Table IV.B.8-2 Summary of Population Forecasts, Alternative I

Year	Resident Population No OCS Activity	Increase in Resident Population	
		OCS Activity 350 bbl	OCS Activity 670 bbl
1998	6,001	0	0
1999	6,067	1	1
2000	6,133	5	6
2001	6,209	13	14
2002	6,293	8	11
2003	6,383	17	16
2004	6,470	21	22
2005	6,603	25	26
2006	6,684	43	129
2007	6,789	43	57
2008	6,901	21	25
2009	7,002	16	19
2010	7,018	54	93
2011	6,952	91	154
2012	6,825	16	190
2013	6,666	133	212
2014	6,499	141	222
2015	6,338	144	225
2016	6,300	140	225
2017	6,200	140	225
2018	6,100	140	225
2019	6,000	140	225
2020	6,000	140	225
2021	6,100	120	225
2022	6,200	140	225
2023	6,300	100	225
2024	6,400	100	225
2025	6,500	100	225
2026	6,600	100	225
2027	6,700	80	225

Sources: For years 1998–2015, Rural Alaska Model, North Slope Borough, 1996. For 2016–2027, MMS.

Jobs working directly for the oil industry in activities associated with Sale 170 also will be available . However, the number of NSB Native residents working directly for oil companies in and near Prudhoe Bay historically has been low— approximately 60 out of more than 6,000 workers or about 1 percent of the total (UAA, ISER, 1993). While the proposed sale is projected to generate a large number of direct oil-industry jobs in the region, the number of jobs filled by permanent Native residents of the region is not projected to be large. It is assumed NSB-resident Natives will hold approximately 1 percent of the oil-industry jobs, based on historical experience.

Employment generated in the event of oil-spill-cleanup activities also would have economic effects. The most relevant historical experience of a spill in Alaskan waters was the EVOS of 1989, which spilled 240,000 bbl. This spill generated enormous employment that rose to the level of 10,000 workers directly doing cleanup work in relatively remote locations. Smaller numbers of cleanup workers returned in the warmer months of each year following 1989 until 1992. Numerous local residents quit their jobs to work on the cleanup at often significantly higher wages. This generated a sudden and significant inflation in the local economy (Cohen, 1993). Similar effects on the NSB would be mitigated due to the likelihood that cleanup activities, including administrative personnel and spill-cleanup workers, would be located in existing enclave-support facilities.

The number of workers actually used to clean up the possible two 7,000-bbl oil spills associated with Sale 170 would depend to a great extent on what procedures were called for in the oil-spill-contingency plan, how well prepared with equipment and training the entities responsible for cleanup were, how efficiently the cleanup was executed, and how well coordination of the cleanup was executed among numerous responsible entities. Activities associated with Sale 170 could generate cleanup work for about 3 percent of the workers associated with the EVOS—or 300 cleanup workers for 6 months in the first year, declining to zero by the fourth year following the spill.

c. Effects of Subsistence Disruptions on the NSB Economy: Disruptions to the harvest of subsistence resources could affect the economic well-being of NSB residents primarily through the direct loss of subsistence resources. See Section IV.B.10 for effects on subsistence-harvest patterns.

Summary: Exploration, development, and production is projected to generate increases in property taxes above the levels without the sale starting in the year 1998 and averaging about 1 to 2 percent above the level without the sale each year through the production period.

Direct oil-industry employment in an enclave is anticipated to peak in the range of 1,400 to 1,800 jobs during the development phase, decline to a level in the range of 800 to 1,200 in the years 2011 to 2020, and then decline further to the range of 500 to 1,200 by 2027. Of these direct oil-industry jobs, 1 percent is anticipated to be held by NSB-resident Natives.

Total resident employment is anticipated to increase in the range of 63 to 100 jobs in the peak of production and level off to 27 to 42 in the production phase after 2011. The peak increase during development is about 4- to 6-percent greater than resident employment without Sale 170 and about 2- to 3-percent greater during the production phase.

The cleanup operation of an oil spill would generate jobs for up to 300 cleanup workers for 6 months in the first year, declining to zero by the fourth year following the spill.

Disruptions to the harvest of subsistence resources could affect the economic well-being of NSB residents primarily through the direct loss of subsistence resources. See Section IV.B.10 for conclusions on the effects on subsistence-harvest patterns.

Conclusion: Production is projected to generate increases above the levels without the sale as follows: property taxes, 1 to 2 percent; direct oil-industry employment, 500 to 1,200; resident employment, 2 to 3 percent. The cleanup operation of an oil spill would generate jobs for up to 300 cleanup workers for 6 months in the first year.

9. Subsistence-Harvest Patterns: This section analyzes the effects of developing the resource estimate of Alternative I on the subsistence-harvest patterns of communities close to the proposed Sale 170 area. This analysis is organized by types of effects and discusses effects on subsistence-harvest patterns on each affected community as a result of discharges, disturbance, and oil spills. Analytical descriptions of affected resources and species as well as indigenous Inupiat knowledge concerning effects are described in more detail in Section IV.B.10 of the Beaufort Sea Sale 144 FEIS (USDOI, MMS, 1996a) and are incorporated here by reference.

Effects on communities outside of the sale area are not discussed in this analysis because: (1) effects of noise and disturbance on subsistence are very localized and would not affect the subsistence harvests of Alaskan (or Canadian) communities other than Barrow, Nuiqsut, and Kaktovik; (2) it is extremely unlikely that an oil spill would contact subsistence-harvest areas of Alaskan (or Canadian) communities other than Barrow, Kaktovik, and Nuiqsut; and (3) pipelines would be constructed only in the sale area, and effects from construction would be localized.

The Sale 170 area includes the eastern portion of Barrow's subsistence waterfowl-harvest area, the western half of the major portion of Kaktovik's subsistence-harvest area, and most of the marine-subsistence-harvest areas of Nuiqsut (see Sec. III.C.3). Moreover, if economically recoverable amounts of oil were discovered, onshore pipelines and roads associated with its development could affect the terrestrial subsistence resources that are harvested by Nuiqsut.

As noted in Sections III.C.2 and 3, onshore-oil developments at Prudhoe Bay already have affected the subsistence-harvest system. Many of these effects are the indirect result of increased wage employment made available through projects and services funded by the NSB. Wage employment has led to an upgrading of hunting technology but, alternatively, has constricted the total time available for hunting. Additionally, Prudhoe Bay development has restricted access to traditional hunting areas in the vicinity. Currently, diminished household incomes, reduced by the loss of high earnings from NSB CIP activity in the early to mid-1980's, tend more to encourage subsistence activity and to foster an increase in harvest levels for many subsistence resources.

Access to subsistence resources, subsistence hunting, and the use of subsistence resources could be affected by reductions in subsistence resources and changes in subsistence-resource-distribution patterns. These changes could occur as a result of disturbance from seismic surveys, aircraft and vessel traffic, drilling activities, and construction activities that include offshore dredging; pipeline construction; and structure placement and onshore-pipeline, support-base, pump-station, and road construction. The following analysis examines the effects of each of these causal agents on the communities near the Sale 170 area, with specific information on the subsistence resources harvested by the Inupiat living in these communities. This analysis discusses impacts on the marine and terrestrial resources harvested by the residents of Barrow, Nuiqsut, and Kaktovik.

The factors affecting the subsistence-harvest patterns of Barrow, Nuiqsut, and Kaktovik are summarized as follows:

- ☐ Heavy reliance on caribou in the annual average harvest for Barrow (22-58%), Nuiqsut (30-37%), and Kaktovik (11-16%) (see Table III.C.2-3; Stoker, 1983, as cited by Alaska Consultants, Inc, (ACI)/Braund, 1984; Stephen R. Braund 1989b; State of Alaska, Dept. of Fish and Game (ADF&G) 1995d; Stephen R. Braund and Associates and ISER, 1993b; Pedersen, 1995a, 1995b; Stephen R. Braund and Associates, 1996).
- ☐ Heavy reliance on bowhead whales in the annual average harvest for Barrow (21-38%), Kaktovik (27-63%), and Nuiqsut (4-38%) (see Table III.C.2-3; Stoker, 1983, as cited by ACI/Braund, 1984; Stephen R. Braund and Associates 1989b; ADF&G, 1995d; NSB Planning Dept., 1993; Kaleak, 1996). Percentages have continued to rise because IWC quotas have almost doubled in recent years.
- ☐ Reliance on fish in the annual average harvest for Barrow (6-7%), Nuiqsut (44-33%), and Kaktovik (13-21%) (see Table III.C.2-3; Stephen R. Braund and Associates 1989b; ADF&G 1995d).
- ☐ Hunting ranges overlap for many species harvested by Barrow, Nuiqsut, and Kaktovik.
- ☐ Hunting and fishing are cultural values that are central to the Inupiat way of life and culture.
- ☐ In 1990, the population of Barrow was 3,469; Nuiqsut, 354; and Kaktovik, 224. In 1995, the Alaska Dept. of Labor estimates were 4,234 for Barrow, 410 for Nuiqsut, and 210 for Kaktovik (ADF&G, 1995d).

Eugene Brower, in recent testimony in Barrow at the public teleconference for the MMS DEIS for the 5-Year OCS Oil and Gas Leasing Program, asserted the importance of the

subsistence harvest to Inupiat life ways in the Chukchi and Beaufort Seas: "These two oceans produce the main food supply for the Inupiat people living off the two oceans. And these two oceans are our garden. They may not produce oranges or apples or sauerkraut or cauliflower, cattle, or chicken, but they produce the food that keeps us alive. You may not like how we eat it, but the good Lord put these animals in this region so that we, The Inupiat, can live off these animals" (Brower, 1996, as cited in USDOI, MMS, 1996c). Frank Long, Jr., President of the Nuiqsut Whaling Captains Association, expressed the importance of the bowhead whale hunt to the Inupiat way of life at an Arctic Synthesis Meeting convened by MMS in Anchorage, Alaska, in 1995: "We know that whaling is dangerous, but it is our livelihood. We have to supply our community's nutritional needs for the winter. The captain doesn't get the whole whale; after it is harvested, it belongs to the whole community. We share it. . ." (Long, 1996). In 1994, Glenn Roy Edwards, whaler and Arctic Slope Regional Corporation official related: "Without whaling, there would be no purpose to Barrow. I depend on my job; I like my job. But if it came down to a choice, I'd leave it to come out here and go whaling. I am first a whaler" (Balzar, 1994).

a. Causal Agents Affecting Subsistence-Harvest Patterns:

(1) Discharges: Discharge effects would be associated with disturbance to subsistence resources and harvests from (1) drilling activity discharges, particularly muds and cuttings, (2) produced waters, and (3) other discharges (see Sec. IV.A.1-1).

(a) General Effects: Standard industry practice is to reinject formation waters or to treat them before discharge, in which case a USEPA discharge permit is required. Drilling-mud discharges are limited by USEPA NPDES permits that prohibit discharges in waters <5 m; these permits also establish a low toxicity limit, and the USEPA believes such permitting will lessen the persistence of elevated trace-metal concentrations in shallow marine sediments. In deeper waters, barium discharged in drilling muds may persist in marine sediments at concentrations 100 times greater than naturally occurring concentrations in marine sediments. These concentrations are not expected to exceed water-quality criteria outside a 100-m radius from the drill site (see Sec. IV.B.1). The amount of sea bottom impacted and the subsequent pelagic zooplankton affected would be insignificant when compared to the total available feeding habitat for bowhead whales. Effects on subsistence whale species (bowhead) in the communities of Barrow, Nuiqsut, and Kaktovik due to drilling discharges are expected to be negligible.

