due to noise and traffic disturbance and construction activities in Peard Bay on Barrow's, Wainwright's, and Atqasuk's subsistence harvests. However, noise and traffic disturbance from platforms, support vessels, and icebreakers and construction activities in Peard Bay and near Point Lay would continue to affect the bowhead whale harvests in Wainwright and Point Hope and the beluga harvest in Point Lay. Under the high case, effect levels would be reduced to MODERATE in Wainwright, and would remain MODERATE in Barrow, Point Lay, Point Hope, and Atqasuk (harvested with Barrow). The elimination of the pipeline from Point Belcher to the TAP would eliminate effects on caribou and fish harvests. Effect levels in Nuiqsut would be reduced to NEGLIGIBLE. A pipeline from Cape Beaufort to Kivalina would affect subsistence-harvest patterns in the Kivalina area. However, the pipeline would not affect the caribou harvested by Point Hope and Point Lay because the herd would not have to cross any pipeline to and from its primary winter range (see Sec. B.8). The pipeline also should not cause Point Hope hunters to be unable to harvest caribou, although the

pipeline could create some difficulties in accessing the caribou. Effects on subsistence-harvest patterns in the Sale 109 area are expected to be reduced to MODERATE under the high-resource case.

11. Effect on Sociocultural Systems: Effects on the sociocultural systems of communities affected by Sale 109 would be less than those associated with the mean-case scenario. A pipeline from Cape Beaufort to near Kivalina would be constructed instead of a pipeline from Point Belcher to the TAP. This would eliminate effects in Barrow and Wainwright from increased onshore industrial facilities, population and employment increases, and effects on Wainwright's subsistence-harvest patterns due to noise and traffic disturbance associated with construction activities for the pipeline landfall and shorebase facilities at Point Belcher. Overall effects on Wainwright's subsistence harvests would be reduced to MODERATE under the high-case scenario, while effects on Barrow's subsistence-harvest patterns would be reduced to MINOR due to effects from oil spills. The decrease in subsistence-harvest effects in Wainwright, in addition to reduced effects as a result of industrial activities and population and employment increases, would reduce effects on Wainwright's sociocultural systems from MODERATE to MINOR. Although industrial activities and population and employment would decrease in Barrow under the high case, effects on Barrow's sociocultural systems would remain MINOR--the same as for the proposal--due to effects on Barrow's subsistence-harvest patterns.

Cape Beaufort is 90 kilometers from Point Lay and 140 kilometers from Point Hope. The Cape Beaufort area is not as crucial to subsistence harvests in Point Lay or Point Hope as Point Belcher is to Wainwright. Effect levels from construction activities on Point Lay and Point Hope subsistence-harvests would not alter under the high-case scenario; however, oil-spill risks would increase. There would be insignificant employment or population effects in these communities due to the shorebase facility at Point Beaufort. Thus, effects on Point Lay and Point Hope sociocultural systems would not alter under the high-case scenario. MINOR effects are expected on Point Lay's and Point Hope's sociocultural systems. Effects on Atqasuk's and Nuiqsut's sociocultural systems also would not alter under the high-case scenario--MINOR in Atqasuk and NEGLIGIBLE in Nuiqsut. Kivalina's sociocultural system would be affected in the high case. Industrial activities occurring near Kivalina (the pipeline would run to a tank farm south of Kivalina) would affect Kivalina; however, these effects would not be greater than those already experienced as a result of the Red Dog mine to be constructed near Kivalina. Population and employment increases also could be expected, as well as effects on Kivalina's subsistence-harvest patterns. Under the high-case scenario, overall effects on Kivalina's sociocultural system are expected to be MODERATE. Overall effects on sociocultural systems in the communities affected by Sale 109 are expected to be MODERATE.

12. Effect on Archaeological Resources: The high-resource case would involve 4.88 billion barrels of oil. This resource would increase the expected number of oil spills of 1,000 barrels or greater to 15 spills. One of these spills is expected at Kivalina. One spill of 100,000 barrels or greater also is expected. Little increase in effects would occur offshore due to the activities resulting from spills and due to the low probability of prehistoric archaeological sites existing in the sale area.

Onshore activities (seaward to 3 miles) resulting from cleanup of oil spills could increase the risk to archaeological resources. Oil and oil-tar removal would require moving bulldozers, trucks, and other cleanup equipment from airports to beaches by constructing roads or driving over archaeological sites.

An increase in the number of offshore platforms and the accompanying increase in tankering of oil would increase the hazards to National Register sites due to increased population at facilities and possibly in the communities of Wainwright and Kivalina. A spill from a tanker in Unimak Pass could endanger archaeological sites to a greater extent than the proposal because of the increased activities resulting from cleanup of an increased number of predicted spills.

Shipwrecks along the shore would be increasingly affected by oil-spill cleanup activities; shipwrecks out to 3 miles offshore could be affected by increased pipeline construction and repair activities. All of these causes would increase the overall effect on archaeological resources to be MODERATE under the high case. Effects of the high-case development scenario on the Cape Krusenstern National Monument are expected to be MAJOR if a tanker-loading spill or a platform spill occurred somewhere within 16 kilometers of shore. Effects on the Bering Land Bridge National Preserve are expected to be MAJOR under the high-case development scenario.

The effect of the high-case scenario on archaeological resources is expected to be MODERATE.

13. Effect on Land Use Plans and Coastal Management Programs: Higher oil reserves and a different method for transporting produced oil would create different levels of effects on birds, endangered species, economy, subsistence-harvest patterns, archaeological resources, and caribou. In all but the last instance, effect levels could be raised under the high-case scenario. The high-case scenario also includes development in the Northwest Arctic Borough. However, no new land use or coastal management regulations are applicable. The Northwest Arctic Borough has not yet developed land use regulations, and the Coastal Management Program (CMP) developed for the district has not yet been approved by the U.S. Department of Commerce. The new levels of effects and the high-case scenario do, however, create variations in the potential for conflict with the NSB Land Management Regulations and the standards of the Alaska CMP (ACMP). These variations are the focus of this analysis.

The NSB land management policies that applied to the mean case also would apply to the high case. However, the change in locations used in the scenario could lead to variations in the special conditions attached to the NSB Land Management permit that would be specific to the new location. One additional policy would become relevant with the scenario for the high case. The transportation system used for the high case would conflict with a Best-Effort Policy prohibiting development that accommodates petroleum transportation via marine tankers. For such development to be approved, the NSB would need to find that a best effort has been made to comply with the policy and that there is no feasible and prudent alternative.

Development along the shoreline would be more extensive in the high case. However, the facilities would be water-dependent and would not conflict with the first part of the ACMP standard for coastal development (6 AAC 80.040[a]). A terminal would be added to the types of development itemized in the mean case that would need to comply with the regulations of the U.S. Army Corps of Engineers (6 AAC 80.040[b]). No conflict with these standards is inherent in the scenario.

Because there would be more development and activity offshore in the high case, ice hazards would be of greater concern. Conformance with Alaska OCS Orders would ensure that safety measures are incorporated into the design and installation of offshore platforms. Transportation of produced hydrocarbons via marine tankers also would be subject to an extensive regulatory review. Through these processes, conflict with the standard for geophysical hazards (6 AAC 80.050) should be avoided.

Conformance with the standard for energy-facility siting (6 AAC 80.070) would be comparable to that for the mean case. The proposed pipeline, road, and terminal would be in areas currently used for subsistence purposes. One advantage to the high-case scenario would be realized if the road developed for the Red Dog Mine also could be shared by the oil and gas industry, thereby utilizing existing infrastructure and consolidating facilities as much as possible.

Conflicts with standards for transportation and utility corridors (6 AAC 80.080); mining (6 AAC 80.110); and air, land, and water quality (6 AAC 80.140) should be similar to those for the proposal. Because the potential for MODERATE degradation of water quality, the conflict with the standard for air, land, and water quality noted for the proposal would remain significant.

Potential conflict with the habitat standard for seacliffs (6 AAC 80.130[c][5]) and offshore (6 AAC 80.130[c][1]) would be increased in the high case, reflecting the greater potential for offshore oil spills when tankers are used instead of onshore pipelines. The pipeline route from Cape Beaufort to Kivalina crosses fewer streams. However, the route parallels two rivers--the Kukpowruk and the Wulik. As a result, the potential for oil to enter a stream remains. Special attention would be required to ensure that all feasible and prudent steps are taken to protect the river, lake, and stream habitat (6 AAC 90.130[c][7] and [d]).

Because the potential for affecting archaeological resources is greater in the high case, the opportunity for conflict with the ACMP standard for historic, prehistoric, and archaeological resources (6 AAC 80.150) is increased. Most conflict would occur during cleanup efforts but could be moderated with careful site planning.

In the high case, potential conflict with ACMP standards would either remain the same as in the mean case or be increased. As a result, the conclusion is expected to remain MAJOR, the same as for the proposal.

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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 the 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 $198 million have been spent on Alaska-related studies since 1974. It is 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, the Atlantic, and the 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 direct-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 decisionmaking. 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 look at 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.

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 recent studies on endangered species include emphasis on surveys of distribution and abundance of endangered whales, feeding ecology of gray whales, and experimental research on the behavioral responses of migrating gray whales and feeding gray and humpback whales to noise sources associated with oil and gas exploration and development. The probabilities of gray and bowhead whales encountering oil spills have also been investigated.

° Living Resources: There are large numbers of cetaceans and pinnipeds in the Alaska offshore that are not endangered species. These include ringed, bearded, and fur seals; beluga whales; walruses; sea otters; and others. The studies program has investigated life history, food 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 in the Southern Chukchi.

° 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 the 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. Additional modeling is being done in conjunction with the laboratory experiments, including the behavior of oil in the presence of sea ice and sediments.

° 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 a circulation model. These simulations are key to sale-specific environmental impact statement 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. A model and a users' manual for oil weathering in open water have been completed and are being expanded to include data on ice-filled waters.

° Environmental Geology: The cold climate of the Alaska offshore 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 bottom gouging by ice ridges, ice-ridge and lead formations, ice motion, and--to a lesser degree--marine permafrost. The information from these studies is used in defining potential areas of exploration difficulty.

° Ecosystems: Several recent studies have performed field analyses of key ecosystem, including Peard Bay in the Chukchi Sea.

° 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 biological-monitoring needs under the OCSLAA.

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.

For Sale 109, forecasts were developed for population growth, shifts in population demography, employment, and North Slope Borough revenues and expenditures. Such projections form the basis for part of the assessment of social effects caused by the growth (or decline) of the local population and changes in North Slope Borough finances. The analyses of these effects appear in Section IV. 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 Sale 97 in the Beaufort Sea. Among these studies are: Chukchi Sea Sociocultural Systems Baseline Analysis, Barrow Arch Socioeconomic and Sociocultural Description, Description of the Socioeconomics of the North Slope Borough, Effects of Renewable Harvest Disruption on Socioeconomic/Sociocultural Systems for Wainwright, the Nuiqsut Case Study, Monitoring Methodology and North Slope Institutional Change Study, and the Barrow Case Study.

Relevant studies planned for 1986 and 1987 include the North Slope Subsistence Study, which will focus on the collection of subsistence-harvest data in Barrow and Wainwright; the Social Indicators Monitoring Study; and the Point Lay Case 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. Continuing studies address the behavioral responses of whales and other marine mammals to OCS activities and the potentially negative effects of those activities on populations, habitat usage, feeding, reproduction, and subsistence harvest.

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, and seabird-colony monitoring.

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, 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.

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 January 1986. Studies proposed for 1987 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 over 12 years.

The Peard Bay Habitat Study is a major effort now being completed. The primary goals of this study are (1) to determine the ecological processes that structure biological utilization of Peard Bay, (2) to contrast these results with similar studies conducted on Beaufort Sea ecosystems, and (3) to determine the vulnerability of Peard Bay to activities associated with oil and gas development. A preliminary report has been prepared, and further analysis is being completed.

In FY 1986, additional ice and transport data will be collected in association with ongoing projects being conducted in the arctic. Biological studies will continue to monitor ringed seal populations that frequent ice-covered waters

and to conduct aerial surveys of endangered whales. Two new efforts will be carried out through 1988: (1) Study of the Chukchi Shelf Benthos--including distribution, abundance, and community structure of dominant plant and animal species located between the summer pack-ice edge and the nearshore; and (2) Bering Strait/Hope Basin Habitat Characterization and Utilization--including an evaluation of existing environmental information and subsequent field work, as needed, to assess habitat use and the physical/biological processes that influence the utilization of these major habitats. This study was designed to be compatible and supportive of a 5-year, National Science Foundation-funded Inner-Shelf Transfer and Recycling Study (ISHTAR), which focuses on nutrient dynamics and lower trophic relationships in the northern Bering and central Chukchi Seas.

Three additional studies are under consideration for FY 1988: (1) Chukchi Sea Fisheries Investigations--including stock origins, timing, and range in coastal waters, (2) Distribution and Size of Kelp Beds in Chukchi Sea Coastal Environments, and (3) Distribution and Abundance of Amphipods in the Chukchi Sea.

Technology Assessment and Research Program (TA&RP): In addition to the ESP, the MMS has funded or contributed toward about 100 studies being conducted under the TA&RP. Many of these studies, which focus on arctic-engineering 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. The 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 will be published in 1986.

MMS ALASKA OCS REGION STUDIES PROGRAMS

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Prehistoric Resource Analysis for
Proposed Chukchi Sea Sale 109

Purpose

In accordance with the Minerals Management Service (MMS) Handbook for Archaeological Resource Protection (MMS 620.1-H, June 17, 1985), this archaeological analysis was prepared for proposed offshore lease Sale 109 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 stipulations.

Project Area Description

The area of the proposed lease sale (Fig. 1) is offshore the State of Alaska in the eastern Chukchi Sea. It is bounded on the south by 68°17'N. latitude; on the west by 169°W. longitude; on the north by 73°N. latitude, from 169°W. longitude to 162°W. longitude; thence south to 71°N. latitude and east from 162°W. longitude to the 3-geographical-mile line, which forms the eastern boundary from 71°N. latitude to 68°17'N. latitude.

The sale area contains approximately 11.9 million hectares and 5,448 blocks. Because the sale area is ". . .extensive frontier terrain that is incompletely explored and entirely untested for petroleum" (Grantz et al., 1982), all blocks are included in this archaeological analysis.

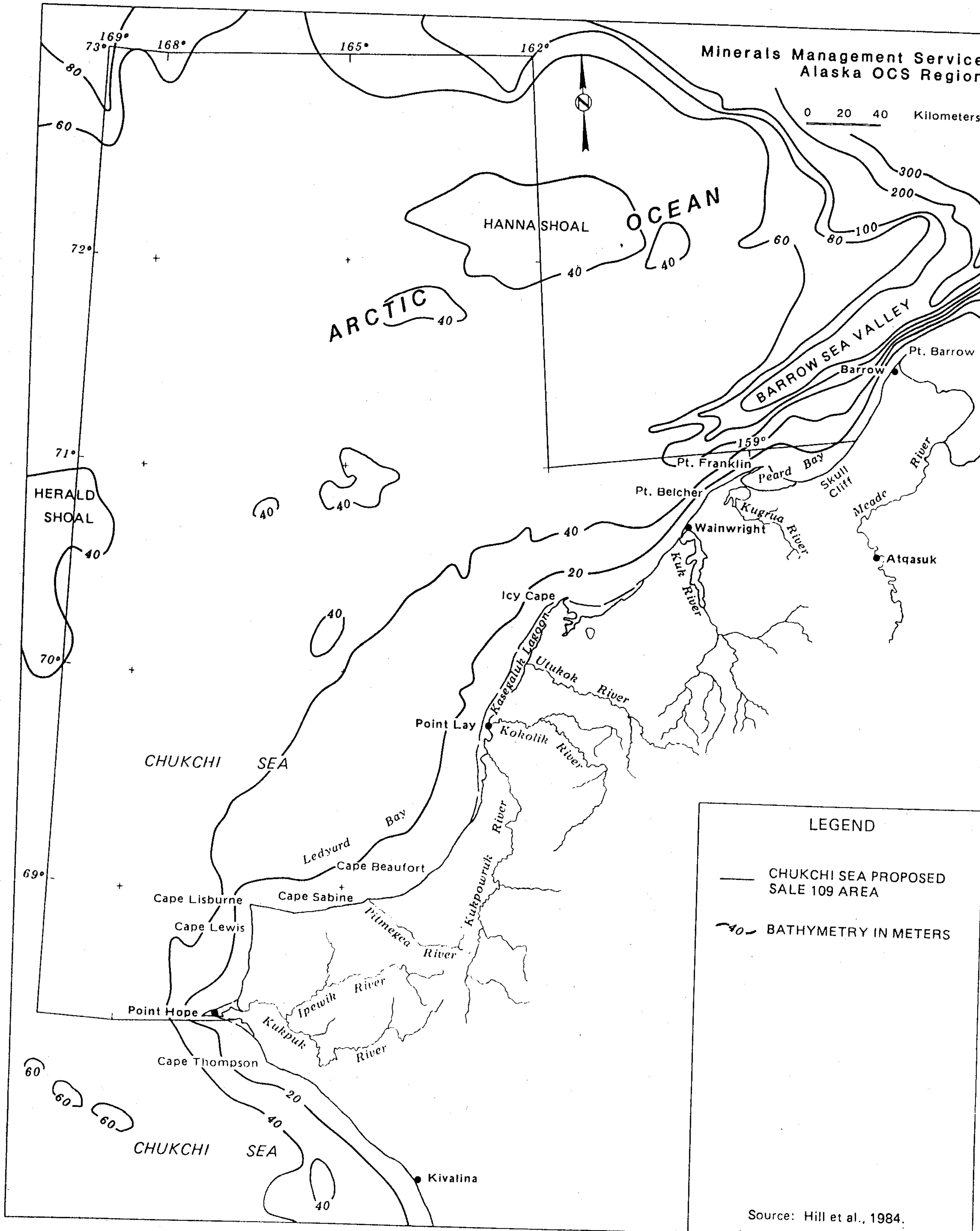
Method

The method used to develop the archaeological analysis was established in the Handbook for Archaeological Resource Protection (MMS 620.1-H, June 17, 1985).

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, which includes a technical interpretation of existing geophysical/geological data in order to establish sea-level changes and identify relict landforms. This technical interpretation will provide the basis for evaluating the potential for prehistoric-resource occurrence (habitability) within the proposed sale area. The process of integration should begin at the broadest data-base level and proceed toward the specific. Preparation of the analysis may be conducted in the following manner:

(1) Review the baseline study. If the regional baseline study indicates that the entire proposed sale area lies with in an area of low probability for the occurrence of prehistoric resources, and no new data exist which



Minerals Management Service
Alaska OCS Region
0 20 40 Kilometers
ARCTIC OCEAN
HANNA SHOAL
BARROW SEA VALLEY
HERALD SHOAL
CHUKCHI SEA
CHUKCHI SEA
Pt. Barrow
Barrow
Pt. Franklin
Peard Bay
Skull Cliff
Pt. Belcher
Wainwright
Kugrua River
Meade River
Atqasuk
Kuk River
Icy Cape
Kasegaluk Lagoon
Utukok River
Point Lay
Kokolik River
Kukpowruk River
Ledyard Bay
Cape Beaufort
Cape Lisburne
Cape Sabine
Cape Lewis
Pitmegea River
Ipewik River
Point Hope
Kukpuk River
Cape Thompson
Kivalina
LEGEND
CHUKCHI SEA PROPOSED SALE 109 AREA
40 BATHYMETRY IN METERS
Source: Hill et al., 1984.

Figure 1

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 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 reports.

(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-resource lease stipulation or right-of-way permit requirements.

Analysis

Step 1 - Review of the Baseline Study

Using the above method, 5,448 blocks contained in this proposed action were reviewed. Baseline studies which cover portions of the study area include:

- Bering Land Bridge Cultural Resource Study (Dixon et al., 1976);

- Beaufort Sea Cultural Resource Study (Dixon et al., June 1978); and

- Alaska Outer Continental Shelf Cultural Resource Compendium, Technical Report No. 119 (Dixon et al., March 1986)

The baseline studies have developed a general model which delineates areas likely to contain archaeological sites on the Outer Continental Shelf (Dixon et al., 1978). The criteria used for designating probability zones are:

Areas of High Probability

1. Nonglacial 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. Areas of possibly enhanced marine-coastal-habitat diversity and availability.

Areas of Medium Probability

1. 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 windblown, snow-free winter range. 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.

Step 2 - Review of Sea-Level Curves to Determine Habitability

The second step is to examine the regional sea-level curves. Dixon et al. (1978) state that -125 meters was the maximum sea-level recession during the late Wisconsin. Hopkins et al. (1979) reexamine the body of literature dealing with sea-level changes in Beringia. It establishes that the sea level fell to a minimum depth of -90 meters between 25,000 and 17,000 years before present (BP), in the southern Bering Shelf. In the northern portion, the sea level reached a minimum of -115 meters. It is the latter figure, -115 meters, which will be utilized in this analysis as a factor to determine habitability. Hopkins et al. (1979) do not disagree with the earlier interpretations of global sea level having been -125 meters, stating ". . .the position of the ancient shoreline on any given segment of the continental margin differs as a result of local differences in tectonic history and local isostatic effects." They feel that Beringia deviated significantly from the worldwide norm.

For the purpose of this archaeological analysis, ". . .almost all of the area is less than 60 meters (200 feet), and none of it is more than 100 meters (330 feet below sea level" (Grantz et al., 1982); thus, no areas are deleted on the basis of depth of sea level curves. Additionally, the authors (ibid.) note that the seabed in the sale area is remarkably flat, and more than 80 percent of it lies between the 30- and 60-meter isobaths. The head of Barrow Sea Valley barely enters the sale area north of Wainwright, and several broad sea valleys extend a short distance into the area near 73°00'N. latitude. The deepest parts of these features, however, are only about 75 to 100 meters below sea level. Except for the nearshore and the large sand ridges at Blossom Shoal off Icy Cape, the shallowest part of the area is at Hanna Shoal, near 72°N. latitude, 162°W. longitude. A small area of the seabed there is less than 25 meters below sea level.

Step 3 - Review of the Geological/Geophysical Data to Determine Survivability

Step 3 is to use ". . .information regarding forces or processes that might have destroyed potential prehistoric sites (survivability) or rendered them unrecoverable." Dixon et al. (1976) focused on the probability of paleo-Indian populations inhabiting the offshore area before the postglacial marine transgression. This report also identified topographic features that these prehistoric groups would have sought to occupy and, in a general way, identified such features within the Beaufort Sea area.

The geological report (Appendix 1) discusses the following three stages of Beringian geomorphological evolution: the subaerial processes of sedimentation and erosion; processes associated with inundation by the rising sea; and marine erosion and sedimentation.

Three areas of high archaeological-site potential have been identified (Dixon, 1986, oral comm.). They are the areas of Point Hope, Icy Cape, and the probable prehistoric-lake formation east of Herald Shoal.

Sediments are of a sufficient depth to contain prehistoric sites. In most cases, marine transgression, thermal abrasion, ice gouging, and other geological processes would have destroyed archaeological sites giving the area a low probability of survivability.

Step 4 - Review to Identify Significant Landforms

Step 4 calls for the examination of the ". . .geology report, appropriate hazard survey, etc.,. . ." to determine the likelihood of significant landforms and the habitability and survivability of possible sites. Examination of sonographs, fathograms, and sub-bottom siesmic profiles generated for the sale area indicate that significant landforms are difficult to recognize.

Geophysical records examined during the previous review for Barrow Arch Sale 85 were from the following sources: Creager and McManus, 1967; Grantz and Eittreim, 1979; Grantz et al., 1975; Grantz et al., 1982; Hunkins et al., 1962; Moore, 1964; and Toimil, 1978. According to archaeological information collected and analyzed over the last 50 years, early man was most likely to have inhabited areas now identified as drowned stream canyons, passes, ancient estuaries/lagoons, and channel-filled bays.

Landforms identified by recent review of the data indicate that the areas off Point Hope, Icy Cape, and the probable prehistoric lake east of Herald Shoal (Dixon, 1986, oral comm.) contain landforms which might have been habitable by early man. Intense ice gouging and marine transgressions would probably have destroyed any archaeological sites (Phillips, 1986, oral comm.).

Step 5 - Prehistoric Site-Potential Recommendation

Step 5 calls for the integration of all available data and information in order to make a recommendation as to which blocks should be designated as having a high potential for prehistoric sites.

Extensive ice gouging, reworking by marine transgression, thermokarst erosion, and thermal abrasion cover the entire sale area. These geological processes make it highly unlikely that any prehistoric archaeological sites would have survived.

At this time no further attention is required to archaeological resources in the proposed Sale 109 area. If new data become available, this analysis could be reassessed to further evaluate which blocks would require an archaeological-resource report at the postlease stage.

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Summary of Geomorphological Processes Pertaining to Survivability of Archaeological Resources in the Chukchi Sea Sale 109 Planning Area

Introduction:

The Sale 109 planning area is included within a larger area of continental shelf termed Beringia. Beringia was subaerially exposed during the last glaciation and has since been submerged by the rising sea level. At its greatest extent, Beringia, as used in this report, included the Chukchi and Bering continental shelves of the USSR and USA (see Figure 1).

Friedman and Schneider (2) analyzed the potential for prehistoric site survival for the proposed Barrow Arch lease sale. This analysis concluded that ice gouging and absence of surficial sediments or significant landforms resulted in no prehistoric sites existing or surviving in the Sale 85 planning area. Since the analysis, Dixon (1) has identified a paleolake in the Sale 109 area, not previously considered as a significant landform, which might contain prehistoric sites. Phillips (8) has reported subsurface stratigraphy throughout the Chukchi Sea, not previously recognized by Friedman and Schneider (2).

This summary discusses three stages of Beringian geomorphological evolution: first, the subaerial processes of sedimentation and erosion; second, the processes associated with the inundation by the rising sea; and finally, the marine erosion and sedimentation which have occurred after submergence are discussed. The report then addresses the presence of landforms and potential for site survivability for areas of high archaeological potential, as designated by Dixon.

I. Subaerial Sedimentation and Erosion

Hopkins (5) reported widespread areas of loess and redeposited loess in Beringia. Tomirdiaro (11) reports yedoma deposits, perennially frozen loess of late Pleistocene age, once stretched from western Europe across Siberia and Beringia to Alaska.

Thermokarst depressions, characterized by modern peat bogs and thermokarst lakes, may be initiated by the melting of subsurface ice. The resulting lakes grow by actively eroding their shorelines. It is the growth of thermokarst lakes by collapse of their banks which would be expected to destroy most archaeological sites.

The vast expanses of Yedoma soils were transformed into the current wet tundra by thermokarst lakes. The date of the start of this transformation would coincide with the date for the development of wet tundra 8,500 years ago as quoted by Hopkins (5). This date is considerably later than the proposed inundation of Beringia. Thus, the Beringian landscape may have been submerged prior to the onset of extensive thermokarst erosion.

Another form of thermokarst erosion is called thermal abrasion. This process occurs on coastlines and along the shores of major rivers. Thermal abrasion requires permafrost terrain, a body of water large enough to generate waves, and a nearshore current capable of removing the abraded debris.

II. Inundation:

The inundation of Beringia was due to a world-wide melting of glaciers and consequent sea level rise. This sea level rise is complicated in some areas by glacial rebound. Since no glaciers covered Beringia during the last glaciation, no glacial rebound is expected to have occurred. Tectonic uplift of the coast can be viewed at Cape Kruzenstern, but tectonic uplift in Beringia during the past 20,000 years has not yet been fully investigated. The occurrence of paleoshorelines, identified by Sharma (10) at a constant subsea elevation, suggests tectonic uplift may not have been pronounced over Beringia. Paleoshorelines were formed at the onset of a period of rapid transgression and abandoned as sea level quickly rose above them.

During the height of the last ice age, 18,000 years ago, the exposed continental shelf of the southern Chukchi Sea was drained by a river flowing out of what is today Kotzebue Sound northwest to enter the Arctic Sea near Wrangel Island. McManus et al. (6) have named this river the Chukchi River and the valley through which it ran the Chukchi Valley (Figure 4).

With the rise of sea level, the valley was quickly flooded to become Chukchi Estuary. Since the estuary was probably ice covered nearly year-round, it may not have formed a significant barrier to land migration (Figure 5). Chukchi Valley was flooded when sea level had risen to 60 meters below its present elevation. McManus et al. (6) date this event at about 15,500 years ago, while Morner's (7) sea level curve would indicate a somewhat later date of 13,200 years ago. (See Figures 2 and 3).

The Chukchi Estuary became an embayment of the Arctic Ocean with the flooding of Long Strait between Wrangel Island and Siberia and the flooding of the Cape Lisburne-Herald Shoal Peninsula. This occurred when sea level had risen to 48 meters below its present height. McManus et al. (6) dated this event at about 14,400 years ago. Using Morner's (7) sea level curve, this level would have been reached 12,800 years ago. (See figures 2 and 3). The Chukchi Embayment was initially transformed to Chukchi Sea with the rapid opening of Anadyr Strait which also occurred at this time (see Figure 1). This permitted the waters of the Bering Sea to enter the Arctic Ocean through a narrow, tortuous passage.

The event which provided Alaskan coastal waters a direct access to the Arctic Ocean was the opening of Shpanberg Strait. This occurred when sea level had reached 32 meters below its present height. McManus et al. (6) dated this at 12,000 years ago while Morner's (7) sea level curve predicts a date of 9,300 years ago. (See Figures 2 and 3). It was at this time that currents developed with speeds comparable to those of today.

III. Marine Sedimentation:

Surficial sediments consist of gravel, sand, and mud (silts) (Figure 4). Phillips et al. (9) state that "Over much of the Chukchi Sea Shelf a thin blanket of Holocene-Quarternary sediment overlies inclined and folded bedrock . . . . Thicker accumulations of Quarternary sediments are reported in channel-fill deposits of paleovalleys that were cut into the shelf during Pleistocene sea level lowstands."

Local accumulations of up to 14 meters of sediment exist directly west of Cape Lisburne at depths of 32 meters. The sediment thins toward the shore. North of Cape Lisburne a wide band of sediments from 4 to 5 meters thick trends to the northeast along the coast. This sediment thins both to the southeast (landward), as water depths shallow to 20 meters, and northwest (further offshore). Off Icy Cape the outer shelf sands contain over 10 meters of sediment overlying bedrock.

West of Point Franklin at the head of Barrow sea valley the sediments are over 14 meters thick. The thickest sediments are generally in water depths greater than 55 meters and trend to the northeast in linear bands paralleling the valley axis. Within the Barrow Sea Valley modern channels are eroding the Quaternary sediments.

Neogene Stratigraphy:

Phillips (8) mapped sediment thickness above folded bedrock (Figure 5). Sediments consist of a blanket of volcanic ash of possible Miocene age, successively overlain by a pebbly mudstone, an oxidized sandstone and Holocene marine sands and muds. The sandstone consits of a reworked, quartz-rich, arkosic blanket aeolian sand (loess) 150 to 200 centimeters in thickness, which has been reworked by marine transgression beneath 50 to 440 centimeters of recent marine sediments offshore of Icy Cape. This sand pinches out to the northwest. No data are available on the extent of this sand in the southwestern portion of the sale area.

Phillips (8) also reported a large multi-storied deltaic complex in the northwestern Chukchi Sea. The complex now occupies a bathymetric low located between Hanna Shoal to the north and Herald Shoal to the south. Channel-fill stratigraphy records repeated erosional and depositional events. The channels contain fluvial and marine sediments within four distinct seismic units. The lower-most unit is discontinuous and poorly preserved. It records a period of initial channel down-cutting and deposition of fluvial sediments. The overlying unit varies in thickness from 2 to 28 meters. Marine conditions have prevailed during deposition of this sequence; however, bay or estuarine sediments might also produce a similar-appearing depositional sequence. The third unit represents fluvial dominated sedimenation, but this sequence may also include some marine, estuarine, lagoonal, and terrestrial facies, all of which have been reworked by the marine transgression. This unit carries in thickness from 14 to 32 meters, averaging 18 meters. The uppermost unit represents fluvial to marine sedimentation and would include deposits of the Holocene transgression. This unit is up to 6 meters in thickness.

Ice-Gouging:

Grantz et al. (3) gives an interpretation of the geologic framework of the lease offering area based on several seismic reflection surveys and defines the density distribution of ice gouges on the seabed of the Chukchi Sea. Ice gouge density zones are indicated on Figure 6 by the letters A to H designating the relative amount of recent gouges.

The distribution of ice gouging reported by Grantz (3) is generally supported by Phillips (8) (Figure 7). Phillips reports:

"Ice gouging is pervasive on the Chukchi Shelf, but away from topographic highs and the nearshore slopes, gouging is rare and gouge depths are shallow. Furthermore, in the deep water areas gouge depth is commonly subdued, indicating that the waves, currents, and biological activity are perhaps the dominant surface reworking processes, since gouging is less frequent"

Friedman and Schneider (2) concluded that the southern Zone A, as identified by Grantz (3), had enough sediments for prehistoric site protection, but there were no significant landforms "observed on seismic records, therefore indicating a low probability of prehistoric sites." The southern portion of the paleolake, identifed by Dixon (1), falls within this zone (as shown in Figure 6). In this area, sediments are Holocene marine deposits, which may overlie Pleistocene sediments which have been reworked by marine transgression. Prehistoric sites in the Pleistocene sediments would probably have been destroyed during the marine transgression.

Friedman and Schneider (2) further concluded that Zone H, as identified by Grantz (3), from Point Hope to Cape Barrow was an area of pervasive gouges within which any potential prehistoric sites would have been destroyed. The sedimentary sequence reported by Phillips is present in this zone off Icy Cape, but any prehistoric sites within this sand would likely have been destroyed by marine transgression.

IV. Analysis of Site Significant Landforms and Survivability for Areas of High Archaeological Site Potential:

Depression east of Herald Shoal:

The large, elongate, closed depression east of Herald Shoal (See Figures 8 and 9) has been proposed by Dixon (personal communication) 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. (6) or much more rapidly at 12,500 years ago according to Morner's (7) curve. (See Figures 2 and 3).

Surficial sediments within the depression consist of sand and mud (Figure 6). Phillips (8) reported 3 to 4 meters of sediments above folded bedrock at the site (Figure 5). Sediments within the northern part of the depression (as shown on Figure 8) are part of the deltaic complex. If sediments in the southern section include the oxidized sand (loess), recognized in cores to the east, the Holocene trangression which reworked the sand would likely have destroyed any prehistoric sites.

Several other sites have been proposed by Dixon as paleolakes (see Figures 8 and 9) since today they form closed bathymetric depressions. Five such depressions were located partially or completely within the sale area. These depressions do not have a 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. (4)]. 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.

Areas of Icy Cape and Point Hope:

Dixon has reported (verbal 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. No Pleistocene sediments have been found offshore above 35 meters below modern sea level. The processes of thermal abrasion and other coastal erosion processes make prehistoric site survival unlikely

Barrow Sea Valley:

The southern head of Barrow Sea Valley impinges 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 (8) reports sand waves and more than 6 meters of sediments cover the site. In this area Pleistocene sediments may exist on the sea floor. The down-cutting of modern channels in the sea valley has exposed Quarternary sediments and some of these may be Pleistocene deposits. If the area does have a high archaeological site potential, then prehistoric sites within the Pleistocene sediments would have been reworked during the marine transgression.

Northwestern Delta:

The age of these channels is unknown. Phillips et al. (9) offer several reasons to believe the channels are of a Late Pleistocene age. The authors felt, however, that a major problem with the channel's presumably "young" age was the identification of the channel's sediment source. The major Late Pleistocene drainage patterns were along the ancient Chukchi Valley to the south and along Barrow Sea Valley to the north. The location of paleochannels is poorly known at present. The large number of channels suggests they may have been the principal agent of erosion and sedimentation on the Chukchi Plain. These channels may contain terrestrial sediments within fluvial sequences all of which have been reworked by marine transgression.

No other landforms presently considered as areas of high archaeological site potential by Dixon (1) have been identified.

Conclusion

With the exception of Holocene channels currently eroding the side of Barrow Sea Valley, the upper portion of the existing Chukchi Sea floor is composed of marine sediments which would not be expected to contain cultural resources. Ice gouging, waves, currents, and biological activity have reworked the existing sea floor surface, making it unlikely that prehistoric sites on or immediately beneath the surface have survived.

The channels in Barrow Sea Valley expose Pleistocene sediments which have been reworked by marine transgression. This transgression would likely destroy any prehistoric sites buried in these sediments.