Kaktovik elder Flossie Hobson, testifying in August 1979 for the Sale BF public hearings, expressed a concern about the bioaccumulation of carcinogenic compounds from oil and gas development (Hobson, as cited in USDOI, MMS, 1979b). Eugene Brower from Barrow, testifying at hearings for the Beaufort Sea Oil and Gas Lease Sale 124, expressed concern that disposal of drilling muds could cause contamination (Brower, as cited in USDOI, MMS, 1990c). A Barrow whaling captain stated during Northstar Project hearings that he wanted to see strict monitoring of what goes into the ocean, such as waste disposal, leaks, and reinjection materials (Dames and Moore, 1996a). Local concern was voiced in Nuiqsut about dumping out drill muds from Seal Island into the ocean and the effects on fish and wildlife (Dames and Moore, 1996b).

(2) Disturbance: The noise-producing exploration and construction activities of seismic surveys, aircraft traffic, vessel traffic (including icebreaking and supply vessels), and offshore and onshore construction activities are those most likely to produce disturbance effects to subsistence species that include bowhead whales, belukha whales, caribou, fish, seals, walrus, and birds. A more detailed narrative of the effects from these activities on important subsistence species can be found in Section IV.B.10 of the Beaufort Sea Sale 144 Final EIS (USDOI, MMS, 1996a) and is incorporated here by reference. The Beaufort Sea Sale 144 narrative is summarized with additional sources, as cited.

Disturbance effects would be associated with aircraft and vessel noise, construction activities, and oil-spill cleanup; specifically: (1) seismic surveys that are part of the preliminary activities of the lease-sale exploration and development phase; (2) aircraft support of exploration and development activities; (3) vessel supply and support of exploration and development activities; (4) drilling activities during the exploration and development and production phases; (5) offshore construction, including pipeline dredging and pipelaying operations, as well as the movement and installation of drilling structures; (6) onshore construction, including pipeline, road, support-base, landfall, and pump-station construction; and (7) oil-spill-cleanup activities in the event of an oil spill. Noise and traffic disturbance would be a factor throughout the life of Alternative I.

Disturbance from construction activities could cause some animals to avoid areas in which they normally are harvested or to become more wary and difficult to harvest. The latter could be a concern in the case of bowhead whaling. Current research indicates bowheads do not seem to travel more than a few kilometers out of their original swimming direction due to noise-disturbance events, and that these changes in swimming direction are temporary, lasting from a few minutes for aircraft and vessel noise to up to 1 hour in response to seismic activity. Traditional Inupiat testimony often does not agree with the conclusions of Western scientific research, contending that whales are

affected by noise at greater distances and alter their swimming directions for longer periods. In some instances, as in the case of nesting birds, construction activities may decrease the biological productivity of an area. Restrictions may be placed on the use of firearms in areas surrounding new oil-related installations (such as roads, landfalls, and pipelines) to protect oil workers and valuable equipment from harm. Finally, structures such as onshore pipelines may limit hunter access to certain active hunting sites.

Trenches for the offshore pipeline would be cut and the pipe would be laid during the winter season; these pipelaying activities could require ice-management operations. Onshore segments of pipelines and support roads would be constructed from landfalls to connect with the TAPS. These onshore-construction activities could take place at any time of the year. Construction activities associated with the onshore pipelines and support roads could affect Nuiqsut and Kaktovik's subsistence-harvest patterns. Oil-spill-cleanup activities could be quite disruptive to Inupiat subsistence resources and harvests.

(3) Oil Spills: Important marine mammal-harvest areas used by the communities of Barrow, Nuiqsut, and Kaktovik would be vulnerable if an oil spill occurred and contacted these areas. For Alternative I, no spills are assumed to occur for the exploration phase. During development and production, the OSRA estimates a 46- to 70-percent chance of one or more spills ≥1,000 bbl occurring (Table IV.A.2-1). The average size of such a spill is 7,000 bbl. Combined probabilities of spill occurrence and contact factor in the volume of oil assumed to be produced and the estimated spill rates for platforms, pipelines, and tankers and express the percent chance of one or more spills ≥1,000 bbl occurring and contacting a specific land segment within a certain period over the assumed production life of Sale 170.

b. Effects on Subsistence Species:

(1) Bowhead Whales:

(a) Effects of Discharges: See Section 9.a.(1)(a), Discharges, General Effects.

(b) Effects of Disturbance: Industrial activity is not expected to result in distributional changes in the bowhead population (Sec. IV.B.4). However, support vessels and platforms in the vicinity of the subsistence-harvest area could disturb the harvest without disturbing the general bowhead population. If a vessel or rig were in the path of a whale chase, it could cause that particular harvest to be unsuccessful. Noise from icebreakers moving through the whale-harvest area also could contribute to an unsuccessful harvest. Icebreakers could be sent to the Sale 170 area prior to the open-water season during the spring bowhead whale migration (beginning mid-April) and the whale-hunting season. Recent evidence indicates that bowheads react to vessel-engine noise, although disruption is likely to be short term and temporary (Sec. IV.B.4). Such disturbance most likely would be short term and temporary enough that, during a normal whaling season of about 2 months' duration, there would be ample opportunities to harvest other whales. However, during a year when the weather and ice conditions are poor and the whalers' ability to harvest any whales is limited, the noise disruption could occur during the brief periods when harvesting a whale is possible. Recent acoustic work indicates that bowheads showed behavioral changes from recorded drilling and icebreaker noise at levels 20 dB or more above ambient levels. Whales could react to icebreaking noise at distances as great as 6 to 30 m (Alaska Report, 1995). According to Burton Rexford, chairman of the AEWC: "Loud noises drive the animals away. . .We know where whales can be found; when the oil industry comes into the area, the whales aren't there. It is *not* the ice; it is the noise" (USDOC, NOAA, NMFS, 1993).

In a March 1997 workshop on seismic effects conducted by the MMS in Barrow, Alaska, with subsistence whalers from the communities of Barrow, Nuiqsut, and Kaktovik, whalers agreed on the following statement concerning the "zone of influence" from seismic noise: "Factual experience of subsistence whalers testify that pods of migrating bowhead whales will begin to divert from their migratory path at distances of 35 miles from an active seismic operation and are displaced from their normal migratory path by as much as 30 miles."

Possible landfall construction could occur at Oliktok Point and Point McIntyre. Cross Island, the area most commonly used by Nuiqsut hunters for their base camp for hunting bowhead whales, is offshore of these possible landfall sites. A landfall there would concentrate noise and traffic disturbance in this harvest area. It is likely that construction activities would begin after the onset of the open-water season and would end during or after the fall whale migration; this analysis assumes that such activities would occur during the whaling season. Bowhead whales' sensitivity to stationary noise and boat-traffic disturbance from construction activities (which could occur over a period of 7 years) probably would result in only periodic and short-term avoidance (see Sec. IV.B.4). Therefore, landfall construction could disturb Nuiqsut's bowhead whale harvest, but Nuiqsut's bowhead whale harvest would not become locally unavailable or reduced in harvest numbers. Barrow and Kaktovik bowhead whale subsistence harvests could experience intermittent effects from air- and vessel-traffic disturbance. Negligible effects from construction would be experienced by Barrow and Kaktovik, as their harvest areas would be outside the area of Sale 170 construction activity.

(c) Effects of Oil Spills: Subsistence resource areas for Barrow, Nuiqsut, and Kaktovik are shown in Figure III.C.2-1 to indicate important marine-mammal-harvest areas used by communities that would be vulnerable if an oil spill occurred and contacted these areas. More in-depth descriptions of affected resources and species, as well as additional indigenous Inupiat knowledge concerning oil-spill effects, are described in more detail in Section IV.B.10 of the Beaufort Sea Sale 144 FEIS (USDOI, MMS, 1996a) and are incorporated here by reference.

During the spring and fall seasons, possible oil-spill contact could affect whaling. An oil spill during Barrow's spring bowhead hunt could cause the whale harvest to be discontinued, because bowheads could become unavailable and undesirable for use for the entire season; the OSRA estimates a low risk of contact. In Nuiqsut, although it is possible that an oil spill might reduce or eliminate the bowhead whale harvest for one season, it is more likely that a spill would force subsistence hunters to move to new harvest locations. The forced move to more distant hunting locations would shorten the whaling season and possibly decrease the number of whales harvested. The OSRA discussion for Kaktovik indicates that spill contact to its bowhead whale harvest area is very low; nevertheless, in all three communities, any disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during their inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season and could effectively end subsistence-bowhead whale hunting for that season, even though bowhead whales would not become unavailable.

(2) Belukha Whales:

(a) Effects of Discharges: See Section 9.a.(1)(a), Discharges, General Effects.

(b) Effects of Disturbance: Belukha whales are not as likely as bowhead whales to avoid industrial activities in the Arctic, although belukha whales can react to active icebreaker noise 35 to 50 km (22-31 mi) away from the source. Supply-vessel traffic and icebreaker noise would result only in short-term, local displacement on belukha whale migrations and distributions, but such displacement could affect the availability of belukha whales to subsistence hunters for that season (see Sec. IV.B.6). Mitigating possible vessel disturbance effects are: (1) the belukha hunting season for Barrow, Nuiqsut, and Kaktovik takes place under two different conditions (in ice leads and in open water); (2) hunting is possible at different times over a 6-month period; and (3) the belukha is not intensively hunted by any of these villages. In Nuiqsut, icebreaker noise and vessel traffic could make belukha whales unavailable to subsistence hunters for an entire season. Periodic disruptions to Kaktovik's subsistence belukha whale harvest could occur from vessel traffic and icebreaker noise, but belukha whales would not be unavailable to subsistence hunters. Negligible effects from vessel noise would be experienced by Barrow, as its belukha harvest area would be outside the area of Sale 170 activities.

During construction of landfall facilities and construction of an offshore pipeline from drilling platforms to these facilities, the Nuiqsut belukha whale hunt might be disturbed periodically by construction noise. These activities could cause periodic disruptions to Kaktovik's subsistence belukha whale harvest. Negligible effects from construction would be experienced by Barrow, as its belukha harvest area would be outside the area of Sale 170 construction activity.

(c) Effects of Oil Spills: Possible spill contact during the open-water season could affect belukha whaling. In Barrow, short-term effects could occur to belukha whales but would have no apparent effect on Barrow's subsistence belukha hunt. Negligible effects on belukhas could be expected in Nuiqsut, where harvest dependence is very low. Negligible effects to belukha whales could be expected in Kaktovik, where there is little recorded harvest.

(3) Caribou:

(a) Effects of Discharges: See Section 9.a.(1)(a), Discharges, General Effects.

(b) Effects of Disturbance: Noise- and vehicle-traffic-disturbance effects on caribou are likely to occur as a result of exploration and development and production air-support traffic as well as construction of the onshore pipeline and support road projected to be built in the development and production phase of the resource estimate (see Sec. IV.B.7).