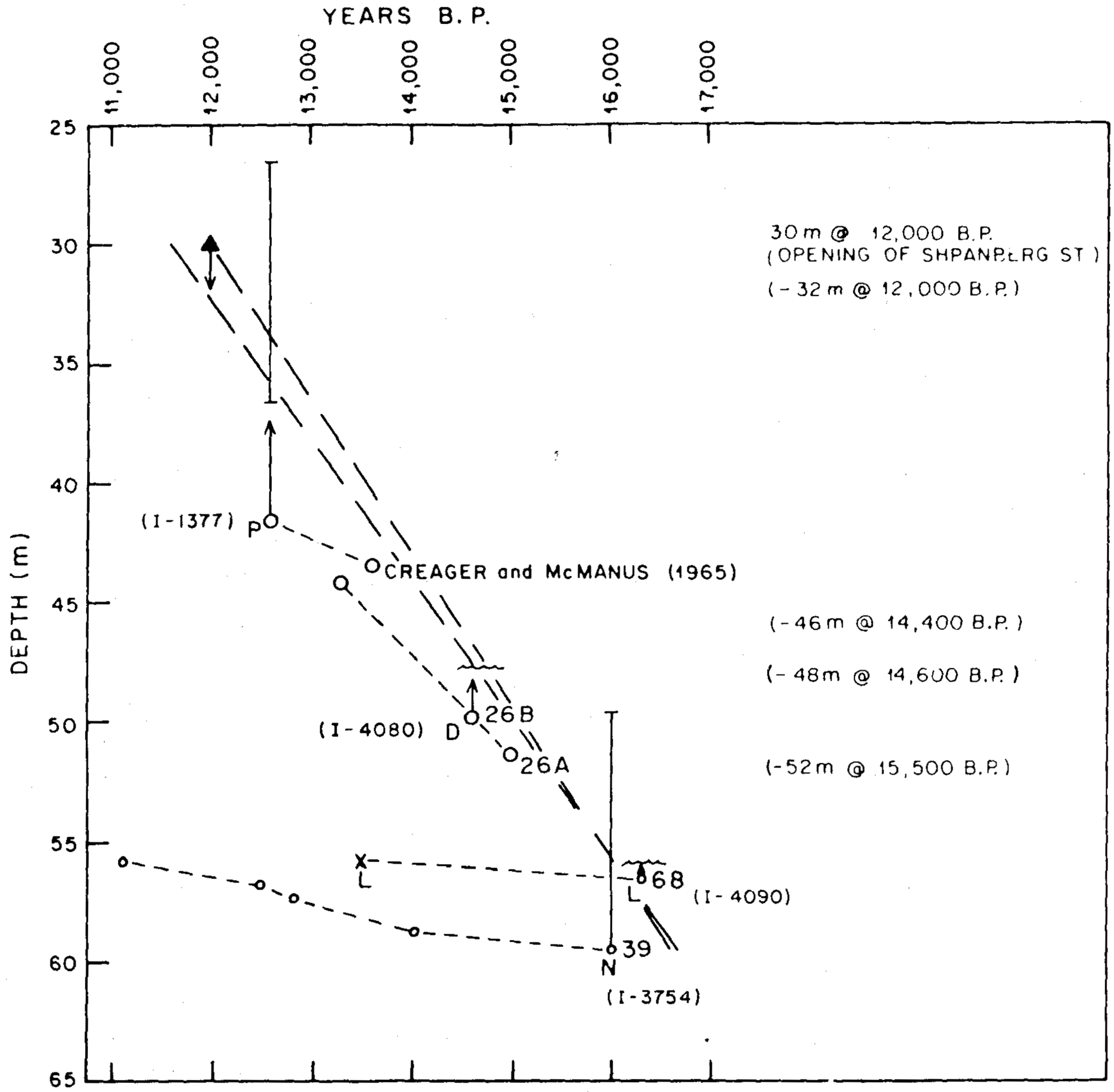
The area of high archaeological site potential east of Herald Shoal described by Dixon (personal communication) may have escaped extensive thermokarst erosion and thermal abrasion. The measured sediment thicknesses may include reworked sediments in the southern portion of the paleolake. Evidence suggests these sands are pinching out to the northwest of Icy Cape, and data are not available on the extent of these sediments in the southwest portion of the sale area. Prehistoric sites would probably have been destroyed during the marine transgression which reworked these sediments.

Archaeological sites off Icy Cape and Point Hope have probably been destroyed by thermal abrasion of the coast or other coastal erosion processes. Although sufficient thickness of sediments exists, which could have preserved the lowermost sediments from reworking by currents and ice gouging in these areas, potential prehistoric sites would likely have been destroyed during the marine transgression similar to the Herald Shoal area.

The deltaic complex in the northwestern part of the sale area contains channels with marine reworked fluvial and terrestrial sediments. The marine transgression would have destroyed any prehistoric sites contained within these sediments.

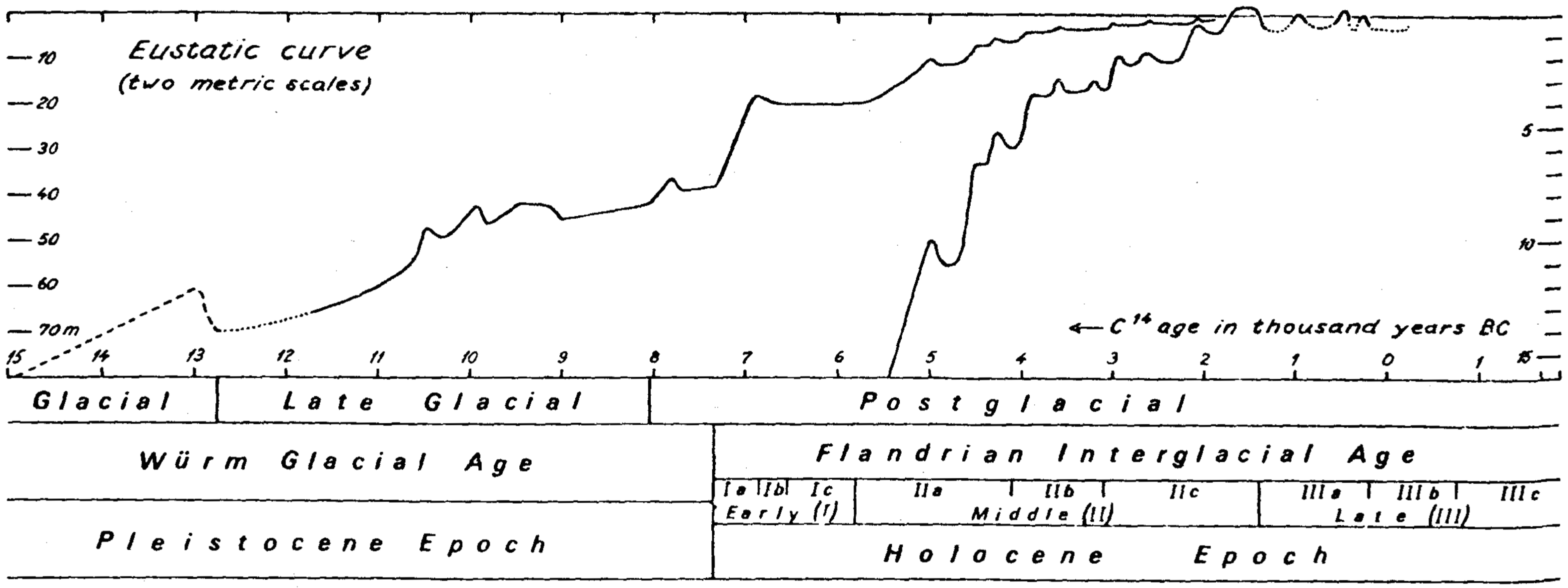
Because of the ice gouging, waves, currents, and biological activity, which have reworked existing surface sediments in the Sale 109 area, and the indication that subsurface sediments which may have contained prehistoric sites have been reworked by one or more marine transgressions, there is little probability that prehistoric sites would have survived.

FIGURE 1. LOCATION MAP OF BERINGIA (Hopkins, op. cit., p. 4)



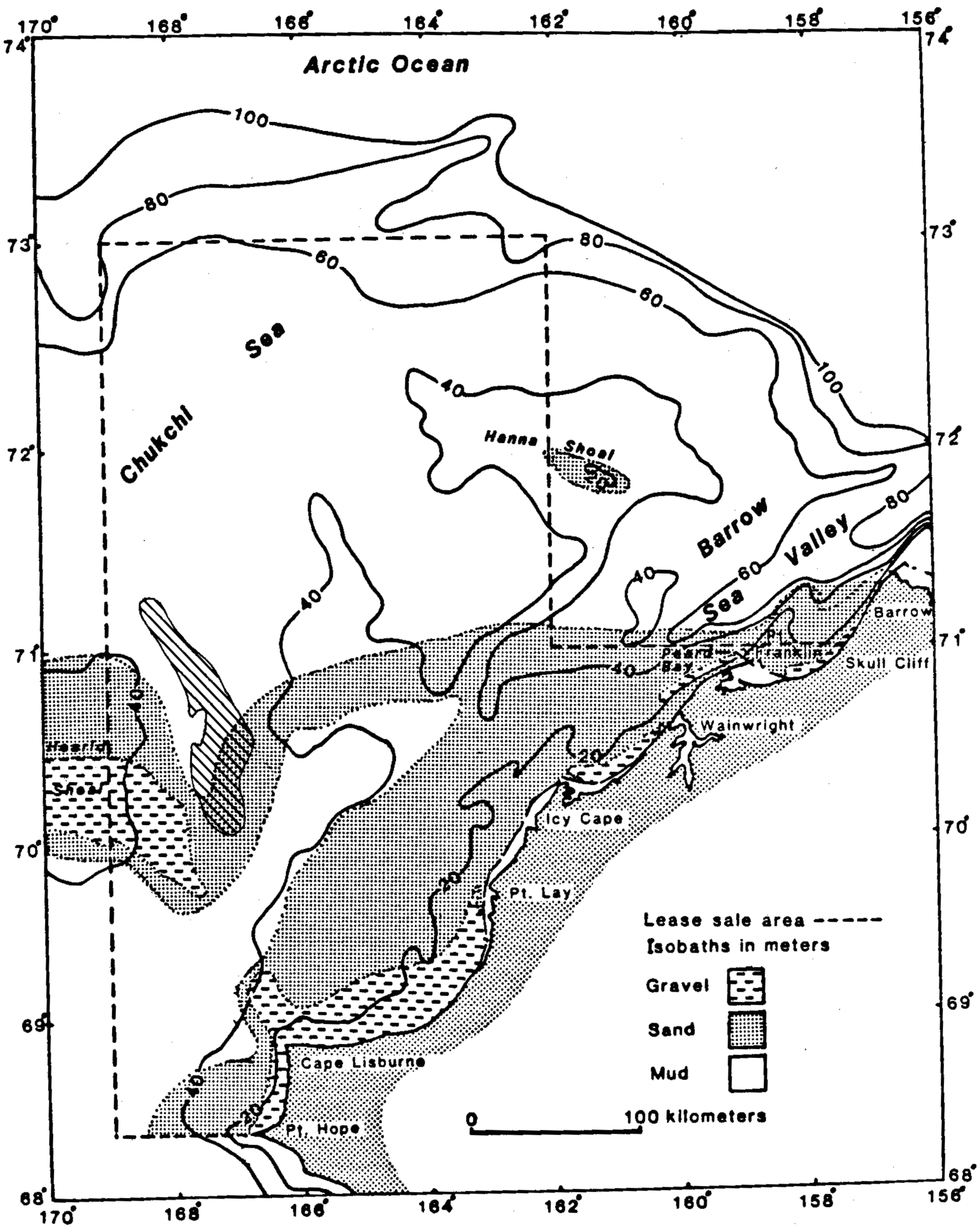
Estimated sea level curve for the Chukchi Sea (16,500 to 12,000 B.P.). Lines of short dashes connect sample data in cores 26 (A and B), 39, and 68 (for locations see Fig. 1) and the core described by Creager and McManus (1965). Circles represent dates and depths below present sea level of samples in 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 2. 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.

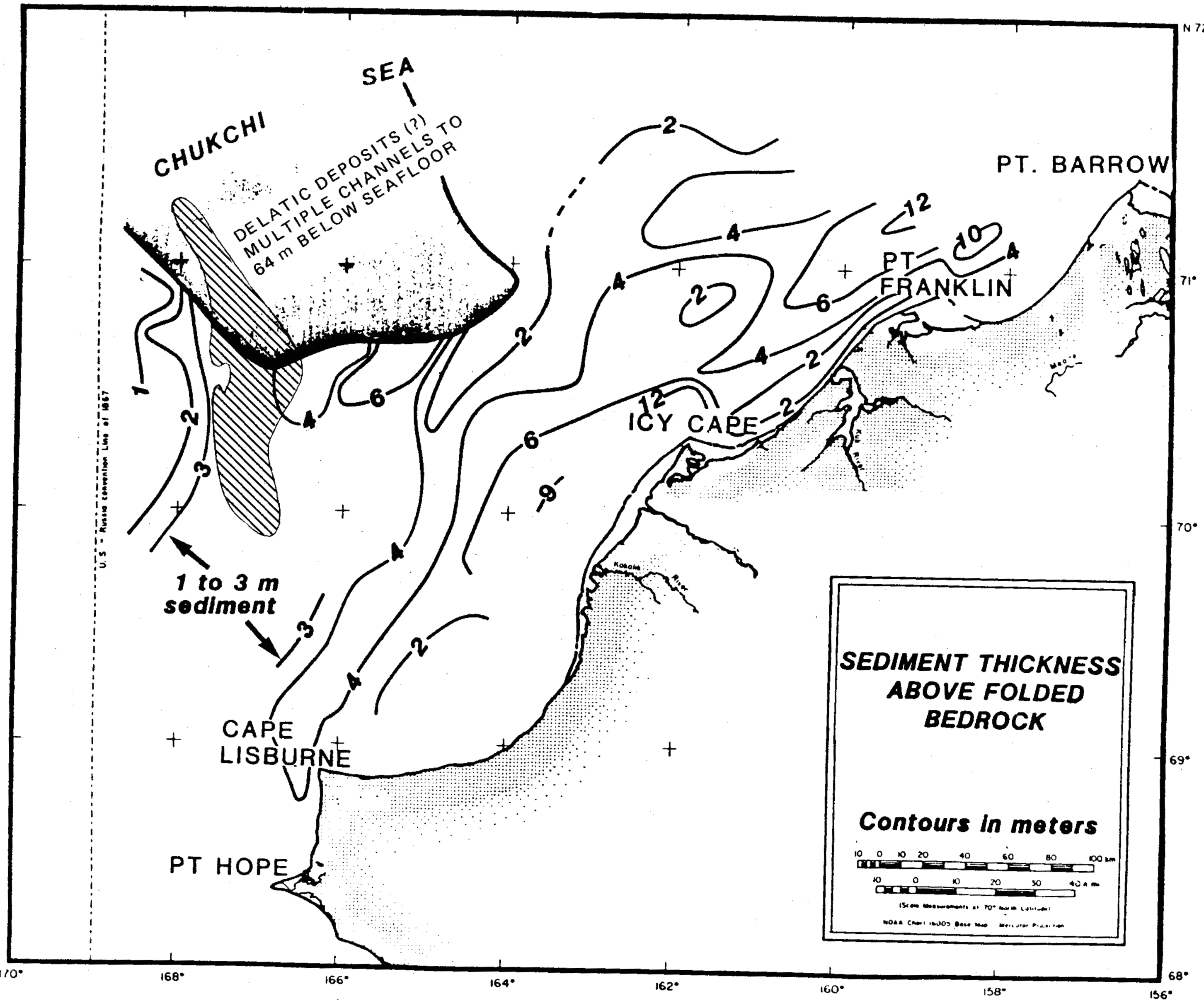
FIGURE 3. LATE PLEISTOCENE SEA LEVEL RISE (Morner, op. cit., p. 396)



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 4. SURFICIAL SEDIMENTS IN THE CHUKCHI SEA WITH BATHYMETRIC CONTOURS IN METERS (Phillips, internal memo MMS)



AREA OF HIGH ARCHAEOLOGICAL SITE POTENTIAL

FIGURE 5. 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)

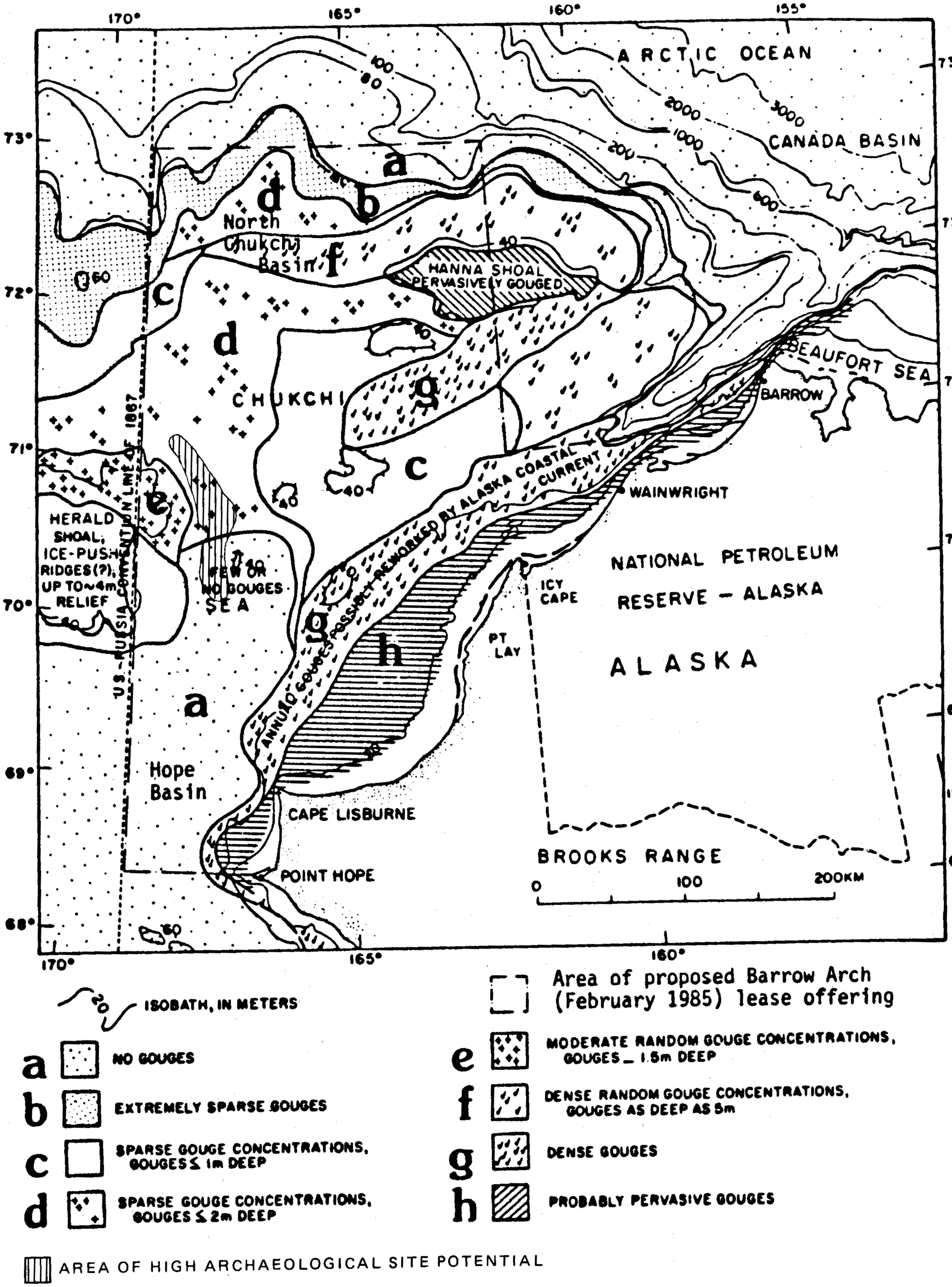


FIGURE 6. DISTRIBUTION OF ICE GOUGES ON THE SEABED OF THE CHUKCHI SEA (after Grantz et al., 1982)

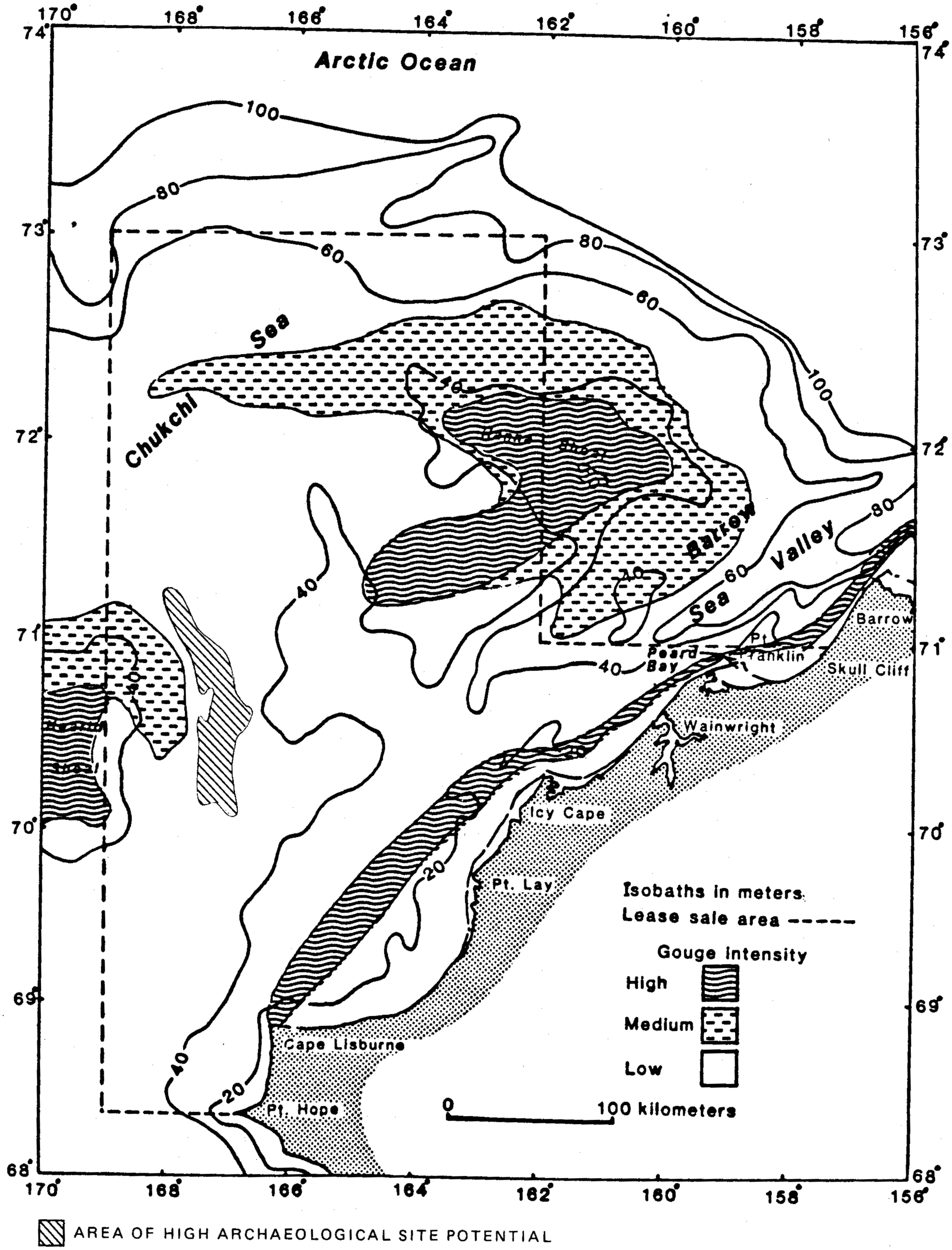
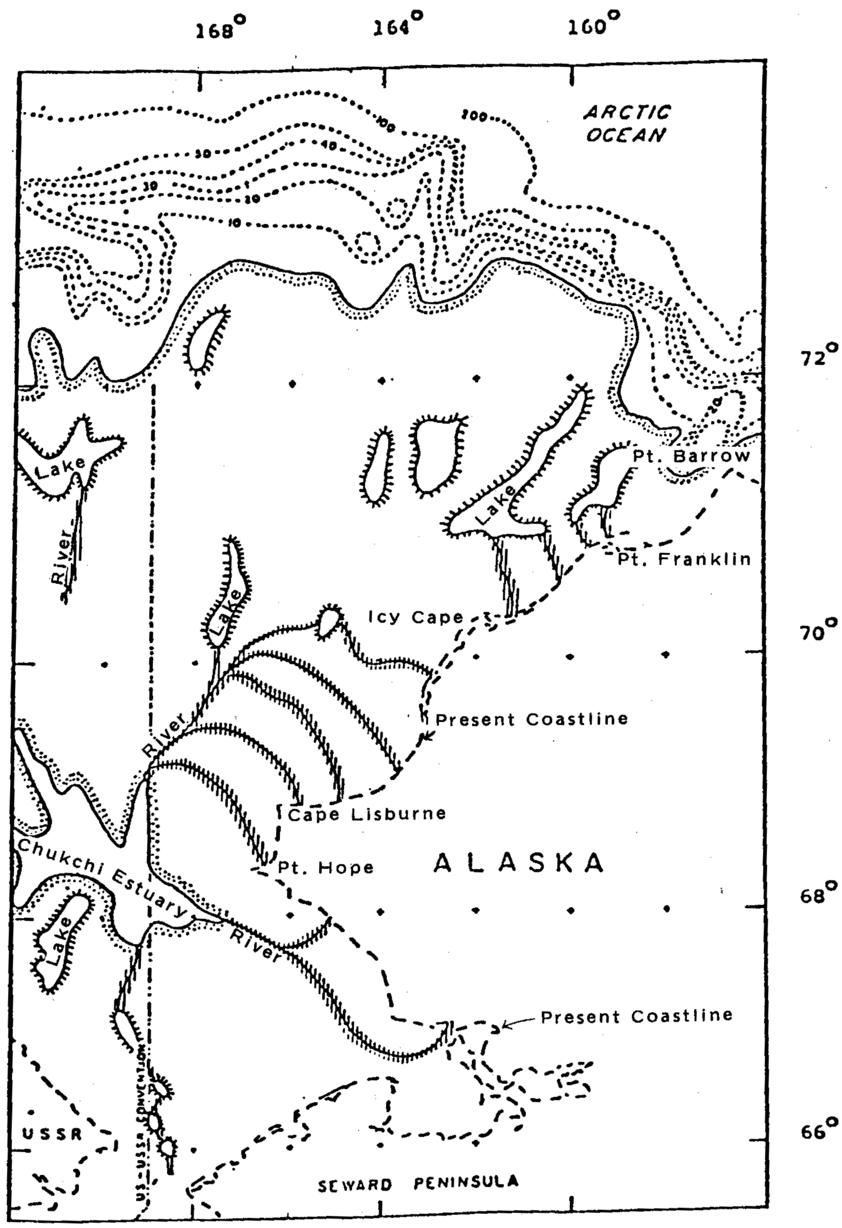


FIGURE 7. ICE GOUGE INTENSITY IN THE CHUKCHI SEA WITH BATHYMETRIC CONTOURS IN METERS
(Phillips, internal memo, MMS)

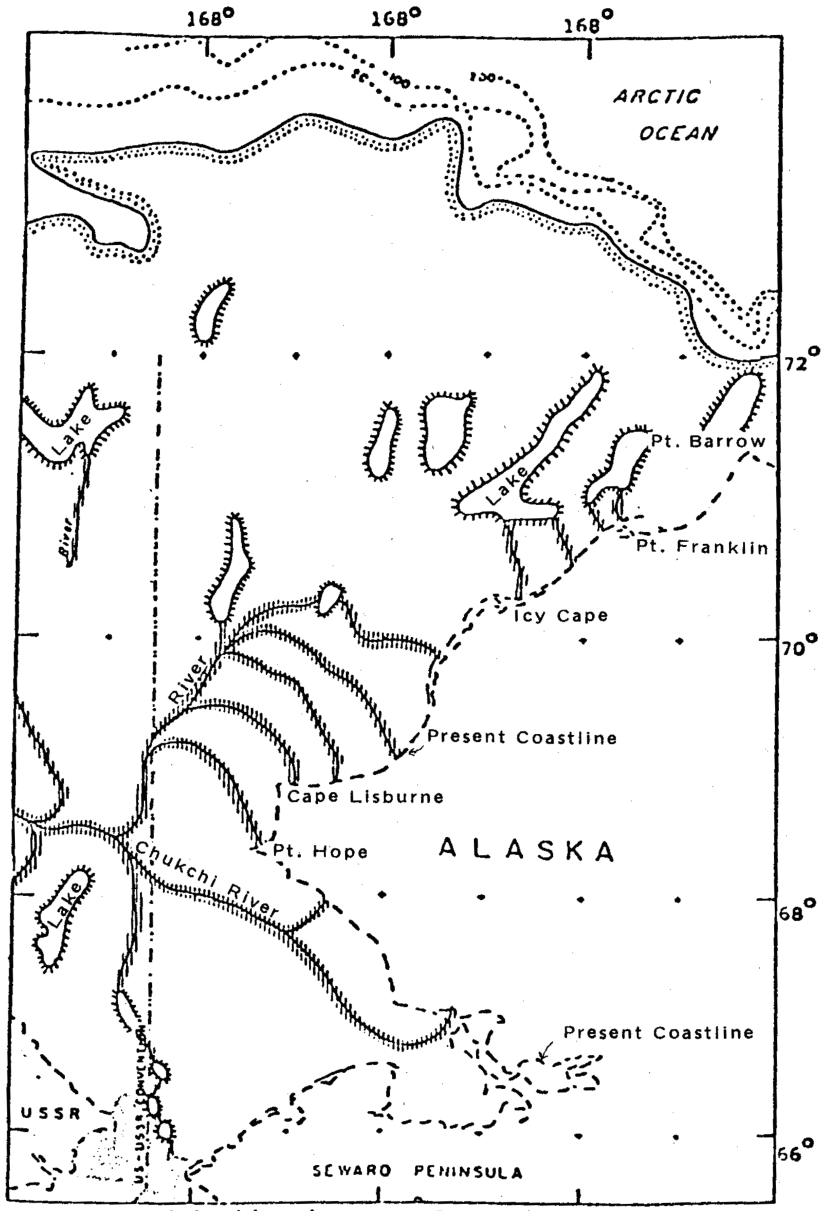


Chukchi/Arctic coast, Standstill II, 16,000 B.P.
Compiled by G.D. Sharma from National Ocean Survey charts 1215 N-10, 1711N-17B, 1711N-18M, 1714-11B, 1714N-12B, 1814-10B and unpublished data of the University of Washington.

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 8. 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 9. NORTHERN BERINGIA, BATHYMETRY (m), PALEOLAKES, AND PALEORIVERS AT GLACIAL MAXIMUM (Dixon, op. cit., p. III–52)

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SHIPWRECK UPDATE ANALYSIS
FOR PROPOSED SALE 109

This report is written in accordance with Chapters 1, 2, 7, and 8 of OCS Oil and Gas Prelease Procedures MMSM 621.1-H: Handbook for Archaeological Resource Protection. The Handbook states that if baseline studies exist to detect potential for affecting shipwrecks, then a shipwreck update analysis should be done to determine if there is the potential for any shipwreck resources occurring in the proposed lease area to survive marine transgression and other physical processes, and if the resource can be detected by state-of-the-art geophysical technology.

Baseline studies of shipwrecks exist. A computer file was made by the State of Alaska which includes most Alaskan ships (State of Alaska, 1986). Two technical papers on Cultural Resources and Shipwrecks exist (Tornfelt, 1981, 1982). A computer file with details about 500 shipwrecks exists at the MMS Alaska OCS Region. An MMS report on shipwrecks in all of the Alaskan OCS is in final preparation (Tornfelt, 1987). These studies show general locations for shipwrecks and, in some cases, archaeological sites. A list of the shipwrecks on the Chukchi Sea shelf and shore is provided in Table E-1, and a list of blocks and the number of shipwrecks in each block are shown in Table E-2. Figures E-1 and E-2 show where these resources are located.

The MMS Archaeological Analysis of the Proposed Lease Offering for the Barrow Arch Offshore Area (Friedman and Schneider, 1983) is an adequate analysis of the probabilities of any archaeological site surviving outside of the 3-geographical-mile line. This MMS report concludes that because of the extensive ice gouging, sparse sediment cover, and lack of landforms in the lease-sale area, there is little probability that a prehistoric site exists or could survive. New information that has not changed this conclusion is included in the Prehistoric Resource Analysis in this Appendix (areas shoreward of the 3-mile line are not analyzed in this analysis). Figures E-1 and E-2 show nearshore (3-miles and closer) shipwrecks as well as those beyond 3 miles. For shipwrecks, the situation is somewhat different than for prehistoric sites or landforms. Shipwrecks may have survived in the area just northeast and west of Peard Bay and Point Franklin--simply because the waters are deep there and ice gouging is sparse, and in some shallower areas because the shipwrecks have been there only a short time compared to prehistoric landforms. The shipwrecks, therefore, have increased chances of surviving some ice gouging.

Table E-I
Shipwrecks on the Chukchi Sea Shelf and Shore

Date Lost	Vessel	Approximate Location of Wreck (as described by survivors or witnesses)	Value of Hull and Cargo at Time of Loss[1/]
1861	Ship Caulaincourt	Point Belcher	Unknown
1864	Ship Henry Kneeland	Chukchi Sea	Unknown
1866	Bark Ontario	Chukchi Sea	Unknown
1868	Bark Hae Hawaii	Sea Horse Islands (Near Point Franklin)	Unknown
1869	Bark Eagle	Chukchi Sea	Unknown
1871	Bark Awashonks	Near Wainwright Inlet	$45,000
1871	Bark Carlotta	Near Wainwright Inlet	$45,000
1871	Ship Champion	Near Point Belcher	$50,000
1871	Brig Comet	Near Point Belcher	Unknown
1871	Bark Concordia	Near Point Belcher	$55,000
1871	Ship Contest	Near Point Belcher	Unknown
1871	Bark Elizabeth Swift	Near Wainwright Inlet	$40,000
1871	Bark Emily Morgan	Near Point Belcher	$42,000
1871	Bark Eugenia	Near Wainwright Inlet	$40,000
1871	Bark Fanny	Near Wainwright Inlet	$51,000
1871	Ship Florida	Near Wainwright Inlet	$62,000
1871	Ship Gay Head	Near Point Belcher	$53,000
1871	Bark George.	Near Point Belcher	$38,000
1871	Bark George Howland	Near Wainwright Inlet	$50,000
1871	Bark Henry Taber	Near Wainwright Inlet	$38,000
1871	Bark J.D. Thompson	Near Point Belcher	$50,000
1871	Bark John Wells	Near Point Belcher	$40,000
1871	Ship Julian	Near Wainwright Inlet	Unknown
1871	Brig Kohola	Near Wainwright Inlet	Unknown
1871	Ship Mary	Near Wainwright Inlet	$53,000
1871	Bark Massachusetts	Near Point Belcher	$57,000
1871	Bark Monticello	Near Wainwright Inlet	$41,000
1871	Bark Navy	Near Wainwright Inlet	$55,000
1871	Bark Oliver Crocker	Near Wainwright Inlet	$40,000
1871	Bark Paiea	Near Wainwright Inlet	Unknown
1871	Ship Reindeer	Near Wainwright Inlet	$43,000
1871	Bark Roman	Near Seahorse Islands (Near Point Franklin)	$41,500
1871	Bark Seneca	Near Wainwright Inlet	$55,000
1871	Bark Thomas Dickeson	Near Wainwright Inlet	$60,000
1871	Brig Victoria	Near Wainwright Inlet	Unknown
1871	Bark William Rotch	Near Wainwright Inlet	$43,000
1876	Ship Arctic	Off Sea Horse Islands (Near Point Belcher)	$60,000
1883	Bark Cyane	Point Belcher (Onshore)	Unknown

Table E-1
Shipwrecks on the Chukchi Sea Shelf and shore
(continued)

Date Lost	Vessel	Approximate Location of Wreck (as described by survivors or witnesses)	Value of Hull and Cargo at Time of Loss 1/
1883	Bark John Howland	Off Point Hope	Unknown
1884	Bark Bowhead	48 kms N. of Icy Cape	Unknown
1885	Bark George and Susan	14.4 kms N. of Wainwright Inlet (Onshore)	$50,000
1885	Bark Mabel	14.4 kms N. of Wainwright Inlet (Onshore)	$50,000
1886	Schooner Clara Light	24 kms N. of Point Franklin	$50,000
1890	Schooner Silver Wave	Abandoned at Point Hope (Bockstoce) Sea Horse Shoals (N. of Point Franklin) (Listed at Barrow by Andrews)	$10,000
1892	Bark Helen Mar	Chukchi Sea	$55,000
1893	Schooner Emily Schroeder	Maryatt Inlet (Near Point Hope)	Unknown
1896	Brig Hidalgo	Within 1.6 kms of Jabbertown (Wrecked onshore)	$30,000
1897	Steam Bark Jesse H. Freeman	Off Seahorse Islands (Listed at Barrow by Andrews)	$50,000
1897	Steam Bark Orca	Off Point Franklin (Bockstoce) (Listed at Barrow by Andrews)	$100,000
1897	J. Louise Kenney	Jabbertown (Near Point Hope)	Unknown

Sources: Andrews, 1916; Bockstoce, 1977; Tornfelt, 1987.

1/ In New Bedford, Massachusetts, the home of the arctic whaling community, a 3-bedroom home sold for $500 in 1871; the price of the same home is now about $50,000--an increase of 100 times the amount. Using this multiplier, the average loss per ship in the 1871 disaster was about $3.7 million--a total of approximately $122 million in today's dollars.

Table E-2

Blocks in the Chukchi Sea Area
Where Shipwrecks Probably Occurred

Official Protraction Diagram	Block Number	Number of Wrecks
NR 2-8:		
	16	1
	61	1
Subtotal		2
NR 3-4:		
	810	2
	595	1
Subtotal		3
NR 4-1:		
	771	1
	976	2
	984	3
Subtotal		6
NR 4-2:		
	501	1
	502	1
	503	1
	548	1
	630	1
	633	2
	637	1
	677	4
	720	1
Subtotal		13
NR 4-3:		
	10	1
	17	3
	54	2
	61	2
	68	1
	98	1
	112	1
	142	1
	144	1
	149	1
	188	1
	190	1
	191	1
	230	3
	232	1
	233	2
	274	3
	278	1
	280	1
	318	2
	324	1
Subtotal		31
NR 4-4:		
	46	1
Subtotal		1
Total number of shipwrecks		56

Source: MMS, Alaska OCS Region.