Development of the pipeline corridor would increase hunter access to the CAH and thus increase pressure on the population, but current regulation of the harvest and of road access should prevent overhunting. Also to be noted is the disturbance to caribou from scientific study noted by Noah Itta in 1993 public testimony, where he related having to kill a caribou that was suffering from rubbing the hair and skin off its legs trying to get free of a radio collar (USDOC, NOAA, NMFS, 1993). Onshore pipelines can create physical barriers to subsistence access making subsistence hunters' pursuit of caribou more difficult (Kruse et al., 1983). Additional onshore pipelines built as a result of Sale 170 could disrupt the Nuiqsut subsistence caribou hunt. Onshore pipelines constructed to the Point Thompson field and an associated landfall at Flaxman Island could cause disruptions to Kaktovik's subsistence caribou harvest from access conflicts. Negligible effects

from construction would be experienced by Barrow, as its caribou harvest area would be outside the area of Sale 170 construction activity.

(c) **Effects of Oil Spills:** Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence caribou hunters are low. In Nuiqsut and Kaktovik, onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil-spill effects would be periodic but have no apparent effect on the subsistence caribou harvest.

(4) **Fishes:**

(a) **Effects of Discharges:** See Section 9.a.(1)(a), Discharges, General Effects.

(b) **Effects of Disturbance:** Fishes subject to disturbance from aircraft, vessel, and drilling activities most likely would experience temporary, nonlethal effects (see Sec. IV.B.3). Specifically, effects from noise and disturbance and construction activities associated with Sale 170 might periodically affect Nuiqsut subsistence fish resources. Such disturbance could affect the Nuiqsut subsistence fish harvest. The western half of Kaktovik's subsistence fish harvest area might experience periodic effects from noise and disturbance and construction activities associated with Sale 170, but no apparent effects on subsistence harvests are expected. Effects from noise and disturbance and construction activities associated with Sale 170 would have no lasting effects on subsistence fish harvests in Barrow, as its subsistence fish harvest area locations are outside the proposed sale area.

Native concern about onshore-development effects on fish stocks has been evident ever since the Endicott Project was developed. Testifying at the Public Hearings for the Endicott Development Project in 1984, Thomas Napageak, a Nuiqsut whaling captain and AEWC Commissioner for the village of Nuiqsut, stated that: "The causeway sticking out into the ocean will change currents along the coast. Furthermore, it will change the migration route of the fish we depend on" (Napageak, 1984). Eugene Brower from Barrow opposed the construction of causeways for the same reason (Brower, 1984). Complaints about reduced fish size and harvest size persist in Nuiqsut, although subsistence fish resources still accounted for 33 percent in 1993 (Pedersen, 1996) and 25 percent in 1995 of the total subsistence harvest for the community (Brower and Opie, 1997). Wilber Ahtuangaruak from Nuiqsut maintains that there "aren't as many whitefish since the oil companies started drilling at Flaxman Island" (Ahtuangaruak, 1979, as cited in USDOI, MMS, 1979a); and Joseph Akpik from Nuiqsut asserts that offshore exploration would affect the cisco population (Akpik, 1995, as cited in USDOI, MMS, 1995b).

(c) **Effects of Oil Spills:** During the fall, possible oil-spill contact could affect ocean-fish netting. In Barrow, probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low; therefore, spill effects on subsistence fish harvests in Barrow would not make fishes unavailable or undesirable for use. The OSRA indicates the highest oil-spill contact would be to land segments used by Nuiqsut subsistence hunters for the harvest of fishes. Fishes are likely to experience nonlethal effects from an oil spill; however, fishes overwintering in critical habitats (river-delta areas) could experience significant losses (Sec. IV.B.3). As with other subsistence resources, fishes that were oiled in a spill event likely would be rendered inedible or perceived as such and, as a consequence, would be unharvestable. In Nuiqsut, if a spill contacted critical overwintering habitat, subsistence fish resources would be undesirable and unavailable for an entire season (1 year). Spill effects on subsistence fish harvests in Kaktovik would not make fishes unavailable or undesirable for use.

(5) **Seals:**

(a) **Effects of Discharges:** See Section 9.a.(1)(a), Discharges, General Effects.

(b) **Effects of Disturbance:** Seals experience disturbance from aircraft noise and vessel traffic, but industrial activity associated with Sale 170 is not expected to result in changes to seal migrations and distributions (see Sec. IV.B.6). In Nuiqsut, icebreaker noise and vessel traffic could alter the availability of seals to subsistence hunters for an entire season. Periodic disruptions to Kaktovik's subsistence seal harvest could occur from vessel traffic and icebreaker noise, but seals would not become unavailable to subsistence hunters. Negligible effects from vessel noise would be experienced by Barrow, as its seal harvest areas would be outside the area of Sale 170 activities. Nuiqsut whaling captain Frank Long, Jr., stated that oil-industry activity offshore has not only affected whales but seals and birds as well (Long, as cited in USDOC, NOAA, NMFS, 1993).

Onshore development for offshore-pipeline landfalls at Oliktok Point and Point McIntyre could disturb the hunting of ringed, spotted, and bearded seals by Nuiqsut and Kaktovik residents. Flaxman Island is an important area for Nuiqsut and Kaktovik spotted, ringed, and bearded seal harvests. Onshore pipelines constructed to the Point Thompson field and an associated landfall at Flaxman Island could cause disruptions to Nuiqsut and Kaktovik's subsistence seal harvest from access conflicts. The area in the vicinity of Oliktok Point also is an important area for Nuiqsut seal harvests. A landfall at Oliktok Point would

concentrate noise and disturbance in this harvest area. If construction occurred during peak harvest periods (June and July), Nuiqsut and Kaktovik harvests of bearded and ringed seals could be affected. However, the long seal-harvest period would enable residents to harvest seals during other times of the year. Disturbance to Nuiqsut and Kaktovik seal harvests would last for <1 year but would not render seals unavailable. Effects from noise and disturbance and construction activities associated with Sale 170 would have negligible effects on seal harvests in Barrow, as its subsistence seal harvest areas are outside the proposed sale area.

(c) **Effects of Oil Spills:** During the winter, spring, and open-water seasons, possible oil-spill contact could affect sealing. Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low, and no apparent effects would occur to the subsistence seal harvest in this community. The Nuiqsut subsistence seal harvest could experience oil-spill effects that would make seals unavailable and undesirable for a period up to 1 year. Probabilities of an oil spill occurring and contacting land segments in areas used by Kaktovik hunters for subsistence seal harvesting are low, and no apparent effects would occur to the harvest.

(6) Walruses:

(a) **Effects of Discharges:** See Section 9.a.(1)(a), Discharges, General Effects.

(b) **Effects of Disturbance:** Walruses experience disturbance from aircraft noise and vessel traffic, but industrial activity associated with Sale 170 is not expected to result in changes to walrus migrations and distributions (see Sec. IV.B.6). In Nuiqsut, icebreaker noise and vessel traffic could alter the availability of walruses to subsistence hunters for an entire season. In Kaktovik, periodic disturbance to walruses could be expected but not render walruses unavailable. It should be noted that the subsistence walrus hunt in Nuiqsut and Kaktovik in recent years has not been intensive. Negligible effects from vessel noise would be experienced by Barrow, as its walrus harvest areas would be outside the area of Sale 170 activities.

Construction of offshore pipelines to landfalls at Oliktok Point and Point McIntyre would concentrate noise and traffic disturbance in these areas; however, none of these areas are traditional locations for walrus harvests. Disturbance and displacement from construction activities associated with Sale 170 on walrus hunting in Nuiqsut and Kaktovik would be localized and short term and would not render walruses unavailable for subsistence use. In Barrow where landfall and pipeline construction is not a factor, there would be no apparent disturbance to walrus harvests.

(c) **Effects of Oil Spills:** If a spill did occur during the open-water season, it could affect walrus hunting. Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low. As primary walrus-feeding habitat is north and northwest of Point Barrow, walruses are extensively hunted more in the Chukchi Sea, and the oil-spill risk is very low (<0.5%); no apparent effects to the Barrow subsistence walrus hunt would occur. Negligible effects would be expected on Nuiqsut's walrus hunt, as the pursuit of walrus in Nuiqsut is not intensive. The harvest of walruses is not pursued in Kaktovik.

(7) Birds:

(a) **Effects of Discharges:** See Section 9.a.(1)(a), Discharges, General Effects.

(b) **Effects of Disturbance:** Noise caused by construction of both offshore and onshore oil facilities produced by low-flying aircraft, supply-boat traffic, onshore-construction equipment, and greater human presence could disturb waterfowl-feeding and waterfowl-nesting activities (see Sec. IV.B.5). Effects on all bird harvests in the Sale 170 area from noise and traffic disturbance and from construction activities are expected to be periodic and short term and would have no apparent effect on subsistence harvests. Kaktovik resident Mike Edwards stated in public testimony that he thought noise would adversely affect the waterfowl—an important springtime source of food (Edwards, 1979, as cited in USDOI, MMS, 1979b).

(c) **Effects of Oil Spills:** During the spring and open-water seasons, possible oil-spill contact could affect bird hunting. Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low, and no apparent effects would occur to normal subsistence bird harvests in Barrow. Effects from oil spills related to Sale 170 most likely would affect subsistence bird harvests in Nuiqsut for a period not exceeding 1 year, but bird species would not become unavailable for use. No apparent effects would occur to normal subsistence bird harvests in Kaktovik.

(8) Polar Bears:

(a) **Effects of Discharges:** See Section 9.a.(1)(a), Discharges, General Effects.

(b) **Effects of Disturbance:** Polar bears could experience short-term, localized aircraft-noise-disturbance effects that would cause some disruption in the polar bear harvest but would not affect annual harvest levels. Icebreaker noise would result only in short-term, local displacement on polar bear migrations and distributions, but such displacement could affect the

availability of polar bears to subsistence hunters for that season. In Nuiqsut, effects due to aircraft noise, icebreaker noise, and vessel traffic could make polar bears unavailable to subsistence hunters for an entire season. Periodic disruptions to Kaktovik's subsistence polar bear harvest could occur from aircraft noise, vessel traffic, and icebreaker noise, but polar bears would not be unavailable to subsistence hunters. Negligible effects from aircraft noise, vessel traffic, and icebreaker noise would be experienced by Barrow, as its polar bear-harvest areas would be outside the area of Sale 170 activities. Nuiqsut and Kaktovik polar bear harvests could be temporarily disturbed by construction activities at Oliktok Point, Point McIntyre, and Point Thompson, but effects would be short term and have negligible effects on the subsistence polar bear harvest. Barrow polar bear harvest areas would be outside the area of Sale 170 onshore-construction activities.

Nuiqsut whaling captain Thomas Napageak noted in his testimony for Beaufort Sea Sale 144 that because of endangered species regulations, ". . .the taking of polar bears is not very important to us now because we can't do nothing with the hide. The hide, valuable as it is, goes to waste when we kill a polar bear. Because of federal regulations, we cannot sell it" (Napageak, 1995, as cited in USDOI, MMS, 1995bSale 144 Public Hearings, Nuiqsut, Nov. 6, 1995).