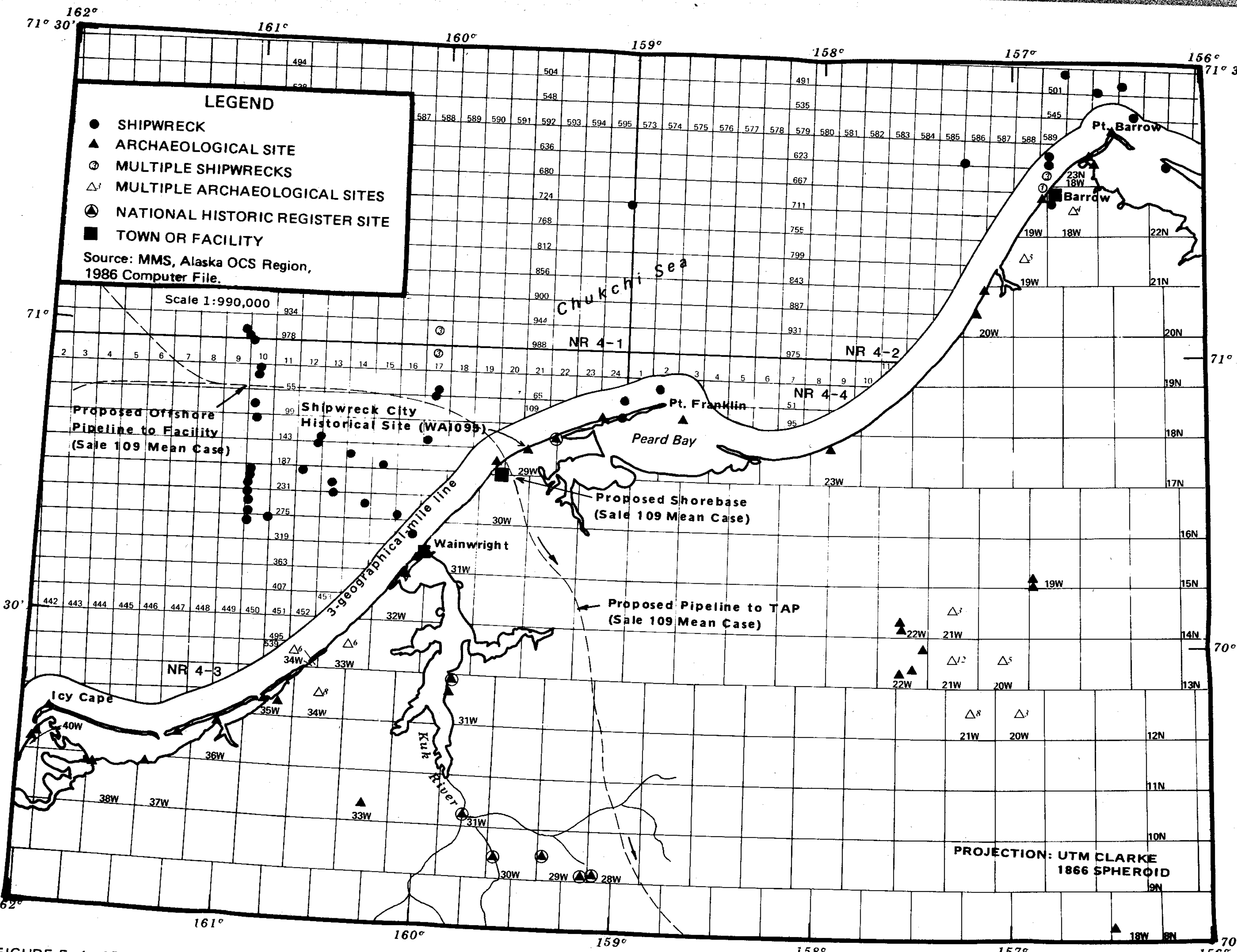

FIGURE E–1. APPROXIMATE LOCATIONS OF SHIPWRECKS, ARCHAEOLOGICAL SITES, AND PROPOSED INDUSTRIAL FACILITIES IN THE NORTHERN CHUKCHI SEA

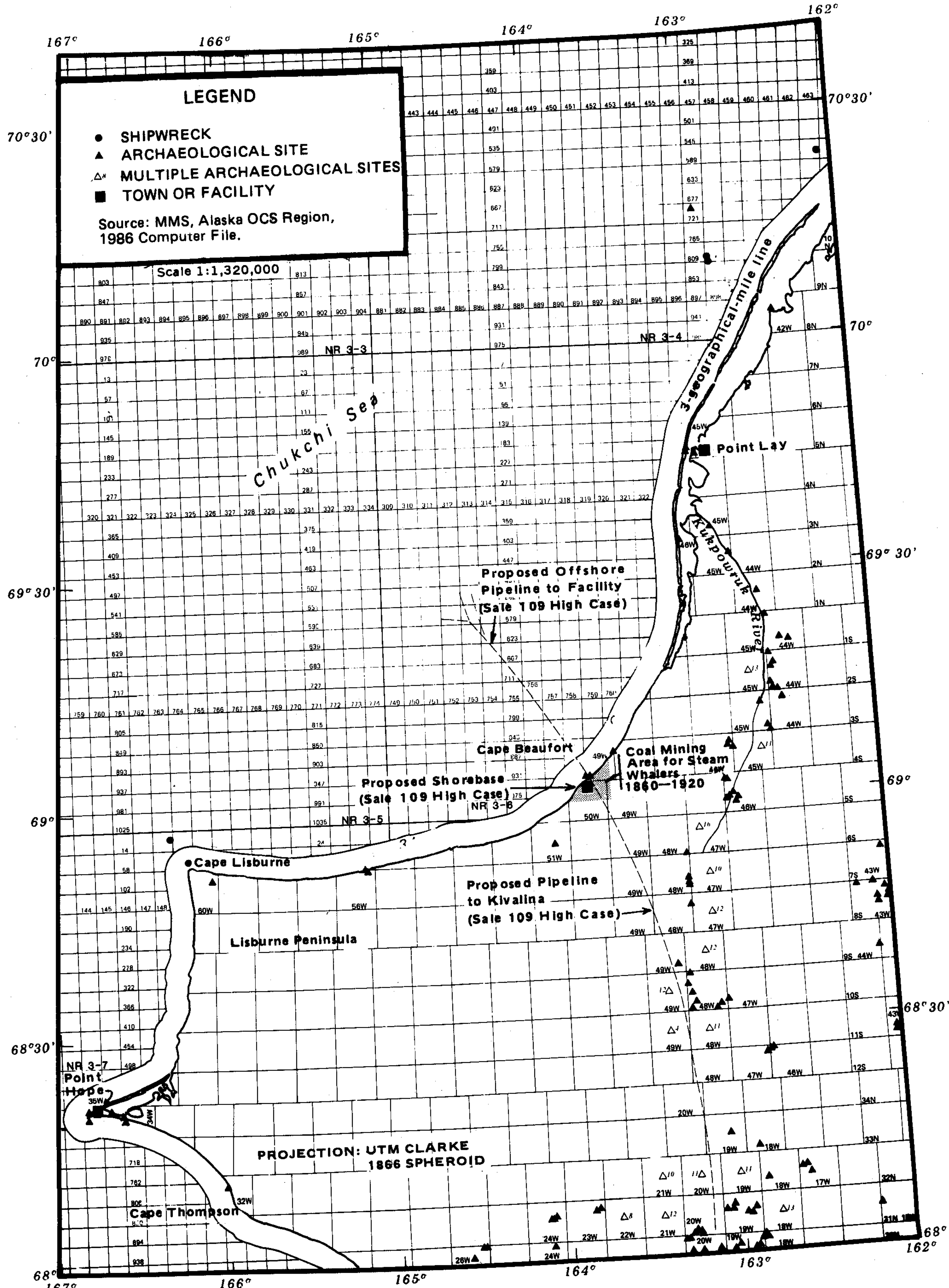

FIGURE E–2. APPROXIMATE LOCATIONS OF SHIPWRECKS, ARCHAEOLOGICAL SITES, AND PROPOSED INDUSTRIAL FACILITIES IN THE SOUTHERN CHUKCHI SEA

Table F-1
Direct-Employment Assumptions per Unit of Work for Proposed Sale 109 - by Work Type

TYPE OF WORK (one unit) and associated tasks	CREW SIZE 1/	SHIFT FACTOR 2/	ROTATION FACTOR 3/	NUMBER OF AIRCRAFT OR BOATS	TOTAL WORK FORCE 4/	DURATION (MONTHS)	TOTAL WORK-MONTHS	PERCENT OF OUT-OF-STATE COMMUTERS
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 SHOREBASE	67	1	2.0	-	133	12.0	1,600	79.0
OPERATING AN EXPLORATION SHOREBASE (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
INSTALLING A PRODUCTION PLATFORM (& EQUIP)								
All Work by Platform-Installation Crews	150	2	2.0	-	600	10.0	6,000	89.5
Helicopter Support-Platform Installation	5	1	2.0	2.0	20 5/	10.0	200	47.5
Tugboat Support for Platform Installation	10	1	1.5	4.0	60 5/	1.0	60	58.0
Supply/Anchor Boat Support-Platform Inst.	13	1	1.5	3.0	59 5/	10.0	585	58.0
Longshoring for Platform Installation	20	1	1.5	-	30 5/	10.0	300	35.0
Other Onshore Support for Platform Inst.	25	1	1.5	-	38 5/	10.0	375	89.5
CONSTRUCTING A PRODUCTION SHOREBASE	50	2	2.0	-	200	12.0	2,400	47.5
DRILLING A PRODUCTION OR SERVICE WELL	28	2	2.0	-	112	1.0	112	79.0
LAYING OFFSHORE OIL PIPE (160 km)								
All Work of Laying Barge Crews	175	2	2.0	1.0	700	3.3	2,310	89.5
Helicopter Support for Pipelaying	5	1	2.0	1.0	10 5/	3.3	33	47.5
Tugboat Support for Pipelaying	10	1	1.5	2.0	30 5/	3.3	99	58.0
Supply/Anchor Boats for Pipelaying	13	1	1.5	3.0	59 5/	3.3	193	58.0
Longshoring Support for Pipelaying	20	1	1.5	-	30 5/	3.3	99	35.0
Other Onshore Support for Pipelaying	35	1	1.5	-	53 5/	3.3	173	89.5
LAYING ONSHORE OIL PIPE (160 km)	250	2	2.0	-	1,000	6.7	6,667	79.0
CONSTRUCTING AN ONSHORE PUMP STATION	100	1	2.0	-	200	8.0	1,600	47.5
OPERATING A PRODUCTION PLATFORM (1 YEAR)								
All Work of Platform Operations Crews	40	2	2.0	-	160	12.0	1,920	25.0
Helicopter Support-Platform Operations	5	1	2.0	1.0	10 5/	12.0	120	25.0
Supply/Anchor Boats-Platform Operations	12	2	1.5	1.0	36 5/	12.0	432	25.0
Longshoring for Platform Operations	6	1	1.5	-	9 5/	12.0	108	25.0
Other Onshore Work for Platform Operations	2	1	1.5	-	3 5/	12.0	36	25.0
MAINTENANCE ON ONE MAJOR PLATFORM	10	1	2.0	-	20	4.0	80	25.0
WELL WORKOVERS FOR ONE OIL PLATFORM	10	1	2.0	-	20	6.0	120	25.0
OPERATING A PRODUCTION SHOREBASE (1 YEAR)	40	1	2.0	-	80	12.0	960	25.0

Source: Dames and Moore, 1982, and MMS Alaska OCS Region.

1/ Work-months (180 hours) per shift.
2/ Rotations per month: "2.0"--15 days on/15 off schedule, "1.5"--20 days on/10 off schedule.
3/ Total work-months per month.
4/ Shifts per rotation.
5/ 240-hour work-month.

Table F-2
Summary of Assumptions Used for North Slope
Model Medium-Base-Case Projections

CATEGORY	ASSUMPTION
Population Model	
° Native birth rates and survival rates	Based on 1980 census data for non-Anchorage Alaska Natives
° Age distribution of non-Native residents	1980 age distribution
° Maximum unemployment rate for Natives (unemployment cannot rise above this rate due to out-migration)	50%
° Share of newly unemployed workers who leave the North Slope	20%
Employment Model	
° Federal and State Government employment	Historical until 1984; then remains at 1984 level of 178
° Support employment	.24 x (resident employment)
° NSB CIP employment	2.02 x (NSB CIP spending in in $million)
° Other CIP employment	2.20 x (NSB CIP spending in $million)
° NSB operating employment	13.09 x (NSB operations spending in $million)
° Oil-industry-related employment	Declines gradually from 7,191 in 1986 to 3,344 in 2000 and 1,461 in 2010; based on ISER MAP Model assumptions
° Minimum number of oil jobs reserved for Natives	Constant at 30

Table F-2
Summary of Assumptions Used for North Slope
Model Medium-Base-Case Projections
(continued)

CATEGORY	ASSUMPTION
<u>Income Model</u>	
° Per-capita transfer income	$1,450 for Natives; $0 for non-Natives
° Wage rate (all jobs)	$37,500 per year
<u>Labor-Market Model</u>	
° Labor-force-participation rate	Equivalent to 74.1% for adult Natives between ages 19 and 64; 100% for adult Non-Natives. Only 10% of Natives unable to find other work are assumed to be willing to take oil-industry jobs.
° Share of jobs available to Natives, by type of employment	56% NSB operations jobs 83% of NSB CIP jobs 37% of all other CIP jobs 55% of support jobs 32% of Federal and State jobs 2% of oil industry jobs
<u>Fiscal Model</u>	
° Per-capita nonproperty-tax noninterest operating revenues (State and Federal transfers)	Declines from $6,410 in 1985 to $4,210 in 2010 due to drop in State revenues
° State-imposed per-capita-property-tax limit for operating revenues	Constant at 1985 level of $5,009
° Property value	Rises from $12.3 billion in 1985 to $16.3 billion in 1990; then declines steadily to $4 billion in 2010
° NSB CIP expenditures	Declines from $211 million in 1985 to annual level of $5 million after 1990

Source: University of Alaska, ISER, 1986.

Table F-3
Direct-Employment Requirements of Proposed Sale 109 by Category and Year, 1988 to 2010

Year	Exploration	Development	Production	Industry Headquarters in Anchorage	Total
1988	133			10	143
1989	189			15	204
1990	189			20	209
1991	649			40	689
1992	649			50	699
1993	649			60	709
1994	649			70	719
1995	342	278		80	700
1996	265	1,154	8	100	1,527
1997		3,610	40	200	3,850
1998		4,807	80	200	5,087
1999		653	952	200	1,805
2000			2,042	200	2,242
2001			2,042	200	2,242
2002			2,159	200	2,359
2003			2,192	200	2,392
2004			2,192	200	2,392
2005			2,192	200	2,392
2010			2,192	180	2,372

Source: MMS, Alaska OCS Region.

MAJOR PROJECTS CONSIDERED IN CUMULATIVE-EFFECTS ASSESSMENT

Information in this appendix supplements and updates material contained in Appendix B of the FEIS's for Sales 71, 87, and 97, which are incorporated by reference (USDOI, MMS, 1982, 1984a, and 1987a, respectively). The 19 projects described in this section are depicted on Graphic No. 3 and summarized in Table IV-2.

EXISTING DEVELOPMENT

1. Trans-Alaska Pipeline (TAP): Approximately 16.3 square miles are occupied by the 800-mile 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 2 million barrels of oil a day 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 million barrels per day to approximately 2.4 million barrels a day. The Alyeska Pipeline Service Company designed, constructed, and now operates the TAP (Alyeska Pipeline Service Co., 1984).

2. The North Slope Borough (NSB) Capital Improvement Program (CIP): One of the goals in the formation of the NSB was improvement of living conditions in North Slope Inupiat communities. With revenues from the Prudhoe Bay Field, a network of Borough and construction subcontractor management, and maximum participation of Inupiat men and women in each project, the CIP has been used to construct schools and housing in every community, acquire land and gravel, improve airport runways in each community, 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 North Slope community during the 1970's and early 1980's. Many of the projects have been completed. The focus of future expenditures emphasizes health and social 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 important 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 million barrels of oil per day from the Sadlerochit Formation, approximately 17 percent of the total U.S. production. By June 1987, over 5 billion barrels of the 9.6 billion barrels estimated as recoverable resources for PBU had been produced. ARCO Alaska, Inc., operates the east half of the field and Standard Alaska Production Company (Standard) 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 kilometers of roadways and 1,160 kilometers of oil and gas pipelines have been constructed within the PBU. This includes 80 kilometers of pipeline constructed for production from the Lisburne Field.

Original well spacing was based on 65 hectares per well; spacing is being reduced to 32 hectares per well. Gravel pads, which typically are 46 by 400 meters, accommodate up to 40 wells. Waterflooding, a secondary recovery technique, is expected to increase production by approximately 1 billion barrels. Seawater, processed at the treatment plant, is distributed via 21 kilometers of 40-inch-diameter pipe to the eastern injection plant and 18 kilometers of 36-inch-diameter pipe to the western injection plant. Operating the waterflood system increased employment at Prudhoe Bay by 42 persons per shift.

In addition to waterflooding and infilling, production was increased further when the world's largest gas-processing plant came on line. As much as 335 million cubic feet per day of miscible gas are injected through 42 injection wells to enhance production at 152 production wells. As much as 50,000 barrels per day of liquid natural gas can be comingled with the Prudhoe Bay crude oil and piped through the TAP (Oil and Gas Journal [OGJ], 1987).

4. Lisburne Field: The Lisburne Field lies under the Prudhoe Bay Unit. 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 call for a sixth platform to be placed offshore. However, this portion of the development requires an environmental impact statement (EIS) before the U.S. Army Corps of Engineers (COE) can make a decision on the necessary COE permit. Issues that need to be addressed in the EIS include the individual and cumulative effects relating to the loss of anadromous-fish habitat; hindrance to anadromous-fish migration; and changes in current and circulation patterns, water quality (temperature and salinity), and coastal processes (USDOD, Army COE, 1985).

ARCO constructed 80 kilometers of pipeline and drilled approximately 180 wells on 6 pads for an initial production rate of 100,000 barrels per day. Production began in December 1986. Three to 4 rigs are to be used for drilling between 1985 and 1991. From 100 to 240 persons would be employed during drilling, and about 1,000 persons were employed during construction. 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, Dames and Moore, and S. Braund and Assoc., 1985; Andrews, 1985, oral comm.). One drill site could be in the center of Prudhoe Bay; the North Slope Borough has given tentative approval of a 4-kilometer causeway for the offshore platform. NSB approval is contingent upon implementing an adequate fish-monitoring program and provision of a fish-enhancement program if the solid-fill causeway interferes with fish migration (Epler, 1985).

5. Kuparuk River Unit: The Kuparuk River oil field lies approximately 48 kilometers northwest of Prudhoe Bay. ARCO, the major shareholder, operates the unitized field for the 8 owner companies. Oil in place is estimated to range from 4 to 5 billion barrels. Total recoverable oil with a successful waterflood is estimated at 1.6 billion barrels. A waterflood-demonstration project began in 1983. The present rate of production--approximately 250,000 barrels per day--makes Kuparuk second only to Prudhoe Bay in U.S. daily production. By December 1984, 240 wells were drilled. A total of 800 wells

(including oil, gas, water, and injection wells) ultimately will be drilled. At full production, almost 500 persons will be employed 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 518-meter gravel airstrip. A bridge across the Kuparuk River connects the 150 kilometers of roads in the Kuparuk Unit to those of the PBU. Oil is transported through 668 kilometers of pipeline. Pipeline distance includes a 24-inch pipeline running 42 kilometers to the TAP. In 1984, the 24-inch pipeline replaced a 16-inch 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. 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 oil can be recovered by conventional methods; development would not occur until oil prices improve and became more stable (Anchorage Daily News, January 21, 1987). Spacing for each well was 2 hectares. In the future, wells would have 8-hectare spacing. If the field is developed fully, between 100,000 and 200,000 barrels per day could be produced; total production could reach 2 billion barrels. ARCO estimates that 15 to 25 billion barrels are in place, of which 20 percent ultimately may be recovered (Oil and Gas Journal [OGJ], 1984).

7. Endicott Development Project: In December 1984, the COE issued a permit under Section 10 of the River and Harbor Act of 1899 and Section 404 of the Clean Water Act to Standard for the Endicott Development Project. Work permitted includes construction of 2 gravel islands that are located approximately 4 kilometers offshore and 24 kilometers east of Prudhoe Bay; a 5-kilometer solid-fill gravel causeway connecting the 2 drilling islands; a 3-kilometer gravel causeway with 213 lineal meters of breaching extending from the Sagavanirktok (Sag) River Delta to the interisland causeway; a 2.5-kilometer gravel-causeway approach through the Sag Delta and a 14-kilometer gravel road through Sag Delta wetlands that connects with the existing Prudhoe Bay road system at Drill Site 9; elevated oil pipelines along the onshore road segments to TAP Pump Station No. 1; and an onshore disposal pit to contain drilling discharges determined to be unsuitable for offshore disposal.

Activities to date include the placement of approximately 5 million cubic meters to construct the two production islands, the 8-kilometer causeway, and 16 kilometers of onshore roadway and causeway. Gravel was hauled by 44 belly-dump trucks working 2 12-hour shifts at a rate of 32,824 to 34,351 cubic meters per day. Major activities completed in 1986 include the installation of the bridges for the breaches; construction of a base camp for 600 people, warehouse and office facilities, and the base operations center; installation of smaller modules (e.g., seawater-intake basin, utilities, fuel tanks, etc.); laying pipelines; development drilling (9 wells on the Main Production Island and 7 on the Satellite Island); and completing the final slope on the islands. In 1987, all 45 kilometers of pipeline should be completed and a dock constructed to receive the large modules scheduled to arrive in the 1987 sealift (Moon, 1985, 1986, oral comm.). Production should begin in 1987.

8. Milne Point Unit: Conoco operates Milne Point, an (approximately) 8,500-hectare 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 3 barges during the 1985 sealift. During periods of construction, approximately 300 persons reside in camp. Since development is proceeding in several phases, 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. An 18.5-kilometer, 14-inch pipeline was built from the Milne Point field to connect with the West Kuparuk pipeline and the TAP. Production from 24 wells located on 2 pads began in November 1985 at approximately 20,000 barrels a day. By December 1986, production had been suspended pending a rise in the price of oil. Recoverable reserves are estimated at 100 million barrels (Anchorage Daily News, Nov. 6, 1985; Hastings, 1986, oral comm.).

9. Red Dog Mine: The Red Dog Mine is located 87 kilometers from the Chukchi Sea and 145 kilometers north of Kotzebue. The seaport for the mine is located approximately 27 kilometers southeast of Kivalina. The road connecting these two points required two major agreements. The first was entered into by the State of Alaska, NANA (Northwest Arctic Native Association) Regional Corporation, and Cominco Alaska, Inc. This agreement dealt with financial arrangements for the construction of the transportation system. The second agreement was established by Congress and set the terms and conditions for a road easement through Cape Krusenstern National Monument. The following information is derived from a key data sheet prepared by Cominco Alaska, Inc., in June 1987.

Production is scheduled to begin in 1990 with 1.1 million metric tons. Full production at a rate of 1.9 million metric tons per year is expected to begin in 1993 and continue into the future. Variations in production after 1992 reflect different percentages of lead, zinc, and other mineral concentrates in the ore that is mined. The operating schedule for the mine indicates that two 10-hour shifts per day would operate 350 days per year. At full production, 5.5 thousand metric tons per day would be mined. The tailing-impoundment area will be about 2.4 million square meters and will have an embankment 46 meters high and 752 meters long at the crest. Fill volume will be 1.9 million cubic meters. Life of the field is estimated at 50 years.

The 84-kilometer road between the mine and the port facility is 9 meters wide, with passing lanes at 3-kilometer intervals. Nine bridges will be needed. Approximately a thousand metric tons of ore concentrate will be trucked per day to the port facility. Procedures have been established for curtailing truck traffic if caribou surveys--generally run in March, July, and September or October--indicate that caribou are migrating toward the road. When caribou are within 4.8 kilometers of the road, the road will be closed.

The port facility consists of a dock and causeway 40 meters wide and 60 meters long that extends into a water depth of 4 meters. Ore will be loaded from a dock that consists of 3 cells 23 meters in diameter that are filled and connected with a covered conveyer system and walkway. This dock will be about 210 meters long and extend to a water depth of 5.5 meters.

Although shipping the ore will occur only during open-water periods (approximately 120 days/year), port operations are expected to continue nearly year-round and around the clock, with 14 12-hour shifts occurring each week.

Mine facilities will consist of a primary crusher; primary, secondary, and tertiary grinders; lead- and zinc-flotation and dewatering facilities; a power plant; water-treatment plant; service facilities; and storage for concentrate at the mill site. These facilities encompass approximately 6,500 square meters. Accommodations are expected to encompass about 9,600 square meters.

Facilities at the port site will include living accommodations for 30, a power plant, storage building, desalination plant, sewage- and refuse-disposal system, truck-unloading shed, hopper and conveyer system to transport concentrates to storage, a 28,000-square-meter frame structure to store 455,000 metric tons of concentrates, conveyer system to the shiploader, mobile equipment for unloading mill supplies, and 4 diesel-fuel storage tanks.

NANA Regional Corporation--Cominco Alaska, Inc.'s, partner--will receive a minimum payment of $1 million a year at the onset of development and 4.5 percent of net smelter royalties once the mine is operating. When Cominco recovers its investment interest, NANA's income will increase to 25 percent of net smelter royalties. Each following year, NANA will receive an additional 5 percent of net smelter royalties until its share reaches 50 percent. Cominco also will provide vocational training so that the permanent work force at the mine eventually will be Inupiat.

EXPLORATION AND POTENTIAL DEVELOPMENT

10. Discovered Resources (Oil Fields, Gas Fields, and Mining): Possible new projects that are described in Maynard and Partch, Dames and Moore, and S. Braund and Associates (1985) primarily include oil reserves too viscous to produce and gas reserves. 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 11,000-hectare field, located north of the west operating area of the PBU, was unitized in 1979 and is still being evaluated. One well sited at the shoreline will be drilled in 1987. In the past, Conoco, Hamilton Brothers, Cities Service Company, and Mobil/Chevron have drilled approximately eight wells. A ninth well located just onshore was drilled in 1987.

Between 6 and 11 billion barrels of oil have been identified in the Ugnu reservoir, which lies in the northern part of the Kuparuk River and Milne Point Units. 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 reserves 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 billion cubic feet per day could be extracted for 25 years without substantially affecting the production of oil. Proven reserves total 28,183 trillion cubic feet. Estimates of gas reserves at Endicott indicate initial production could reach 250 million cubic feet 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; to date, 15 wells have been drilled. Although 350 million barrels of gas condensate have been estimated for the Point Thomson Unit, no announcements of field development have occurred (Van Dyke [State of Alaska, DNR], 1985, oral comm.). Production is contingent upon 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. Estimates reach 317 billion cubic feet.

Kemik, Kavik, and East Umiat Fields contain lesser accumulations. Kemik and Kavik could be commercial only if a gas pipeline were constructed adjacent to them. East Umiat is considered noncommercial.

Mining: Approximately 20 kilometers northwest of the Red Dog Mine (Project No. 9) is the Lik deposit, which contains at least 22 metric tons of lead-zinc ore. Once development of the Red Dog Mine opens the area for mining, this deposit could become economic to produce.

Along the Chukchi Sea coast from Cape Lisburne to Wainwright, especially near Cape Beaufort, coal and its development also is a potential source for cumulative effects in the North Slope. During 1984, a State-funded study of coal resources around Cape Beaufort and the Deadfall Syncline located approximately 6 miles east of the Chukchi Sea near Mormon Creek was conducted to determine if the reserves could be used as an economic replacement for the fuel oil currently being imported into communities, industries, and military installations along the northern and western coasts of Alaska. The coal deposit of the Deadfall Syncline located 10 kilometers from the Chukchi Sea and about 65 kilometers south of Point Lay was identified as the best source for this purpose. A detailed feasibility assessment was completed in 1986. Development of this resource has been recommended and awaits a commitment for funding (Arctic Slope Consulting Engineers, 1986).

11. Seal Island: Seal Island is constructed on a lease obtained by Shell during the Joint Federal-State Beaufort Sea Lease Sale held in 1979. Recovery of 300 million barrels of oil has been estimated from a discovery announced by Shell in January 1984. Shell would like to start producing about 100,000 barrels per day of oil, possibly by 1992. An oil discovery from Northstar 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 1985-1986 winter drilling season (Van Dyke [State of Alaska, DNR], 1987, oral comm.).

12. National Petroleum Reserve-Alaska: The NPR-A is administered by the U.S. Department of the Interior. Reserves are estimated at 6.4 billion barrels of

oil and 11 trillion cubic feet of gas; recoverable reserves are estimated at 1.85 billion barrels of oil and 3.74 trillion cubic feet of gas.

More than 90 wells have been drilled on the NPR-A (Schindler, 1983). Although none has proven commercial, the wells that have been drilled in Simpson Field (35 wells with an estimated 12 million barrels in place) and Umiat (11 wells with an estimated reserve of 66 million barrels) eventually may become commercial (Maynard and Partch, Dames and Moore, and S. Braund and Assoc., 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 the NPR-A. Two lease sales were held in 1982 in which the most promising areas were leased. Plans call for 1 lease sale a year for 5 years beginning July 20, 1983. However, no acreage was leased in 1984. Due to continued lack of industry interest, no sale has been held since 1984. Two areas have been deleted from lease-sale plans, removing approximately 3 percent of the estimated oil reserves. 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 salt-marsh 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 Brontosaurus Prospect about 48 kilometers south of Barrow, was plugged and abandoned.

13. 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 Environmental Impact Statement (FLEIS) on the potential effects of exploration and development on the coastal plain in April, 1987 (USDOI, FWS, 1987). The FLEIS analysis was based on a 250-kilometer pipeline that would extend from the easternmost development hypothesized in the ANWR to TAP Pump Station No. 1 (see Fig. 2 of FLEIS). The conditional, economically recoverable resource in the mean case was estimated at 3.2 billion barrels with a 19-percent probability of oil being present. Approximately 5,120 hectares, or 0.8 percent of the 1002 area, would be modified from its initial condition. Approximately 320 to 500 kilometers of all-season gravel roads within several oil fields and about 180 kilometers 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 FLEIS 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, 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 the ANILCA states that "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 the USDOI, the Kaktovik Inupiat Corporation, and the Arctic Slope Regional Corporation (ASRC). Through this exchange, the Native corporations received 37,232 hectares within the refuge. 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 the 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 kilometers of seismic lines were run over the course of 2 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.

14. Recent State of Alaska Arctic Lease Sales: Seven State sales were held in the mid-Beaufort area between May 1982 and February 1986. Approximately 3.4 million hectares were offered. Onshore acreage included the Prudhoe Bay and Kuparuk Uplands, the Colville River Delta, along the Northwest border of the ANWR, and in the now-defunct Mikkelsen Unit. Offshore tracts leased were off the Colville River Delta and in the vicinity of Flaxman Island and the Canning River.

Two wells were drilled in the Prudhoe Bay Uplands near the western boundary of the ANWR (Sale 34 acreage). Both wells were plugged and abandoned; no further drilling has been proposed. One other well was drilled in acreage leased in State Lease Sale 36.

15. Post-Sale Activity on Areas Leased in Previous OCS Sales in the Beaufort Sea: Three sales have been held for Beaufort Sea OCS oil and gas leases. The first 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. Finally, Sale 87 offered tracts between Barrow and Canada and generally out to the 200-meter isobath. Leases were awarded on 372 tracts totalling 786,617 hectares. Based on projections in the Beaufort Sea Sale 97 FEIS (USDOI, MMS,

1987a), oil reserves in the leased area are estimated to be 600 million barrels. In the 6 years following Sale 87, the drilling of 14 exploration wells is anticipated. Two platforms would be constructed for the production of oil, which would be pumped from 24 wells. The estimated 400 kilometers of pipeline are sufficient to transport oil from finds both east and west of the TAP. TAP capacity should be adequate for all oil coming from the North Slope. Production of natural gas in the Beaufort Sea, considered uneconomic at this time, may become economic in 20 years or more.

Most of the drilling from leases issued in the joint sale has been done on State tracts. Indeed, the Endicott Prospect (Project No. 7) is located on the State tracts. On Federal leases, two wells drilled at Beechy Point (Lease OCS-Y 0191) were determined to be producible and were plugged and abandoned. Two wells drilled from Tern Island (Leases OCS-Y 0195 and 0196) were determined to be producible and were temporarily abandoned. Results from a third well drilled on Lease OCS-Y 0197 will be available in 1987. Some wells drilled from Seal Island (Leases OCS-Y 0180 and 0181) also were determined to be producible (see Project No. 11) and have been abandoned temporarily.

Several wells have been drilled on leases issued in Sale 71. Both Mukluk (Lease OCS-Y 0334) (1 well drilled from a gravel island) and the Antares Prospect (Lease OCS-Y 0280) (2 wells drilled from the Concrete Island Drilling System [CIDS]) were determined to be nonproducible and were plugged and abandoned. Another well was drilled from the CIDS in 1985 on Lease OCS-Y 0804. Drilling of the Harvard Prospect, located north of Kuparuk on Lease OCS-Y 0370, was completed in 1985 from Sandpiper Island, a gravel island constructed in the winter of 1984-1985. A discovery was announced in February 1986, and a delineation well was begun on Lease OCS-Y 0371 (Anchorage Daily News, Feb. 26, 1986). In 1986, drilling on the Mars Prospect (Lease OCS-Y 0302) was undertaken from an ice island. Boundary modifications between State and Federal waters may affect jurisdiction over this prospect.

Drilling from blocks leased in Sale 87 began in the summer of 1985. Drilling on the Hammerhead Prospect (Lease OCS-Y 0849) north of the Canning River was completed in 1985. The drillship then was moved to the Corona Prospect (Lease OCS-Y 0871), located north of Camden Bay. The Corona Prospect was completed in the 1986 drilling season and the drillship was relocated to the Hammerhead Prospect where a second well was drilled. The Erik Prospect (Lease OCS-Y 0912), located northeast of Kaktovik, may be drilled in the future from the Kulluk, a conical drilling unit. Drilling for each of these prospects typically is supported by three ice-class vessels, as was done in 1985 and 1986 when 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 and perform tasks similar to the smaller vessels. The Belcher Prospect (Lease OCS-Y 0918), located near the Canadian border, is scheduled to be spudded from a drillship in August 1987. An exploration plan has been submitted for the Thorgisl Prospect (Leases OCS-Y 0903 and 0904) located between the Erik and Belcher Prospects. Near Harrison Bay, plans call for using the CIDS to drill two or more wells on the Orion Prospect (Lease OCS-Y 0804) located north of Cape Halkett. Northwest of Oliktok Point (Lease OCS-Y 0338), Tenneco used the Single Steel Drilling Caisson (SSDC) placed on a steel mat during the 1986-1987 season. (See Roberts, 1987, for a more complete description of activities that have occurred and are anticipated to occur on previously leased Federal tracts and blocks in the Beaufort Sea.)

16. Arctic Slope Regional Corporation (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 2 million hectares, both surface and subsurface estate, located in the northern part of the State. The ASRC lands are located principally to the west and south of the NPR-A boundaries. The ASRC has leased approximately half its acreage to various oil companies (Arctic Slope Consulting Engineers, 1985). ASRC lessees have drilled several exploratory wells to date; the most notable are the wells drilled in the ANWR (see Project No. 13) and Gubik, east of the NPR-A (see Project Nos. 6 and 10).

17. Canadian Beaufort Sea: In 1982, Dome Petroleum, Ltd; Esso Resources Canada, Ltd.; and Gulf Canada Resources, Inc., prepared a Beaufort Sea-Mackenzie Delta EIS. This description summarizes the information found in the Sale 87 FEIS (USDOI, MMS, 1984a), which was based on information from the Dome Petroleum, Ltd., et al. (1982) EIS; Alaska OCS Region Technical Paper No. 7 (Roberts and Tremont, 1982); and the Beaufort Bulletin (June 1983).

According to its EIS, Canadian industry anticipates that four offshore and three onshore reservoirs should be on line during the years of hydrocarbon production. For oil and gas exploration, delineation, production, and injection, 655 additional wells are expected. Between 1987 and 2000, the work force will increase gradually to approximately 8,500 persons. Construction of a gas pipeline between 1989 and 1992 could employ 10,000 persons and would peak in 1990. The figures used for the 1982 EIS for Canadian development are based on the confirmation of a commercial field by 1983 or 1984, production beginning as early as 1986 or 1987, minimum estimated reserves of between 6.3 and 32 billion barrels of oil, and a production rate of 700,000 barrels per day. Since then, resource estimates have been adjusted to 9.2 billion barrels and a production rate of 375,000 barrels per day (Hatter, 1984). Production will begin in 1987 but on a limited basis (see current status below). As a result, the dates used for the EIS should be adjusted by a minimum of 2 years into the future, and the level of activity should be reduced.

Options for the transportation system that were considered for full production include a tanker route through the Northwest Passage, an overland pipeline through the Mackenzie Valley, or a combined tanker-pipeline route.

Current Status: Drilling began in the 1960's. By 1985, over 150 wells had been drilled in the Canadian Arctic, both offshore and onshore. Most oil shows, however, have been offshore. Among the promising fields is Amauligak; with resource estimates of 700 to 800 million barrels, it is considered the cornerstone of commercial development. In 1988, the mobile arctic caisson, Molikpaq, will be used to produce oil from Amauligak on a seasonal basis. Shipments of 2.5 million barrels a year will be transported by shuttle tanker around Point Barrow to Pacific Rim nations. Construction for sustained production via pipeline should begin 4 years later (OGJ, 1987). Other finds in the area include Tuk J-29, Pitsiulak, and Nipterk (OGJ, 1985). Wells have been drilled from gravel islands, caisson-retained islands (Tarsiut), bottom-founded mobile units (Single-Steel Drilling Caisson and Mobil Arctic Caisson), and floating units (drillships and a conical drilling unit).

Tuktoyaktuk and McKinley Bay are the primary service bases. Additional facilities are on Hershel Island and have been proposed for King Point in the Yukon Territory. McKinley Bay's ship-repair facilities are adequate to service the entire range of vessels present in the Arctic (Evans, 1985, oral comm.).

FUTURE LEASE SALES

18. Future State of Alaska Leasing Offshore and Onshore: Eight 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, 1987). Offerings in the Beaufort Sea coastal area are considered to have moderate to high resource values. Offshore areas extend from Canada to Tangent Point just east of Dease Inlet. Onshore areas are in the Prudhoe Bay and Kuparuk Uplands, Colville River Delta, and foothills of the Brooks Range between Umiat and Anaktuvuk Pass.

The three sales on the 1986 sale schedule for acreage on the Chukchi Sea coast of the North Slope Borough (Sale 53 west of the NPR-A between Icy Cape and Cape Beaufort, Sale 58 submerged lands from the north end of Kasegaluk Lagoon to Cape Beaufort, and Sale 60 submerged lands north of Sale 58 to approximately 35 kilometers south of Barrow) were deleted from the 1987 sale schedule. Sale 45 (Kotzebue Sound) also was deleted from the schedule. However, if oil prices rebound, the State plans to reschedule the areas deferred from the 1987 lease-sale schedule.

19. Future Federal OCS Leasing:

a. Chukchi Sea: In the Proposed 5-Year OCS Oil and Gas Leasing Program for mid-1987 through mid-December 1992 (USDOI, MMS, 1987b), Sale 126 is scheduled for 1991. Activities that could ensue from a future lease sale in the Chukchi Sea would build on activities resulting from Sale 109. Because the entire planning area is being offerred in Sale 109, the assumptions for future sales in the area would be the same as for this sale (see Tables II-1 and II-3 of this EIS).