(c) **Effects of Oil Spills:** During the winter season, possible oil-spill contact could affect polar bear hunting. Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low, and no apparent effects would occur to normal subsistence polar bear harvests in Barrow. Effects from oil spills most likely would affect polar bear harvests in Nuiqsut for a period not exceeding 1 year, but polar bears would not become unavailable for use. No apparent effects would occur to normal subsistence polar bear harvests in Kaktovik.

c. **Effects on Communities:** Effects on Barrow, Nuiqsut, and Kaktovik from oil-industry-development disturbance are discussed in detail in Section IV.B.10 of the Beaufort Sea Sale 144 FEIS (USDOI, MMS, 1996a). See previous discussions in this section of effects on the primary subsistence species: bowhead whales, belukha whales, caribou, fish, seals, walruses, birds, and polar bears. Effects assessments from these sections are summarized below; also included is a synthesis of traditional knowledge that address the specific disturbance agents.

(1) **Barrow:**

(a) **Effects of Discharges:** See Section 9.a.(1)(a), Discharges, General Effects.

(b) **Effects of Disturbance:**

1) **Seismic Surveys:** Barrow bowhead whale subsistence harvests could experience intermittent effects from seismic disturbance. Negligible effects from seismic disturbance would be experienced by Barrow, as its whale-harvest areas would be outside the area of Sale 170 construction activity. Negligible effects from seismic disturbance would be experienced by Barrow, as its subsistence harvest areas for belukhas, seals, walruses, polar bears, fishes, and birds would be outside the area of Sale 170 activities.

Inupiat concern over seismic disturbance is well documented. Don Long from Barrow stated: "Any disruption, whether it be oil spill or noise, would only disturb the normal migration [of bowhead whales], and a frightened or a tense whale is next to impossible to hunt" (Long, 1990, as cited in USDOI, MMS, 1990c). Barrow resident Eugene Brower had similar fears about seismic disturbance, believing that noise associated with drilling and seismic-exploration activities will disturb the migration of the bowhead whales (Brower, 1995, as cited in USDOI, MMS, 1995c). Burton Rexford, Chairman of the AEWC, described seismic effects on whales in a 1993 symposium on Native whaling this way: ". . .I had the. . . experience in Barrow in 1979, 1980, and 1981 of geophysical seismic work in the ocean, and it's a 'no-no' to a hunter during the whaling migration. I know from experience. There were three of us captains that went out whaling in the fall. In those three years, we didn't see one bowhead whale, and we saw no gray whales, no beluga, and no bearded seal. We traveled as far as 75 miles away from our home on the ocean waters in those three years" (McCartney, 1995).

2) **Aircraft Noise:** Being west of the Sale 170 area of activity, Barrow bowhead whale subsistence harvests could experience intermittent disturbance from air traffic, but effects would be negligible. Negligible effects from aircraft noise would be experienced by Barrow, as its subsistence-harvest areas for belukhas, seals, walruses, polar bears, fishes, and birds would be outside the area of Sale 170 activities.

3) **Supply Vessels:** The Barrow bowhead whale subsistence harvest could experience intermittent effects from supply-vessel-traffic disturbance. Negligible effects from vessel noise would be experienced by Barrow, as its whale-harvest area would be outside the area of Sale 170 exploration and development and production activities. Negligible effects from supply-vessel noise on belukha whales, seals, walruses, polar bears, fishes, and birds would be experienced by Barrow, as its harvest areas for these subsistence species are outside the area of Sale 170 activities.

Thomas P. Brower, Sr., from Barrow, who began whaling as a boy in 1917, stated in a 1978 interview that:

> The whales are very sensitive to noise and water pollution. In the spring whale hunt, the whaling crews are very careful about noise. In my crew, and in other crews I observe, the actual spring whaling is done by rowing small boats, usually made from bearded seal skins. . .We keep our snow machines well away from the edge of the ice so that the machine sound will not scare the whales. . .In the fall, we have to go as much as 65 miles out to sea to look for whales. I have adapted my boat's motor to have the absolute minimum amount of noise, but I still observe that whales are panicked by the sound when I am as much as 3 miles away from them. I observe that in the fall migration the bowheads travel in pods of 60 to 120 whales. When they hear the sound of the motor, the whales scatter in groups of 8 to 10 and they scatter in every direction" (NSB, Committee on History and Culture, 1980).

4) Drilling: The Barrow bowhead whale subsistence harvest could experience intermittent effects from drilling disturbance. Negligible effects to bowhead whales from drilling noise would be experienced by Barrow, as its whale harvest area would be outside the area of Sale 170 exploration and development and production activities. Negligible effects from drilling noise on belukha whales, seals, walruses, polar bears, fishes, and birds would be experienced by Barrow, as its harvest areas for these subsistence species are outside the area of Sale 170 activities.

Speaking about the disappointing spring hunt in 1978 when only four whales were caught, Thomas Brower, Sr., from Barrow explained: "The gravel island drilling at this time may make it impossible for the [whaling] captains to supply [the village] with needed winter food supplies. The gravel island drilling at this time may make it impossible for the captains to fill this need for adequate nutrition for the long Arctic winter" (NSB, Committee on History and Culture, 1980). Charles Okakok from Barrow spoke out against drilling because he believed, as many Inupiat subsistence whalers believe and have observed, that the noise may have a detrimental effect on bowhead whale hunting (Okakok, 1990, as cited in USDOI, MMS, 1990c). Barrow resident Arthur Neakok maintained that ice presents an extreme hazard to ships and drilling (Neakok, 1990, as cited in USDOI, MMS, 1990c). At the same hearing, Eugene Brower expressed concern that multiyear ice would cause problems during drilling (Brower, 1990, as cited in USDOI, MMS, 1990c).

5) Construction:

a) Offshore Construction:
Negligible effects to bowhead whales from offshore construction would be experienced by Barrow subsistence hunters, as its harvest area would be outside the area of Sale 170 exploration and development and production activity. Negligible effects from offshore construction noise and disturbance on belukha whales, seals, walruses, polar bears, fishes, and birds would be experienced by Barrow, as its harvest areas for these subsistence species are outside the area of Sale 170 activities.

Testifying at public hearings for a proposed offshore sand and gravel lease, Othniel Oomittuk from Barrow explained that ". . .the water from the dredge operation would also [dis]place the bowhead from their normal fall migration pattern. It drives the whales out, as whalers can't get to them with their small whaling boats" (Oomittuk, 1983, as cited in USDOI, MMS, 1983a).

b) Onshore Construction:
Negligible effects to caribou from onshore construction would be experienced by Barrow, as its subsistence harvest area is outside the area of Sale 170 exploration and development and production construction activity, and landfall and pipeline construction is not a factor. Disturbance effects from onshore construction activities associated with Sale 170 would have negligible effects on seal, walrus, bird, and polar bear harvests in Barrow, as these subsistence harvest areas are outside the proposed sale area.

Barrow resident Charles Brower stated in 1986 that subsistence access could be adversely affected if a pipeline were built; additional hunting restrictions would occur, requiring a permit (Brower, 1986, as cited in USDOI, MMS, 1986a).

6) Oil-Spill Cleanup: Possible disturbance to bowhead whales near Barrow as a result of increased vessel and aircraft activity staging out of Barrow during oil-spill cleanup temporarily could disrupt and displace whales and extend or alter the normal subsistence hunt. Spills occurring under the high resource estimate could increase cleanup-disturbance effects. There is a minimal chance of oil-spill occurrence and contact as far west as Harrison Bay. Therefore, disturbance effects from oil-spill-cleanup activities likely would not affect Barrow's other subsistence species or subsistence-hunting areas.

(c) Effects of Oil Spills: Land Segments 20 through 28 include much of the area used by Barrow subsistence hunters to harvest marine mammals. The OSRA model estimates only a <0.5- to 1-percent chance of one or more spills ≥1,000 bbl occurring and contacting LS's 20 through 28 within 180 days over the assumed

production life of Beaufort Sea Sale 170. This means a minimal chance of oil-spill occurrence and contact at Harrison Bay (LS 28). From here west to Barrow (LS's 27-20), there is a <0.5-percent chance of occurrence and contact over the life of the field. During the winter, such contact could affect sealing and polar bear hunting; during the spring season, it could affect sealing, whaling, and bird hunting; during the fall, it could affect whaling and ocean-fish netting. If a spill did occur during the open-water season, it could affect sealing, whaling (belukha), walrus hunting, and bird hunting.

An oil spill during Barrow's spring bowhead hunt could cause the whale harvest to be discontinued, because bowheads could become unavailable and undesirable for use for the entire season, but the OSRA estimates a low risk of contact. In all three communities, any disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during their inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though the bowhead would not be rendered unavailable. The belukha harvest season in Barrow lasts from the beginning of the bowhead whaling season (late March) until August. Belukhas are primarily hunted in Chukchi Sea areas. Short-term effects could occur to belukha whales but would have no apparent effect on Barrow's subsistence belukha hunt. Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low, and no apparent effects would occur to the subsistence seal harvest in these communities. As primary walrus-feeding habitat is north and northwest of Point Barrow, walruses are extensively hunted more in the Chukchi Sea, and the oil-spill risk is very low (<0.5%), no apparent effects to the Barrow subsistence walrus hunt would occur. No apparent effects would occur to normal subsistence polar bear harvests in Barrow. Onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil-spill effects would be periodic but have no apparent effect on the subsistence harvest. Spill effects on subsistence fish harvests in Barrow would not make fishes unavailable or undesirable for use. No apparent effects would occur to normal subsistence bird harvests in Barrow.

There is considerable Native concern about oil spills, particularly oil-spill response. In 1983, Percy Nusunginya from Barrow related: "This summer there was supposed to be a demonstration on oil spill response but the weather did not cooperate in the Arctic, so we will expect the industry to have an oil spill on a calm day" (Nusunginya, 1983, as cited in USDOI, MMS, 1983b). Don Long from Barrow stated in 1990: "Any disruption, whether it be oil spill or noise, would only disturb the normal migration [of bowhead whales], and a frightened or a tense whale is next to impossible to hunt" (Long, 1990, as cited in USDOI, MMS, 1990c). Eugene Brower from Barrow expressed the general concern that spill-cleanup procedures under ice do not exist (Brower, 1990, as cited in USDOI, MMS, 1990c); and Edward Hopson made a similar assertion in 1995 hearings in Barrow, that technology is not in place to deal with spills in the Arctic Ocean (Hopson, 1995, as cited in USDOI, MMS, 1995b). Marie Adams, also from Barrow, observed that an oil spill in the "fragile ecosystem" of the Arctic could devastate the bowhead whale as these animals migrate through "narrow open-lead systems," which could be the preferred path of an oil spill (Adams, 1990, as cited in USDOI, MMS, 1990c).

(2) Nuiqsut:

(a) Effects of Discharges: See Section 9.a.(1)(a), Discharges, General Effects.