Of the 11.9 million hectares in the Chukchi Sea Planning Area, approximately half are considered to have appropriate geologic structures. Resources are estimated at 2.68 billion barrels, with the marginal probability of success of 20 percent. For the mean case, the hypotheses include the following: 20 exploration wells and 23 delineation wells would be drilled between 1989 and 1996, 9 production platforms would be placed in 1997 and 1998, and approximately 153 production wells would be drilled between 1997 and 1999. One shorebase would be built to support production. Transportation could be either by tanker or pipeline or a combination of the two.

b. Beaufort Sea: The Proposed 5-Year OCS Oil and Gas Leasing Program (USDOI, MMS, 1987b) has two lease sales scheduled for the Beaufort Sea--Sale 97 in 1988 and Sale 124 in 1991. The basic infrastructure established for Sale 87 (USDOI, MMS, 1984a) and Sale 97 (USDOI, MMS, 1987a) would be applicable to the future lease sales.

Assumptions used for Sale 97 include a peak annual production of 105 million barrels per year from four platforms. Production would occur between 1996 and 2011. During exploration and delineation (1985 through 1993), 52 wells would be drilled. A pipeline system linking offshore production to the TAP would be installed between 1990 and 1995. Onshore and offshore pipelines would each be 360 kilometers. Approximately 4,432 hectares would be disturbed during the laying of the offshore pipeline. A 360-kilometer road would parallel the onshore pipeline.

c. Hope Basin: The Proposed 5-Year OCS Oil and Gas Leasing Program (USDOI, MMS, 1987b) includes Hope Basin as a frontier-exploration sale to be held in 1992. The decision to initiate the lease-sale process will be made in light of responses to the Request for Interest. Hope Basin includes the area outside the State waters of Kotzebue Sound and extends west to the International Date Line. Hope Basin ajoins the Chukchi Sea lease-sale area to the north and the Norton Sound lease-sale area to the south. The conditional mean-resource estimate of economically recoverable oil in the Hope Basin is 145 million barrels.

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ALTERNATIVE-ENERGY SOURCES AS AN ALTERNATIVE TO THE OCS PROGRAM

A. Introduction

The oil and gas that could become available from the proposal could add to National domestic production. To delay or eliminate the proposed sale in part or in whole would reduce future OCS oil and gas production, necessitate escalated imports of oil and gas, and/or require the development of alternative-energy sources to replace the energy resources expected to be recovered if the proposed sale took place.

If the proposed sale were canceled, an additive effect of greater oil and gas deficits could be expected to result in increased imports; and the following energy actions or sources might be used as substitutes. (Some of these actions are not feasible at this time and may not be feasible during the estimated production life of the Beaufort Sea Planning Area.)

Imported Oil and Gas	See Section B of this appendix
Coal	See Section C
Coal Conversion to Synthetic Fuels	See Section D
Oil-Shale Conversion to Synthetic Fuels	See Section E
Biomass Conversion to Synthetic Fuels	See Section F
Domestic Onshore Oil and Gas	See Section G
Geothermal Power	See Section H
Solar Power	See Section I
Wind-Turbine Power	See Section J
Hydroelectric Power	See Section K
Nuclear Power	See Section L
Conservation	See Section M

This appendix briefly discusses these alternatives. For more detailed information on each of these energy sources and their respective environmental effects, refer to "Energy Alternatives: A Comparative Analysis" (University of Oklahoma, 1975), prepared for the Bureau of Land Management by the Science and Public Policy Program of the University of Oklahoma and the Proposed 5-Year Outer Continental Shelf Oil and Gas Leasing Program, Mid-1987 to Mid-1992 (USDOI, MMS, 1987).

B. Imported Oil and Gas

1. Background Considerations

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. Between 1948 and 1972, the real price of oil fell. U.S. consumption of oil simultaneously increased while production remained constant; imports were relied upon to make up the difference.

Two major shocks to the world oil market focused public attention on oil-supply issues. The 1973-1974 Arab oil embargo cut off Middle Eastern oil sources from unrestricted trade in world oil markets and resulted in escalation of oil prices from a pre-embargo world price of $7.74 per barrel in 1970

to a postembargo price of $24.40 in 1975. The world oil market received its second major jolt during the 1979-1980 Iranian revolution, which once again reduced oil-supply levels and accelerated prices to a 1980 world price of $42.36 per barrel.

In response to these events, the U.S. and the rest of the world instituted a wide variety of measures to conserve energy and to find alternative sources of supply. The results of these efforts to reduce imports generally have been successful. The underlying market structure for energy has been altered. World demand for oil peaked in 1977 and appears to be in a structural decline. Gross national products have been rising along with nonenergy output, alternative-energy sources, and non-OPEC (Organization of Petroleum Exporting Countries) production. The overall success for these measures was reflected by the 1984 decline in the world oil price to about $29.00 per barrel.

The inability of the OPEC to secure the cooperation of its members to reduce production and halt this price slide contributed to decisions by certain OPEC members to substantially increase production. During 1986, the combination of lower demand--initially brought about as a response to high OPEC pricing--and the decisions to increase rates of production resulted in very rapid declines in oil prices to levels that were inconceivable only months eariler. During 1986, world oil prices on the spot markets also frequently fell to levels well below $10.00 per barrel; by year's end, prices had increased modestly to approximately $15.00 per barrel.

2. Environmental Effects

The primary hazard to the environment from increased oil and gas imports is the possibility of oil spills, which can result from intentional or accidental (tanker casualties) discharges. For a more detailed discussion of the environmental effects from oil spills, see Section IV.A of this EIS.

Intentional discharges would result largely from uncontrolled deballasting of tankers. The effects of this 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. Further, even relatively small spills from tankering of imported oil can have major effects on sensitive coastal environments. For example, in less than one year, two spills occurred off San Francisco and generated serious effects on marine and coastal birds around the Farallon Islands National Marine Sanctuary and up and down the coast of California. Over 2,000 seabirds were killed by the Puerto Rican tanker spill, which contacted the Farallon Islands.

The assessment of cumulative effects in the Proposed 5-Year OCS Leasing Program (USDOI, MMS, 1987) includes the estimated mean number of oil spills associated with importing oil and refined products via tanker. The assumed frequency of tanker spills greater than 1,000 barrels was 1.3 spills per billion barrels transported. Further, only one-half of the 1.3 spills per billion barrels was assumed to occur in U.S. waters. The estimated most likely number of large oil spills from tankering of imported oil used in the cumulative case--based on estimated imports over a 30-year period--was equal to 61 spills of 1,000 barrels or greater. This compares with an estimated

most likely number of 157 spills from all sources (all past and future OCS leasing, all domestic and import tankering). Thus, oil spills associated with imports represent nearly 40 percent of all oil spills greater than 1,000 barrels over the 30-year period used in the assessment of cumulative effects.

3. Conclusions

Major oil spills from tankers could result in the most significant environmental effect associated with the use of imported oil. Additional major environmental concerns include effects from tanker spills that occur in sensitive areas that are otherwise protected from oil spills, e.g., the Farallon Islands; air-quality effects associated with tanker unloadings; and increased vessel traffic and port congestion.

C. Coal

1. Background Considerations

Coal is a combustible rock that contains more than 50 percent by weight and 70 percent by volume of carbonaceous material from the accumulation, and physical and chemical alteration, of vegetation. Classification of coal is based on chemical analysis and certain physical reactions that measure the progressive response of coal to heat and/or pressure. The analysis involves the determination of four constituents: (1) moisture, (2) mineral impurity (ash), (3) volatile material (gas/vapor), and (4) fixed carbon (solid residue after removal of the gases). Based upon these constituents, coal is ranked from low-ranked lignite through subbituminous and bituminous coal to high-ranked anthracite and meta-anthracite. Ninety-seven percent of the U.S. coal reserves are either bituminous (66%) or subbituminous (31%), with the remaining coal being anthracite.

Most of the bituminous coal produced in the U.S. is burned to obtain thermal energy for generating electricity, processing raw or manufactured material, and heating industrial complexes (see Tables H-1 and H-2). Other uses include gasification and liquefaction (see Secs. C.1 and C.2 of this appendix).

The total demonstrated U.S. reserve base is about 488 billion tons (Table H-3). The Federal Government manages about 60 percent of the coal resources within Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming. At the close of Fiscal Year 1983, 18 competitive and noncompetitive coal leases were issued covering 22,108 acres. As of September 30, 1982, 691 coal leases covering 1,288,310 acres were active (USDOI, 1984).

Coal showed a slight recovery in 1984 and 1985 after a series of setbacks due to the recession and the falling export market (Table H-2). Coal usage indicated an increase of coal consumption, particularly by the utilities and steel industries (Table H-1). Coal consumption was 791.3 million tons in 1984 and 818.6 million tons in 1985, and coal production was 898.9 million tons in 1984 and 886.1 million tons in 1985.

2. Environmental Effects

Numerous environmental effects can result from the mining and combustion of coal--land-disturbance effects of mining; reclamation procedures; acid-mine-

Table H-1
Coal Consumption by End-Use Sector
(million short tons)

Year	Electric Utilities	Coke Plants	Other Industrial	Residential and Commercial
1980	569.3	66.7	60.3	6.5
1981	596.8	61.0	67.4	7.4
1982	593.7	40.9	64.1	8.2
1983	625.2	37.0	66.0	8.4
1984	664.4	44.0	73.7	9.1
1985(a)	693.5	40.9	76.3	7.9

Source: Energy Information Administration, Annual Energy Review 1985, (a) Preliminary.

Table H-2
Coal Overview
(million short tons)

Year	Production	Consumption	Imports	Exports
1980	829.7	702.7	1.2	91.7
1981	823.8	732.6	1.0	112.5
1982	838.1	706.9	0.7	106.3
1983	784.9	736.7	1.3	77.8
1984	895.9	791.3	1.3	81.5
1985(a)	886.1	818.6	2.0	92.7

Source: Energy Information Administration, Annual Energy Review 1985, (a) Preliminary.

Table H-3
Demonstrated Reserve Base of the Major Coal Provinces in the United States

Province	Underground	Surface	Total
	Demonstrated reserves (in millions of tons)		
Appalachian	97,000	19,200	116,900
Interior	94,000	41,400	135,400
Western	140,900	95,200	236,000
	331,900	155,800	488,300

Source: Energy Information Administration, Annual Energy Review 1985.

drainage problems; problems of air pollution, including the local and global effects of sulfur oxides and carbon-dioxide emissions; and problems associated with transportation. While existing environmental problems related to the present coal-fuel cycle are likely to increase in scale, additional problems are likely to arise as new coal-gasification and -liquefaction plants begin operating. These new plants may be needed to offset the shortfall in availability of existing fuels if OCS oil and gas is reduced through delay or elimination, in part or whole, of the proposed OCS leasing program.

Coal can be mined by two methods--surface mining and underground mining. Surface-minable coal accounts for about 32 percent of the demonstrated coal reserves in the U.S. (Table H-3). Surface mining can result in effects on air, land, and water by creating conditions that promote water and wind erosion, destruction of topsoil, elimination of vegetation, and contamination of soil and water from weathering of toxic strata.

According to Federal Office of Surface Mining Final EIS (1980), surface mining of coal completely eliminates existing vegetation, destroys the genetic soil profile, displaces or destroys wildlife and wildlife habitat, degrades air quality in the area, alters the current land uses, and--to some extent--changes the general topography of the area being mined. Without diligent reclamation, surface-mined lands are often unsuitable for other uses.

The Department of Energy (DOE) Environmental Development Plan on Coal Extraction and Preparation (USDOE, 1979) reports significant water-quality degradation from former mining sites, with severe effects on aquatic ecosystems. Streams and reservoirs (primarily in the eastern U.S.) have been affected by sedimentation from surface mines, acid-mine drainage, and erosion of spoil piles from mining and coal cleaning and preparation.

Surface-mining effects on ground water include: (1) drainage of usable water from shallow aquifers, (2) lowering of the water table in adjacent areas and changes in flow direction within aquifers, (3) contamination of aquifers below mine operations from leakage of mine waters, and (4) increased infiltration of precipitation on spoil piles. The improper removal of overburden can cause the loss of topsoil and exposure of the parent material, and can create vast wastelands. The stockpiling of topsoil from the area can destroy or alter many of the natural soil characteristics.

Surface mining of coal causes indirect and direct effects on wildlife that come primarily from the removal and redistribution of the land surface. The area being surface mined (open pit) and the associated stockpiles are not capable of providing food or cover for wildlife. Without proper rehabilitation, the area must go through a weathering period and may require a few years to several decades before vegetation is re-established. Broad and long-lasting effects on wildlife within the area can occur from this alteration of the habitat.

Mechanical cleaning of coal also causes effects on land use. Although the amount of land required for disposal of coal-cleaning wastes varies with coal-extraction techniques and characteristics, National estimates range from 0.3 to 0.9 acres used per million tons of coal cleaned.

Underground mining of coal has the potential to result in subsidence, dropping of the water table, or interception of surface-water drainages. Subsidence is probable in most underground coal mining. Depending upon the degree of extraction, subsidence occurs immediately or at some future time. Subsidence may disrupt aquifers, damage surface facilities, and trigger mud slides or rock falls. In some cases, subsidence can lead to permanent loss of coal resources.

The health and safety of mine workers are major concerns associated with both surface and underground mining. Safety and health hazards to the workers, especially in underground mining, are the highest of any industry. Additional discussion on effects associated with coal development can be found in the Final EIS on the Proposed Federal Coal Leasing Program (USDOI, 1974).

Coal is transported by rail, truck, water, slurry pipeline, or conveyor belt. The environmental effects of coal transport occur during loading, while enroute, and during unloading. All forms of coal transport exhibit common environmental-effect factors. All forms use land for terminal/handling plants or for railroad installations or pipeline throughways. Rail transport and trucks cause damage to buildings, and trucking causes major structural damage to highways. Air pollutants and noise are emitted from engines powering the transportation facility. The transport of coal necessarily involves fugitive dust emission, which further affects the air quality.

Combustion of coal results in the emission of carbon dioxide, sulfur oxides, and nitrogen oxides, which contribute to the problems of acid rain and potential climatic warming (greenhouse effect). Acid rain is being recognized as a major environmental concern that adversely affects aquatic and terrestrial ecosystems. Many uncombusted or partially combusted carbon compounds, including known or potential mutagens and carcinogens such as polycyclic aromatic hydrocarbons are also emitted during coal combustion. These carbon-compound emissions are cause for ecological and human-health concerns.

3. Conclusions

The major environmental effects of expanding coal production include disruption of large areas of land surface with surface mines, additional acid-mine-drainage problems, and the greater air-quality effects associated with burning coal rather than natural gas or oil in power plants.

D. Coal Conversion to Synthetic Fuels

1. Background Considerations

Synthetic-fuel development has slowed down due to the sagging price of crude oil that resulted from a world surplus. Oil-price moderation, soaring costs, and lack of Federal assistance have led operators throughout the U.S. to shelve, delay, or abandon commercial synfuel ventures. Some operators have kept their projects in order to alleviate future depression of fossil fuels.

Coal can be converted to synthetic fuel by either gasification (synthetic gas) or liquefaction (synthetic liquid). These processes involve the breaking, or "cracking," of heavy hydrocarbon molecules into lighter molecules and the simultaneous enrichment of the molecules with hydrogen.

Water is required in both processes as a source of hydrogen and for other process steps (e.g., removing sulfur compounds and as a cooling component). In general, lower-quality coals (lignitic, subbituminous, and bituminous) are more efficiently converted to synthetic fuels than anthracite (Rickert and Ulman, 1979).

a. Coal Gasification

The coal-gasification process uses coal to produce gaseous fuel products that can be directly combusted in a boiler, used as chemical feedstock, or used as a product that can be converted into liquid fuels (see Sec. D.1.b of this appendix).

Three ingredients are required to chemically synthesize gas from coal--carbon, hydrogen, and oxygen. The synthesis is performed by reacting coal under sufficient heat with steam and air. Depending on combustion (air vs. pure oxygen), the gas produced is either a low-Btu (100-200 Btu's standard ft^3) or medium-Btu (300-650 Btu's) gas. The medium-Btu gas can be further processed by methanation to produce high-Btu (950-1,050 Btu's) gas (Bentz and Salmon, 1981).

Several types of gasifiers are commercially available for the production of low and medium Btu gas (Koppers - Tetzek, Winkler, and Lurgi). A detailed discussion on the chemical and design considerations, as well as a process description, can be found in "Environmental, Health, and Control Aspects of Coal Conversion: An Information Overview" (Braunstein and Copenhasier, 1977).

Coal gasification seems to be the leading commercial-scale synfuel project throughout the world. In the U.S., only 30 coal-to-synthetic-fuel projects were in operation in 1981. Of these, only 8 are commercial operations. The remainder are demonstration/pilot plants or process-development plants.

The state-of-the-art gasifier available for use in gasification of the highly caking eastern bituminous coal and other coals is an atmospheric Koppers-Totzek unit. The most advanced gasifier is the pressurized Texaco gasifier.

b. Gas Liquefaction

Coal can be liquefied by both direct and indirect processes. Indirect-liquefaction processes convert coal to liquid products by first gasifying coal to a mixture of carbon monoxide and hydrogen (synthetic gas) and then allowing these gases to react in the presence of a catalyst to form liquid products. In the direct-liquefaction process, a coal slurry is reacted directly with hydrogen in the presence of a catalyst, thus eliminating the step involving the indirect-liquefaction process. After hydrogeneration, the solids and liquids are separated. The residual solids are then burned in a gasifier to generate hydrogen and steam. The quality of the liquid can be either a boiler-fuel grade or a synthetic-crude grade.

The Fisher-Tropsch process, which converts synthetic gas to a liquid product, has been operating in South Africa's Sasol plants using a commercial gasifier (Lurgi). These facilities convert coal mined onsite into 27 different fuel and chemical products. The combined coal consumption of all three plants will be about 33 million metric tons per year. It is predicted that Sasol, Ltd., could produce sufficient quantities of hydrocarbon to make South Africa self-sufficient (Engineering and Mining Journal, November 1982). Four major direct-liquefaction processes are under development: Solvent Refined Coal (SRC) I and II, H-Coal, and Donor Solvent.

2. Environmental Effects

The major potential environmental, health, and socioeconomic problems related to coal conversion are terrestrial, air- and water-quality effects resulting from discharged effluents, air emissions, and solid-waste disposal associated with mining, transportation, and processing of the coal. (See Sec. C of this appendix for a discussion of the effects associated with the mining of coal to supply coal-gasification or liquefaction plants.)

In its EIS on Synthetic Fuels and the Environment - An Environmental and Regulatory Impact Analysis (USDOE, 1980), the DOE reports that substantial quantities of solid-waste material will be generated in each stage of the coal-conversion process. Waste material will be generated directly from the process that is part of the original feed, such as ash, unreacted carbon in the form of chars and tars, and fly ash from auxiliary boilers. Secondary wastes consist of added materials/chemicals, such as catalysts or coal conditioners, lime from scrubbers, and added reactants from water treatment.

There is concern for the health and safety of workers since many hazardous and toxic substances are formed and used in the synfuel process. Many substances are identified carcinogenic materials that can form in coal conversion, e.g., benzo(A)pyrene, dibenz(a,h)anthracene, chrysene, and 7-methylbenz(c)-acridine as well as aromatic amines (e.g., naphthylamine and benzidine) (USDOE, 1980).

Air-quality emissions from coal-conversion facilities can include sulfur oxides, particulate matter, nitrogen oxides, hydrocarbons, hydrogen sulfides, ammonia, hydrogen cyanide, polynuclear aromatic hydrocarbons, nitrogen and sulfur containing heterocyclic compounds, and trace elements. The appropriate use of existing available technology should control source emissions to levels in compliance with applicable current regulations.

Wastewater will result from numerous sources within the process. Standard treatment systems using flocculation and biodigestion should prevent water-quality problems.

3. Conclusions

The major environmental effects of expanding the use of coal in synthetic-fuel production include air-quality effects generated by synthetic-fuel plants, wastewater generated in the production of synthetic fuels, and concerns for the health and safety of workers in synthetic-fuel plants.

E. Oil-Shale Conversion to Synthetic Fuels

1. Background Considerations

The production of synthetic fuels from oil shale provides an alternative-energy source. Oil shale is a fine-grained, sedimentary rock containing material called kerogen. Kerogen is of high molecular weight and has low

solubility in any solvent. The only practical method of recovering hydrocarbons from the oil shale is by heating the rock to high temperatures (approximately 500°C) and thereby recovering shale oil and hydrocarbon gases--a process known as retorting. The retorting of oil shale can be achieved by (1) surface retorting, (2) in situ retorting, and (3) modified in situ retorting.

There are two methods for surface retorting of oil shale--the direct- and indirect-heat methods. In both cases, heat is required to bring about pyrolysis of the raw shale. In the direct-heated process, the heat is supplied by the creation of a combustion zone within the retort. In the indirect-heated processes, gases are circulated to an external reactor for combustion. Heat is transferred back to the retort by recirculating gases or solids through the retort and the external reactor.

In situ retorting refers to a process of retorting the shale in place, without the removal of any material. This eliminates the disposal problem associated with surface processing. In this process, the oil shale is fractured underground, after which heat is introduced to liquefy the kerogen. The produced oil is then removed through wells, utilizing natural permeability.

The modified in situ oil-shale process involves mining or removing up to 30 percent of the shale from the retort zone so that void volume is created and permeability is increased. The remaining oil shale in the retort is then explosively fractured and retorted in place. In the case of leached shale, the shale is not fractured; hot gas is injected as the retorting medium. Retorting can then be accomplished by moving the retorted oil either horizontally or vertically.

After retorting, the raw shale oil is processed to remove water and other contaminants by a separation system that typically consists of a closed-cycle processing unit, such as impingement or centrifugal separators, or mechanical demisters. The principal functions of the system are separation and recovery of oil or gaseous products from contaminants that include water produced in the retorting process as well as particulate material carried over the retort.

Following product recovery, crude shale oil requires further treatment to remove nitrogen, oxygen, and sulfur compounds and to reduce viscosity and pour points to allow pipeline or tanker transport. Removal of the nitrogen compounds requires a special refinery process.

Large areas of the western U.S. are known to contain oil-shale deposits; those in the Green River Formation in Colorado, Wyoming, and Utah have the greatest commercial potential. The oil-shale resources of the Green River Formation are estimated at 54 billion barrels of recoverable oil with an assay of 30 gallons per ton, and 600 billion barrels of reserves in place from shale with an assay exceeding 25 gallons per ton. Therefore, the Green River Formation represents 20 to 30 times the known reserves of conventional crude oil in the U.S.

Development in the U.S. shale industry is concentrated in Colorado's Piceance Basin, where approximately 85 percent of the western high-grade deposits are found (Rickert and Ulman, 1979). The oil-shale projects, in some cases, are funded or underwritten by the DOE. Several of the projects are experiencing

the effects of soaring costs, sagging oil prices, and delayed development. Many of the companies are extending their timetables and reducing production goals.

In the eastern U.S., the shale deposits underlie Indiana, Ohio, Illinois, Kentucky, Tennessee, Michigan, and Pennsylvania. The eastern shales are of a lower quality than the western shales, but the deposits are more extensive. The eastern shale has a poor carbon-hydrogen ratio and is therefore required to be retorted in the presence of hydrogen. In contrast, the western shale requires only the application of heat to release the oil.

There is an estimated 1 trillion barrels of recoverable reserves within U.S. deposits. The 1-trillion-barrel figure is based on hydrogen retorting rather than on Fischer assay (International Petroleum Encyclopedia, 1982).

2. Environmental Effects

The conversion of oil shale to synthetic fuels will have effects on air, land, and water quality. These effects are related to various air emissions, effluent discharges, and solid-waste disposal (spent shale from surface retorting).

Air-quality concerns relate to (1) the production of both criteria pollutants and (2) particulate matter and noncriteria pollutants associated with dust from mining and crushing of raw shale, and resuspension of disposed spent shale.

Control of particulates resulting from the production of oil shale can be a problem. For large surfaces at the mine, "wetting" or vegetation of the stock piles is an adequate control, whereas for more limited areas (e.g., conveyors and crushers), baghouse filters, scrubbers, and cyclones are used to control particulate emissions. Fugitive emissions due to traffic and wind are a potential problem and may require the use of chemical additives and best control-management practices.

Sulfur in raw-oil shale amounts to about 0.7 percent by weight, either as organic sulfur or associated with iron pyrite. During retorting, about 40 percent of the organic sulfur in shale appears as H_2S in the produced gases; and the other 60 percent appears as heavier sulfur compounds in the raw shale oil, spent shale, or water residuals. If shale oil or low-Btu gas from the retort is used for steam generation or any other combustion process, sulfur oxides will be formed and flue-gas-desulfurization scrubbers will need to be used for tail-gas cleanup.

The kerogen fraction of the raw shale can contain up to 2 percent of nitrogen. The extent of NO_x formation from the use of retort off-gases or shale oil to heat the retort will be related to flame-temperature-residence time and the air/fuel mixture. Combustion efficiency during oil-shale retorting is not expected to be a significant problem. HC and CO emissions will therefore be small. The low-Btu gas formed during retorting will either be flared or used for onsite steam production with traditional flue-gas-cleanup controls.

Water-resource effects encompass effluent control and water-supply issues. In the semiarid Piceance and Uinta geological basins in Colorado and Utah, where

most of the high-quality-oil-shale resource is found, water pumped from mines or drawn for process use is expected to be recycled or consumed. Effluent problems are focused on potential contamination of aquifers and surface waters by leaching from spent-shale piles, evaporative and lagoon concentrates, or burned-out in situ retorts, rather than from direct emissions. Problems with in situ processes concerning backflood water and fugitive-gas emissions may result in contamination of ground-water aquifers. Ground-water supplies and surface-water supplies fed by ground-water aquifers might be affected for very long periods of time, thereby creating difficulties in securing adequate water supplies for retort operation.

Wastewater from surface-retorting operations (up to 8 gallons/ton of input shale and more from some in situ operations) and process water from product-upgrading operations will have to be controlled. Wastewater can then be used for moisturizing spent shale. Under current planning, oil-shale developers envision zero discharge of their wastewaters.

Disposal of spent shale and storage of raw shale could create land disturbances of large magnitude, potential accumulation of toxic substances in vegetation, and contamination of ground waters and surface waters from runoff.

The DOE (1980) reports that retorted shale contains varying amounts of organic and inorganic residuals depending on the retorting process. It presents a major solid-waste-management and disposal problem for the surface and modified in situ operations from both the amount and its content. Retorted shale will have a density of about 75 to 100 pounds per cubic foot after compaction. This means that for every 50,000 barrels of surface-retorted shale oil produced, there will be enough spent shale to occupy a volume of almost 2 million cubic feet, or about a 2-foot depth over a square mile for every month of operation.

Above-ground-retorted shale from modified in situ operations would have considerably less solid waste for disposal. Large areas are required for the storage of raw shale and the disposal of retorted shale. The resulting potential loss of habitat for plant and animal communities and natural erosion of the disposal piles by wind and water may not be fully mitigated by vegetating or physically stabilizing the disposal piles. Problems and uncertainties related to the vegetation of retorted shale include water requirements, accumulation of toxic trace substances in the vegetation, and long-term stability.

Potential problems with stability of waste piles will require several years to emerge, and uncertainties will remain for 10 to 20 years. Spent shale can either be returned to the mine or stockpiled above, in which case it will be compacted and vegetated or otherwise stabilized to prevent erosion by wind or water. Dust control will be accomplished by application of water or chemical wetting agents. Surface-disposal options include filling valleys and recontouring surfaces. The major consideration is to ensure that the large quantities of spent shale can be economically disposed of with minimum environmental damage.

The occupational work force will be exposed to an environment largely uncharacterized in terms of industrial hygiene and safety analyses. The miners will be subject to exposure to possible toxic materials.

3. Conclusions

The major environmental effects of oil-shale development include: effects from disposal of spent shale, air-quality effects from dust and vehicle emissions, disruption of land, the large quantities of water needed in processing, and water-quality effects from wastewater disposal.

F. Biomass Conversion to Synthetic Fuels

1. Background Considerations

Biomass conversion is the process of transforming biomass (organic material) into usable energy sources. This conversion transforms the biomass into (1) liquid form (alcohol) or (2) methane gas.

A biomass-fueled gasification project that will convert peach pits into gas is planned for a greenhouse in Lodi, California. This is the first commercial application of an automated, small-scale, biomass-fueled gasifier in California (California Energy Commission, 1984). The gas produced will be used to supply heat to greenhouses. The system will result in a substantially reduced energy cost compared with the existing natural gas system. As a result, the growers will be able to expand their growing seasons, increase plant yield, and expand their market to include high-energy plants.

a. Ethanol and Methanol

Ethanol from grain is one of the alternative fuels that can be produced from a renewable resource. Ethanol can partially replace current transportation fuels derived from petroleum. Although ethanol can be produced from grain, 70 percent of the high-proof ethanol is made synthetically from ethylene gas derived from petroleum (USDOE, 1980).

Ethanol may also be derived from any carbohydrate source, such as starch in corn and other grains. The DOE (1980) reports that nearly 12 billion gallons of ethanol would be required to produce a National 10-percent alcohol/gasoline blend by the year 2000. Assuming an average yield of 100 bushels per acre and an ethanol yield of 2.5 gallons per bushel, this amount of alcohol would require 48 million additional acres of corn production.

Methanol production is based upon the gasification of wood to produce a medium-Btu gas followed by a chemical reaction to combine water and carbon monoxide to form hydrogen and carbon dioxide (see Sec. C of this appendix). Additional carbon monoxide is combined catalytically with hydrogen to produce methanol.

Forest residue--"slash" cuttings left behind after conventional logging, and stump/root systems--can be used to generate methanol. A recent assessment estimated that forest-industry waste (lumber and pulp mills) could serve as the major resource for methanol production.

b. Organic (Urban) Waste

The basic processes for converting urban waste to energy are combustion, pyrolysis, and bioconversion. Each process requires waste collection and

transportation. Some processes require mechanical preprocessing to separate the municipal solid waste into a refuse-derived fuel and other noncombustible and nonbiodegradable materials. Some of the noncombustible and nonbiodegradable materials such as ferrous metal, aluminum, and glass are recyclable.

Combustion of urban wastes in waterfall boilers is the most developed process, with eight plants commercially operating in U.S. cities. Urban-waste furnaces are being demonstrated at a facility processing 600 tons per day in Milwaukee, Wisconsin; and a 200-ton-per-day unit has been undergoing tests (joint Environmental Protection Agency [EPA] and DOE sponsorship) with 50-percent refuse-derived fuels at Ames, Iowa, since 1974.

Pyrolysis or thermal-gasification processes have been tested in Charleston, West Virginia; Baltimore, Maryland; and El Cajon, California. Municipal solid waste is decomposed in an oxygen-deficient atmosphere to produce combustible gas and liquids. Scrubbing is used to remove hydrochloric acid, hydrogen sulfide, and SO_2. Wastewater is a byproduct that requires treatment.

The bioconversion process for converting solid and liquid urban wastes into methane is in the research and early pilot-plant stages. The processes leave a waste-disposal problem in the form of liquid-digester residues, microorganisms, and inorganic nonbiodegradable material. A DOE-sponsored digestion plant at Pompano Beach, Florida, and the ANFLOW project are currently producing methane.

2. Environmental Effects

Biomass conversion to synthetic fuels, and its residual wastes, will have effects on water and air quality and on the land (erosion and nitrogen depletion of the soil). Additionally, the general public may be exposed to aesthetic problems--dust, noise, and odor.

Following is a description of the adverse effects on the ecosystem from biomass conversion.

a. Ethanol and Methanol

Growing corn for ethanol production requires large amounts of nitrogen. In order to prevent nitrogen loss in the soil, rotation of crops with legumes or the use of anhydrous ammonia would be required. The runoff and leaching of pesticides and fertilizers would accompany increased grain cultivation. This can have an adverse effect on the ecosystem and possibly on humans.

The loss of sediments due to erosion, as well as the leaching of salts, could cause a wide variety of effects on ecosystems and could cause a reduction in land productivity.

Extensive production of methanol from silviculture-biomass resources may disturb up to 50 percent (350 million acres) of current forest land. In addition to pollution effects, methanol production has the potential to cause severe ecosystem effects, such as the elimination of the range of certain species, elimination of threatened and endangered species, and elimination of specific ecotypes.

Silviculture-biomass production and residue-removal schemes have the potential to significantly increase air and water erosion of the soil. Erosion of the soil from cleared areas is fairly predictable and can be serious in areas of high rainfall and hilly topography.

Silviculture for methanol production should not contribute to air pollution as dusting does to farming. For a plant that would process 2,000 tons per day of green wood and produce 170,000 gallons per day of methanol, it has been estimated that 1,000 tons per day of CO_2 would be vented into the atmosphere (USDOE, 1980).

With the generation of methanol from wood using an estimate of 0.25-percent product loss to the air, 1.4 tons per day of hydrocarbons are estimated. The facility would also generate 0.44 ton per day of particulate emission from the grinding room. When grain starch is converted to alcohol by means of hydrolysis and fermentation, approximately equal weights of ethanol and carbon dioxide are formed in the process.

Residual wastes (solids remaining after the fermentation process) have been estimated for a 20-million-gallon-per-day ethanol plant. The amount of raw waste might range from approximately 12 to 55 gallons per gallon of product. The waste may contain contaminants equivalent to 0.12 to 0.17 pound of (5-day biochemical oxygen demand/gallon of ethanol product).

Approximately 0.5 pound of excess activated sludge can be expected for each pound of BOD_5 removed. Assuming that the raw waste contains 0.17 pound of BOD_5 per gallon of product ethanol, 95-percent removal corresponds to 961 tons of BOD_5 removed per 1,012 Btu's produced. Excess waste will amount to 480 tons per 1,012 Btu's.

For a 170,000-gallon-per-day methane plant with activated-sludge treatment, it has been estimated that 0.64 ton per day of BOD_5 would be produced along with 6 tons per day of waste-activated solids and 25 tons per day of ash and unburned carbon.

b. Organic (Urban) Waste

Waste-conversion processes greatly reduce municipal solid-waste volume but still leave waste residuals that go into landfills or impoundments. The chemical composition and source (domestic, industrial) of the municipal solid waste--leachability of fly and bottom ash, pyrolysis byproducts, scrubber sludge, and the anaerobic digestion sludge--is a concern. Selection of landfill sites and facility siting may be affected.

Effluents discharged at disposal sites (pits, ponds, lagoons) are likely to contain the same ingredients that are present in raw municipal waste and may pose a hazard to water resources and ecosystems.

Waste-plant, front-end processing, storage, and transport operations may pose an occupational hazard to workers. Data indicate that dust, micro-organisms, hazardous chemicals, and noise are all highest close to equipment for providing and storage of municipal solid waste.

Emissions from combustion and co-combustion facilities are known to contain fly ash, organic compounds, and trace elements and are a health-and-welfare concern.

The presence of combustible dust may create explosion hazards. These operations also expose the general public to aesthetic problems (dust, noise, and odor), which can result in siting problems. Traffic flow in the vicinity of the plant is also a concern.

3. Conclusions

The major environmental effects associated with expanded production of synthetic fuels generated from biomass include the land erosion associated with farming and silviculture water-quality effects associated with wastewater disposal, residual solid wastes, and air-quality effects--especially from burning urban waste for power generation.

G. Domestic Onshore Oil and Gas

1. Background Considerations

The Annual Energy Review 1985 estimated that onshore, undiscovered, recoverable oil resources ranged from 42 billion barrels (Bbbls) of oil with a 95-percent probability to 71 Bbbls with a 5-percent probability (mean resource of 55 Bbbls). Onshore, natural gas resources range from 320 trillion cubic feet (Tcf) of gas with a 95-percent probability to 570 Tcf of gas with a 5-percent probability (mean resource of 430 Tcf).

The major areas for oil and gas activities (exploration and development) in the U.S. are within three regions: the Rocky Mountain Region, the Mid-Continent, and the Eastern Overthrust Belt. According to the 1984 International Petroleum Encyclopedia, 7,914 new-field wildcat wells were completed during 1982, with 1,402 wells completed as producers--for a success rate of 17.72 percent. That compares with 17.67 percent producers in 1981 and a record 19.05 percent in 1980. The 1,402 new-field discoveries of 1982 represent a 1.5-percent decrease from 1981. The American Association of Petroleum Geologists estimated that 1982's new-field discoveries contained reserves of 651.64 million barrels of oil and condensate and 3.84 Tcf of gas--a decrease of 0.2 percent in liquids and 10.7 percent in gas from figures reported for 1981.

2. Environmental Effects

The environment can be affected by the different phases of oil and gas activity--exploration and development, and production. The environmental effects of onshore oil and gas are similar to those already described (see Secs. IV.A and IV.B of this EIS). These include physical, biological, and socioeconomic effects resulting from drilling activities, transportation, and processing of the oil and gas.

In the exploratory phase, two activities--off-road-vehicle traffic and exploratory techniques--would have an effect on wildlife populations and habitats. Noise from heavy-duty exploratory vehicles and associated human involvement would adversely affect wildlife, particularly ground-nesting birds, reptiles, and burrowing animals. Seismic exploration utilizes explosives, thumpers, and vibrators to test for oil and gas resources. These techniques disturb wildlife by disrupting their habitat and creating loud, sudden noise.

Off-road vehicles, seismic activity, drilling of test wells, excavation of construction materials (sand and gravel), and building of service roads and drilling pads cause soil particles to become unconsolidated and increase the soil's susceptibility to wind and water erosion. The disposal of drilling muds and dumping of waste oil in sump pits would contaminate soils in the area of drilling sites.

In areas where unstable soils are located and the potential for natural revegetation is low, such activities can cause long-range effects on surface-water quality, increase erosion, and decrease wildlife habitat and vegetative cover. Accidents such as fires, explosions, well blowouts, spills, and leaks can lead to major contamination and higher temperatures for surface waters when oil enters streams, ponds, or lakes, and to adverse effects on terrestrial vegetation.