(b) Effects of Disturbance:

1) Seismic Surveys: Nuiqsut bowhead whale subsistence harvests could experience intermittent effects from seismic disturbance, but most seismic activity is timed to be completed before conflicts with the whale migration or subsistence whaling season arise or agreements are negotiated between the oil industry and the local whalers, if the two activities will seasonally overlap. In 1995, the AEWC brokered an agreement between themselves, the Nuiqsut and Kaktovik whaling captains' associations, and BP that coordinated seismic activity for the Northstar Project with the Nuiqsut subsistence whaling hunt staged on Cross island. British Petroleum pledged to reduce the level and volume of ongoing seismic activity and move to Northstar's westernmost boundary when whaling began at Cross Island and any adverse effect to migrating whales was observed (Lavrakas, 1996:1,5). With whaling agreements in place, bowhead whales might be periodically disturbed, but the subsistence-harvest hunt would not be disrupted. Seismic-disturbance effects to belukha whales, seals, walruses, and polar bears are expected to be short term, producing no apparent effects to subsistence harvests. During the winter season, fishes in river delta areas would be particularly vulnerable to seismic disturbance. Seismic disturbance in delta areas could alter spawn behavior, causing decreased survival of young or prevent spawning altogether, depending on the range of the disturbance. Seismic disturbance could stress fishes that cannot avoid it and adversely affect food reserves with a possible decrease in overwinter survival (see Sec. IV.B.3).

Thomas Napageak, Nuiqsut resident and whaling captain since 1973, related in 1979 that he hadn't seen one whale while going to Cross Island every year and believes it is the result of seismic activity in the area (Napageak, 1979, as cited in USDOI, MMS, 1979a). Maggie Kovalsky from Nuiqsut, testifying in 1984 on Endicott development,

explained that with all the noise and activities, bowhead whales that migrate not far from that area all the way to Canada probably will be hurt (Kovalsky, 1984). In a Statewide survey conducted from 1992 to 1994 by the ADF&G, Division of Subsistence, 86.7 percent of the respondents in Nuiqsut believed that there were fewer marine mammals as a result of OCS development (ADF&G, 1995b).

2) Aircraft Noise: Nuiqsut bowhead whale subsistence harvests could experience intermittent effects from disturbance from aircraft overflights, but the majority of overflights could be expected over shallow nearshore waters out of the primary migration route. Short-term, local effects from aircraft-noise disturbance to belukha whales and walruses (not hunted extensively by the village), seals, caribou, and birds would be expected in Nuiqsut from Sale 170 activities. Such disturbance to these species would not make them unavailable to subsistence hunters. Aircraft noise could temporarily relocate fishes and could adversely stress those in the immediate flight paths, although fishes would not become unavailable to subsistence hunters. Effects due to aircraft noise could make polar bears unavailable to subsistence hunters for an entire season.

Expressing concern about aircraft disturbance, a Nuiqsut resident and whaling captain said in recent testimony for an offshore lease sale that ". . .seismic. . . traffic [and] helicopter overflights. . .these were the cause of whales migrating further north out to the ocean, 20 mi further north than their usual migration route" (USDOI, MMS, 1995b). This same sentiment had been expressed earlier by Patsy Tukle from Nuiqsut, who explained that ships and helicopters are interfering with whale hunting even though they are not supposed to. He affirmed the need for controls to be enforced so that whaling may go on unimpeded (Tukle, 1986, as cited in USDOI, MMS, 1986b).

3) Supply Vessels: Nuiqsut bowhead whale subsistence-harvests could experience intermittent effects from disturbance from vessel traffic, but the majority of this traffic could be expected in shallow nearshore waters out of the primary migration route. Disturbance from vessel traffic would produce short-term, local effects on marine mammal migrations or distributions but vessel disturbance, particularly icebreaker noise, could cause displacement of belukha whales, seals, walrus, and polar bears that could affect their availability to subsistence hunters for that season. It should be noted that the subsistence walrus and belukha hunt in Nuiqsut in recent years has not been intensive. Boat noise would have only transitory effects on fishes and cause short-term displacement to subsistence bird species, but there would be no apparent effects on subsistence harvests.

Nuiqsut resident, Joan Taleak maintained reservations about local industrial vessel traffic during her 1983 testimony for a proposed OCS sand and gravel lease sale. She was concerned about the hauling of barges with gravel [conflicting with] her way of life from fishing since her childhood. She recounted her worry that there would be no more whitefish if the sale activities occurred (Taleak, 1983, as cited in USDOI, MMS, 1983a). At a village meeting for the Northstar Project in 1996, Nuiqsut residents explained their fear of effects from the Northstar Project because [it] was in the migratory path of the bowhead whales. They made it clear that seismic and transportation noise are of primary concern to Beaufort Sea residents for impact to bowhead whales (Dames and Moore, 1996c).

4) Drilling: Nuiqsut bowhead whale subsistence harvests could experience intermittent effects from drilling disturbance. Drilling disturbance would produce short-term, local effects on belukha whales, seals, walruses, and polar bears, but there would be no apparent effects on subsistence harvests. It should be noted that the subsistence walrus and belukha hunt in Nuiqsut in recent years has not been intensive. Drilling-noise disturbance could affect the survival of certain overwintering fish species; however, a significant number of fishes or fish species would not be affected. Short-term displacement to subsistence bird species would occur from drilling disturbance, but there would be no apparent effects on subsistence harvests.

Subsistence hunter Isaac Nukapigak from Nuiqsut observed that cisco are not spawning out near the Colville Delta anymore, explaining that State activity there is having an effect (Nukapigak, 1995, as cited in USDOI, MMS, 1995e). Billy Oyagak from Nuiqsut described restricted access to subsistence resources from oil development, stating that there was interference while whale hunting by supply ships, choppers, and drilling, which made it difficult to find any animals. That year, the hunt required 5 weeks to complete (Oyagak, 1986, as cited in USDOI, MMS, 1986b).

5) Construction:

a) Offshore Construction: Nuiqsut bowhead whale subsistence harvests could experience intermittent effects from disturbances caused by offshore construction. Construction could cause bowheads to temporarily avoid areas where it occurred. Offshore construction disturbance would produce very local noise disturbance and adverse habitat effects from offshore platform placement and offshore pipeline installation on belukha whales, seals, walruses, and polar bears but there would be no effects to their populations and no apparent effects on subsistence harvests. The Nuiqsut belukha whale hunt might be periodically disturbed by construction noise, and construction of offshore pipelines to landfalls at

Oliktok Point and Point McIntyre would concentrate noise and traffic disturbance to walruses in these areas; however, none of these areas are traditional locations for walrus harvests. It should be noted that the subsistence belukha and walrus hunts in Nuiqsut in recent years have not been intensive. Offshore-construction disruption of bottom substrates would not significantly affect fish abundance and only temporarily disturb fishes in the immediate area of activity. Pipeline activity would likely affect fish distribution in the area of construction. Platform installation could temporarily displace (≤1 season) bird use within 1 mi of installation sites, but birds would not become unavailable to subsistence hunters.

Edward Nukapigak, Sr., speaking at public hearings in Nuiqsut, declared that: " . . . from what I understand, the white people want to eliminate us Inupiat people and our food. If they want gravel, they should not get it from the paths of the animals that we eat" (Nukapigak, 1983, as cited in USDOI, MMS, 1983a). At village meetings in Aug. 1996 for the Northstar Project, concern was voiced that currents can change the bottom contours, potentially affecting the buried pipeline, particularly from river overflow (Dames and Moore, 1996b). Nuiqsut whaling captains believe that Seal Island, as planned, needs more protection from natural elements to be considered safe by the community (Dames and Moore, 1996c). Another whaler voiced concern that BP and/or the Federal Government will block the whalers from taking their traditional whaling route to Cross Island, preferring to travel within the barrier islands, because they are more protected from the sea (Dames and Moore, 1996c).

b) Onshore Construction:

During construction of landfall facilities, the Nuiqsut belukha whale hunt might be periodically disturbed by construction noise; the subsistence belukha hunt in Nuiqsut in recent years has not been intensive. Onshore construction disturbance would be short term and local, disturbing and possibly displacing a small number of seals within a few kilometers of landfall sites at Oliktok Point and Point McIntyre for <1 year, but not rendering them unavailable. Nuiqsut polar bear harvests could be temporarily disturbed by construction activities at Oliktok Point, Point McIntyre, and Point Thompson, but effects would be short term and have negligible effects on the subsistence polar bear harvest. Also, polar bears are not intensively pursued by Nuiqsut subsistence hunters. Onshore pipelines can create physical barriers to subsistence access, making subsistence hunters' pursuit of caribou more difficult (Kruse et al., 1983). Additional onshore pipelines built as a result of Sale 170 development and production could disrupt the Nuiqsut subsistence caribou hunt, but disturbance would be temporary. Effects from the construction of possible short jetties in conjunction with the shore approach of pipelines is likely to have only localized and short-term effects on fish movements and migrations, and no apparent effects on subsistence harvests are expected. Effects on all bird harvests in the Sale 170 area from construction activities are expected to be periodic, short term, and have no apparent effect on subsistence harvests.

Concerns about access restrictions have been voiced by local residents. Sarah Kunaknana, talking about local subsistence hunters, observed that others have stated that they don't hunt near Prudhoe Bay anymore because of oil development (Kunaknana, as cited in Shapiro, Metzner, and Toovak, 1979). Elder Bessie Ericklook from Nuiqsut maintained that since the oil fields have been established [at Prudhoe Bay], the fox have been dirty and discolored in [the] area of Oliktok [Point] (Ericklook, 1979, as cited in USDOI, MMS, 1979a). Leonard Lampe, former Nuiqsut vice mayor, recently expressed further air-pollution problems and habitat concerns, asserting that Nuiqsut has been experiencing such effects for some time: "A lot of air pollution, asthma, bronchitis—a lot with young children. We see smog pollution that goes from Prudhoe Bay out to the ocean and sometimes to Barrow when the wind is blowing that way. Tundra damage around the village. I swear they seismiced the entire North Slope. It's dangerous with snowmachines to run into deep seismic trails. There's wire cables all over the place" (Lavrakas, 1996:1, 5). Nuiqsut fish harvesters have noted that the number of arctic cisco have been down, coinciding with the [operation of] the Endicott water treatment plant (Dames and Moore, 1996b). Concern was expressed at the same meeting about the possibility of steel and concrete fatigue over the 15-year project life of the Northstar Project (Dames and Moore, 1996b). Ruth Nukapigak from Nuiqsut expressed concern about constructing a landfall at Oliktok Point. She felt it was a bad place for a landfall because of the great pressure ridges that she had observed when living there (Nukapigak, 1995, as cited in USDOI, MMS, 1995e).

In 1979, Nuiqsut resident Nannie Woods talked about fish and caribou being abundant at the Sag River, but now the river isn't as abundant since the development at Prudhoe Bay. She explained that the tributaries off the river don't have as many fish either, and that there are fewer caribou than there used to be in the summer (Woods, 1979, as cited in USDOI, MMS, 1979a).

Access problems were expressed by Nelson Ahvakana from Nuiqsut. He was concerned that areas that are supposed to be left open for subsistence hunting will be effectively closed because of increased security associated with the new drill sites, and that access to subsistence resources will be restricted (Ahvakana, 1990, as cited in USDOI, MMS, 1990d). This concern takes on even more substance as the Northstar Project and development at the Alpine field become realities. During the 1996 Northstar Project Nuiqsut community meeting, two Nuiqsut men

described being denied access to fishing and hunting areas around Prudhoe operations, even though they have traditional rights to be there. They do not want to be restricted or denied access by new projects (Dames and Moore, 1996c).