Oil and gas activity can cause degradation of water quality and reduction of water supplies. During exploration, water supplies can be lost or reduced from seismic testing, stratigraphic testing, and wildcat drilling. During exploration, the ground-water hydrology can be altered from the fracturing of impermeable zones below aquifers, permitting the water resources to be lost or reduced through vertical drainage. Well drilling can also require large quantities of water, especially if porous and permeable formations are encountered. Oil spills and/or leaks, blowouts, and spills or leaks of caustic, salty, or polluted water can cause adverse effects.

During the development and production phase, the removal and handling of water from producing wells and separation facilities can cause further degradation of surface-water quality. Upon abandonment of a producing oil field, those facilities that contain residual oil, brine waste, or solid wastes may cause further water pollution. Batteries, tanks, sumps, and pipelines may deteriorate and release pollutants into adjacent surface and ground waters.

Injection of additional waters into a producing well may become necessary during the production phase to obtain additional oil production through flooding with massive amounts of water. This may be either fresh or produced (brackish) water. Such production techniques generally require additional water resources and deplete the availability of ground-water supplies.

3. Conclusions

The major environmental effects associated with expanded production of onshore oil and gas resources include effects on pristine areas from roads; off-road-vehicle traffic; and other oil and gas infrastructure that generates loss of natural vegetation and erosion, effects on air quality, and effects on water quality.

H. Geothermal Power

1. Background Considerations

Geothermal energy is the heat contained in and continuously flowing from the earth. Today, it is proving to be a viable source of energy for the generation of electricity and space heating. There are four different types of high-grade geothermal reservoirs that may be exploitable--(1) the hyperthermal system, (2) the geopressured system, (3) the molten-rock system, and (4) the hot-dry-rock system. At the present time, only the hyperthermal system is viable.

The hyperthermal systems that are being exploited around the world have extremely high temperatures (500-600°F) and often occur at depth (frequently 2 miles). All occur in hot, fractured rock with a high water content. This water serves as a heat-exchange medium that flows into the boreholes. The heat is then carried to the surface and to the electrical-generating turbines. The pressure of the overlying rock and water generally keeps the water in the reservoir in a liquid state, even when temperatures are far above the liquid's boiling point. However, as the drill bit penetrates the cap rock of the reservoir, the pressure is relieved and the contained water flashes to steam. A few reservoirs such as those found at the Geysers, California, and Lardarello, Italy, consist of superheated, high-pressure steam.

The largest geothermal development is underway at the Geysers Geothermal Field in California's Sonoma and Lake Counties, located about 90 miles north of San Francisco. The field yields almost 750,000 kilowatts of installed electrical-generating capacity. Plans presently call for an additional 220,000 kilowatts of capacity. Predictions are that full development in the Geysers Field will account for about 2 million kilowatts of generating capacity by the end of the decade (International Petroleum Encyclopedia, 1982). Pacific Gas and Electric Company's complex of 17 geothermal power plants at the Geysers produced a record 6 billion kilowatt-hours of electricity in 1983 (California Energy Update, August 8, 1984). See Table H-4 for annual U.S. production of electricity from geothermal sources.

Another development program is underway in southern California's Imperial Valley. The geothermal resources present would generate more than 3 million kilowatts of electrical-power capacity. A second prospect, Heber, in the Imperial Valley, contains enough geothermal energy to provide a capacity of 500,000 kilowatts for at least 30 years (International Petroleum Encyclopedia, 1982).

Utah Power and Light has proposed a 20,000-kilowatt electrical-power-generating plant fueled by geothermal energy from Roosevelt Hot Springs, in southwest Utah. Phillips Petroleum has also entered into a commercial geothermal venture at Roosevelt Hot Springs. The Roosevelt prospect is thought to be capable of supporting 200,000 to 400,000 kilowatts of power capacity. Other areas of potential development include the Jemez Mountains in New Mexico, Dixie Valley in Nevada, and Desert Peak in California.

2. Environmental Effects

Environmental effects from the development of geothermal resources vary depending upon the pre- and postlease exploration and development activities,

Table H-4
Production of Electricity from Geothermal Sources

Year	Net Summer Capacity On-Line (thousand kilowatts)	Production (million kilowatt-hours)
1979	667	3,889
1980	909	5,073
1981	909	5,686
1982	1,022	4,843
1983	1,207	6,075
1984	1,231	7,741
1985	1,590	9,325

Source: Energy Information Administration, Annual Energy Review 1985.

and the nature of the geothermal find. The chief effect from the use of geothermal power occurs during the period of development of the field and construction of the steam-gathering lines and power plants. Natural steam does contain a small percentage of noncondensable gases, including hydrogen-sulfide and methane, that are vented to the air and that may affect air quality. Impurities in the water released from the development of geothermal energy also may affect water quality in the area.

Any effects of geothermal development upon climate will be localized and should not affect regional patterns. Local temperature patterns will change by several degrees due to waste heat emitted from the power plants, particularly from the cooling towers.

According to Department of Interior (1980) Final EIS for Proposed Leasing within the COSO Known Geothermal Resource Area, the principal gaseous emissions associated with geothermal development are the noncondensable gases hydrogen sulfide (H_2S) and carbon dioxide (CO_2), and water vapor from flow testing and from cooling towers. In addition, fugitive dust will be emitted into the atmosphere as a result of construction and vehicle activity and by wind erosion.

Noise effects can result from direct geothermal activities such as well drilling and power-plant operation, and from related activities such as automobile and truck traffic. Noise can also result from developmental operations, during preparation and construction of well pads and power plants. Further noise effects are likely to occur during drilling, cleanout, and flow testing of new wells; noise associated with these activities is short-term.

The operation of the power plant represents the major long-term, continuous noise source resulting from geothermal development. Major contributors to the noise include cooling towers, turbines, and stream-jet ejectors. The cooling towers, which are physically large and have a large-band-frequency spectrum, become the dominant noise source at distances greater than 200 feet from the unit.

Subsidence and seismic activities may be accentuated during the production phase. The potential for subsidence is greatest in hot-water systems produced from unconsolidated sediment. Since the majority of geothermal systems are in more competent rock, they are not subject to large amounts of subsidence. Geothermal systems are often found in areas of seismic activity. Possible fault movements can result from the removal and reinjection of fluids causing cyclic variations in reservoir pressures.

Geothermal development requires cooling water, which could displace other uses or degrade other supplies. It also produces enormous amounts of liquid waste requiring disposal. Exploration and well drilling and construction of development facilities can cause short-term effects of surface erosion and drilling-waste disposal. This could cause alteration of surface runoff and erosion patterns, sediment yield, and ground-water degradation. The development and production of geothermal energy could lower the water table. Degradation of the natural water could locally reduce the temperature of the fluids, causing mineral precipitation and/or depletion of the geothermal reservoir.

The amount of land used and altered ranges from zero in the very earliest stages of exploration to many tens of acres in a field that has undergone fuel-stage development. Surface-disturbing activities generally are (1) road building; (2) drill-pad, power-line, and/or other facility-site construction; and (3) construction and clearance of pipelines and transmission facilities.

Effects on wildlife could result due to increased vehicular traffic, drilling activities, removal of wildlife habitat, and noise associated with construction and production activities.

Recreational uses would be affected by noise, dust, traffic conflicts, or physical displacement from specific recreation-use areas. Public-safety concerns could restrict recreational use of an area until drilling operations ceased. Geothermal development could modify the landscape character of an area if striking contrasts occurred in form, line, color, or texture of landscape features.

3. Conclusions

The major environmental effects generated by increased use of geothermal resources include the considerable noise associated with the operation of many geothermal-power plants, air-quality effects, development pressures in pristine areas, and water-quality effects.

I. Solar Power

1. Background Considerations

The sun is the earth's most abundant source of energy. Only an infinitesimal fraction of the sun's radiant energy strikes the earth. It is estimated that about 180 trillion kilowatts of electricity--more than 25,000 times the world's present industrial-power capacity--is received. However, this energy requires conversion to a suitable form.

Solar energy can be captured either directly through rooftop collectors, photovoltaic cells, and building-design features or indirectly through storage of solar energy in nature. In comparison to producing energy from conventional fuels, direct solar energy is relatively clean and pollution-free.

Solar systems convert the sun's radiation into energy for heating and air conditioning by means of absorptive coolers, industrial-process heat, and electricity generation. Photovoltaic cells convert sunlight directly into electricity, although the relatively low conversion efficiency requires large collector areas. Another method of utilizing solar power is solar thermal, wherein the sun's rays are directed by mirrors to a central point and are then capable of being used as the heating source for a thermal-power plant. There are four different solar-thermal systems that have different temperature ranges, applications, and types of collectors: (1) solar pond, 140-180°F; (2) flat plate, 100-250°F; (3) parabolic concentrating, 300-1,500°F; and (4) heliostats, 500-2,000°F. Much of the recent work in solar-energy production has focused on reducing the manufacturing costs of solar collectors, improving their efficiencies and reliabilities, and simplifying their design and installation.

Solar technologies will require more land per unit of capacity than will conventional-energy systems due to the diffuse nature of the solar resource and the generally low efficiencies of solar devices. If the facility is to provide process steam to an industry or utility, the collectors must be in close proximity to the point of end use. If the plant is electricity generating, it must give a clear access for an electrical interconnection with the local-utility-grid network. The amount of available solar radiation at a specific geographic location dictates the number and size of the collectors required. The amount of available solar radiation can vary dramatically from site to site. Table H-5 gives an estimate of the collector-area-to-land-area ratios.

Legal right to the sun is an important aspect of solar power. Height of structures, trees, or land features on adjacent land--especially on the south side--is important because of potential shading of the collectors. Sheahan (1981) reports the recommendation that there be an uninterrupted view of the south down to an angle of 10 degrees above the horizon and clear to the southwest and the southeast, to the point where the sun rises and sets on the summer solstice. This area may need to be controlled through legal restrictions or land acquisition.

Land surfaces need to be as flat as possible with grades not exceeding 10 percent. If the land is contoured, more spacing would be required due to potential shading from collectors on the higher ground.

Areas with excessive wind would need to be avoided, since windblown sand and dirt would erode mirrored collector surfaces. Similarly, high wind could cause structural damage to the sail-like collectors. Hailstones and heavy snowfalls could also damage the collectors. In addition, adjacent industrial facilities may give off air emissions that could erode mirrored collector surfaces.

2. Environmental Effects

The major environmental effect of solar-energy-conversion systems results from the relatively large surface area required for the collectors and from disruptions that occur during development. During the manufacture of photovoltaic cells, minimal air-quality effects would result, with some water-quality degradation occurring due to discharge of waste-rinse solutions. Other effects from solar-energy development include cooling-water (aquatic-thermal-pollution) requirements, height requirements for a solar-power tower, and heat and light-beam intensity from mirror collectors.

Solar energy will not contribute to air pollution except during the production of solar equipment or during the cleaning of the mirrors. Increasing solar use will cut emissions of particulates, hydrocarbons, sulfur oxides, carbon monoxides, and nitrogen oxides. At the same time, solar systems will not increase atmospheric carbon-dioxide levels that could cause major changes in global climate.

Some solar-thermal electric plants with once-through cooling could have significant water requirements. Leakage and disposal of antifreeze and anticorrosion fluids from solar heating and hot-water systems could produce a minor water-pollution problem.

Table H-5
Solar Energy Collector to Land Ratios

Collector	Collector Area	Land Area
Solar Pond	1.0	1.0
Flat Plate	1.0	2.0-2.2
Photovoltaic Array	1.0	2.0-2.2
Parabolic Trough	1.0	2.2-2.4
Parabolic Dish	1.0	3.4-3.8
Heliostats	1.0	3.0-3.8

Source: Sheahan, 1981.

The height of a solar-power tower is significant and could be potentially as high as 1,000 feet for a 100-megawatt plant. Therefore, if a solar-plant site is proposed in proximity to an airport or major airline route, special precautions are required.

The solar reflections from heliostats and parabolic collectors can be very intense, and special precautions must be taken when working in the area of operating collectors. The solar beam with an intensity of approximately 70 heliostats in Albuquerque, New Mexico, melted through a one-quarter-inch steel plate in 2 minutes. Therefore, cleaning and maintaining the mirrored surfaces must be a nighttime procedure.

Biological resources can be affected during the installation and development stages. There also are many possible effects from support activities, such as road building to provide access to the solar sites, development of electric-feeder and transmission lines, and construction and maintenance of substations. Immediate habitat loss due to solar-energy development would occur during the construction of roads, solar plant, substations, and power-distribution and transmission lines. Other indirect effects include increased human activity, noise and visual disturbance, and subtle habitat changes, such as the invasion of new plant species in disturbed areas.

3. Conclusions

The major environmental effects generated by increased use of solar-energy production include use of the major land areas needed for reflectors or heliostats with attendant loss of wildlife habitat; intense reflections from heliostats; and air- and water-quality effects associated with the manufacture of solar equipment. However, operation of solar-energy-production facilities does not cause air- or water-quality effects.

J. Wind-Turbine Power

1. Background Considerations

Wind has been used as an energy source for centuries. Historians believe that the earliest wind machines probably were primitive devices used to grind grain in Persia around 200 B.C. Manufacturers presently are producing small wind machines (less than 100 kilowatts) to be used in homes, farms, factories, and small businesses. Although the home market for wind turbines is growing rapidly, energy experts say that the type of wind technology most beneficial to the Nation will be the large turbines that feed electricity to the utilities. Several utilities are experimenting with wind power.

A wind turbine needs a supply of wind in order to operate. The velocity, direction, and time (frequency and duration) of the wind would need to be calculated prior to site selection. Potential obstructions such as buildings, vegetation, and other wind turbines can affect the supply of wind to a wind turbine in two ways--the velocity can be altered, and the turbulence can be increased.

A decrease in velocity means that reduced energy output and an increase in turbulence may also reduce the energy output and, perhaps more critically, reduce the useful life of the turbine. Buildings and vegetation are more of a problem with small machines and with machines in urban areas. The only man-made structure in rural areas that would affect wind turbines is another wind turbine.

Southern California Edison's 10-year resource plan calls for generation of 2,100 megawatts of power from renewable resources by 1990. Wind turbines could contribute almost 7 percent of these needs and provide 1.226 trillion kilowatt hours on an annual basis (USDOI, 1982). Southern California Edison is targeting 360,000 kilowatts of wind-generated power by 1990 (International Petroleum Encyclopedia, 1982).

International Petroleum Encyclopedia (1982) reports that the Pacific Gas and Electric Company (PG&E) signed a contract with Windfarms, Ltd., of San Francisco to buy most of the 360,000 kilowatts to be generated. This project will entail installation of 146 wind turbines at a cost of about $700 million. When completed in 1989, it could yield as much as 963 million kilowatt-hours of electricity.

PG&E also plans to purchase all the electricity to be generated by a wind park to be built by U.S. Windpower of Burlington, Massachusetts. The project involves installation of 600 horizontal-axis wind turbines at an estimated cost of $60 million.

California Energy Update (August 8, 1984) reports that wind-project developers within California are announcing and installing record numbers of wind turbines. Over 2,400 wind turbines totaling more than 250 megawatts have been approved by zoning commissions and planning councils or announced by project developers. Major permitted wind-turbine projects include Altamont Pass, a total of 7,626 wind turbines; San Gorgonio Pass, a total of 1,352 wind turbines; and Tehachapi, 280 wind turbines. A total of 2,400 turbines have already been erected at Altamont Pass.

2. Environmental Effects

The primary environmental effects that would result from wind-turbine-energy production include adverse ecological effects from site development and presence of the structures, noise levels, interference with television reception, and potential recreational and visual conflicts.

Biological resources can be affected by many stages of wind-energy development, including initial material acquisition and processing, turbine production and assembly, and turbine installation and operation. There are also many possible effects from support activities, such as road building to provide access to turbine sites, development of electric-feeder and transmission lines, and construction and maintenance of substations. Other indirect effects include increased human activity, noise and visual disturbance, and subtle habitat changes, such as the invasion of new plant species in disturbed areas.

The USDOI (1982) reports that the direct effects of wind-energy development on biological resources include two main categories: (1) loss of animals through surface disturbance at turbine sites and in road and along powerline rights-of-way; and (2) at substation sites, disturbance of animal behavior through interference with courtship, rearing of the young, feeding, and other necessary aspects of animal-life histories.

Wildlife activity would decrease significantly in the immediate construction area or facility site, and animal habitats near development will often be deserted. If associated long-term indirect effects are high, the developed area may be permanently abandoned. Such indirect effects include immediate habitat loss as well as long-term, cumulative habitat deterioration.

The potential exists for low incident rates of collision between birds and wind-turbine generators. Placement of large turbines along ridge tops may affect the behavior of large soaring birds that utilize air currents deflected upwards by the terrain as a source of lift. Certain species, including small mammals and lizards, would be very vulnerable to crushing and other direct effects from construction of the turbines and roads.

Noise effects can result from the construction of the wind turbines by earth-moving equipment and increased traffic on local roads and highways in the study area. There are a number of potential noise sources from wind-turbine operations. Noise would be generated from the operation of the generator, the transformer, and the gearbox, and from the wind-turbine blades. The turbine blades would be the predominant noise source in the far-field of the wind turbine. The other noise sources would generally be discernible only in the near-field of the wind turbine.

Noise would be generated from a number of phenomena associated with wind-turbine-blade interaction with the air. The primary causes of noise are (1) fluctuating lift resulting from the interaction of the blades with the atmospheric turbulence of the wind, (2) interaction of the blade turbulent-boundary layer with the trailing edge of the blade, (3) direct acoustic radiation from the turbulent-boundary layer, (4) direct acoustic radiation from the wakes of the blades, and (5) interaction of the tower wake with the turbine blades on wind turbines where the blades are downwind of the tower. Of these causes, the first two are the dominant causes of noise. Noise associated with the operation of the wind turbines has become an increasing concern with residents in the area of the wind park.

Placement of the turbines in an area can cause a reduction in the area's suitability for recreational and other land uses. Conflicts have arisen due to the potential placement of wind parks in areas designed for wilderness review, and in areas of highly concentrated archaeological resources. Wind turbines are highly visible because of their height. Wind development in an area would have a significant visual effect on the character of the existing landscape. Visual aesthetic effects would result from removal of vegetation; soil disturbances associated with construction of wind-tower pads, access and service roads, electrical-transmission lines; and introduction of a variety of wind-turbine structures.

Wind and water erosion are likely to result from the construction of wind farms in an arid environment. Localized desert-pavement development would occur as a result of construction. This could result in a worsening of flood-hazard potential and downstream-sediment deposition. Changes in natural drainage courses could also increase channel erosion.

Wind turbines may interfere with television reception by causing visual distortions. Sengupta et al. (1980) report that interference to television reception is caused by the scattering of television signals by the wind

turbines. In the vicinity of an appropriately oriented wind turbine, a television receiver will receive the scattered signals in addition to the direct signal. The scattering by the rotating blades of the wind turbine will produce both amplitude and phase modulations of the signals at the receiver. Since video information in television signals is transmitted by amplitude modulation, any extraneous amplitude modulation will, if sufficiently strong, distort the video reception.

The upper ultra-high-frequency channels are found to be particularly vulnerable to such distortions. For a given television channel, the maximum distance from the wind turbine at which adverse interference may occur is a function of the wind-turbine-blade dimensions and orientations and the receiving-antenna characteristics. The size of the interference decreases as the television-channel number is decreased.

3. Conclusions

Expanding the generation of electricity with wind power would cause the following major environmental effects: disturbance of sizable areas with thousands of giant windmills disrupting existing uses and affecting wildlife, visual impacts, considerable noise generated by the operation of windmills, and wind turbines interfering with television reception.

K. Hydroelectric Power

1. Background Considerations

Hydroelectric sites operating today were developed in the early 1950's. The total developed and undeveloped hydroelectric power in the U.S. is 6.75 trillion kilowatt hours (see Table H-6).

a. Hydroelectric Dams

Conventional hydroelectric developments convert the energy of naturally regulated streamflows to produce electric power. The construction of a dam for hydroelectric power interrupts the flow of a river, creating a lake or reservoir behind the dam. This alters the physically unstable riverine ecosystem and shifts it into a relatively stable lacustrine ecosystem.

PG&E's 65 hydroelectric plants produced three times more energy in 1983 (almost 18.1 billion kilowatt-hours) than in 1982. In addition to production from its own hydro plants, PG&E purchased 24.5 billion kilowatt-hours of economical hydro power produced mainly in the Pacific Northwest. Hydroelectric power accounted for 59 percent of the electricity available to PG&E customers in 1983.

b. Pumped-Storage Projects

Pumped-storage projects generate electric power by releasing water from an upper pool 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 off-peak, low-value energy to high-value, peak energy. To meet peak-load requirements, power companies have been utilizing pumped-storage hydroelectric stations to a greater degree. There are many

Table H-6
Hydroelectric Power in the United States - Total Potential

Geographic Division	Average Annual Generation (1,000 kilowatt hours)
New England	13,589,232
Middle Atlantic	37,763,815
East North Central	9,779,997
West North Central	17,645,343
South Atlantic	34,324,480
East South Central	27,879,762
West South Central	10,585,090
Mountain	97,658,028
Pacific	249,284,546
Alaska	176,290,145
Hawaii	333,400
Total - United States	675,133,838

Source: Federal Power Commission, 1976.

advantages to pumped-storage hydroelectric power, which increases the number of sites acceptable for construction of dams whose primary purpose is to supply peak-power needs.

Relatively small streamflows can support large generating capacities, since water is stored and a portion of it can be reused. The pumped-storage plant also does not require a large stream in a deep, natural valley.

PG&E announced in 1984 that the Helms Pumped-Storage Project, the largest hydroelectric plant in its 65-plant hydro system, had begun commercial operation. Located about 50 miles east of Fresno, California, the plant produces electricity during peak hours by drawing water from the Courtright Reservoir. Once the water passes through the hydraulic-turbine generator, it is released into Wishon Reservoir. The units are then reversed and the water is pumped back up to the Courtright Reservoir for use during the next peak period. Each of the three units at the Helms Project is capable of generating 402,000 kilowatts (California Energy Update, July 1984), and total capacity would be approximately 1.2 million kilowatts. This makes any one of the units among the largest reversible hydroelectric systems in the world.

2. Environmental Effects

The generation of hydroelectric power causes a variety of environmental effects. The following information describes effects resulting from hydroelectric dams and pumped-storage projects.

a. Hydroelectic Dams

Construction of a dam represents an irreversible commitment of the land resources beneath the newly created lake. Flooding eliminates wildlife habitat and prevents uses such as agriculture, mining, and some recreational activities. The interruption of the river's flow, even if only temporarily eliminated during the period required for the reservoir filling, can affect the flora and fauna downstream. However, with the construction of a dam, new water-related recreational facilities will be generated.

Changes in the hydrologic system resulting from the construction and operation of a hydroelectric dam are physical but can directly and indirectly bring about changes in all the dependent biological and human systems.

With the construction of a dam, the relative stabilization of the water level in the basin would affect the volume of discharge and current velocity downstream, thereby affecting the energy flow of the ecosystem. Increased input to ground-water supplies could result in possible benefits to distant aquifers. In comparison to the previous riverine ecosystem, reduction in turbidity through settling of sediments and possibly from the reduction of erosion in the new lake could result. Furthermore, probable reduction of turbidity downstream may also reflect settling (basin action) of the reservoir, in addition to benefits of stabilized water flow through the system. An increase in basin evaporation loss could occur due to (1) the existence of a large open body of water and (2) increased evapotranspiration of emergent aquatic plants.

A change of water chemistry would be detectable within the reservoir, and in some cases would cause stratification of the water, represented by deep-water,

oxygen-depleted zones. These zones would be unable to support fish life. Decomposition within the reservoir of submerged vegetation and organic material may produce an explosive release of chemical nutrients into the biosystem. Alteration of water temperature would occur not only within the reservoir but also downstream, influenced by lake-water outflow from the dam.

Depending on factors such as moisture content, temperature, and movement of air masses, along with regional topography and size of reservoir, alteration in the local microclimate may result from a hydroelectric impoundment.

The biological systems in the reservoir area and downstream usually show marked changes as a result of the dam's effect on the hydrologic system. This can have an effect on both terrestrial and aquatic ecosystems. The terrestrial habitat above the dam shrinks as the reservoir fills, yet the land/water interface increases. Both factors will be reflected in the floral and faunal changes.

If seasonal flooding has been arrested downstream, long-established patterns of water/soil-fertility relationships would be altered. Net reduction of soil-moisture content and changes in nutrient input and nutrient cycling would result in changes in flora and fauna.

The initial flooding that covers plants, animals, and organic-soil components sets the stage for a sudden release of nutrients into the water. This can cause an increase in the density and extent of higher aquatic plants. An increase in the aquatic plants within the reservoir can, in turn, cause interference with human activities such as boating, fishing, and even power generation (should the turbines or water intakes become clogged).

For migratory aquatic (e.g., fish) species, a hydroelectric dam may act as a physical barrier that can be ultimately destructive to a species population.

b. Pumped-Storage Projects

Lakes and impoundments created for pumped storage are usually much smaller than those created by dams. The effect on local water systems caused by the construction of a dam can be severe (see Sec. J.2 of this appendix) and can affect total changes in the area. The pumped-storage-project changes need not be as great, since they are physically smaller and constitute branches of local water systems. Water in pumped-storage systems can be reused. Natural flows are required only for make-up purposes and the initial filling. Percolation from the upper reservoir into locally surrounding land can cause land instability and water-quality effects. The reservoirs can cause disruption of migratory- fish species. Nonmigratory species seem to survive in the upper reservoirs; therefore, this area can be utilized for sportfishing.

Although each case is special--involving local characteristics of terrain, water quality and flow patterns, fish populations, human factors, and effects on visual appearance of the countryside--the total adverse effects are less than those of the conventional hydroelectric-power plant.

3. Conclusions

The major environmental effects associated with increased use of hydroelectric power include irreversible commitment of the land and resources beneath newly constructed lakes, modification to destruction of river or streamflow patterns below the dam, and changes in the ecology of the floodplain below the dam.

L. Nuclear Power

1. Background Considerations

Commercial use of nuclear fission as an energy source has a history of less than 30 years. This first electric-power-generating plant went into operation at Shippingport, Pennsylvania, in 1957. At the present time, there are 95 operable nuclear-power-generating plants in the U.S. with a summer capacity of 79.5 million net kilowatts (see Tables H-7 and H-8). Although nuclear energy is an alternative-energy source, delays and cancellation of plants have occurred. Since the incident at Three-Mile Island occurred, it has been argued that nuclear-power plants are unsafe and uneconomical.

The two main types of nuclear reactors include light-water reactors--which are widely used in the U.S. breeder reactors, and gas-cooled reactors--which are used in the United Kingdom. Light-water reactors include two types--the boiling-water reactors and pressurized-water reactors. The fuel in both is usually slightly enriched uranium in the form of oxide pellets contained in stainless-steel and zircaloy tubes. Water is used as both coolant and moderator.

In the boiling-water reactor, the cooling-water boils in the core, and the steam generated is used directly to drive a steam turbine, thereby driving a generator. The steam is then condensed to water and pumped back to the reactor to complete the cycle. Thus, the reactor acts as the boiler in the process.

In the pressurized-water reactors, the core-cooling water is kept at a very high pressure and is heated to 600°C. The water is then sent to a separate heat exchanger, where a secondary water supply is boiled and used to drive the turbines.

The problem with the boiling-water-type reactor is that the cooling water becomes radioactive from slight leaks in the thin cladding of the fuel rods and/or radioactively induced by the neutrons just outside the cladding. The radioactive steam goes directly to the turbines, so great care must be exercised to avoid steam leaks in the turbine. This problem is avoided in the pressurized-water-reactor system, because the cooling water and the steam for driving the turbines are separate.

McMullan et al. (1983) report that there are two main criticisms of light-water-moderated reactors. First, it is alleged that the technology of welding the very heavy steel sheets of the pressure vessels is not capable of providing the necessary reliability. This is important due to the potential catastrophe that would occur if the pressure vessel ruptured. Second, there are the possible effects of a sudden failure in the water supply to the core; if this occurred, the large mass of fuel and radioactive-fission products could

Table H-7

Status of Nuclear-Reactor Units, December 31, 1985

Status	Number of Reactors 1/				Capacity 1/ (thousand net kilowatts)	
	Boiling-Water Reactors	Pressurized-Water Reactors	Other 2/	Total	Total	Average 3/ (per reactor)
Operable 4/	33	60	2	95	62,809	785
In Startup	1	2	0	3	3,431	1,144
Construction Permits Granted	7	23	0	30	59,064	1,114
Construction Permits Pending	0	0	0	0	0	--
Units on Order	0	2	0	2	2,240	1,120
Total	41	87	2	130	127,544	924

Source: DOE, April 1984; Energy Information Administration, Annual Energy Review 1985.

1/ The capacity for operable units is net Maximum Dependable Capacity (MDC). For other units, the capacity is net Design Electrical Rating (DER).

2/ Includes one graphite-moderated and one gas-cooled reactor in full operation.

3/ Based on the net DER.

4/ Includes units with "full power" or "operating license" units (units in power ascention or in commercial operation). Excludes the following previously licensed units which have been inoperative for at least 4 years: Humboldt Bay, Dresden-1, and Three-Mile Island-2. Three-Mile Island-1 is considered operable although it has not been permitted to operate since March 1979.

Table H-8
Nuclear-Power-Plant Operation

	1979	1980	1981	1982	1983	1984	1985[1/]
Operable Reactors (Number)	68	70	74	77	80	86	95
Nuclear-Based Electricity Generation (million net kilowatt hrs)	255,155	251,116	272,674	282,773	293,677	328,177	383,700
Nuclear Portion of Domestic Electric Generation (percent)	11.4	11.0	11.9	12.6	12.7	13.6	15.5
Net Summer Capacity of Operable Reactors (*million* net kilowatts)	49.33	51.06	55.53	59.55	62.81	69.70	79.50

Source: Energy Information Administration, Annual Energy Review 1985.

1/ Preliminary Data

become so hot as to cause a meltdown. From a meltdown, radioactive containment could possibly infiltrate the ground-water supply and become a hazard.

In breeder reactors, neutrons are captured by U238 to form PU239. No moderator is used in the reactor core to slow the neutrons down; as a result, the neutrons are captured by the uranium. From this reaction, the reactor produces significant quantities of plutonium.

The breeder reactor has some unpleasant characteristics that are reg rded by its critics as rendering it unacceptable for generating electric power. The first of these is that plutonium is highly toxic. It also has a very low thermal conductivity that adds to the difficulty of extracting the heat from the reactor core. Further, there is no moderator. The core runs at a very-high-energy density and must be cooled, not by water or by a gas, but by a liquid metal--sodium. Therefore, the sodium must reach extremely high speeds in the tightly packed core in order to remove the heat that is generated. Failure to remove the heat would lead to a situation that could cause a meltdown, if left uncorrected.

Sodium reacts explosively with water. In the breeder reactor, the sodium is pumped around the reactor core at an elevated temperature; after a while, the coolant becomes radioactive. Any rupture or leak in the cooling system would cause an extremely violent reaction.

Another major criticism of the breeder reactor is that it uses plutonium in its fuel. The fuel rods are enriched in PU239, which can be used as fuel for a nuclear bomb. However, it is likely that any country with the capability to build and operate a series of nuclear-power facilities on a commercial scale also will have the capability to construct the rather less complex facilities needed to prepare fissile materials for nuclear weapons.

Most failures of commercial reactors have been minor in nature except for the incidents at Three-Mile Island and Chernobyl, U.S.S.R., which indicate the potential dangers of nuclear-power generation. Since the Three-Mile-Island incident occurred, there has been a large increase in public concern for the safety of these power plants. Attempts have been made to stop all future construction and shut down all existing nuclear plants in some areas. Yet dependence on this power source tends to preclude total shutdown, because no suitable alternative is available.

2. Environmental Effects

In addition to numerous land use and ecological effects associated with the construction of a nuclear-power plant, there are environmental effects that may result from the utilization of nuclear energy. These include thermal pollution of cooling water, leakage of radiation into water and air, production and transport of the fuel to the use site, radioactive-waste management including transportation and storage or disposal, and the potential for a catastrophic nuclear-reactor accident.

Nuclear plants are essentially the same cooling process as fossil-fueled plants and, thus, share the problem of heat dissipation from cooling water. However, nuclear plants obtain 33-percent conversion to electricity with all

the remaining 67 percent going to the cooling water, thereby requiring larger amounts of cooling water and discharging greater amounts of waste heat to the water than comparably sized fossil-fuel plants. In comparison, per unit of electric energy generated, modern fossil-fuel plants contribute 1.2 units of aquatic-thermal pollution, while nuclear plants contribute 2.0 units.

Thermal pollution causes damage by upsetting or modifying aquatic ecosystems. Thermal pollution can disrupt an ecosystem in a variety of ways: (1) large temperature increases that can kill many aquatic species; (2) reduction of available oxygen (as temperature increases, solubility of oxygen decreases); (3) alteration of the rate of biological activity (i.e., rapid growth of algae or pond weeds); (4) reduction of resistance to diseases; (5) alteration of behavior patterns; and (6) providing a competitive advantage to species that can tolerate temperature changes.

Increased concern has been raised regarding the potential danger of radiation leakage. When an organism sustains a large dose of radiation, acute somatic damage can result. Radiation can cause fatal damage to a large number of cells, resulting in sickness (nausea, vomiting, headaches, weakness, and sometimes death) and delayed somatic damage when an organism receives a dose of radiation that is not fatal. Cells that are lethally damaged by the dose will not reproduce and will be eliminated. Cells that are nonlethally damaged will stay with the organism and may later cause malfunctions (cancer, cataracts, prenatal abnormalities, and nonspecific shortening of lifespan). Genetic damage may result where a reproductive cell is nonlethally affected, and this may give rise to a genetically defective offspring.

While effects associated with an accident in a nuclear-power plant are serious, a more long-term effect can result due to the storage problems associated with the waste products from power generation. Low-level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to a federally licensed storage site and buried. High-level wastes created within the fuel elements remain there until the fuel elements are processed. There exists a potential for radioactive leakage during transportation activities or accidents.

Low-level radioactive solid wastes are buried in near-surface trenches at specific sites where topography, meteorology, and hydrology are such that migration of radioactivity is not anticipated. Low-level waste from a 1,000-megawatt plant and the fuel-cycle activity attributed to the plant require about 2.0 acres of land per year.

High-level wastes are currently stored as liquids in tanks, although storage in bedded-salt formations deep underground has been suggested. Spent fuel is currently stored at facilities licensed by the Nuclear Regulatory Commission. Plans call for recovering unused fuels at reprocessing plants, solidifying the wastes, and placing them in storage at Federal repositories.

The effects associated with the mining and milling of uranium ore are similar to those for coal mining (see Sec. C of this appendix), with the exception of radioactive tailings and water being produced.

3. Conclusions

The major environmental effects associated with expanded use of nuclear energy include the need to mine, process, and use radioactive materials that would result in the release of small amounts of radiation; disposal of the heated cooling water; difficulties associated with selecting and using a suitable disposal site for spent fuel; and considerable public concern about possible accidents.

M. Conservation

1. Background Considerations

This section briefly addresses reducing energy consumption through a variety of improvements in the energy efficiency of each of the five energy-consuming sectors of the U.S. economy--transportation, residential, commercial, industrial, and transformation. Over the past decade, projections of future energy consumption by the U.S. have changed dramatically as a result of much higher world energy prices. A decade ago, projections of U.S. energy consumption in the year 2000 ranged from 150 to 175 quads. The NEPPP's 1985 projections of energy consumption in the year 2000 range from a low of 88.8 quads in the high U.S.-energy-efficiency case, to a high of 104.8 quads in the high U.S.-energy-supply case, with the reference case at 98.6 quads. (The 1985 NEPPP was prepared before the rapid decline of world oil prices in 1986. If lower world oil prices persist, future U.S. energy consumption will increase in response to both lower prices and higher world economic wealth. Nevertheless, projections of future U.S. energy consumption include substantial improvements in the efficiency with which energy is used in the U.S. economy.) Table H-9 provides a comparison of the projected energy consumption for each sector under the assumptions of both the NEPPP-reference case and the high U.S.-energy-efficiency case.

The NEPPP-reference case includes future improvements in energy conservation that are both technologically expected and economically efficient. Future energy consumption is projected for each sector using the energy-conservation improvements that are either already available or expected, given anticipated technological improvements. The rate at which these energy-conservation improvements enter in the NEPPP-reference case is determined by consumer preferences under projected future energy prices. Projected improvements in energy efficiency play a major role in the projected future energy consumption by each sector of the U.S. economy.

Within each of the five categories of energy use, the demand for energy services is the result of two typically offsetting trends--an upward trend caused by population and economic growth, and a downward trend caused by increased efficiency in the use of energy stimulated by higher energy prices. Brief summaries of the expected energy conservation for each sector, which are abstracted from the 1985 NEPPP-reference case, are presented below.

In the residential sector, energy is consumed for space conditioning, lighting, and operating appliances. Total energy use in this sector is dependent on the total number of households and the energy consumed by each. The Census Bureau estimates that, between 1984 and 2010 (the projection period for the 1985 NEPPP), the number of housing units will increase by 30 percent. The

Table H-9
Comparison of NEPPP-Reference and High-Energy-Efficiency Cases
(Quads)

YEAR	TOTAL ENERGY TO U.S.	ENERGY LOSSES TRANS-FORMATION	LIQUIDS	GASES	COAL SOLIDS	ELEC-TRICITY	RENEW-ABLE[1/]	TOTAL	RESI-DENTIAL	COM-MERCIAL	INDUS-TRIAL	TRANS-PORT.
			ENERGY USED BY FINAL CONSUMERS EXCLUDING INPUTS TO UTILITIES AND SYNTHETICS									
ESTI. 1984	76.6	-18.0	29.6	15.2	3.1	7.8	2.8	58.5	9.9	6.1	22.6	19.8
PROJ.												
1990												
REF. CASE	87.3	-22.1	32.3	16.7	3.8	9.1	3.3	65.2	10.8	7.2	28.2	19.2
HIGH EFFIC.	81.6	-20.6	30.6	15.3	3.5	8.5	3.1	61.0	9.7	6.7	26.2	18.5
1995												
REF. CASE	93.1	-25.2	32.3	17.5	3.7	10.3	4.0	67.9	11.2	7.8	29.6	19.4
HIGH EFFIC.	85.4	-23.3	30.0	15.5	3.3	9.5	3.7	62.1	9.7	7.2	27.0	18.4
2000												
REF. CASE	98.6	-28.0	32.9	17.4	3.9	11.5	4.8	70.6	11.3	8.4	30.4	20.7
HIGH EFFIC.	88.8	-25.6	30.0	15.0	3.4	10.5	4.3	63.3	9.6	7.7	27.0	19.2
2005												
REF. CASE	104.2	-30.9	32.9	17.2	4.6	12.8	5.8	73.3	11.3	8.8	31.9	21.4
HIGH EFFIC.	92.7	-28.0	29.6	14.5	3.9	11.5	5.3	64.8	9.4	8.0	27.7	19.7
2010												
REF. CASE	110.8	-34.5	33.0	16.8	5.4	14.3	6.9	76.3	11.2	9.4	33.5	22.3
HIGH EFFIC.	97.9	-31.0	29.4	13.9	4.4	12.8	6.3	66.8	9.5	8.6	28.4	20.4

Source: U.S. Department of Energy, National Energy Policy Plan Projection to 2010, December 1985.