6) **Oil-Spill Cleanup:** Disturbance to bowhead whales near Cross Island as a result of increased vessel and aircraft activity staging out of Prudhoe Bay/ Deadhorse during oil-spill cleanup could temporarily disrupt and displace whales and extend or alter the normal subsistence hunt. In the unlikely event of a large spill contacting and extensively oiling Nuiqsut's coastal subsistence habitats in the Colville River Delta, the presence of several thousand humans, hundreds of boats, and the many aircraft involved in cleanup would displace seals, polar bears, and other marine mammals and increase stress and reduce pup survival of ringed seals, if operations occur during the spring season. Such effects would persist for perhaps 1 to 2 years within 1 km of the cleanup. These same effects would persist during cleanup operations (perhaps 1 or 2 seasons) and affect birds within about ≤ 1 mi of the cleanup activity. Caribou would be displaced and experience temporary seasonal stress (for perhaps 1-2 seasons) in areas near cleanup activity. Oil-spill-cleanup activity would increase disturbance effects to subsistence species, could increase the displacement of subsistence species; and could reduce access to subsistence species by subsistence hunters, thereby altering or extending Nuiqsut's normal subsistence hunt.

(c) **Effects of Oil Spills:** Land Segments 28 through 39 include much of the area used by Nuiqsut subsistence hunters to harvest marine mammals. The OSRA model estimates a 1- to 8-percent chance of one or more spills ≥ 1,000 bbl occurring and contacting LS's 28 through 39 within 180 days over the assumed production life of Beaufort Sea Sale 170. The point at which damaging effects on subsistence resources would occur would be at combined probabilities >5 percent; only LS's 34 through 37 reach or exceed this value. This means a minimal chance of oil-spill occurrence and contact at Harrison Bay (LS's 28-30) and the Colville River Delta (LS's 31-32). Possible occurrence and contact to land segments nearshore of Beechy Point (LS 34, 4-8%), Cross Island (LS 35, 3-6%), and Flaxman Island (37, 3-6%) fall in the higher range of OSRA estimates and, in the event of a spill, conceivably could receive more impact from oil-spill contact. Oil-spill contact in winter could affect polar bear hunting and sealing. Bird hunting, sealing, and whaling, as well as the ocean netting of fish, could be affected by a spill during the open-water season.

Although it is possible that an oil spill might reduce or eliminate the bowhead whale harvest for one season, it is more likely that a spill would force subsistence hunters to move to new harvest locations. The forced move to more distant hunting locations would shorten the whaling season and possibly decrease the number of whales harvested—an effect that is most likely to occur in the Nuiqsut subsistence-harvest area (see OSRA discussion for Nuiqsut above). In all three communities, any disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during their inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though the bowhead would not be rendered unavailable.

Negligible effects on belukhas could be expected in Nuiqsut, where harvest dependence is very low. The Nuiqsut subsistence seal harvest could experience oil-spill effects that would make seals unavailable and undesirable for a period up to 1 year. Negligible effects would be expected on Nuiqsut's walrus hunt, as the pursuit of walrus in Nuiqsut is not intensive. Effects from oil spills most likely would affect polar bear harvests in Nuiqsut for a period not exceeding 1 year, and they would not become unavailable for use. Onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil spills would have periodic effects on caribou but would have no apparent effect on the subsistence harvest. The OSRA indicates the highest oil-spill contact would be to land segments used by Nuiqsut subsistence hunters for the harvest of fishes (see OSRA discussion above). Fishes are likely to experience nonlethal effects from an oil spill; however, fishes overwintering in critical habitats (Colville River Delta) could experience significant losses (Sec. IV.B.3). As with other subsistence resources, fishes that were oiled in a spill event likely would be rendered inedible or perceived as such and consequently would be unharvestable. In Nuiqsut, if a spill contacted Colville River overwintering habitat, subsistence fish resources would be undesirable and unavailable for an entire season (1 year). Effects from oil spills related to Sale 170 most likely would affect subsistence bird harvests in Nuiqsut for a period not exceeding 1 year, but bird species would not become unavailable for use.

Ruth Nukapigak from Nuiqsut, speaking about the effects she's seen from drilling in the vicinity, noted that she had discovered that fish are afraid of suds or foam, and that she has also seen oil in the water. She has heard that when there's an oil spill that they clean it up with suds or foam, and that for those living in Nuiqsut, she believes their food is really going to change from what the oil companies are going to be doing (Nukapigak, 1983, as cited in USDOI, MMS, 1983a). Maggie Kovalsky, also from Nuiqsut, expressed the same fear about effects on Nuiqsut's subsistence foods, explaining that if a spill ever happened, she thinks it would harm a lot of the food they depend on such as fish and bowhead whale and duck (Kovalsky, 1984). Nuiqsut elder Sarah Kunaknana was worried that an

oil spill could occur and damage the habitat of the bowhead whales and other sea mammals (Kunaknana, 1990, as cited in USDOI, MMS, 1990d).

In a Statewide survey conducted from 1992 to 1994 by the ADF&G, Div. of Subsistence, 80 percent of the respondents in Nuiqsut believed that industry could not contain and clean up a large oil spill. Village response to a similar question about the containment and cleanup of a small oil spill elicited negative responses of 60 percent in Nuiqsut (ADF&G, 1995b). Ice forces can be unpredictable, and Frank Long, Jr., a whaler from Nuiqsut, expressed local concern that an oil spill could be caused by ice scraping a pipeline or drill pipe, and the resulting spill would damage the entire food chain (Long, 1995, as cited in USDOI, MMS, 1995b). In 1996, people in Nuiqsut reiterated their belief that the technology does not exist to clean up an oil spill under the ice; they believe it is a matter of *when* a spill will occur, not if it will occur. They want assurance against disaster and impact funds set aside for them in the event of a disaster (Dames and Moore, 1996b).

Issues of using local expertise and manpower are prevalent in Nuiqsut. Leonard Lampe, Nuiqsut's former vice mayor, reported: "As a member of the village oil spill-response team, we were not allowed to go out onto the ice even for drills under certain very dangerous conditions. So what if a spill occurs under those conditions? There will be no way to clean it up" (Lampe, 1995, as cited in USDOI, MMS, 1995b).

(3) Kaktovik:

(a) Effects of Discharges: See Section 9.a.(1)(a), Discharges, General Effects.

(b) Effects of Disturbance:

1) Seismic Surveys: Kaktovik bowhead whale subsistence harvests could experience intermittent effects from seismic disturbance. Negligible effects from seismic disturbance would be experienced by Kaktovik, as its whale harvest areas would be outside the area of Sale 170 construction activity. Negligible effects from seismic disturbance to other subsistence species would be experienced by Kaktovik, as its subsistence harvest areas for belukha whales and walruses (not hunted extensively by the village), seals, polar bears, fishes, and birds generally would be outside the area of Sale 170 activities. If subject to periodic disruptions, these species would not become unavailable to subsistence hunters.

2) Aircraft Noise: Kaktovik bowhead whale subsistence harvests could experience intermittent effects from aircraft disturbance, but negligible effects from such disturbance would be expected, as Kaktovik's subsistence whale harvest area would be outside the area of Sale 170 activity. Short-term, local effects from aircraft-noise disturbance to belukha whales and walruses (not hunted extensively by the village), polar bears, seals, caribou, fishes, and birds would be expected in Kaktovik. If subject to periodic disruptions, these species would not become unavailable to subsistence hunters.

Validating aircraft disturbance to bowhead whales, Kaktovik resident Susie Akootchook related observations made while censussing whales in Barrow:

> I worked with the whale census and worked with Chris Clard that time they did the whale census over at Barrow. And I was with the acoustic crew listening in with speaker phones and those microphones were like a 100, 75 to 50 feet under. And if you guys are planning on using your choppers, there is going to be a lot of noise. One time I was on a ship, and I had the headsets on and then heard an airplane. Mind you, from under the water, listening in, I can hear an airplane flying over. From that end of the mic to that end of the mic, I could hear it all the way clear. And when I went out there and checked, it was way up there. And that noise, whether you use choppers or airplanes, it's going to be disruptive. . ." (Akootchook, 1996, as cited in Dames and Moore, 1996d).

3) Supply Vessels: Kaktovik bowhead whale subsistence harvests could experience intermittent effects from aircraft disturbance, but most of this traffic would be expected to be outside of Kaktovik's subsistence whale harvest area. Short-term, local effects from aircraft-noise disturbance to belukha whales and walruses (not hunted extensively by the village), polar bears, seals, caribou, fishes, and birds would be expected in Kaktovik. If subject to periodic disruptions, these species would not become unavailable to subsistence hunters.

Herman Rexford from Kaktovik recounts that when oil ships are around, it affects the migration of the whales. He would like to see no ships or exploration at Kaktovik during the fall whaling time. He knows that the ships are noisy and can affect whaling routes (Rexford, 1986, as cited in USDOI, MMS, 1986c). Herman Aishanna, Kaktovik vice mayor, recounted recently that ". . .[t]hose tugs make a lot of noise in the summertime" (Aishanna, 1996, as cited in Dames and Moore, 1996d).

4) Drilling: Kaktovik bowhead whale subsistence harvests could experience intermitent effects from drilling disturbance. Negligible effects from drilling disturbance would be experienced by Kaktovik, as its bowhead whale-harvest area would be outside the area of Sale 170 construction activity. Negligible effects from drilling-noise disturbance to other subsistence species would be experienced by Kaktovik, as its subsistence-harvest areas for belukha whales and walruses (not hunted

extensively by the village), seals, polar bears, fishes, and birds generally would be outside the area of Sale 170 activities. If subject to periodic disruptions, these species would not become unavailable to subsistence hunters.

In 1979, village concern in Kaktovik with disturbance of migrating whales from the noise associated with drilling was expressed by whaling captain James Killbear (Killbear, 1979, as cited in USDOI, MMS, 1979b). Former mayor and vice mayor and head of Kaktovik's Whaling Captains' Association, Herman Aishanna maintained that in 1985 when the SSDC was present in the area, it did affect the whale subsistence hunt, even though it was idle. He reported: "We got no whales that year" (Aishanna, as cited in USDOC, NOAA, NMFS, 1993). Fenton Rexford, President of Kaktovik's village corporation, Kaktovik Inupiat Corporation (KIC), stated in his testimony on the MMS DEIS for the 5-Year OCS Oil and Gas Leasing Program 1997-2002 that during exploratory drilling in Canadian offshore waters, ". . .we were not successful or had a very hard time in catching our whale when there was activity with the SSDC, the drilling rig off Canada. And it diverted [bowhead whales] way offshore; made it very difficult for our whalers to get our quota" (Rexford, as cited in USDOI, MMS, 1996d).

5) Construction:

a) Offshore Construction:

Kaktovik bowhead whale subsistence harvests could experience intermitent effects from disturbances caused by offshore construction. Negligible effects from offshore construction disturbance would be experienced by Kaktovik, as its bowhead whale harvest area would be outside the area of Sale 170 activity. Offshore construction could produce periodic disturbance to Kaktovik's subsistence belukha whale, seal, and polar bear harvests, but these marine mammal species would not become unavailable to subsistence hunters. It is more likely that disturbance activity would be outside Kaktovik's subsistence-harvest areas for these species. It should be noted that the subsistence belukha whale hunt in Kaktovik in recent years has not been intensive, and walruses are not pursued. There would be no apparent effects to fish and bird populations and no apparent effects on subsistence harvests, as harvest areas for these species would be outside the area of Sale 170 construction activity.