1/ Renewable central electric is included in electric column.

estimated 1984 average end-use efficiency for the residential sector was 72 percent. The rate of energy-efficiency improvements is projected to be 14 percent over the 1984-to-2010 period. Thus, the net result under the assumptions of the NEPPP-reference case is a gradual increase in total-residential-energy consumption.

In the commercial sector, energy also is consumed for space conditioning, lighting, and operating appliances. Since 1970--apparently in response to the energy-price increases of the last decade--commercial-energy use per square foot has been declining at a little less than 2 percent per year. The estimated 1984 average end-use efficiency of the commercial-sector equipment was 81 percent. The pattern of increased energy efficiency in the commercial sector is expected to continue through the projection period. The net result may be a leveling off in the commercial-sector-energy payments per square foot, despite the projected increase in energy prices.

The industrial sector consumes energy resources for space conditioning, lighting, operating machinery, and feedstocks used to manufacture certain products. In response to the energy-price increases of the 1970's, the decline in energy use per unit of industrial output accelerated from 2 percent per year to 4 percent per year. It is likely that the rate of energy-efficiency improvements has peaked and, therefore, that an average improvement of 2 percent per year is used in the projections. Decreased energy use per unit of output is projected to result from improved process efficiency and a change in the product mix being produced, with energy-intensive productions decreasing as a share of the total.

Motor vehicles (cars and trucks) use the largest share of energy consumed--about 75 percent--to transport people and goods. About one-fourth of the energy consumed in the transportation sector is used in the operation of pipeline, air, rail, and marine transportation. Because of improvements in both the design and mechanics of motor vehicles, it is estimated that the actual road miles per gallon (mpg) for the entire fleet of motor vehicles has increased by as much as 85 percent since the early 1970's. (The actual road mpg for the entire fleet of cars and trucks should not be confused with the EPA's estimated mpg for new cars.) The 85-percent improvement in the actual road mpg represents less than a 2-mpg improvement for the entire fleet of cars and trucks to its present level of around 15 mpg. Improvements in the energy efficiency of the total U.S. fleet are expected to plateau at around 23 mpg toward the end of the projection period. However, the average fleet road mpg will continue to increase beyond 2010.

The two energy-transformation-sector industries are electric utilities and synthetic fuels. Large energy losses are unavoidable in these industries. In terms of energy actually delivered to the end-use sectors, the utility industry has been, for at least the last 20 years, and is expected to continue to be around 32-percent efficient. This is not to say that little has changed or will change in the utility industry. In the 1960's, coal and hydro facilities lost share to oil and natural gas. In the 1970's, this movement reversed; and oil and gas lost share to coal and newly completed nuclear facilities. This trend is expected to continue through the year 2000. See the sections of this appendix that address coal and nuclear and synthetic fuels for further discussion of these trends.

The high-energy-efficiency case in the 1985 NEPPP used assumptions that generate a 10-percent improvement in the overall end-use efficiency in the year 2000 by comparison to the reference case. The efficiency assumptions that were changed to generate this improvement include the consumer discount rate, the energy demand per unit of industrial output, and the fuel efficiency of each transportation mode. Perhaps the most important factor is the assumed change in the discount rate that consumers use in deciding to purchase higher-efficiency equipment like furnaces, air conditioners, and insulation. (By assuming a lower discount rate for consumer decisions, the economic attractiveness of energy-efficient investments is improved.) Further, the high-energy-efficiency case decreased the energy use per unit of industrial output such that energy use was 15 percent lower than in the reference case. The higher-fuel-efficiency assumptions for the transportation sector increased actual road mpg 10 to 12 percent over those used in the reference case. (See Table H-9 for the full sector-by-sector comparisons and the changes in total energy consumption over the projection period.)

Five major types of conservation options are often proposed as substitutes for a wide variety of energy-development projects: (1) improved gas-mileage performance, (2) greater use of mass transit, (3) improved energy efficiency of household appliances, (4) higher energy efficiency in the industrial and commercial sectors, and (5) augmented public and private research in energy conservation. The proposals to use conservation rather than to develop an energy resource typically start with an observation of historical improvements in the efficiency of energy use in the U.S. and other economies. They then assume a specific rate or amount of future improvement and calculate energy savings via the difference between present-use rates and the assumed future-use rates. All such proposals should be examined against the information provided above concerning projections of future gains in U.S. energy efficiency. Very considerable further improvements in energy efficiency are part of the expectations built into the projections of future energy consumption. Thus, much of the calculated energy savings or conservation assumed for each of the five major energy-conservation options are already counted.

Nearly all energy-conservation policies can be classified in one of five broad categories--price, supply restriction/allocation, regulation, incentives, and information.

Price: Energy consumption would be cut by relying on consumers' reaction to higher prices, either for petroleum or for all forms of energy.

Supply Restriction/Allocation: In order to reduce energy consumption, energy supplies would be restricted to a fixed level. Then, employing some nonmarket allocation or rationing scheme, the limited supply would be distributed among competing uses or users.

Regulation: Regulations could be developed that would place restrictions on how energy could be used and would outlaw those uses or technologies thought by lawmakers to be the most wasteful.

Incentives: Incentives, usually monetary, can be developed for energy-saving forms of production and consumption. On the other hand, disincentives, such as taxes, could be used to discourage specific kinds of waste.

Information: Programs would be developed to change consumers' habits of energy use, either by exhorting them to change their lifestyles or by pointing out the economics and other advantages of particular energy-saving practices.

2. Environmental Effects

The reduced production and consumption of energy resources associated with various energy-conservation proposals generates much of the public appeal for these proposals. Simply by learning to use less energy, which appears to have neither cost nor environmental effects, the adverse environmental effects caused by production and use of the energy resources conserved will be avoided or reduced. Potential energy savings through conservation methods would result in reduction of the environmental effects associated with energy production and use.

This summary of the environmental effects of energy conservation separates possible future energy conservation into two parts. The first is the energy conservation that is expected to occur as a result of improved technology in response to future energy prices. This part is included in the 1985 NEPPP-reference case, and it is called "expected conservation" in this summary of environmental effects. The second part of possible future energy conservation includes all additional energy conservation that could result from changes in government policies. (These possible policy changes are summarized at the end of Sec. M.1 in this appendix.) This part of possible future energy conservation is called "additional conservation" in this summary of environmental effects.

The environmental effects associated with the expected part of possible future energy conservation are wholly beneficial. The reductions in energy consumption in the four energy end-use sectors expected to occur under the assumptions of the NEPPP-reference case will mean that fewer pollutants associated with energy use will be emitted.

The environmental effects associated with the additional part of possible future energy conservation are primarily beneficial. The reductions in future energy use that could result from changes in government policies would further reduce the levels of pollutants associated with energy use.

There are, however, costs associated with the additional conservation scenario. Energy-conservation improvements that are mandated by government programs rather than in response to consumer preferences reduce the total value of the Nation's goods and services and thus reduce National income. Such reductions are a form of adverse effect on the quality of the human environment.

Conserving energy resources under government-policy changes could require considerable investments in new or retrofitted equipment. There are environmental effects associated with production of the capital goods needed for most energy-conservation options. For example, production of the more fuel-efficient boilers used in retrofitting existing commercial and industrial buildings would generate a variety of adverse environmental effects that otherwise would not occur. Similarly, in order to render existing buildings more energy-efficient, materials whose production entails adverse environmental effects may be used.

3. Conclusions

Reduction of the environmental effects associated with production and consumption of energy resources is one of the primary advantages of energy-conservation measures. However, the investments and programs often associated with improved energy efficiency generate environmental effects. Thus, energy-conservation options are not void of environmental effects.

N. Combination of Alternatives

A combination of some of the most viable energy sources available to this area (discussed above) could be utilized to attain an energy equivalent comparable to the estimated production within the anticipated field life of this proposed action. However, in order to attain the needed energy mix peculiar to the infrastructure of this area, this combination of alternatives 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.

Allowing favorable technologies and economies, the most viable domestically available energy alternatives 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 sections. The result will be a long-term energy-supply transition from crude oil to alternative-energy sources and less dependence on oil imports. Such patterns will require new and efficient technologies, major capital investments, and a high rate of growth in coal production.

The future U.S. 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, 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 rate of development and the extent of their contribution to total U.S. 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. Relevant factors are:

-- Historical relationships indicate that energy requirements will grow in proportion to the gross National product.

-- Energy requirements can be constrained to some degree through the price mechanisms in a free market or by more direct constraints. One important type of direct constraint that operates to reduce energy requirements is the substitution of capital investment in lieu of energy, e.g., insulation to save fuel. Other potentials for lower energy use have more far-reaching effects and may be long-range in their implementation--they include rationing, altered transportation modes, and major changes in living conditions and lifestyles. Even severe constraints on energy use can be expected only to slow, not halt, the growth in energy requirements within the timeframe of this statement.

-- Energy sources are not completely interchangeable. For example, solid fuels cannot be used directly in internal-combustion engines. Fuel-conversion potentials are severely limited in the short term, although somewhat greater flexibility exists in the longer term and generally involves choices in energy-consuming capital goods.

-- The principal competitive interface between fuels is in electric-power plants. Moreover, the full range of flexibility in energy use is limited by environmental considerations.

-- Regulation of oil and gas prices lowered the price below the product level that refiners (and consumers) paid for domestic oil and prevented the incremental cost of all domestic producing fields from equating to the price of imports. This impaired the economy's ability to adjust to world energy prices. Under deregulation, the real prices of oil and gas will be closer to the marginal costs of alternative energy.

-- A broad spectrum of research and development is being directed toward energy conversion--more efficient nuclear reactors, coal gasification and liquefaction, liquefied natural gas, and shale retorting, among others.

Several of these factors could assume important roles in supplying future energy requirements, although their future competitive relationship is not yet predictable.

FATE AND EFFECTS OF EXPLORATORY PHASE OIL AND GAS DRILLING DISCHARGES IN THE CHUKCHI SEA PLANNING AREA, OCS LEASE SALE 109

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10

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INTRODUCTION

One of the major permits required for the operation of oil and gas drilling facilities is a National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act (the Act or CWA hereafter) for discharges into marine waters. 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.

Section 301(c) of the Act provides that the discharge of pollutants is unlawful except in accordance with the terms of an NPDES permit. Under the Environmental Protection Agency's (EPA) regulations [40 CFR §122.28(a)(2)], EPA may issue a single general permit to a category of point sources located within the same geographic area if the regulated point sources:

(1) involve the same or substantially similar types of operations;

(2) discharge the same types of wastes;

(3) require the same effluent limitations or operating conditions;

(4) require similar monitoring requirements; and

(5) in the opinion of the Regional Administrator, are more appropriately controlled under a general permit than under individual permits.

In addition, under EPA regulations [40 CFR §122.28(c)(1)], the Regional Administrator is required to issue general permits covering discharges from offshore oil and gas facilities within the Region's jurisdiction. Where the offshore area includes areas for which separate permit conditions are required, such as areas of biological concern, a separate individual or general permit may be issued by the Regional Administrator.

Under the Agency's recent permit decisions concerning Alaskan Outer Continental Shelf (OCS) areas, exploratory oil and gas facilities are more appropriately controlled by a general permit than by individual permits. EPA expects to issue a general permit for exploratory drilling operations for Lease Sale 109, the Chukchi Sea Planning Area.

EPA may elect to issue individual NPDES permits for future development and production operations in Lease Sale 109. EPA issued an individual permit for the first offshore oil and gas development and production operation in the Alaskan Arctic, the Endicott Development Project in the Beaufort Sea near Prudhoe Bay. This operation differs significantly from exploratory drilling operations covered by the existing general permit for the Beaufort Sea in that it entails the discharge of substantially larger quantities of drilling muds and cuttings over a period of several years. An individual permit is therefore required to impose the necessary effluent limitations and monitoring requirements for the Endicott Project. This issuance of individual or general NPDES permits for future development and production operations in Sale 109, is, however, not included here as a part of EPA's proposed action.

EPA is contributing to this draft environmental impact statement (EIS) to satisfy certain requirements of the National Environmental Policy Act (NEPA). Review of EPA policy actions is needed because EPA anticipates promulgating New Source Performance Standards (NSPS), under §306 of the CWA, for the offshore subcategory of the oil and gas extraction point source category of industrial dischargers. This is expected in 1988. After promulgation of NSPS, the NPDES permit must be the subject of an environmental review under NEPA, pursuant to §511(c)(1) of the CWA. EPA expects to adopt the Final Environmental Impact Statement for this lease offering in order to satisfy this requirement, in accordance with the requirements of the Council on Environmental Quality's (CEQ's) regulations governing the implementation of the procedural provisions of NEPA [40 CFR Part 1500].

EPA therefore offered to be, and was accepted by the Minerals Management Service (MMS) as a cooperating agency in the development of the EIS. The MMS requested that EPA provide an appendix to the EIS which would evaluate the impacts of exploration phase discharges on marine biota and water quality.

This appendix characterizes the expected discharges and evaluates their potential effects on the environment. This evaluation is based only on the discharges that will occur during exploration activities. It does not address impacts from petroleum development and production, impacts associated with noise, island or causeway construction, spills, or similar perturbations.

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 109 is currently scheduled to be held in October 1987. Exploratory drilling in the blocks leased as a result of this sale could begin in 1989. The first delineation well could be drilled in 1991, the third drilling season. Drilling of exploration and delineation wells could continue through 1996. The amount of time required to drill and test exploration wells is estimated to be about 90 days. (USDOI; 1986).

CLEAN WATER ACT PERMIT REQUIREMENTS

Sections 301(b), 304, 306, 308, 401, 402, and 403(c) of the Act provide the basis for NPDES permit conditions. The general requirements of these sections fall into two categories, which are described below.

OCEAN DISCHARGE CRITERIA

Section 403 of the Act requires that an NPDES permit for a discharge into marine waters located seaward of the inner boundary of the territorial seas be issued in accordance with guidelines for determining the degradation of the marine environment. These guidelines, referred to as the Ocean Discharge Criteria (40 CFR Part 125, Subpart M), are intended to "prevent

unreasonable degradation of the marine environment and to authorize imposition of effluent limitations, including a prohibition of discharge, if necessary, to ensure this goal" (45 FR 65942, October 3, 1980).

If EPA determines that the discharge will cause unreasonable degradation, an NPDES permit will not be issued. If a determination of unreasonable degradation cannot be made because of a lack of sufficient information then no discharge can be permitted except under a very limited set of circumstances. To permit a discharge EPA must be able to determine that the proposed discharge would not cause irreparable harm to the marine environment, and that there are no reasonable alternatives to on-site disposal.

To assess the probability of irreparable harm, EPA is required to make a determination that the discharger, operating under appropriate permit conditions, will not cause permanent and significant harm to the environment during a monitoring period in which additional information is gathered. If data gathered through monitoring indicate that continued discharge may cause unreasonable degradation, the discharge must be halted or additional permit limitations established.

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 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 impacts on human health; impacts on recreational and commercial fishing; applicable requirements of approved Coastal Zone Management Plans; marine water quality criteria developed pursuant to §304(a)(1) of the Act; and other relevant factors.

This appendix is based, largely, on EPA's evaluation (against these criteria) of the effects of discharges resulting from oil and gas exploratory drilling resulting from OCS Lease Sales 87 and 97. These analyses are referred to as Ocean Discharge Criteria Evaluations or ODCEs. EPA also developed a draft ODCE for OCS Lease Sale 109. Preliminary conclusions concerning the fate and effects of drilling effluent discharges, including the results of site specific modeling studies from this ODCE, have also been incorporated into this document.

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

The Act requires particular classes of industrial dischargers to meet technology-based effluent limitations established by EPA. The Act provides for implementation of these technology-based effluent limitations in three stages. First, application of "best practicable control technology currently available" (BPT) was required no later than July 1, 1977. In general, BPT represents the average of the best existing performances of well known technologies for control of traditional pollutants. EPA promulgated effluent limitation guidelines requiring Best Practicable Control Technology Currently Available (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 industrial subcategory limits the discharge of oil and grease in produced water to a daily maximum of 72 milligrams per liter

(mg/l) and a thirty day average of 48 mg/l; prohibits the discharge of free oil in deck drainage, drilling fluids, drill cuttings, and well treatment fluids; requires a minimum residual chlorine content of 1 mg/l in sanitary discharges; and prohibits the discharge of floating solids in sanitary and domestic wastes.

Second, the Act requires that effluent limitations be based on the application of "best available technology economically achievable" (BAT), representing at a minimum the "best" treatment technology performance in the industrial category. Furthermore, control of "conventional pollutants" (oil and grease, biochemical oxygen demand, suspended solids, pH[1], and fecal coliform) must be achieved through "best conventional pollutant control technology" (BCT). Control of "toxic pollutants" (40 CFR §401.15) by BAT and conventional pollutants by BCT must be achieved by no later than July 1, 1984. In no case may BCT or BAT be less stringent than BPT. Permits must impose effluent limitations which control non-conventional pollutants (i.e., those which are not toxic or conventional pollutants) by means of BAT not later than July 1, 1987.

Finally, effluent limitations based on best demonstrated control technology must be imposed with the development of new source performance standards.

BAT/BCT effluent limitations guidelines and NSPS were proposed in August 1985 (50 FR 34592). The Agency currently projects promulgation of final guidelines and standards in 1988. In the absence of effluent limitations guidelines for the Offshore Subcategory, permit conditions must be established using Best Professional Judgment (BPJ) procedures (40 CFR §§122.43, 122.44, and 125.3). NPDES permits issued for offshore oil and gas operations will therefore contain BAT and BCT effluent limitations which reflect either promulgated guidelines or best professional judgment determinations, depending on when the guidelines and permits are issued. Previous BPJ determinations for offshore oil and gas exploratory operations were incorporated into the general permits for the Bering and Beaufort Seas (49 FR 23734; June 7, 1984) and for Norton Sound (50 FR 23578; June 4, 1985).

Proposed BAT guidelines would prohibit the discharge of free oil in the discharges; prohibit the discharge of drilling fluids that are oil-based or that contain diesel oil; prohibit the discharge of drill cuttings that contain diesel oil or that are generated with the use of drilling fluids that are oil-based; limit the acute toxicity of drilling fluid discharges; limit the mercury and cadmium content of drilling fluids; and require a residual chlorine content of 1 mg/l in sanitary discharges. Proposed BCT guidelines are the same as BPT. NSPS are proposed to be the same as BAT/BCT effluent limitations with one exception. NSPS would impose a prohibition on the discharge of produced water from all oil production facilities located in shallow water areas. Shallow water is presently defined as 10 meters or less in the Beaufort sea, 20 meters or less in Norton Basin, and 50 meters or less in

1. pH is a measure of the acidity and alkalinity of liquids. It measures acidity and alkalinity based on an index which quantifies the hydrogen ion concentration of the liquid being tested. pHs range from 1 to 14. Fresh water has a neutral pH (7). The scale is logarithmic; that is, a liquid with a pH of 6 is ten times more acidic than a liquid with a pH of 7.

Cook Inlet/Shelikof Strait, Bristol Bay and Gulf of Alaska. Produced water discharges from all other offshore facilities engaged in exploration, development, and production activities would be limited to a maximum oil and grease concentration of 59 mg/l.[2]

LAND DISPOSAL ALTERNATIVES

In the event that EPA decides (on the basis of the 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 season 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.

EXPLORATION LOCATIONS

Figure 1 presents the boundaries of the proposed Chukchi Sea Lease Sale 109. There has been no exploratory drilling in the blocks of the proposed sale area.

Although the northeastern Chukchi Sea is a frontier area, approximately 40,000 miles of seismic-reflection work has been done (Alaska Oil and Gas Association [AOGA], letter of 11/4/85 in USDOI/MMS; 1986, p.1). In an adjacent onshore sale area, six exploratory wells have been drilled along the coast between Barrow and Icy Cape. Thus an assessment of the petroleum potential of the Sale 109 area is generalized, speculative, and incomplete (Grantz et al. 1982). As a result, any scenario for exploiting petroleum resources is highly speculative. The strategies actually used to explore, develop, produce, and transport the petroleum resources of the Sale 109 area will vary and depend upon many factors, a number of which are unique to each leaseholder or operator (USDOI/MMS; 1986, p. 1).

Due to the typical ice conditions in the region, it is anticipated that the more shoreward areas would receive the initial attention. Water depth in the sale area is generally between 30 and 50 meters, although some deeper areas (80 m) are present (Hill et al., 1984 and Truett, 1984). The water depth

2. The "no free oil" requirement noted at the beginning of this paragraph essentially prohibits any discharge of oil which would result in in sheen on the water. The maximum oil and grease limitation refers to total **extractable** oil and grease that is chemically or physically bound to other components of the discharge such as suspended solids (particulate matter).

will be an important factor in the selection of the appropriate drilling unit, and hence may also influence the initial sites of exploration (USDOI/MMS; 1986, p. 1).

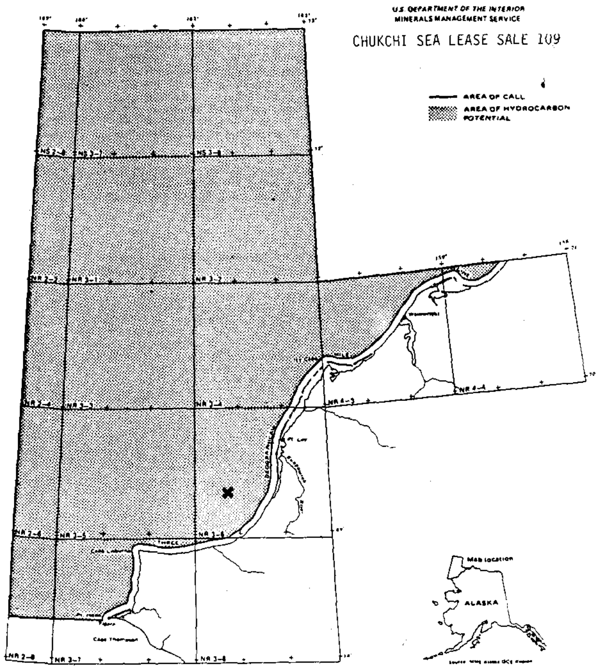


Figure 1. Map showing Chukchi Sea lease sale 109 area. 'X' indicates the rig location used in model simulations.

COMPOSITION AND QUANTITIES OF MATERIALS DISCHARGED

TYPES OF DISCHARGES

The process of oil and gas exploration can produce a wide range of waste materials from the drilling process and from the maintenance and support of equipment and personnel. Discharges from exploratory drilling may include:

- drilling muds
- drill cuttings
- sanitary and domestic wastewater
- desalination unit discharges
- boiler blowdown
- test fluids
- deck drainage
- uncontaminated bilge and ballast water
- non-contact cooling water
- fire control system test water
- blowout preventer fluid
- excess cement slurry

Sanitary waste discharges should be substantially less than 10,000 gallons per day and would consist of secondary treated and chlorinated domestic sewage. Measured discharges from a semi-submersible rig during exploration well drilling in the Navarin Basin were well under 3,000 gallons per day (Cooper Consultants et al.; 1986, p. 2-5). Oxygen consumption of treated sewage effluent is a potential concern during under-ice disposal because ambient oxygen concentrations under ice may approach low levels (6 mg/l) based on recent analyses (Cooper Consultants et al.; 1985a, pp 2-2,3). However, the calculated dissolved oxygen depression resulting from this discharge is small enough that water quality standards should be met outside of the normally established mixing zone (Cooper Consultants et al.; 1986, p. 2-4). Domestic waste (shower and sink drainage) should not result in a significant discharge and is sometimes reused to make drilling muds, rather than discharged.

Desalination units may discharge approximately 200,000-250,000 gallons per day of seawater at a salinity which is twice as high as that of normal seawater (Jones and Stokes; 1984, p. 10). Boiler blowdown may be discharged on an infrequent basis and should not be a significant source of pollutant loadings with volumes of 1-3 percent of boiler capacity.

Test fluids are discharged from a well upon its completion. They may consist of formation waters, oil, natural gas, or formation sands. They are stored and treated to remove oil before being discharged or flared. Previous permits have required that these discharges have a pH of between 6.5 and 8.5 (Cooper Consultants et al.; 1985a, p. 2-5).

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 would carry the drainage (and test water) to a sump tank where oil would be separated from the drainage before the water would be discharged. This discharge is not expected to produce a significant volume. Bilge waters are also treated for the removal of oil prior to discharge. Although ballast waters are not similarly treated, previous permits have prohibited any discharges that would produce an oil sheen on the water. The proposed effluent limitations guidelines and standards (EPA; 1985a) continue this restriction.

The primary constituents of blowout preventer fluid are ethylene glycol and water. Except for its elevated temperature, the composition of non-contact cooling water will not be significantly different from seawater.

Finally, cement, along with muds and cuttings, would be discharged on the ocean floor in the early phases of drilling, before the well casing is set, and during abandonment and plugging (Jones and Stokes; 1984, pp. 9-12).

QUANTITIES OF DRILLING MUDS AND CUTTINGS

Drilling muds and cuttings discharges are the major pollutants associated with exploratory drilling. For exploration and delineation wells, the amount of drilling mud required and weight of cuttings produced are shown in Table 1. The primary disposal method for drilling muds and cuttings would be discharge into the water at the drilling site under conditions prescribed by EPA's NPDES permit.

CHEMICAL COMPOSITION OF DRILLING MUDS

Drilling muds are complex mixtures of clay, barite, and specialty additives. The composition of drilling mud can vary over a wide range from one hole to the next, as well as during the completion of a single hole. As the hole becomes deeper and encounters different formations, the type of mud may need to be changed or the composition altered.

Eight generic mud types have been evaluated by EPA during permit development. Because it is not known which of the muds will be used, a list of potential contaminants and their maximum authorized discharge concentrations has been compiled in Table 2. Water quality criteria are not available for these constituents.

In addition to the generic muds, downhole additives are used for specific problems that may be encountered. These additives can range from simple organic salts to complex organic polymers. These potential specialty additives are summarized in Table 3. The concentrations of these additives in mud can vary widely, and their use is on an infrequent basis. Presently, EPA is permitting their use on a case by case basis.

Water quality criteria are not available for most of the additives. Generally, quantities used are not large. Spotting material lubricants, zinc carbonate, and fillers (cellophane, mica hulls) are used in the greatest quantities. These additives are generally discharged to the environment. Collection and separation of spotting fluid contaminated muds is sometimes required. Expected ambient concentrations cannot be quantified at this time, although they are expected to be low due to high dilution rates and low usage.

For exploratory discharges, the presence of potentially toxic trace elements in drilling muds and cuttings is of primary concern. Metals including lead, zinc, mercury, arsenic, and cadmium can be present as impurities in barite; chromium is present in chrome lignosulfonates and chrome-treated lignite. Drill pipe dope and drill collar dope may also contribute copper, lead, and zinc to the discharges. Data from several sources, including EPA discharge monitoring reports, were combined to produce the expected whole mud maximum trace metal concentrations in drilling muds presented in Table 4.

Using dredged material elutriate partitioning data, Bigham et al. (1982, pp. 292-294) developed estimates of dissolved metal concentrations associated with drilling muds and cuttings. This approach was considered appropriate because the majority of bulk metals in both dredged materials and drilling muds are incorporated into the crystalline lattice of inorganic particles and are, therefore, not bioavailable. Table 5 presents concentrations of metals observed in the solid and dissolved fraction (based on elutriate analyses). The data represent approximately 50 separate analyses of sediments from the East and Gulf Coasts.

Table 1
QUANTITIES OF MATERIALS DISCHARGED, SALE 109[a]

	Mean Resource Case[b]		Maximum Resource Case[c]	
	Exploration	**Delineation**	**Exploration**	**Delineation**
Drilling Mud				
Average per well	599	454	599	454
Total for all wells	11,980	10,442	19,767	18,160
Drill Cuttings				
Average per well	1,360	1,179	1,360	1,179
Total for all wells	27,200	27,117	44,880	47,160

a. All quantities presented in metric tons dry weight.

b. Mean resource case assumes 20 exploration wells and 23 delineation wells.

c. Maximum resource case assumes 33 exploration wells and 40 delineation wells.

Source: Compiled from Draft Development Scenario, Sale 109 (USDOI/MMS 1986, pg. 2).

Table 2

AUTHORIZED MUD COMPONENTS[a]

Generic Description	Maximum Authorized Concentration (Pounds per Barrel) (Unless Otherwise Noted)
Potassium Chloride	50
Starch	12
Cellulose Polymer	5
Xanthum Gum	2
Drilled Solids	100
Caustic	3
Barite	450
Attapulgite	50
Bentonite	50
Lignosulfonate	15
Lignite	10
Soda Ash/Sodium	2
Lime	20.[b]
Acrylic Polymer	2

a. Not all components will be in a given mud.

b. Maximum for all mud types; lime addition is 2 for most muds.

Table 3

AUTHORIZED SPECIALTY ADDITIVES

Primary Function	Generic Description*
Substitute for Attapulgite or Bentonite Clay:	Sepiolite
Detection of Filtrate Re-Entry into Mud System:	Ammonium nitrate Sodium nitrate
Detection of Formation Water Intrusion:	Sodium chloride
Mud lag time measurement:	Calcium carbide
Corrosion Inhibitor: (H_2S scavenger)	Zinc carbonate Zinc carbonate & lime Zinc oxide
Defoamer:	Aluminum stearate Aluminum stearate in propoxylated oleyalcohol Dimethyl polysiloxane in an aqueous emulsion
Dispersant:	Sodium polyphosphate
Emulsifier:	Sulfonated asphalt residuum
Filtrate Reducer:	Lignite resin blend Polymer treated humates Reacted phenol-formaldehyde-urea resin with no free phenol, formaldehyde, or urea
Flocculant:	Vinyl acetate/maleic anhydride copolymer sodium polyacrylate sodium polyacrylamide
Viscosifier:	Organophilic clay

* 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. Some additives have two or more uses. However, only the first use of each additive is listed

Source: Draft Norton Basin General Permit; 50 FR 23601-602; June 4, 1985.

Table 3 (continued)

Primary Function	Generic Description
Lost Circulation Material:	Cellophane flakes Crushed granular nut hulls
	Silicate mineral mica flakes Vegetable plus polymer fibers, flakes, & granules
Lubricant:	Fatty acid esters and alkyl phenolic sulfides in a solvent base
	Liquid triglycerides in a vegetable oil
	Oleates in mixed alcohols
	Phosphoric acid esters and triethanolamine
	Plastic spheres
	Vegetable ester formulation
Spotting Agent:	Sulfonated vegetable ester formulation
	Mineral oil-based fluids
Surface Active Agent:	Aqueous solution of nonionic modified phenol
	Blend of surfactants
	Ethoxylated alcohol formulation
	Fatty acid ester
	Water solution of anionic surfactants
Thinner:	Chrome-free organic mud thinner containing sulfomethylated tannin
	sodium polyphosphate polymer treated humates

Table 4

MAXIMUM TRACE METAL CONCENTRATIONS MEASURED IN DRILLING MUD DISCHARGES[d]

Metal	Concentration (ppm)	Reference
Arsenic	17.2	a
Barium	398,800	b
Cadmium	4.2	b
Chromium	1,300	c
Copper	88	c
Lead	1,270	
Mercury	3.7	b
Nickel	88	c
Vanadium	235	c
Zinc	3,420	b

a. EPA, 1985a, p. 108. Reported as mg/kg drilling fluid.
b. Data from unpublished summary table (personal communication EPA Region 10 to R.D. Cardwell, May 1986), containing results from end-of-well chemical analyses reported to EPA Region 10 in discharge monitoring reports (mg/kg dry weight basis).
c. Northern Technical Services (1981, p. 91) (ppm drilling fluid) and Northern Technical Services (1982, p. 91) (mg/kg solid phase).
d. Statistical analyses to derive measures of dispersion in the data, such as the standard deviation or standard error of the estimate, have not been performed.

Table 5

SOLUBLE AND SOLID METAL CONCENTRATIONS IN DREDGED MATERIALS DUMPED AT SEA, 1978 AND 1979

Metal	Average Concentration Solid Phase mg/kg	Average Concentration Liquid Phase[a] ppm	Dissolved Constituent Concentration Ratio[b]
Arsenic	4.0	0.0049	0.0012
Cadmium	1.2	0.0016	0.0013
Chromium	33.0	0.0048	0.0001
Copper	30.4	0.0027	0.0001
Mercury	0.3	0.0003	0.0010
Nickel	15.0	0.0068	0.0005
Lead	29.6	0.0068	0.0002
Zinc	68.8	0.0325	0.0005

a. From results of elutriate test.
b. Liquid phase:solid phase (mg/l:mg/kg).

Source: Bigham et al. (1982, Pp. 292-294) as reported in Tetra Tech (1984, Table 10).

FATE AND TRANSPORT OF MUDS AND CUTTINGS DISCHARGES

This assessment relied extensively on the results of computer simulation modeling of drilling mud dilution and dispersion at a selected site in the Lease Sale Area. In the following sections, the oceanographic conditions in the Lease Sale Area are reviewed along with the criteria used to determine the site and conditions selected for modeling. Modeling results are then presented and discussed.

The areal extent of the lease area encompasses a wide variety of environmental conditions that are affected by: seasonal intrusion of first-year and multi-year sea ice; strong, sustained winds; and intense oceanographic coastal currents. The potential impacts from the discharge of drilling muds and cuttings into the marine environment will vary greatly depending on the site of the drilling operation. To limit the scope of this impact assessment to a manageable level, a site has been selected which presents a higher potential for vulnerability to drilling activities. The environmental conditions selected to evaluate the potential impact at this site were intended to represent mean and worst case situations during open-water and ice-covered discharge conditions. Methods of muds and cuttings discharge considered in this assessment include open-water, under-ice and above-ice discharge.

DRILLING SITE SELECTION

Much of the eastern and central portions of the Lease Sale Area are occupied by the northward flowing Alaskan Coastal Current and are characterized by high mean current speeds that may be at times in excess of 100 cm/s (Wilson et al., 1982; Hachmeister and Vinelli, 1985). This high current speed would not typically preclude drilling activities, but would lessen disposal impacts due to accompanying higher mixing and dilution ratios. In the spring, heat provided by the coastal current greatly enhances the retreat of the nearshore ice cover and exposes a considerable area of open water. Under certain meteorological conditions this current reverses from its northeasterly direction and flows to the southeast. These flow reversals have been observed to occur between 30 and 40% of the time. To the west of this coastal current, water depths range from 30 to 50 meters and mean open-water currents may exceed 20 cm/s, (Mountain; 1974, p. 8) thus providing for considerable dilution and transport of discharges from the drilling site. However, a shallow low current regime exists to the east of the Coastal Current, and this area may be more sensitive to impact by the disposal of drilling muds and cuttings. Areas of particular sensitivity in this regime occur in the coastal embayments between Cape Lisburne and Pt. Franklin. Other oceanographic features in the area include: the existence of eddies northwest of Pt. Lisburne, Icy Cape and Pt. Franklin during northerly flow periods; the occurrence of meteorologically induced storm surges and/or large current events; and the early occurrence of a persistent nearshore lead in the spring ice cover along the northeastern coast which might accommodate both drilling and shipping activities.

For this impact assessment, a candidate drilling site has been selected in the potentially more sensitive region along the southeastern coastline of the lease area. The site is located just north of Cape Lisburne (see Figure 1) in

20 m of water. This site is not necessarily representative of the development scenarios which are used in the body of this EIS for impact analysis purposes. However, for modeling purposes it should represent a reasonable upper bound on the potential environmental consequences of drilling muds and cuttings discharges from exploration phase activities. The assessment has examined the effects of discharge from drilling activities associated with one well and then five consecutive wells at the single drilling site.

ENVIRONMENTAL CONDITIONS

Two sets of environmental conditions were selected to depict open-water and ice-covered drilling operations. The first set of conditions applies to open-water disposal only and includes (1) a vertically uniform 20 centimeters per second (cm/s) mean current speed, (2) a nominal two-layer density stratification, and (3) a surface wave field appropriate to mean wind conditions at the site. The second set of environmental conditions are more benign, consisting of (1) a 5 cm/s current speed, (2) a nominal two-layer density stratification and (3) no surface wave field. This second set of environmental conditions describes either low wind, open-water conditions which occur periodically in certain coastal regions of the lease area or ice-covered conditions which occur for extended periods of time over a large extent of the lease area.

COMPUTER SIMULATION MODELING OF DISCHARGE DISPERSION

The Offshore Operators Committee (OOC) Model was used to predict initial dilution and deposition of a generic drilling mud for different environmental conditions during the open-water and ice-covered seasons in the lease area. An under-ice discharge scenario was examined separately because the behavior of discharged materials will differ between open-water and ice-covered conditions. Expected dilution and deposition for the different environmental conditions are described below.

Initially, under-ice disposal was thought to be more deleterious environmentally than open-water disposal. Although this continues to be the case with nearfield deposition, open-water deposition may be the most deleterious because a greater area is overlain with a blanket of fine particulates.

The OOC model input parameters for describing the ambient oceanographic conditions were chosen assuming a drilling rig located approximately midway between Cape Lisburne and Pt. Lay (see Figure 1) on the 20 m depth contour. The average estimated current speed for this location is 17 cm/s for Case 1 open-water conditions, and 5 cm/s for Case 2 open-water or under-ice conditions (Aagaard 1984, pp. 46-56; Hachmeister 1985, p. 12). A wave height of 1 meter and a wave period of 4.0 seconds were used for the higher velocity open-water simulations. These estimates were based on wave hindcasting results for the area in August made by Dr. T. L. Kozo (Kozo 1985, p. 216). Conditions of no surface waves were modeled for the low energy Case 2 open-water and under-ice conditions. A discharge rate of 750 bbl/hr, discharge duration of 3,500 seconds, and a mud bulk density of 17.4 pounds per gallon were assumed for a single discharge event. Model conditions included: (1) a single discharge event; (2) twelve discharge events at a

given site under uniform current conditions; and (3) twelve discharge events at a given site with six events occurring under each of two distinct (non-overlapping deposition) current conditions. Twelve discharge events approximates the maximum volume of mud discharged from five exploration and delineation wells at one site. Based on measurements made in the area by Hachmeister (1983), a minimal two-layer density stratification was also assumed. Table 6 summarizes important model inputs parameters and model results.

Table 6

SUMMARY OF OOC DRILLING MUD DISCHARGE MODEL

ASSUMPTIONS AND RESULTS

Parameter	Case 1	Case 2
Discharge Rate	750 bbl/hr	750 bbl/hr
Discharge Duration	3,500 seconds	3,500 sec
Water Depth	20 m	20 m
Unidirectional Current Speed	16.8 cm/sec	4.7 cm/sec
Sea State: H 1/3	1 m	0 m
T 1/3	4 seconds	--
Minimum Solids Dilution at 100 m, 500 seconds after stopping of discharge	627:1	2,245:1
Minimum Fluids Dilution at 100 m, 500 seconds after stopping of discharge	561:1	248:1
Maximum Bottom Accumulation per discharge event 100 m downcurrent of discharge point, averaged over 2,500 ft^2	0.5 cm	0.25 cm

OPEN-WATER DISCHARGES

Based on the OOC model runs used in this evaluation, approximately 75 percent of the solids occurring in drilling mud discharges will eventually be deposited on the seafloor downcurrent of the discharge point for both Case 1 and Case 2 open-water disposal scenarios. Model results indicate that for a single discharge event, sediment accumulation greater than 1.0 cm will cover approximately 2,560 square meters (m^2) of seafloor for the Case 1 open-water simulation and 1,160 m^2 for the Case 2 open-water simulation. For twelve consecutive discharge events under steady, unidirectional current conditions, about 5,110 m^2 and 4,200 m^2 will be covered for Case 1 and Case 2, respectively. For the twelve discharge events occurring under two dominant current directions the areas covered would be about 8,600 m^2 and 6,750 m^2, respectively.

Sedimentation depths at a location 100 meters downcurrent of the discharge point are predicted to be 0.5 cm for Case 1 and 0.25 cm for Case 2 open-water simulations. Twelve times this accumulation would occur for twelve consecutive discharge events under uniform current conditions and six times that amount would accumulate for the case of two dominant current conditions. Maximum drilling mud depositions of 20 cm are predicted at a distance of 30 m from the drilling site for a single discharge event scenario, while 245 and 122 cm accumulations are predicted for a twelve-event scenario under uniform and bimodal current conditions, respectively.

A worst-case scenario would occur for total areal coverage if the twelve discharge events all occurred under different current conditions. For Case 1, about 28,100 m^2 would be covered and for Case 2, 11,400 m^2 would be covered to a depth greater than 1 cm. The area of deposition in this scenario is somewhat less than the sum of the areas covered by twelve separate discharges because there is some overlap in the area covered directly beneath the rig by subsequent discharges.

A breakdown of sedimentation depths by drilling mud particle size is presented in Figure 2 for a single Case 1 and in Figure 3 for a single Case 2 discharge event simulation. Cuttings (not included in either figure) are expected to settle out of the plume more rapidly than the coarsest mud fraction and to accumulate to greater thicknesses than this mud fraction over a more confined area of the seafloor near the drilling rig.

The OOC model also predicts minima of solid and liquid phases at various depths and distances from the discharge point. At 500 seconds after termination of a single 3500 second discharge event, the minimum suspended solid phase dilution was 627:1 and the minimum liquid phase dilutions were 561:1 for the Case 1 open-water simulation. For the lower energy Case 2 open-water simulation these minimum dilution ratios were 2,245:1 for solid and 248:1 for liquid phases.

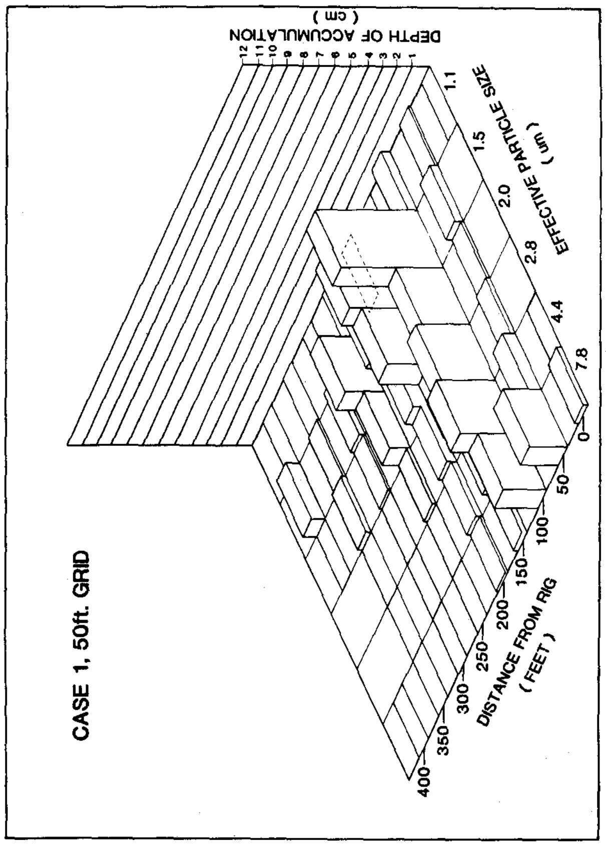


Figure 2. Predicted depths of sedimentation of drilling mud disposed during open water Single Discharge Event

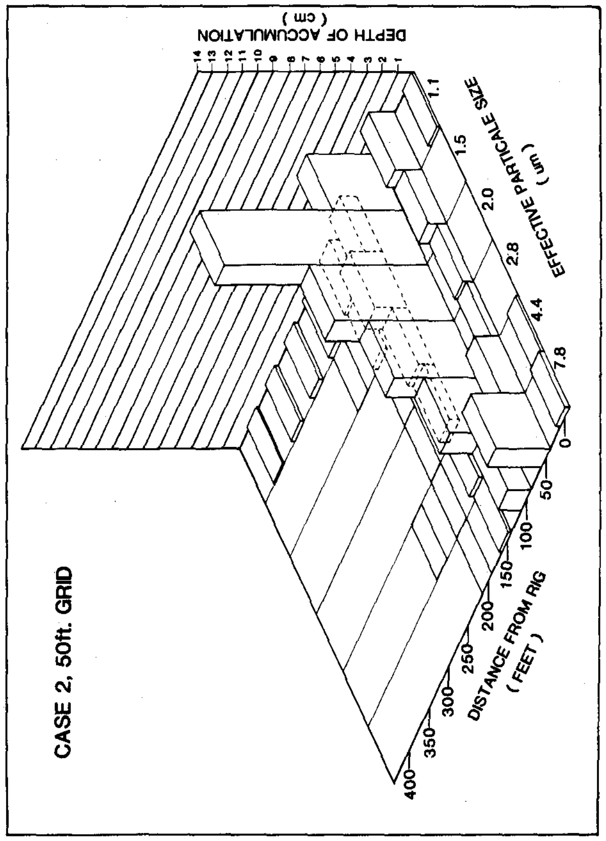


Figure 3. Predicted depths of sedimentation of drilling mud disposed under ice. Single Discharge Event

The accumulation and persistence of drilling muds and cuttings on the seafloor once deposited are inversely related to the energy of the ambient environment. A low energy environment typically does not possess current speeds capable of resuspending or removing deposited materials. In high energy environments, however, the oscillatory movement of water associated with surface waves has been shown to resuspend bottom sediment at depths as great as 70 meters (230 feet) (Cooper Consultants et al. 1985b). In uniform current environments, bottom currents greater than approximately 20 cm/s have also been shown to resuspend bottom sediments. Kennet (1982) has established a relationship for unconsolidated clay which shows that transportation and/or erosion will occur at water velocities greater than 10 cm/s. Given these conditions for resuspension and current meter data available from the shallow (50 m or less) waters extending from the Alaskan Coastal Current westward, it is unlikely that drilling muds released in most of the lease area during the open water season will remain undisturbed for extended periods of time. However, as the deposited clays become more consolidated (<50% water content), they may remain deposited even at current speeds as high as 100 cm/s. This has particular implications for under-ice disposal where sediments may be in a low energy environment for months before higher open-water currents are experienced. In the shallow, more protected waters along the eastern border of the lease area, deposition is more probable and resuspension less likely except under conditions of west-wind generated, storm waves. Within these coastal waters, dynamic oceanographic processes, however, can be expected to reduce the depth of deposition in regions of greater wave and current activity while extending the depositional area. Given identical energy environments, the deeper water environments will incur sedimentation of lesser thickness, covering a greater areal extent (Jones and Stokes; 1984, p. 44, 59).

UNDER-ICE DISPOSAL

The Chukchi Sea is ice covered for approximately eight months of the year, from early October through May. Oceanographic conditions during ice-covered periods are very different from those during open-water periods. These differences affect the dispersion characteristics of muds and cuttings which are released beneath the ice. Current velocities are much lower for much of the lease area during the ice-covered periods except in the region occupied by the Alaskan Coastal Current. Matthews (1981) and Aagaard and Haugen (1977) studied winter under-ice currents along the shallow water of the Beaufort Sea coast. Matthews (1981, p. 70) measured mean current speeds of 6 cm/s under the ice near Prudhoe Bay. At 10 meters below the ice in water depths of 30 to 40 meters offshore Narwhal Island, Aagaard and Haugen (1977, pp. 40-42) observed velocities typically less than 5 cm/s, with mean velocities ranging from 0.1 to 0.3 cm/s. Hachmeister (1985) measured under-ice, nearbottom currents in 20 meters of water northeast of Pt. Franklin ranging from 3.5 to 5.0 cm/s.

As discussed in the Case 2 open-water simulation, the model results indicate that for a single discharge event sediment accumulation greater than 1.0 centimeter will cover approximately 1,160 square meters (m^2)for the low energy, under-ice environment and 6,700 m^2 for twelve consecutive discharge events. Sedimentation depths 100 meters downcurrent from the discharge point are predicted to be 0.25 cm for a single discharge event and 3.0 cm for twelve consecutive discharge events under uniform current conditions. Maximum drilling mud depositions of 37 cm and 444 cm are predicted at a distance of 30 meters from the drilling site of single and twelve discharge scenarios, respectively. The breakdown of sedimentation depths by particle size of the drilling mud discharge for a single discharge event was presented previously in Figure 3. The minimum projected solid and liquid phase dilutions at 100 m were 2,245:1 and 248:1, respectively.

Of all the disposal methods described, under-ice discharge will produce, on the average, the greatest sedimentation depths. A stratified, low-energy environment exists over much of the lease area to the east and west of the Alaskan Coastal Current throughout the winter months, restricting dilution and increasing near-field sedimentation as described in the Case 2 simulations. (Aagaard, 1984; Hachmeister, 1985). The annual occurrence of high energy, open-water conditions in much of the lease area west of the coastal current will tend to resuspend and disperse winter accumulations of drilling muds on a seasonal basis in these regions. However, the persistence of lower energy conditions in shallow coastal embayments east of the Alaskan Coastal Current throughout much of the open-water season may contribute to the persistence of under-ice deposits of drilling muds and cuttings in these regions of the lease area.

ABOVE-ICE DISPOSAL

Disposal above ice is usually accomplished by depositing the material on the ice in large frozen chunks, with no layering attempted. It may also be spread thinly on the ice (in layers), within berms, which may keep the disposal site intact as long as possible during ice breakup. Dilution and dispersion of the effluent occur at breakup, under higher energy wind and water movement conditions. Mud disposed of as large chunks may not be dispersed in the same manner as the layered discharges.

Above-ice disposal allows the slow release of drilling muds into the environment during periods of higher energy. Mud behavior depends on the physical and thermal properties of the mud and sea ice. Depending on the location of the drilling site, one or more of several key factors may influence the dilution and dispersion of above-ice discharges including: relative melting rates of the muds and sea ice, water depth, river over-flooding, and oceanographic conditions during breakup.

Above-ice disposal of drilling muds can cause local modifications in the way ice melts at the disposal site during breakup. Mud tends to melt earlier than the surrounding sea ice, although layers thicker than 1 centimeter retard ablation of the sea ice (Northern Technical Services; 1981, p. 8). The liquid portion of the effluent drains through cracks in the ice at initial breakup. The solid fraction of the discharge remains on top of the ice until the later stages of the ice breakup. Dilution of mud is maximized for disposal sites that remain intact until final stages of the ice breakup process (Northern Technical Services; 1982, p. 5). This allows the mud to be released more slowly and, in the presence of dynamic oceanographic processes, results in greater dilution and dispersion.

Modeling of the transport and fate of muds at above-ice disposal sites is difficult due to the complexities of the ice breakup process. Field study results show that the maximum mud concentration entering the marine environment from above-ice disposal sites is much less than the concentration introduced by below-ice disposal methods. Therefore, the potential adverse effects from above-ice disposal should be substantially less than those caused by below-ice discharge (Northern Technical Services; 1981, pp. 6-121). If the solids are released slowly, dilution of muds discharged above the ice should be similar to or greater than that occurring during discharge to open waters. In shallow coastal water along the eastern portions of the lease area, ice may melt in place. This would cause the muds and cuttings to be deposited in a relatively confined area and, consequently, increase the depth of accumulated materials until such a time that current and wave activity might act to redistribute the materials. In this respect, the above-ice and below-ice scenarios will be similar in that both would rely heavily on post-breakup, open-water conditions for material redistribution.

WATER QUALITY

The CWA §403(c) regulations allow a 100 m radius mixing zone for initial dilution of the effluent. At the edge of the mixing zone, marine water quality criteria must be met. The Offshore Operators Committee (OOC) and EPA discharge models were used to predict worst case initial dilution and solids deposition of below-ice disposal in the Chukchi Sea. The worst case predicted by the computer model consisted of a winter discharge of 750 bbl/hr into 20 m of water and a current speed of 4.7 cm/sec. The worst (lowest) dilution achieved at the edge of the mixing zone was approximately 248:1 at approximately 10 m depth, for dissolved metals with a discharge duration of less than one hour.

Table 7 presents a comparison of applicable water quality criteria with ambient concentrations predicted using a dilution of 248:1 and the liquid phase mud metal concentration estimated from partitioning of the values shown in Table 4. Based on these results, water quality should be well within the acute marine water quality criteria, outside of the zone of initial dilution, for exploratory phase discharges. Concentrations of one metal, mercury (.0001 ppm), exceed maximum chronic exposure levels (0.000025 ppm) but would be well within criteria for acute exposure (0.0021 ppm).

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%) 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 probably readily absorb 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, p. 259) (O'Donnel et al.; 1985, p. 485). Particulate-bound chemicals have variable bioavailability that depends on the chemical and biological species and environmental conditions considered (Anderson et al.; 1978, p. 276).

Table 7

COMPARISON OF EXPECTED DISSOLVED METALS CONCENTRATIONS AT THE EDGE OF THE MIXING ZONE IN LEASE SALE 109 TO MARINE WATER QUALITY CRITERIA

Metal	Dissolved Concentrations[a] ppm		Marine Criteria[d] (one hour average)
	In Discharge[b]	At 100m from Discharge[c]	
Arsenic	0.017	0.00007	0.069
Barium	399.0	1.6	No Criterion
Cadmium	0.004	0.000016	0.43
Chromium	1.3	.005	1.1[e]
Copper	.088	0.00035	0.0029
Lead	1.27	0.005	0.140
Mercury	0.0037	0.00001	0.0021
Nickel	0.088	0.00035	0.071[f]
Vanadium	0.235	0.0009	No Criterion
Zinc	3.42	0.0137	0.087[g]

(a) Based on maximum whole mud metal concentrations as reported in Table 4.
(b) Dissolved concentrations represent 0.1 percent of total concentration in muds. (See dissolved constituent concentration ratios in Table 5.)
(c) Assumed dilution 248:1. Corresponding to discharge 750 bbl/hr into water depth of 20 m and current speed of 4.7 cm/sec.
(d) From 50 FR 30784. EPA 1985b. One hour average concentration (ppm) not to be exceeded more than once every three years on the average, based on the total recoverable method (see notes f,g below).
(e) Hexavalent chromium
(f) From 51 FR 8363. EPA 1986a. Proposed Criteria, based on total recoverable method. Existing criterion is 0.140 ppm.
(g) From 51 FR 19270. EPA 1986b. Proposed criteria for maximum allowable concentration (ppm) based on total recoverable method which is operationally defined as the concentration of metal in an unfiltered sample following treatment with hot diluted mineral acid (EPA 1979).

EFFECTS ON MARINE BIOTA

INTRODUCTION

The Lease Sale 109 area includes waters to depths of 80 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. A simplified food web diagram for the shallow (less than 5 meters) and deep (5-20 meters) nearshore of the Chukchi Sea region is presented in Figure 4. A major feature of this diagram is the detrital base of coastal food webs (Truett; 1984, p. 159).

Truett (1984, p. 161) presented a comparison of the Chukchi Sea and Beaufort Sea coastal ecosystems; major points from this comparison important to the present analyses of exploratory drilling discharges in Sale 109 are summarized below.

Physically, the coastal Chukchi Sea has more open water both spatially and temporally than does the coastal 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 polynya 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.

Chukchi Sea coastal foodwebs, in comparison with the Beaufort Sea, have a greater annual primary productivity 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; and a greater diversity of marine fish species; and a greater diversity and biomass of fish-eating predators.

The vertebrate fauna of the Chukchi Sea coastal zone, in comparison with the Beaufort Sea, has more species and greater biomass of marine mammals per unit area; more species and greater unit area biomass of marine fishes; fewer species, and lesser biomass per unit area of non-salmonid anadromous fishes; a lower density of feeding and molting oldsquaws; a greater density of feeding and molting eiders during summer; and a greater abundance of cliff-nesting seabirds (the Beaufort has essentially none).

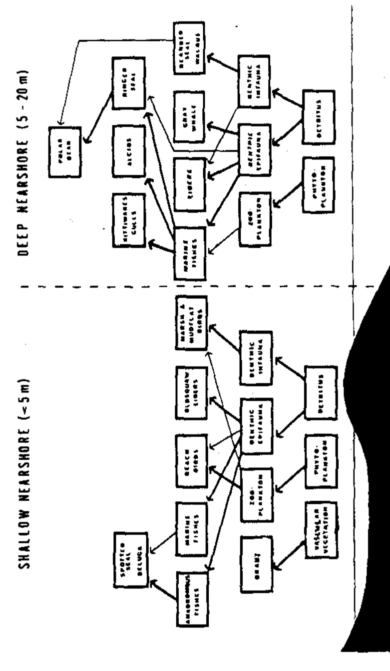


Figure 4. Simplified food web of the Barrow Arch coastal ecosystem. Arrow width indicates relative importance of food source (Truett 1984).

The detritus-based benthic infauna and epifauna are the major sources of food for higher trophic levels in the Chukchi Sea. These benthic communities are expected to be more vulnerable than other marine communities to discharges of drilling muds and cuttings during oil and gas exploration. For these reasons, benthic communities are of primary concern for activities associated with Lease Sale 109.

Most of the important species (as defined by Truett; 1984, p. 153) of the Chukchi Sea are associated primarily with the nearshore area (20 meters and shallower). Exceptions include walrus and bearded seal, which use the pack ice edge and are therefore often in the deeper areas of the Chukchi Sea during summer, and marine fishes. Most of the Sale 109 area is between 30 and 50 meters deep; the biology of these deeper areas is less studied than the nearshore areas. Exploratory drilling in the nearshore area could have greater primary and secondary effects on important marine biota than drilling in the offshore area.

EFFECTS ON BENTHIC COMMUNITIES

The National Research Council (NRC) (1983, p. 105), Ferbrache (1983, p. 12) and Jones and Stokes (1984, p. B-19) have summarized the work of Petrazzuolo (1981), Neff (1981) and Brandsma et al. (1980), identifying the potential detrimental benthic impacts of discharged drilling fluids and cuttings in low-energy environments as:

a) Physical smothering of bottom-dwelling organisms.

b) Effects on 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.

c) Introduction of substances which may have negative effects upon metabolism, health, behavior, or reproductive capability of benthic species (i.e., toxic effects).

PHYSICAL SMOTHERING OF BOTTOM-DWELLING ORGANISMS

Inferences from the Literature

Benthic organisms that are sessile or possess limited mobility are vulnerable to smothering from deposited drilling cuttings and muds (Davies et al., 1984; Jones and Stokes 1984, p. B-19; Rhoads and Young, 1970; Yeo and Risk, 1979; Turk and Risk, 1981; Rose, 1973). An organism's vulnerability to smothering is influenced by its morphology, life history and behavior, the depth and duration of burial, the type of sediment deposited, water temperature and chemical conditions (Auble et al.; 1984, pp. 150-151). Based on the studies referenced above, a sedimentation depth of about 1 cm appears to be the no-effect level for smothering of large (e.g., >5-10 mm) benthic invertebrates, but it probably is considerably less for larval stages or smaller species.

The rate of sedimentation as well as the depth of the sediment are instrumental in determining which species of benthic organisms are adversely affected. In fact the two parameters may be partially independent. Turk and Risk (1981) showed that the deposit-feeding clam[3] Macoma balthica could survive, without mortality or decreases in density, when exposed to sedimentation rates of up to 10.2 cm/month (mo) and sedimentation depths reaching 2.8 cm. Conversely, depths of as little as 3 cm caused 50 percent mortality in populations of the suspension-feeding clam Mya arenaria. Sedimentation rates of 2-2.5 cm per month had a catastrophic effect on populations of the deposit-feeding, tube-building amphipod Corophium volutator. According to the authors, a rate of 1.5 cm/mo may impair recolonization by Corophium.

Sedimentation rates as low as 1.5 cm/mo could slow colonization of benthic habitats. Rose (1973) has shown that the oyster Crassostrea virginica could be killed when covered with 2-15 cm of sediment. Although all these species do not occur in the Chukchi Sea, there are analogous species, and there is no reason to believe that effects on local species would not occur with comparable exposure. Besides the aforementioned studies of sedimentation on marine life, Davies et al. 1984, and Menzie et al. 1980, have also studied the effects of oil drilling discharges on benthic resources.

Davies et al. (1984, p. 365) indicated that the zone of smothering may extend about 200 m from the point of discharge. From 200-500 m distant, benthic populations returned to normal and at distances greater than 500 m no changes were recorded. Their field data appear to be consistent with the results presented above. Species diversity extending outward from the point of discharge increased rapidly from no organisms to levels seen in uncontaminated areas. The latter occurred between 200 and 2,000 m from the point of discharge (Davies et al.; 1984, p. 366). Anaerobic conditions prevailed from 0 to 500 m from the source, as little or no biodegradation occurred due to the weight of the cuttings. In addition there was limited resuspension and dispersal of sediments in this area. Natural sedimentation was believed to be the mechanism for recovery of the area in the immediate vicinity of the drilling rig (Davies et al.; 1984, p. 369).

Localized depression of infaunal communities due to smothering will be most likely in areas where deposition of muds and cuttings on the benthos exceeds approximately 1 cm and persists for more than a few days (Jones and Stokes; 1984, p. B-19). 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 depressed larval recruitment may occur (Menzie et al.; 1980, p. 511), such as discussed above.

Menzie et al. (op cit.) noted reduced abundances of polychaetes, molluscs, and crustaceans up to 370 meters from a well site in a low energy

3. A suspension-feeding clam eats food suspended in the water overlying the sediments. A deposit-feeding clam eats food that is attached to or consisting of particulates on the bottom.

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 (Astropecten americanus) appeared unaffected.

Species attracted to the harder substrates of newly-formed mounds may colonize them in response to a "reef effect" (Shinn 1974 and George 1975 in Northern Technical Services 1981, and Menzie et al. 1980, p. 504).

Inferences Based on Modeling Results

The modeling data reported earlier concerning dilution and dispersion of drilling muds from a presumedly worst-case site in the lease sale area suggest that drilling mud sedimentation depths will be great enough to smother some types of benthos and affect their populations through habitat disruption. These effects are expected to manifest themselves in areas beyond the mixing zone currently allowed for drilling muds and cuttings by EPA, which is 100 m in diameter from the point of discharge.

These conclusions are based on sedimentation depths predicted from modeling two drilling mud discharge scenarios. These scenarios assumed that five exploratory wells would be drilled in one location, each averaging about two and one-half discharge events, for a total of twelve events. For one scenario we assumed that muds from six events would settle in exactly the same location downstream from the discharge point, while the muds from another six discharge events would settle in an exact location in another non-overlapping distinct direction, due to shifting currents. A second scenario modeled twelve distinct discharge events in the same direction depositing muds in exactly the same location downstream from the discharge point. These cases also assumed that disposal would be under the ice and/or a low current velocity (0.155 cm/s).

Under worst-case depth deposition conditions described above, smothering and other effects on benthic habitat could extend well beyond 137 m if more than one well is drilled in one location. Sedimentation from one or two discharge events is not expected to affect the benthos beyond the 100 m mixing zone (Figure 5) because predicted sedimentation at that distance is less than 1.4 mm. But as Figures 6 and 7 demonstrate, sedimentation at one location from six or twelve discharge events is expected to cause smothering well beyond the mixing zone. At 137 m, total sediment depths are predicted to be 8.4 and 16.8 mm for the six and twelve discharge event cases, respectively. At this distance, the sediment should be exclusively the finest mud particles (i.e., 0.0011 mm mean diameter).

As discussed earlier, drilling muds and cuttings have the potential to disrupt benthic habitat as well as smother benthic organisms. As shown in Figure 8, the sedimentation rates at the edge of the 100 m mixing zone for low velocity currents would not exceed 0.27 or 0.68 cm per month, respectively, assuming one or two and one-half discharge events per month. Based on the data concerning sedimentation effects on benthic habitat, the predicted sedimentation rates are probably sufficient to affect some benthic species and life stages. For example, Atema et al. (1982) found that layers of drilling mud of as little as 1 mm (0.1 cm) covering a natural substrate caused severe delays in shelter construction by post-larval Atlantic lobsters (Homarus americanus), while Turk and Risk (1981) found that a sedimentation rate of 1.9 cm per month caused a ten-fold decline in the density of the tube-building amphipod Corophium volutator. Tetra Tech (1984, p. 52) also noted that no studies have been conducted concerning the relationship between the magnitude or duration of solids accumulation on the seafloor and the health of benthic biological communities.

Any effect of sedimentation rate on colonization of benthic infauna would be expected to be observed at a distance of at least 137 meters from the point of discharge because there would still be a substantial rate of deposition of fine particles (mainly 0.0015 mm diameter) at this point.

EFFECTS ON COMMUNITY STRUCTURE AND BENTHIC HABITAT

Community structure close to the point of drilling mud discharges has been demonstrated to change markedly, most characteristically in terms of a proliferation of opportunistic species and the reduction in species diversity. Structural changes can occur with exposure to as little as 0.2 cm of drilling muds (Tagatz et al.; 1982, pp. 133-136). These changes are due to shifts in the particle size of the substrate, and toxicity (Addy et al., 1984, pp. 434-436; Atema et al. 1982; and Turk and Risk 1981). This discussion will address community effects of drilling muds due mainly to changes in the quality of the benthic habitat. Changes in habitat quality due to toxicity are discussed in the next section on Toxicology.

The effect on benthic communities of lignosulfonate-type drilling muds in the sediment and in the water has been studied by Tagatz et al. (1978, pp. 37-39; 1982, pp. 133-136; 1985, pp. 112-117). They found that the number of organisms, as well as the number of species of tunicates, molluscs, and annelids, decreased significantly when recruitment of larvae to the bottom in estuarine water containing 50 ppm of drilling mud was studied. Species diversity actually increased, while growth of the tunicates was negatively affected by exposure to lignosulfonate-type muds. Tagatz et al. (1985, p. 185) found that muds containing the highest content of No. 2 diesel fuel oil were the most lethal to many organisms. Accordingly, EPA has prohibited the discharge of drilling muds containing diesel oil. EPA requires that mineral oils, which have a substantially lower content of the aromatic hydrocarbons (which probably are the most acutely toxic constituents) be used in discharged muds.

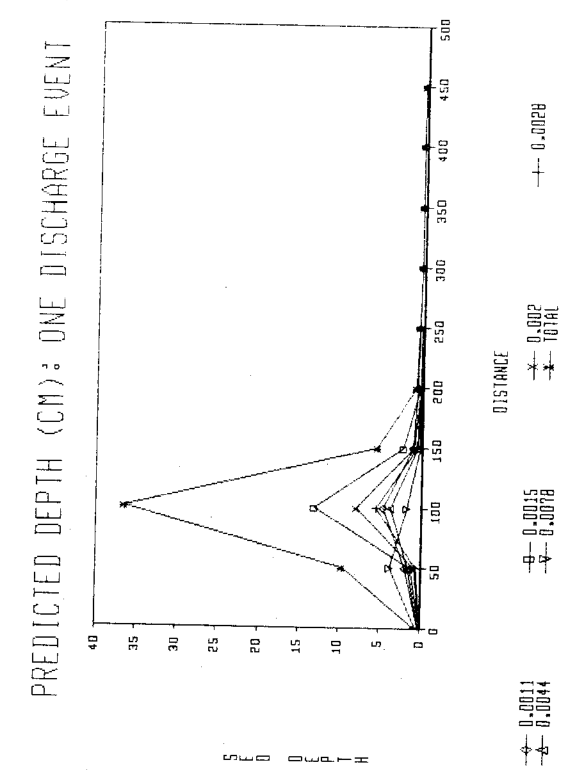


FIGURE 5 Predicted depth of drilling mud deposition (i.e., sed depth, cm) in relation to distance (feet) from the discharge point, assuming that the one discharge event is under the ice in a current of 0.155 feet per second. Each line on the graph represents the mud particles mean diameter (e.g., 0.0011 mm).

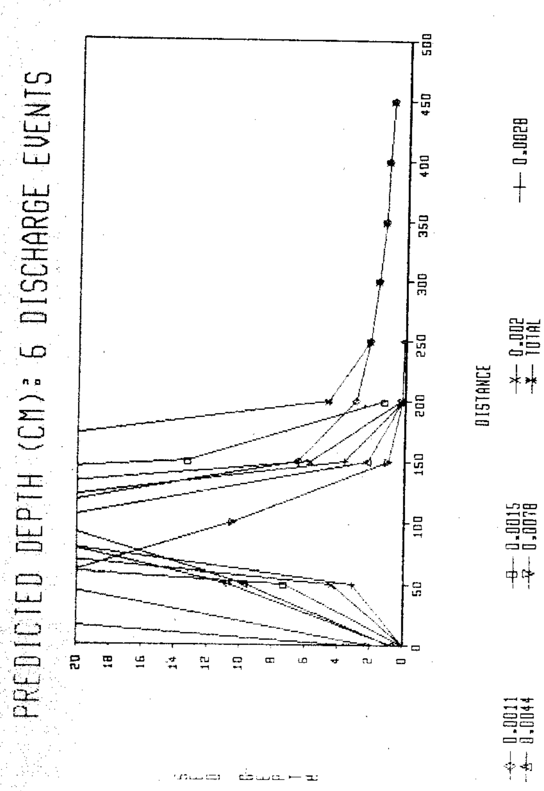


FIGURE 6 Predicted depth of drilling mud deposition (i.e, sed depth, cm) in relation to distance (feet) from the discharge point, assuming that the mud from six discharge events settles in one location under the ice in a current of 0.155 feet per second. Each line on the graph represents the mud particles mean diameter (e.g., 0.0011 mm). The graph has been enlarged to show more precisely sedimentation depths in the range of the assumed thresholds for smothering and habitat disruption of benthic organisms.

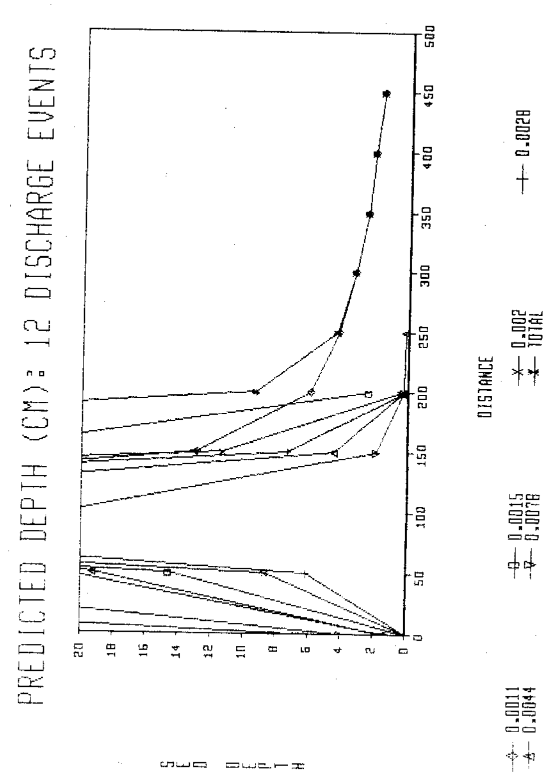


FIGURE 7 Predicted depth of drilling mud deposition (i.e., sed depth,cm) in relation to distance (feet) from the discharge point, assuming that the mud from twelve discharge events settles in one location under the ice in a current of 0.155 feet per second. Each line on the graph represents the mud particles mean diameter (e.g., 0.0011 mm). The graph has been enlarged to show more precisely sedimentation depths in the range of the assumed thresholds for smothering and habitat disruption of benthic organisms.

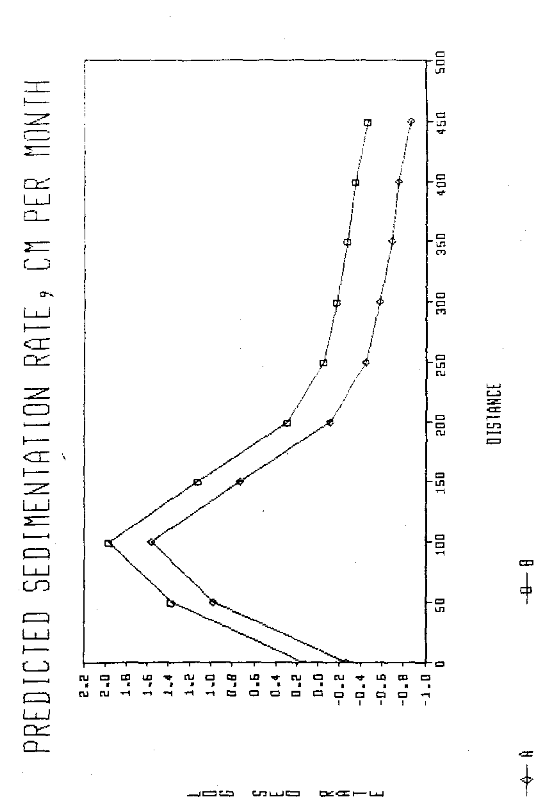


FIGURE 8 Predicted monthly rate of drilling mud sedimentation in relation to distance (feet) from the discharge point, assuming one (A) or two and one-half (B) discharge events per month, under-ice discharge, and a current of 0.155 feet per second.

Bottom-dwelling organisms could be affected in a number of ways by the settleable particulates in drilling mud discharges. Some species near the discharge may experience abrasion or clogging of gills and feeding structures. Mobile invertebrates may be able to move out of the affected area. Impacts on sessile invertebrates may be greater than those to mobile species. The composition of the drilling fluids would be expected to influence the impact on the benthos with the finer, more clay-silt particulate being more detrimental to communities. Menzie (1983, p. 35) notes that densities of polychaete worms decrease in areas of elevated clay content and Addy et al. (1984, p. 434) mention a preference of polychaetes for a coarser sediment. The epifaunal suspension feeding amphipod Erichthonius rubricornis experienced a dramatic decline in population. This was attributed to a change in sediment grain size characteristics, possibly caused by naturally occurring scouring action or the accumulation of drill cuttings (Maciolek-Blake et al. 1983, p. 982). Sherk et al. (1974, pp. vii-viii) found that particulate material can cause mortality, decrease yield, and interfere with energy flow. They found that two suspension-feeding copepods experienced biologically significant reductions in ingestion when exposed to suspensions of Fuller's earth, fine sand, and river silt at concentrations greater than 250 mg/l.

Recruitment of colonizing benthic organisms is reduced where sediments are covered with layers of drilling mud (Atema et al. 1982; Menzie 1983, p. 34; Turk and Risk 1981). Many organisms have planktonic larvae that can selectively settle and may be able to detect sediments that are altered physically or chemically. As noted above, Atema et al. (1982) found that layers of drilling mud of as little as 0.1 cm covering a natural substrate caused severe delays in shelter construction and in the quality of burrows produced by post-larval Atlantic lobsters. These in turn would increase their exposure to predators and currents. Turk and Risk (1981) observed that a sedimentation rate of 1.9 cm/mo of natural sediment caused a ten-fold decline in the density of the amphipod, Corophium volutator. Because both species have reasonably related analogous species in the Chukchi Sea, similar effects are anticipated with similar exposure. Anderson et al. (1978, p. 787-789) however, found minimal effects on recruitment with sediment containing (initially) concentrations as high as 30 ppm methylnapthalenes and 12 ppm methylphenanthrenes. These concentrations decreased by an order of magnitude in 100 days and were not detectable after 200 days. Still, it is surprising that a greater inhibition of recruitment did not occur.

Although the recovery of benthic communities to their baseline structure or abundance appears to be slow in low-energy environments, Menzie et al. (1980) and other authors suggest that benthic communities within the initial impact zone commence recovery within a year following cessation of discharge. Nearshore changes in community structure should return to background levels of variability as drilling fluids and cuttings are dispersed by wave-induced resuspension of sediments and long-shore mixing. In deeper, low-energy portions of the nearshore, reworking of persistent, built up materials by benthic organisms and recolonization from adjacent areas will contribute to recovery of smothered species and reestablishment of community structures.