Archie Brower in Kaktovik, for public hearings on Beaufort Sea Sale 144, commented on research disturbance to bowhead whales, observing that radios were put onto some whales the previous fall, and they stopped coming close to land. The whales were then seen about 20 miles out because they were using boats to tag them, and whalers saw the whales further from shore. After the whales were tagged, they returned closer to land (Brower, 1995, as cited in USDOI, MMS, 1995d). Nuiqsut whaling captain Thomas Nupageak, commenting on a slide presentation of a scientific whale tagging/tracking study, related that: "I can just feel the bowhead whale trying to come up, trying to break the ice, with a tag on it, like a sliver. That's harassing" (Proceedings of the 1995 Arctic Synthesis Meeting, 1996).

b) Onshore Construction:

Flaxman Island is an important area for Kaktovik spotted, ringed, and bearded seal harvests. Onshore pipelines constructed to the Point Thompson field and an associated landfall at Flaxman Island could cause disruptions to Kaktovik subsistence seal harvest from access conflicts; and if construction occurred during peak harvest periods (June and July), Kaktovik harvests of bearded and ringed seals could be affected. However, the long seal-harvest period would enable residents to harvest seals during other times of the year. Kaktovik polar bear harvests could be temporarily disturbed by construction activities at Point Thompson, but effects would be short term and have negligible effects on the subsistence polar bear hunt. Walruses are not normally pursued by Kaktovik subsistence hunters. During construction of landfall facilities, the Nuiqsut belukha whale hunt might be periodically disturbed by construction noise, but the subsistence belukha hunt in Nuiqsut in recent years has not been intensive. Onshore pipelines can create physical barriers to subsistence access, making subsistence hunters' pursuit of caribou more difficult (Kruse et al., 1983). Additional onshore pipelines constructed to the Point Thompson field and an associated landfall at Flaxman Island could cause disruptions to Kaktovik's subsistence caribou harvest from access conflicts, but effects are expected to be short term. Effects on all bird harvests in the Sale 170 area from construction activities are expected to be periodic, short term, and have no apparent effect on subsistence harvests. Effects from the construction of possible short jetties in conjunction with the shore approach of pipelines is likely to have only localized and short-term effects on fish movements and migrations, and no apparent effects on subsistence harvests are expected. Effects on all bird harvests in the Sale 170 area from construction activities are expected to be periodic and short term and would have no apparent effect on subsistence harvests.

6) Oil-Spill Cleanup:

Possible disturbance to bowhead whales near Kaktovik as a result of increased vessel and aircraft activity staging out of Prudhoe Bay/Deadhorse during oil-spill cleanup temporarily could disrupt and displace whales in the western portion of Kaktovik's bowhead whale-hunting area. Such disturbance could extend or alter the normal subsistence hunt in the event of a large spill contacting and extensively oiling Kaktovik's coastal subsistence habitats from the Sagavanirktok River Delta east to Demarcation Bay. The presence of several thousand humans, hundreds of boats,

and the many aircraft involved in cleanup would displace seals, polar bears, and other marine mammals and increase stress and reduce pup survival of ringed seals, if operations occur during the spring season. Such effects would persist for perhaps 1 to 2 years within 1 km of the cleanup. These same effects would persist during cleanup operations (perhaps 1-2 seasons) and affect birds within about ≤ 1 mi of the cleanup activity. Caribou would be displaced and experience temporary seasonal stress (for perhaps 1-2 seasons) in areas near cleanup activity. Oil-spill-cleanup activity would exacerbate and increase disturbance effects to subsistence species caused by exploration, development, and production construction activities; could increase the displacement of subsistence species; and could alter or reduce access to subsistence species by subsistence hunters, thereby altering or extending Kaktovik's normal subsistence hunt.

(c) **Effects of Oil Spills:** Land Segments 36 through 45 include much of the area used by Kaktovik subsistence hunters to harvest marine mammals. The OSRA model estimates a 1- to 6-percent chance of one or more spills ≥ 1,000 bbl occurring and contacting LS's 36 (Sagavanirktok Delta/Bullen Point/Mikkelsen Bay) through 45 (Demarcation Bay) within 180 days over the assumed production life of Beaufort Sea Sale 170. With a threshold combined probability at which damaging effects on subsistence resources would occur at 5 percent, only LS's 36 and 37 (Mikkelsen Bay/Flaxman Island region) reach or exceed this threshold. This means a minimal chance of oil-spill occurrence and contact from here east to Demarcation Bay. Oil-spill contact in winter could affect polar bear hunting and sealing. Bird hunting, sealing, and whaling, as well as the ocean netting of fish, could be affected by a spill during the open-water season.

The OSRA discussion for Kaktovik indicates that spill contact to its bowhead whale harvest area is very low; nevertheless, in all three communities, any perceived disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during the bowhead inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though whales would not be rendered unavailable. Negligible effects to belukha whales could be expected in Kaktovik where there is little recorded harvest. Onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil spills would have periodic effects on caribou but would have no apparent effect on the subsistence harvest. Spill effects on subsistence fish harvests in Kaktovik would not make fishes unavailable or undesirable for use. Probabilities of an oil spill occurring and contacting land segments in areas used by Kaktovik hunters for subsistence seal harvesting are low, and no apparent effects would occur to the harvest. The harvest of walruses is not pursued in Kaktovik. No apparent effects would occur to normal subsistence bird and polar bear harvests in Kaktovik.

Over many years, Kaktovik has voiced its concerns over ice hazards to oil rigs and possible oil spills. In 1979, Philip Tiklul from Kaktovik observed that the ice movements are strong enough to damage an oil rig and cause a spill (Tiklul, 1979, as cited in USDOI, MMS, 1979b). Nuiqsut subsistence hunter Jonas Ningeok explained that the weather is very unpredictable. Sudden snowstorms can be dangerous. Pressure ridges may form in the ice and damage the oil rig causing a spill (Sale 124 Public Hearings, Apr. 18, 1990). At the same hearing in 1990, Nolan Soloman expressed a similar concern when he stated that oil rigs may fail under the strain of the ice (Soloman, 1990, as cited in USDOI, MMS, 1990b). Recently, Fenton Rexford, President of KIC and subsistence hunter, declared that: ". . .[T]he Inupiat. . .here in Kaktovik are adamantly against offshore production until there is proven technology of a cleanup of an oil spill under ice-infested waters. It wasn't quite proven yet on onshore even. . ." (Rexford, 1996, as cited in Dames and Moore, 1996d).

The threat from oil spills to subsistence food resources has been articulated often by Kaktovik residents. Herman Rexford voiced concern in 1982 that an oil spill would damage the food the whales live on (Rexford, 1982, as cited in USDOI, MMS, 1982a). During public hearings in 1995, whaling captain Isaac Akootchook worried that an oil spill could occur under the ice and go unnoticed, incurring significant damage to subsistence resources (Akootchook, 1995, as cited in USDOI, MMS, 1995d). Fenton Rexford at hearings for the Northstar Project, related that: "We know there are a lot of waterfowl that come from all over the world that go through this area. . .so that is one of. . .the issues I would like to see in here [the EIS]. They come from all over the world for only a 3-month period, and if there is a spill, that would have a drastic effect" (Rexford, 1996, as cited in Dames and Moore, 1996d).

Effectiveness of Mitigating Measures: Mitigating measures are assumed to be in place Alternative I, and effects levels reflect this assumption. Mitigation that would apply to subsistence-harvest patterns includes the stipulations on the Orientation Program, the Industry Site-Specific Bowhead Whale-Monitoring Program, and Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities. The Orientation Program stipulation requires the lessee to conduct a program that educates personnel working on exploration or development and production activities about the environmental, social, and cultural concerns that relate to the area and area communities. The program is expected to increase personnel sensitivity and understanding of local Native community values, customs, and lifestyles and to prevent any conflicts with subsistence activities. The

Industry Site-Specific Bowhead Whale-Monitoring Program stipulation requires industry to conduct a whale monitoring program if exploratory drilling or seismic activity are conducted during the bowhead whale migration to assess the behavioral effects on bowheads from these activities. The monitoring plan is subject to the review of the NSB and the AEWC, invites NSB and AEWC representatives to serve as observers, and requires the plan be independently peer reviewed. The stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities requires industry to conduct operations in a manner that prevents unreasonable conflict with subsistence activities, especially the bowhead whale hunt. Prior to submitting a plan, the lessee must consult with potentially affected subsistence communities of Barrow, Nuiqsut, and Kaktovik; the NSB; and the AEWC about the operations proposed to ensure that they minimize any potential siting and timing conflicts with subsistence whaling and other subsistence harvest activities. When an operations plan is submitted to MMS, the AEWC will participate in a concurrent review of the plan. If conflicts between industry and subsistence whalers arise over planned exploration or development and production activities, any of the affected parties can request that MMS convene a conflict-resolution panel composed of members from industry, the subsistence communities, the NSB, the AEWC, and NMFS. Only after this group has convened will MMS make a final decision on the adequacy of measures taken to prevent unreasonable conflicts to subsistence-hunting activities. Lease-related use will be restricted if it is determined necessary to prevent such conflicts with subsistence hunting. Subsistence whalers and industry have established a history for negotiating agreements that work for both parties. A recent agreement coordinating the timing of seismic activity for the Northstar Project and the subsistence whale hunt was successfully negotiated by BP Exploration and the NSB, the AEWC, and the city of Nuiqsut.

The Orientation Program, Industry Site-Specific Bowhead Whale-Monitoring Program, and Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities stipulations would serve collectively to mitigate disturbance effects on Native lifestyles and subsistence practices. If these mitigation measures were not in place, increased disturbance effects would not raise overall effects levels above those already assessed for Alternative I.

Summary: Effects on the subsistence-harvest patterns of the communities in the Sale 170 area would occur as a result of discharges; disturbance effects from seismic activity, aircraft noise, supply-vessel traffic, drilling noise, off- and onshore construction, and oil-spill cleanup; and oil spills. The Sale 170 area includes the eastern portion of Barrow's subsistence waterfowl-harvest area, most of the marine subsistence-harvest areas of Nuiqsut, and roughly the western half of Kaktovik's subsistence-harvest area. If economically recoverable amounts of oil were discovered, landfalls, onshore pipelines, and roads associated with oil development could affect the terrestrial subsistence resources harvested by the communities of Nuiqsut and Kaktovik.

Access to subsistence resources, subsistence hunting, and the use of subsistence resources could be affected by reductions to subsistence resources and changes to subsistence-resource-distribution patterns. Major factors considered in the effects analysis of subsistence-harvest patterns of the communities of Barrow, Nuiqsut, and Kaktovik are: (1) heavy reliance on bowhead whales, caribou, and fishes in the annual average harvest; (2) the overlap of subsistence-hunting ranges for many species harvested by the three Native communities; and (3) subsistence hunting and fishing as central cultural values in the Inupiat lifeway.