TOXICOLOGICAL EFFECTS

As stated earlier, drilling muds contain chemicals that are toxic to aquatic life. Cuttings can also contain up to 10% oils (wet weight). The toxic materials include heavy metals, semimetals like arsenic, a variety of aromatic hydrocarbons like naphthalenes and phenanthrenes, chemicals like lignosulfonates, and an excess of hydroxide ions (i.e., highly alkaline pH). Because their specific chemical composition is complex, as well as poorly understood, toxicity bioassays are needed to define their toxicity potential and check for chemical interactions. Some of the toxicants in drilling muds are bioaccumulated by aquatic life and one--methylated mercury--can be biomagnified under certain conditions (Cooper Consultants, Inc. 1985a). Consequently, such compounds may pose a threat to fish, wildlife and people consuming contaminated fish and shellfish.

Despite their toxicity potential, drilling muds and cuttings will never prove toxic unless organisms are exposed long enough to toxic concentrations of biologically available (i.e., bioavailable) constituents. Bioavailable constituents are ones that exist in forms that can pass into the organism, e.g., via its gills, lungs, epidermis, or guts. In general, organisms residing in the water column are not expected to be exposed long enough to drilling mud constituents to be affected adversely. Most of the toxicity data consist of exposures lasting dozens of hours, while water column species are exposed for only a few minutes or hours at most. Once the mud settles to the bottom, however, exposure is sufficiently long to imperil species living on or in the bottom. Accordingly, concerns about acute toxicity, acute chronic toxicity, and bioaccumulation are valid and must be evaluated.

The most important toxic property of drilling muds is probably their chronic toxicity to benthic species; toxicity to other groups of organisms (e.g., fish, plankton) appears to be substantially less significant.

The following summary concerning the effects of drilling muds and cuttings pertains to species indigenous to the United States, with emphasis on Alaskan species where sufficient data exist. The analysis extends beyond Alaskan species simply because there is no evidence that Alaskan species are inherently more or less sensitive than those from other regions. The EPA's (1985b) water quality criteria also found no reason to differentiate between regions of the country, but did allow site-specific testing if there was any reason to believe resident species had unusual sensitivities.

Acute Toxicity

Based on past studies, the eight generic drilling muds do not possess a high degree of acute toxicity to marine life; the 96-hr LC_{50}[4] for the most toxic mud and the mysid Mysidopsis bahia was 27,000 ppm for the suspended particulate phase (EPA 1985a, Table V-II). Moreover, their toxicity potential appears limited when they are suspended in the water column because toxic concentrations are so ephemeral. Under most conditions they are diluted so quickly that concentrations rapidly fall below those causing acute toxicity. In addition drilling muds apparently are not rapidly acting, based on studies of shrimp and crab larvae by Carls and Rice (1984, p. 45), and on a field study

4. LC_{50} is the concentration killing 50 percent of the test animals.

by Gerber et al. (1980, p. 891). The latter study indicated that toxicity and sublethal effects would be expected for organisms exposed to used drilling muds close to the source. At high discharge rates (i.e., 275-1,000 bbl/hr), some form of toxicity might occur in the water column 20 to 30 meters downstream from the discharge point. However, pelagic animals affected sublethally may recover when carried by the currents to areas possessing lower concentrations of contaminants.

In the water column, planktonic and larval forms generally appear to be the most sensitive of the organisms tested to date. This is to be expected because their small size makes it easier for chemicals to be absorbed compared to larger species or individuals, and they are believed to possess less effective detoxification systems.

In the water column, planktonic species and larval stages generally appear to be the most sensitive of the organisms tested to date. This is to be expected because their small size makes it easier for chemicals to be absorbed compared to larger species or individuals, and they are believed to possess less effective detoxification systems (Rand and Petrocelli; 1985, pp. 6 and 542). For example, juveniles of a planktonic, epibenthic mysid (Mysidopsis bahia) were tested to determine 96-hr LC_{50s} for seven of the eight generic mud types prescribed by EPA (Gaetz et al.; 1986, pp. 813-821). The lowest 96hr LC_{50s} obtained were 114,000 ppm for the liquid phase (ranging from 114,000 to > 150,000 ppm), and 726 ppm for the suspended particulate phase (ranging from 726 to > 50,000 ppm). The least dilution predicted by the OOC modeling for the edge of the mixing zone, 100 m from the discharge, would produce a drilling mud concentration exceeding 4,000 ppm, occurring only during the 1.5 to 2 hours of discharge. Therefore, effects on some species would be anticipated provided the organisms occupied the plume and exposure was long enough. However, this is not expected to be the case.

Not all planktonic organisms are sensitive to short-term exposure to drilling mud. Carls and Rice (1984, p. 45) found several drilling muds to have low toxicity to the larvae of six Alaskan species of shrimp and crab. $LC_{50's}$ for the liquid phase of a drilling mud-seawater mixture ranged from 6,000 to 82,000 ppm, with shrimp larvae being slightly more sensitive than crab larvae.

Chronic Toxicity

After the mud settles to the bottom, in certain areas it will persist long enough to be acutely and chronically toxic to some benthic-dwelling species. This conclusion is based on Figure 9, which indicates that the predicted concentrations of copper, lead, chromium and mercury in the 14 drilling muds in Table 8 may be acutely or chronically toxic, or both, depending on which drilling mud is being used. Of greatest interest is copper because predicted dissolved concentrations of five of the fourteen types of water-based drilling muds (Table 8) could be toxic to some species. According to the USDOI MMS (1984, p. IV-49), effects of metals in drilling muds are sublethal, which is consistent with this assessment. Most of the chronic effects are expected to be manifested in community effects, which--as discussed in the preceding section--are expected to be a function of the mud's particle size and organic content, in addition to the toxicity of its constituents.

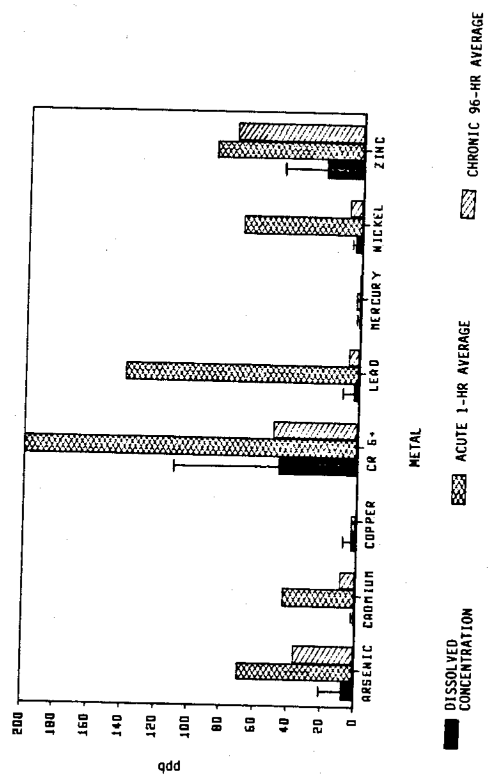
Bioaccumulation

It is well known that the majority of fish and shellfish species will accumulate the metals and petroleum hydrocarbons in drilling muds to varying degrees. Statistically significant accumulations of metals have been found in the tissues of various benthic species exposed to drilling fluids (Mariani et al.; 1980, p. 448). However, Crippen et al. (1980) and Windom et al. (1980, p. 192) reported, in general, poor correlations between the levels of heavy metals in the substrate or in food and levels of the metals in the tissues of the organisms. This is due to the limited bioavailability of the chemicals plus the capacity of the organisms to detoxify and excrete most of the chemicals (Leland and Kuwabara; 1985, p. 394). It should be noted that the Crippen et al. (1980) study was influenced by gravel island construction impacts as well as drilling muds. Within the context of currently available information, it is likely that bioaccumulation of drilling mud constituents by marine life will be minor in areas where exploratory drilling is being conducted (Ferbrache; 1983, p. 41).

Because most organisms appear to have the ability to detoxify and excrete most of the constituents in drilling muds, most of the compounds are not accumulated to high concentrations or biomagnified. The only exception is the methylated form of mercury. Other than methyl mercury, none of the heavy metals or hydrocarbons in the muds appear to be biomagnified. This conclusion is based on the literature (see Leland and Kuwabara 1985, p. 394) and inspection of the bioconcentration factors in EPA's water quality criteria documents (e.g., EPA 1980, 1985b).

Certain of the metals, like lead and cadmium, can be quite toxic to mammals if eaten in sufficiently large amounts, but neither the Food and Drug Administration nor the EPA has set maximum levels of these chemicals in fish and shellfish slated for human consumption. Tetra Tech Inc. (1986) came up with estimated levels of a number of organic chemicals and heavy metals in aquatic life based on the lowest dose known to cause either cancer or other effects on human health. Analysis of these data indicate that for the five inorganic chemicals evaluated -- arsenic, hexavalent chromium, mercury, nickel and silver -- existing EPA water quality criteria should protect the public from unacceptable adverse effects arising from consumption of fish and shellfish.

FIGURE 9
COMPARISON OF ESTIMATED DISSOLVED METAL CONCENTRATIONS TO MARINE WATER QUALITY CRITERIA



Estimated concentrations (ppb 95% confidence limits) of selected metals dissolved in the interstitial seawater of sediment from the deposition of approved EPA drilling muds compared to EPA acute (1-HR average) and chronic (96-HR average) marine water quality criteria for these metals. (Refer to Appendix for explanation of how the estimated dissolved metal concentrations were derived.

Table 8

SELECTED TOTAL METAL CONCENTRATIONS IN GENERIC DRILLING MUDS[(a)]

Generic Mud No.	Type of Mud	Zn mg/kg	Ba mg/kg	Cd mg/kg	Cr mg/kg	Cu mg/kg
1	KCl Polymer	26.2	246	0.22	< 3.0	3.96
2	Seawater Lignosulfonate	42.4	74.0	0.472	764	27.5
3	Lime	37.0	41.2	0.378	908	40.6
4	Nondispersed	35.9	286	0.446	< 3.0	6.78
5	Spud	8.68	293	0.74	< 3.0	1.61
6	Seawater/Freshwater Gel	3.28	65.4	0.42	< 3.0	0.70
7	Lightly Treated Lignosulfonate Mud	2.26	408	0.142	299	2.86
8	Lignosulfonate Freshwater	90.4	54.6	0.36	770	72.2
2-01	Mud 2 + 1 Percent Vol. Mineral Oil	43.4	71.3	0.395	740	26.8
2-05	Mud 2 + 5 Percent Vol. Mineral Oil	40.8	144.1	0.717	720	26.0
2-10	Mud 2 + 10 Percent Vol. Mineral Oil	46.0	47.5	0.470	640	26.1
8-01	Mud 8 + 1 Percent Vol. Mineral Oil	86.8	1240	0.18	610	68.9
8-05	Mud 8 + 5 Percent Vol. Mineral Oil	66.6	27.0	0.28	541	77.3
8-10	Mud 8 + 10 Percent Vol.	77.8	39.5	0.36	560	42.8

(a) Dry weight basis, average of two samples of laboratory prepared muds. The muds were "hot-rolled" prior to the analyses in order to simulate chemical changes induced by downhole conditions.

Source: U.S. EPA 1985a, p. 108.

TABLE 8 (Continued)

SELECTED TOTAL METAL CONCENTRATIONS IN GENERIC DRILLING MUDS[(a)]

Generic Mud No.	Type of Mud	Ni mg/kg	Pb mg/kg	Hg mg/kg	As mg/kg
1	KCl Polymer	< 6.0	7.74	0.261	4.64
2	Seawater Lignosulfonate	< 6.0	1.82	0.264	2.40
3	Lime	< 6.0	1.42	0.753	17.2
4	Nondispersed	< 6.0	41.2	0.437	5.25
5	Spud	< 6.0	52.5	< 0.010	0.258
6	Seawater/ Freshwater Gel	< 6.0		0.297	0.621
7	Lightly Treated Lignosulfonate Mud	< 6.0	1.53	0.0961	0.497
8	Lignosulfonate Freshwater Mud	< 6.0	17.8	0.355	11.7
2-01	Mud 2 + 1 Percent Vol. Mineral Oil	7.76	6.83	0.107	1.47
2-05	Mud 2 + 5 Percent Vol. Mineral Oil	9.80	6.20	0.091	1.70
2-10	Mud 2 + 10 Percent Vol. Mineral Oil	6.98	1.17	0.072	1.97
8-01	Mud 8 + 1 Percent Vol. Mineral Oil	< 6.0	24.5	0.391	12.2
8-05	Mud 8 + 5 Percent Vol. Mineral Oil	< 6.0	13.0	0.368	9.61
8-10	Mud 8 + 10 Percent Vol. Mineral Oil	< 6.0	9.48	0.287	9.24

(a) Dry weight basis, average of two samples of laboratory prepared muds. The muds were "hot-rolled" prior to the analyses in order to simulate chemical changes induced by downhole conditions.

Source: U.S. EPA 1985a, p. 108.

Summary

Bottom-dwelling organisms are expected to be the most vulnerable group of organisms to drilling muds and cuttings, particularly those that are immobile. It does not appear that planktonic and pelagic organisms will be exposed to drilling mud discharges for long enough and at high enough concentrations to be affected adversely, though effects on some species and life stages are conceivable.

Discharges of drilling muds could adversely affect bottom-dwelling organisms in a number of ways, via smothering, alteration of the character of the bottom (i.e., altering benthic habitat), or via chemical toxicity. Most probably, a combination of these factors operate. At least two studies have shown that as little as 1 mm of drilling mud deposited on the bottom can adversely affect recruitment of some benthic species, ultimately reducing the number of species. For open-water disposal, these levels of drilling mud may occur beyond the 100 m mixing zone currently authorized by EPA. Bottom-dwelling species also could be exposed to concentrations of lead, copper and perhaps mercury and hexavalent chromium that could be chronically toxic.

Given these assessments, effects of drilling mud discharges, which appear to be limited to areas less than 500 m in diameter, are conceivable for under-ice discharges. Because the assessment considered worst-case conditions, it is likely that the actual effects associated with under-ice disposal during exploratory drilling will generally be less than projected. Moreover, in many areas impacts will be transitory because sediments will be reworked biologically and physically. The probability of adverse impacts would be even more localized with above-ice and open-water disposal. With above-ice disposal, they may not be detectable. Consequently, due to the limited quantity of materials discharged and the small areas affected by the discharges, the impacts are expected to be insignificant in all areas save perhaps those constituting special aquatic sites (e.g., a critical feeding area for marine birds or mammals).

EFFECTS ON LOWER TROPHIC LEVELS

MACROPHYTES

Macroalgae communities are distributed throughout the coastal zone of the Chukchi Sea, and are known to be more widespread than in the Beaufort Sea (Truett; 1984, p. 142). However, these communities are considered to be insignificant contributors of carbon to Chukchi Sea food webs except, perhaps, in localized, shallow coastal habitats. The locations of known kelp beds, primarily _Laminaria saccharina_ and _L. solidungula_, are shown in Truett (1984, p. 145). Gravel or larger-grained substrates in shallow water areas, which are protected from gouging by moving ice, offer the best habitat for these algae; water clarity is presumedly also important (Truett; 1984, p. 142).

Possible impacts of drilling mud and cuttings discharges to macrophyte communities include:

- Reduced primary production due to increased turbidity;

- Increased mortality through smothering;
- Reduction in available habitat resulting in decreased distribution.

No impacts of exploratory drilling to macrophyte communities are expected except in cases where drilling and discharge activities are in the immediate area of such communities. Little information exists to predict the responses of macrophytes to increased sedimentation and/or pollutant concentrations resulting from drilling discharges, but some changes in algal density and community structure are likely under these conditions (Truett; 1984, pg. 150).

PHYTOPLANKTON

No special aquatic 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;
- Stimulation of primary production by trace nutrients in the discharge (Jones and Stokes; 1984, p. A-9).

Several considerations suggest that the discharge of drilling muds will have little impact on phytoplankton. First, the rapid dilution and short residence time of the drilling and discharges in the water column make it very unlikely that phytoplankton would be exposed long enough to the high concentrations necessary to show toxic effects. Second, the discharges are intermittent and of relatively short duration. Third, most metals in the discharge are bound to particulates and are, therefore, unavailable for uptake by the organisms. Fourth, the area likely to be covered by detectable discharge plumes is very small. Finally, the significant potential for recruitment from nearby unaffected areas means that recovery periods should be relatively short (Jones and Stokes; 1984, pp. A-9 - A-10).

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;
- Indirect enhancement or inhibition of zooplankton populations resulting from impacts on phytoplankton (Jones and Stokes; 1984, p. A-10).

Although these impacts are theoretically possible, no significant impacts are expected for the same reasons as outlined in the discussion of phytoplankton impacts, above.

EFFECTS ON FISH RESOURCES

Fish and most mobile pelagic species may avoid discharge plumes and areas of high turbidity resulting from exploratory drilling operations. Jones and Stokes (1984, p. C-16) suggest 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 may return to a discharge area, particularly if the settlement of discharged cuttings and drilling fluid 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 larger numbers of demersal fish eggs (Jones and Stokes; 1984, p. C-16). 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 which the discharges could exert on benthic communities, phytoplankton, and zooplankton suggest negligible reductions in food supplies of fish (Jones and Stokes; 1984, p. C-19). Thus, only minor impacts on fish are anticipated from exploratory phase discharges.

EFFECTS ON MARINE AND COASTAL BIRDS

The marine and coastal avifauna of the Sale 109 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).

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 locations in the Sale 109 area were identified by Truett (1984, p. 104) as being particularly vulnerable to impacts on birds from oil and gas activities due to large concentrations of birds using 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 used by foraging birds.

Effects on marine and coastal birds resulting from toxicity, bioaccumulation, or food supply effects are not expected to occur (Jones and Stokes; 1984, pp. E-11,12).

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 and Stokes; 1984, pp. D-13,14). The high mobility of the species in question, the intermittent and brief duration of discharges of drilling effluents and the dilution of discharge plumes are all factors in this conclusion.

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 primarily 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, pp. 47-51, 154).

Gray whales (an endangered species) feed on ampeliscid amphipods by plowing and straining benthic sediments. The carrying capacity of the Chukchi Sea for gray whales is determined by the numbers and locations of dense patches of prey (Truett; 1984, p. 60). Gray whales are dependent on areas rich in benthic amphipods during the summer feeding period; they fast while on their wintering grounds (Morris; 1981, p. 74).

The addition of impacts to benthic communities from drilling discharges, although deemed minor to negligible when taken 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.

CUMULATIVE EFFECTS

Irreversible and significant impacts to the marine biota are not anticipated due to the limited areal extent and quantities of discharges associated with Sale 109 exploratory drilling activities. In addition, the anticipated low number of exploration/delineation drilling units available at one time further diminish the probability of such effects. Potential cumulative impacts could result from concurrent and nearby drilling, particularly in nearshore areas with open-water discharge.

EFFECTS OF LAND DISPOSAL

INTRODUCTION

Lam (1982) reported on several disposal methods in a survey of drilling fluid disposal techniques for Canadian offshore drilling. He found that the suitability of land disposal was dependent upon the availability of acceptable sites of sufficient size in an appropriate location. In his opinion the major disadvantage to land disposal is that it is not a permanent solution to the problem because sites eventually fill and new locations must be sought. He stated that for offshore drilling the method is even more unattractive because of the high cost of transportation or drilling a disposal well. Lam did conclude that the method might be considered for certain locations if the fluids could be dewatered before transport. In the recent proposed effluent limitations, guidelines and standards for the offshore segment of the oil and gas extraction industry, land disposal was not recommended as a viable option for New Source Performance Standards (NSPS) or Best Available Technology (BAT). This was due to the high aggregate compliance costs and problems with availability of sufficient suitable land disposal sites (EPA 1985a). On a case-by-case basis, however, land disposal may be a selected option under §403(c) of the CWA if required for protection of the marine environment.

STORAGE IN PITS OR SUMPS

Impacts associated with disposal of drilling muds in pits or sumps would include the land area required to form the pit and that needed for distribution and docking facilities and haul roads if the pits are not located near the barge docking facility or pipeline terminus. The analysis assumes that standard arctic construction practices protecting permafrost will be used. Presently, the shoreline in the sale area is virtually undeveloped and construction of haul roads would be mandatory.

Dragnich (1983) reported that reserve pits of 50-60,000 barrels capacity were used by Exxon for storage of drilling muds and cuttings for onshore drilling in the Beaufort Sea area. A similar technology should be transferable to the Chukchi Sea area. The magnitude of land loss is dependent upon how many such pits would be needed and how much time would be required to reclaim these lands with vegetative cover.

The Alaska Department of Environmental Conservation has just issued guidelines for onshore disposal of drilling muds in pit facilities. (ADEC 1985). Pits are generally constructed above grade with gravel dikes and bottoms to protect permafrost. The guidelines encourage using a landfill. That is, it is desirable to maximize the solids and take out liquids before the muds are deposited in the pit. This will limit problems with leaching and breaking of the dikes. When the pit is filled, a 2-foot thick gravel cap is to be placed over the top. The gravel may contain some bentonite. The cap may be scarified and fertilized to encourage vegetation recovery by native tundra species but such recovery will probably take five or more growing seasons.

Meyers and Barker (1982), as well as Dietrich (1985), point out that a considerable volume of drifting snow may accumulate in these pits during the winter. During spring breakup, there is danger of flooding and dike breaching unless these pits are dewatered. Disposal of fluids, normally done by vacuum truck, is accomplished by spraying on roads and pads for dust control. Water quality varies with age of the pit (older pits generally have better water quality) and can vary over the summer period as well. In the

sale 109 area, the corresponding onshore facilities may not be sufficient to warrant complete use of fluids by spraying.

Drilling muds and fluids may contain potentially toxic materials such as oils and grease, heavy metals, soluble salts and various synthetic and natural organic compounds. If pits are not lined, these materials may leach into surface and groundwaters and pose potential hazards to organisms in or directly dependent on these resources. If left exposed, these pits may attract waterfowl and other wildlife and pose potential hazards to them as well.

The major problem associated with pit water is salt contamination but total suspended solids, pH, oil, total organic carbon and chemical oxygen demand can also present problems. Salt levels in the four pits studied by Meyers and Barker (1982) ranged from 605 mg/l to 5,257 mg/l total dissolved solids (TDS). They found that impacts of spraying pit water on tundra vegetation were directly proportional to the salt concentration applied; at 4,000 mg/l TDS physiological stress was induced in willows but below 2,000 mg/l TDS these species were not affected. Other species tested were less sensitive than willows. Pit fluids did not significantly concentrate in soils or adversely affect solid conductivity or pH. In addition to salt induced problems, mechanical and physical damage to vegetation can be induced during water discharge unless some means of energy dissipation is used. Meyers and Barker (1982) conclude that direct tundra disposal of pit fluids can be environmentally acceptable under certain circumstances. Limitations on salt content, mitigation for physical damage to tundra and a sampling program conducted concurrently with dewatering are recommended to ensure safe operation.

STORAGE IN ABANDONED GRAVEL PITS AND QUARRIES

Except that no new land areas are needed for pit construction, storage of drilling muds in abandoned gravel pits and quarries poses many of the same problems encountered with storage pits constructed expressly for that purpose. However, because of their size or irregular shape, it may not be possible to line gravel pits or otherwise protect them from the leaching of potentially hazardous materials to surface and groundwaters. Location of abandoned gravel pits may or may not make them more accessible to barge or pipeline transportation of waste drilling muds. This alternate has not been recommended or documented by any known source. Sufficient pits and quarries are not likely to be found in the shore areas adjacent to this lease sale area.

DIRECT LAND DISPOSAL

There are no known studies dealing with the effects of direct application of fresh water drilling muds to tundra vegetation and soils (Dietrich 1985). The U.S. Fish and Wildlife Service (FWS) has begun to look at effects from land disposal for older wells (30 years old) but results of these studies are not yet available. Disposal of drilling muds directly on the tundra poses several potential impacts.

As discussed above, physiological damage to vegetation as a result of high salt concentrations and physical damage from spraying can occur as a result of dewatering pit storage facilities. It is assumed that fresh muds may be more saline and might therefore cause greater physiological stress to tundra plants. Certainly the possibility for physical/mechanical damage is greater due to the greater weight and potential for smothering and burial of vegetation. Heavy metals and oils and greases may pose additional problems. Heavy metals may be taken up by plants and accumulated and magnified in food chains. Oils and greases can have direct toxic and damaging physical effects on vegetation and soils (Walker et al. 1978; Everett 1978). The area potentially affected by direct land disposal could be significantly larger than the area affected by the other land disposal alternatives.

A study on the application of salt-water based drilling muds to tundra (French and Ross; 1985) is of limited utility. Based on observations of one experimental disposal operation in the Canadian Arctic, it found that:

> "(a) no significant deleterious changes in water quality occurred in adjacent [sic] Hoodoo River as a result of overland seepage of waste effluent, (b) leaching of heavy metals appeared to be slow and soluble components were quickly diluted to background levels, and (c) terrain disturbance was considerably less than that which might have occurred if a sump had been constructed."

This study's usefulness is limited because the researchers took very few water quality samples and only looked at the short-term effects of the disposal operation. Longer term toxicity effects and biological changes have not yet been examined.

Ferrante (1981) reported that:

> "Studies with terrestrial plants in laboratory and field experiments show that the fluids and some fluid components exhibit phytoxic properties reducing seed germination, growth and yield. Phytotoxicity in whole drilling fluid is attributed to soluble salt concentrations. The range of lethal concentrations of fluid components in toxicity studies was from less than 1 to 75,000 mg/l and that for whole drilling fluids from 0.29 to 85 percent by volume."

SUBSURFACE INJECTION

Subsurface injection of drilling muds at the drillsite is currently a common disposal technique (Dietrich 1985). It is not known if any subsurface zones exist in the Chukchi Sea area that can accommodate this disposal

method. Impacts of onshore subsurface injection would include transportation and logistic impacts, noted in the alternatives section of this appendix, as well as impacts associated with exploring for and drilling additional onshore injection wells.

MONITORING RECOMMENDATIONS

BENTHIC INVERTEBRATES

Monitoring of benthic invertebrate populations is conditionally recommended to determine whether the benthic community is affected adversely by thin layers of drilling muds and cuttings as suggested by the data presented in this EIS. The recommendation is conditional, dependent on a determination of whether significant numbers of marine mammals are expected to be foraging in the area of the proposed exploratory drilling. If so, then a monitoring program and perhaps toxicity bioassays should be accomplished. Toxicity bioassays of drilling muds and cuttings containing mineral oil should be conducted to acquire information on their toxicity potential. Because mineral oils have variable proportions of aromatic hydrocarbons, which are the most acutely toxic hydrocarbon fraction, the potential for toxicity exists. Solid phase acute toxicity bioassays with the cuttings overlain by a supernatant of seawater are recommended. The test protocol should follow the EPA-Corps of Engineers test methodologies for evaluating the toxicity of dredged materials.

The need for monitoring of additional exploratory drilling operations will have to be decided on a case-by-case basis, dependent on the results of the initial monitoring program. The need for a benthic invertebrate monitoring program is based on at least two independent studies which have demonstrated that as little as 0.1 cm of drilling mud can adversely affect the benthos. There is the potential for drilling muds to be spread over an area greater than the 100 m mixing zone currently authorized by EPA for drilling mud accumulations exceeding 0.1 cm depth.

The benthic invertebrate monitoring program should measure sedimentation depths, the size of the sedimented particles, and concentrations of selected aromatic hydrocarbons and metals in the interstitial water of the top 4 cm of sediment. These are the drilling mud parameters that appear to control effects on the benthic invertebrates. Densities of key species and community characteristics (e.g., species richness) of the benthic species should be monitored along with the physical and chemical parameters.

MARINE MAMMAL RESOURCES

Monitoring of marine mammals populations should be carried out if (1) a preliminary assessment demonstrates that the site selected for exploratory drilling lies within a significant feeding area of whales or walrus and, (2) monitoring of the benthic invertebrate prey community reveals that a large enough population of prey has already been adversely affected by the drilling discharges to suspect potential effects on their predators.

PACIFIC WALRUS

Pacific walrus populations in the Chukchi Sea appear to be approaching the carrying capacity of their main food resource, bivalve molluscs. Recent estimates are that the walrus population is consuming virtually the entire annual productivity of its principal prey (Fay et al. 1977). While walrus distribution is primarily a function of ice conditions, there may be certain areas, such as waters northeast of Cape Lisburne, that are heavily used for feeding.

The effects of drilling discharge on localized benthic bivalve populations could, in turn, affect walrus feeding opportunity in specific feeding areas, especially if drilling activities are geographically concentrated. A specific monitoring program is recommended during the exploratory drilling phase in Sale 109 to gather more information on this topic.

The recommended monitoring program would consist of benthic infaunal surveys in the potential deposition areas around proposed drilling platforms. Survey objectives would be to quantify the distribution and abundance of bivalve molluscs before drilling activities, and monitor the effects of drilling discharges on these populations. Results of on-going walrus research and surveys should be reviewed to identify specific areas of walrus feeding.

GRAY WHALE

Gray whales are known to feed in nearshore and offshore waters of the Chukchi Sea during summer months. These animals are benthic feeders, relying heavily on dense aggregations of amphipods, particularly in deeper waters, where whales suck up the top few centimeters of sediment and ingest infaunal and epibenthic amphipods. The carrying capacity for gray whales appears to be related to the numbers and locations of the dense concentrations of amphipods. Specific studies have not been conducted to determine the distribution or patchiness of these food resources, but indications are that these areas of prime gray whale feeding habitat may be scarce in offshore waters of the Chukchi Sea (Stoker 1978, In: Truett 1984, p. 60). Areas of food concentration that do exist could be of critical importance to gray whales (Truett; 1984, p. 60).

The effects of oil and gas drilling discharges on gray whale feeding resources is unknown. The physical presence of drilling rigs in potential feeding areas may hinder the whales in using this resource. Accumulation of mud and cuttings discharges in drilling areas may affect any existing amphipod concentrations.

The monitoring program recommended would quantify infaunal and epifaunal amphipod concentrations in potential deposition areas around drilling rigs. These populations would be monitored to determine the effects of drilling discharges. It should be noted that cuttings accumulations might attract amphipods, thus increasing population densities. In addition, gray whale research should be reviewed to determine any patterns in whale distribution that might indicate the locations of critical feeding areas.

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ACRONYM GLOSSARY*

AAC	Alaska Administrative Code
ABSORB	Alaska Beaufort Sea Oilspill Response Body
ACMA	Alaska Coastal Management Act
ACMP	Alaska Coastal Management Program
ACORP	Alaska Cooperative Oilspill Response Planning Committee
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
AMSA	Area Meriting Special Attention
ANCSA	Alaska Native Claims Settlement Act
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
APLA	Artificial Production and Loading Atoll
AS	Alaska Statute
ASNA	Arctic Slope Native Association
ASPM	Arctic Single Point Mooring
ASRC	Arctic Slope Regional Corporation
ASTM	American Society for Testing Materials
AVCP	Association of Village Council Presidents
BAST	best available and safest technology
bbls	barrels
Bbbls	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
BTF	Biological Task Force
Call	Call for Information and Nominations
CASPPR	Canadian Arctic Shipping Pollution Prevention Regulations
CDU	Conical Drilling Unit
CETA	Comprehensive Employment and Training Act
CEQ	Council on Environmental Quality
CIDS	Concrete Island Drilling System
CIP	Capital Improvements Program (North Slope Borough)
cf	cubic feet
CFR	Code of Federal Regulations
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter

*Glossary includes several common abbreviations.

ACRONYM GLOSSARY
(continued)

cm/s	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
CSLC	California State Lands Commission
CZM	coastal zone management
CZMA	Coastal Zone Management Act
dB	decibel
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)
DOC	Department of Commerce (U.S.)
DOD	Department of Defense (U.S.)
DOE	Department of Energy (U.S.)
DOI	Department of the Interior (U.S.)
DOT	Department of Transportation (U.S.)
DPP	Development Production Plan
DST	deep-stratigraphic test
DWT	deadweight tonnage
EA	Environmental Assessment
EIS	environmental impact statement
E&MJ	Engineering and Mining Journal
EP	exploration plan
EPA	Environmental Protection Agency (U.S.)
ESA	Endangered Species Act
ESP	Environmental Studies Program
EWC	Eskimo Whaling Commission
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
IRA	Indian Reorganization Act
ISHTAR	Inner Shelf Transfer and Recycling Program
ITL	Information to Lessees
ITM	Information Transfer Meeting
IUM	Information Update Meeting
IWC	International Whaling Commission

ACRONYM GLOSSARY
(continued)

kg	kilogram
km	kilometer
km^2	square kilometer
kW	kilowatt
LNG	liquefied natural gas
m	meter
m^2	square meter
m^3	cubic meter
MAC	Mobile Arctic Caisson
Mbbls	thousand barrels
mi	mile
mm	millimeter
MMbbls	million barrels
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOU	Memorandum of Understanding
m/s	meters per second
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOS	Notice of Sale
NPDES	National Pollution Discharge Elimination System
NPR-A	National Petroleum Reserve-Alaska
NPS	National Park Service
NRC	National Research Council
NRDC	Natural Resources Defense Council
NSB	North Slope Borough
NTL	Notice to Lessees
NWAFC	Northwest and Alaska Fisheries Center
OCS	outer continental shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act of 1953
OGJ	Oil and Gas Journal
OMB	Office of Management and Budget (State of Alaska)
OPEC	Organization of Petroleum Exporting Countries
OSC	on-scene coordinator
OSCP	oil-spill contingency plan
OSRA	oil-spill-risk analysis

ACRONYM GLOSSARY
(continued)

PBU	Prudhoe Bay Unit
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
RD	Regional Director/Resource Unit
RRT	Regional Response Team
RSFO	Regional Supervisor, Field Operations
RTWG	Regional Technical Working Group
RU	Research Unit
SESP	Socioeconomic Studies Program
SHPO	State Historical Preservation Office/Officer
SID	Secretarial Issue Document
SSDC	Single Steel Drilling Caisson
TAP	Trans-Alaska Pipeline
u	micro
uPa	micro Pascal
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
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VLCC	very large crude carrier
VOC	volatile aromatic compound
WSF	water-soluble fraction

SCI. NAMES

GLOSSARY OF SCIENTIFIC NAMES

ENDANGERED AND THREATENED SPECIES

arctic peregrine falcon	*Falco peregrinus tundrius*
bowhead whale	*Balaena mysticetus*
fin whale	*Balaenoptera physalus*
gray whale	*Eschrichtius robustus*
humpback whale	*Megaptera novaeangliae*

FISHES

arctic cod	*Boreogadus saida*
arctic flounder	*Liopsetta glacialis*
arctic fourhorn sculpin	*Myoxocephalus quadricornis*
arctic staghorn sculpin	*Gymnocanthus tricuspis*
Bering cisco	*Coregonus laurettae*
Bering flounder	*Hippoglossoides robustus*
Canadian eelpout	*Lycodes polaris*
capelin	*Mallotus villosus*
chum salmon	*Oncorhynchus keta*
hamecon	*Artediellus scaber*
least cisco	*Coregonus sardinella*
Pacific herring	*Clupea harengus pallasi*
Pacific sand lance	*Ammodytes hexapterus*
pink salmon	*Onchorhynchus gorbuscha*
rainbow smelt	*Osmerus mordax*
saffron cod	*Eleginus gracilis*
salmon	*Oncorhynchus* spp.
shorthorn sculpin	*Myoxocephalus scorpius*
smelts	Osmeridae
starry flounder	*Platichthys stellatus*
twohorn sculpin	*Icelus bicornis*
whitefishes and ciscos	*Coregonus* spp.
yellowfin sole	*Limanda aspera*

INVERTEBRATES

euphausiid	*Thysanoessa raschii*

Phytoplankton and Algae

brown alga	*Laminaria saccharina*
	Desmarestia viridis

Phytoplankton and Algae (continued)

diatoms	Nitzschia frigida Nitzschia cylindrus Nitzschia grunowii Chaetoceros Navicula marina
kelp	Phyllaria dermatodea
sea lettuce (green algae)	Ulva

Zooplankton

calanoid copepods	Pseudocalanus spp. Oithonia similis
cladoceran	Evadne nordmani Metridia lucens
copepods	Eurytemora pacifica Acartia clausi Calanus plumchrus Eucalanus bungii

Benthic Invertebrates

amphipods	Gammaracanthus loricatus Gammarus spp. Onisimus litoralis Pontoporeia femorata
brittle star	Ophiura sarsi
clams	Mya Spisula Serripes Astarte borealis Macoma calcarea Nucula tenuis Yoldia hyperborea
isopod	Saduria entomon
mysid	Mysis litoralis
soft coral	Eunephtya spp.
sea cucumbers	Psolus spp. Cucumaria spp.

MARINE AND COASTAL BIRDS

arctic tern	*Sterna paradisaea*
Pacific brant	*Branta bernicla*
black guillemot	*Cepphus grylle*
black-legged kittiwake	*Rissa tridactyla*
common eider	*Somateria mollissima*
common murre	*Uria aalge*
common raven	*Corvus corax*
crested auklet	*Aethia cristatella*
dunlin	*Caldris alpina*
glaucous gull	*Larus hyperhoreus*
gyrfalcon	*Falco rusticolus*
least auklet	*Aethia pusilla*
northern pintail	*Anas acuta*
oldsquaw	*Clangula hyemalis*
pectoral sandpiper	*Erolia melanotos*
red phalarope	*Phalaropus fulicarius*
Ross' gull	*Rhodostethia rosea*
semipalmated sandpiper	*Ereunetes pusillus*
snow goose	*Chen caerulescens*
snowy owl	*Nyctea scandiaca*
thick-billed murre	*Uria lomvia*

NONENDANGERED MARINE MAMMALS AND TERRESTRIAL MAMMALS

bearded seal	*Erignathus barbatus*
beluga whale	*Delphinapterus leucas*
harbor porpoise	*Phocoena phocoena*
killer whale	*Orcinus orca*
minke whale	*Balaenoptera acutorostrata*
narwhal	*Monodon monoceros*
Pacific walrus	*Odobenus rosmarus divergens*
polar bear	*Ursus maritimus*
ribbon seal	*Phoca fasciata*
ringed seal	*Phoca hispida*
spotted seal	*Phoca vitulina largha*
Steller's sea lion	*Eumatopias jubatus*

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