Effects on subsistence whale species and other marine mammals harvested by the communities of Barrow, Nuiqsut, and Kaktovik due to drilling discharges are expected to be negligible and have no apparent effects on subsistence harvests.

In Barrow, negligible effects to bowhead whales from offshore construction would be experienced by subsistence hunters, as its harvest area would be outside the area of Sale 170 exploration and development and production activity. Negligible effects from offshore construction noise and disturbance on belukha whales, seals, walruses, polar bears, fishes, and birds also would be experienced by Barrow, as its harvest areas for these subsistence species are outside the area of Sale 170 activities.

Nuiqsut bowhead whale subsistence harvests could experience intermittent effects from disturbances caused by offshore construction. Construction could cause bowheads to temporarily avoid areas where construction occurred. Offshore construction disturbance would produce very local noise disturbance and adverse habitat effects from offshore platform placement and offshore pipeline installation on belukha whales, seals, walruses, and polar bears, but there would be no effects to their populations and no apparent effects on subsistence harvests. The Nuiqsut belukha whale hunt periodically might be disturbed by construction noise, and construction of offshore pipelines to landfalls at Oliktok Point and Point McIntyre would concentrate noise and traffic disturbance to walruses in these areas; however, none of these areas are traditional locations for walrus harvests. It should be noted that the subsistence belukha and walrus hunts in Nuiqsut in recent years have not been intensive. Offshore construction disruption of bottom substrates would not significantly affect fish abundance and only temporarily disturb fishes in the immediate area of activity. Pipeline

activity likely would affect fish distribution in the area of construction. Platform installation could temporarily displace (≤ 1 season) bird use within 1 mi of installation sites, but birds would not become unavailable to subsistence hunters.

In Kaktovik, negligible effects from offshore construction disturbance would be experienced by Kaktovik, as its bowhead whale harvest area would be outside the area of Sale 170 activity. Offshore construction could produce periodic disturbance to Kaktovik's subsistence belukha whale, seal, and polar bear harvests, but these marine mammal species would not become unavailable to subsistence hunters. It is more likely that disturbance activity would be outside Kaktovik's subsistence-harvest areas for these species. It should be noted that the subsistence belukha whale hunt in Kaktovik in recent years has not been intensive, and walruses are not pursued. There would be no apparent effects to fish and bird populations and no apparent effects on subsistence harvests, as harvest areas for these species would be outside the area of Sale 170 construction activity.

Oil spills occurring during the winter season could affect sealing and polar bear hunting. In spring, whaling, sealing, and bird hunting could be affected. In the open-water season, whaling, sealing, walrus hunting, and bird hunting could be impacted.

An oil spill during Barrow's spring bowhead hunt could cause the whale harvest to be discontinued, because bowheads could become unavailable and undesirable for use for the entire season, but the OSRA estimates a low risk of contact. In all three communities, any disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during their inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though the bowhead would not be rendered unavailable. The belukha harvest season in Barrow lasts from the beginning of the bowhead whaling season (late March) until August. Belukhas are primarily hunted in Chukchi Sea areas. Short-term effects could occur to belukha whales but would have no apparent effect on Barrow's subsistence belukha hunt. Probabilities of an oil spill occurring and contacting land segments in areas used by Barrow subsistence hunters are low, and no apparent effects would occur to the subsistence seal harvest in these communities. As primary walrus-feeding habitat is north and northwest of Point Barrow, walruses are extensively hunted more in the Chukchi Sea, and oil-spill risk is very low (<0.5%), no apparent effects to the Barrow subsistence walrus hunt would occur. No apparent effects would occur to normal subsistence polar bear harvests in Barrow. Onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil-spill effects would be periodic but have no apparent effect on the subsistence harvest. Spill effects on subsistence fish harvests in Barrow would not make fishes unavailable or undesirable for use, and no apparent effects would occur to normal subsistence bird harvests in Barrow.

In Nuiqsut, it is possible that an oil spill might reduce or eliminate the bowhead whale harvest for one season, but it is more likely that a spill would force subsistence hunters to move to new harvest locations. The forced move to more distant hunting locations would shorten the whaling season and possibly decrease the number of whales harvested—an effect that is most likely to occur in the Nuiqsut subsistence-harvest area (see OSRA discussion for Nuiqsut above). In all three communities, any disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during their inmigration, summer feeding, and outmigration could disrupt the bowhead hunt for an entire season, even though the bowhead would not be rendered unavailable. Negligible effects on belukhas could be expected in Nuiqsut, where harvest dependence is very low. The Nuiqsut subsistence seal harvest could experience oil-spill effects that would make seals unavailable and undesirable for a period up to 1 year. Negligible effects would be expected on Nuiqsut's walrus hunt, as the pursuit of walrus in Nuiqsut is not intensive. Effects from oil spills most likely would affect polar bear harvests in Nuiqsut for a period not exceeding 1 year, and polar bears would not become unavailable for use. Onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil spills would have periodic effects on caribou but would have no apparent effect on the subsistence harvest. The OSRA indicates the highest oil-spill contact would be to land segments used by Nuiqsut subsistence hunters for the harvest of fishes (see OSRA discussion above). Fishes are likely to experience nonlethal effects from an oil spill; however, fishes overwintering in critical habitats (Colville River Delta) could experience significant losses (Sec. IV.B.3). As with other subsistence resources, fishes that were oiled in a spill event likely would be rendered inedible or perceived as such and consequently would be unharvestable. In Nuiqsut, if a spill contacted Colville River overwintering habitat, subsistence fish resources would be undesirable and unavailable for an entire season (1 year). Effects from oil spills related to Sale 170 most likely would affect subsistence bird harvests in Nuiqsut for a period not exceeding 1 year, but bird species would not become unavailable for use.

The OSRA discussion for Kaktovik indicates that spill contact to its bowhead whale harvest area is very low; nevertheless, in all three communities, any perceived disruption of the bowhead whale harvest from oil spills and any perceived tainting anywhere during the bowhead inmigration, summer feeding, and outmigration could

disrupt the bowhead hunt for an entire season, even though whales would not be rendered unavailable. Negligible effects to belukha whales could be expected in Kaktovik, where there is little recorded harvest. Onshore oil-spill effects to caribou would be localized and are not expected to significantly contaminate or alter caribou range within the pipeline corridors (see Sec. IV.B.7). Oil spills would have periodic effects on caribou but would have no apparent effect on the subsistence harvest. Spill effects on subsistence fish harvests in Kaktovik would not make fishes unavailable or undesirable for use. Probabilities of an oil spill occurring and contacting land segments in areas used by Kaktovik hunters for subsistence seal harvesting are low, and no apparent effects would occur to the harvest. The harvesting of walruses is not pursued in Kaktovik. No apparent effects would occur to normal subsistence bird and polar bear harvests in Kaktovik.

Barrow: Some of Barrow's subsistence resources likely would be affected for up to an entire season (1 year), but no resource would become unavailable, even though an oil spill affecting any portion of the bowhead whale migration route might create the perception that bowheads were undesirable for use (tainted) by subsistence hunters.

Nuiqsut: Some of Nuiqsut's subsistence resources (seals, fishes, polar bears) likely would be affected for up to an entire season (1 year), possibly making them unavailable, undesirable for use, available in reduced numbers, or their pursuit more difficult (with hunters having to travel farther than normal to harvest them); an oil spill affecting any portion of the bowhead whale migration route might create the perception by subsistence hunters that bowheads, even though available, were undesirable for use (tainted).

Kaktovik: Some of Kaktovik's subsistence resources likely would be affected for up to an entire season (1 year), but no resource would become unavailable, even though an oil spill affecting any portion of the bowhead whale migration route might create the perception that bowheads were undesirable for use (tainted) by subsistence hunters.

Conclusion: Overall effects on subsistence-harvest patterns in the communities of Barrow, Nuiqsut, and Kaktovik from the Sale 170 resource estimate as a result of discharges, disturbance effects from seismic activity, aircraft noise, supply-vessel traffic, drilling noise, off- and onshore construction, oil spills, and oil-spill cleanup likely would render one or more important subsistence resources unavailable, undesirable for use, available in reduced numbers, or their pursuit more difficult (with hunters having to travel farther than normal to harvest them) for up to an entire season (1 year).

10. Sociocultural Systems:

This discussion is concerned with those communities that could be affected by Beaufort Sea Sale 170. These include the communities of Barrow, Nuiqsut, and Kaktovik. Under Alternative I, the main onshore support infrastructure would be upgraded facilities at the Prudhoe Bay/Kuparuk units. The offshore pipeline landfall closest to Nuiqsut would be located at Oliktok Point. Landfalls at Point McInyre and eventually one at Flaxman Island would be close to Nuiqsut and Kaktovik.

The primary aspects of the sociocultural systems covered in this analysis are (1) social organization and (2) cultural values, as described in Section III.C.3. For the purpose of effects assessment, it is assumed that effects on social organization and cultural values could be brought about at the community level, predominantly by industrial activities, increased population, increased employment, and effects on subsistence-harvest patterns associated with the sale. Potential effects are evaluated relative to the tendency of introduced social forces to support or disrupt existing systems of organization and relative to how rapidly they occur and their duration (see Langdon, 1996).

North Slope Inupiat continue to express concern about the lack of perception of their culture by the dominant culture. Rex Okakok from Barrow expressed the problem when he said "Our land and sea are still considered and thought by outsiders to be the source of wealth, a military arena, a scientific laboratory, or a source of wilderness to be preserved, rather than as a homeland of our Inupiat" (Okakok, 1987, as cited in USDOI, MMS, 1987). Considering such use of Inupiat territory, Robert Edwardson from Barrow said that he would like to see revenues paid to the Inupiat for mineral rights (Edwardson, 1995, as cited in USDOI, MMS, 1995c). Mayor Lon Sonsalla from Kaktovik believes that to deal with such perception and the activities it creates, it is important to have an impact office established to deal with processing EIS documents and monitoring of offshore activities (Sonsalla, 1996, as cited in USDOI, MMS, 1996d).

a. Parameters of This Analysis: An analysis of the social organization of a society involves examining how people are divided into social groups and networks. Social groups generally are based on kinship and marriage systems, as well as on nonbiological alliance groups formed by such characteristics as age, sex, ethnicity, community, and trade. Kinship relations and nonbiological alliances serve to extend and ensure cooperation within the society. Social organization could be affected by an influx of new population that causes growth in the community and/or change in the organization of social groups and networks. Disruption of the subsistence cycle also could change the way these groups are organized. Activities such as the sharing of subsistence foods are profoundly important to the maintenance of family ties, kinship networks, and a sense of community well-being (see Sec. III.C.3). In rural Alaskan Native communities, task groups associated with subsistence harvests are important in

defining social roles and kinship relations: the individuals one cooperates with help define kin ties, and the distribution of specific tasks reflects and reinforces the roles of husbands, wives, grandparents, children, friends, and others (see Sec. III.C.3). Disruption of these task groups would damage the social bonds that hold the community together. Any serious disruption of sharing networks could appear as a threat to the way of life in that community and could trigger an array of negative emotions: fear, anger, and frustration, as well as a sense of loss and helplessness. Because of the psychological importance of subsistence in these sharing networks, perceived threats to subsistence activities are a major cause for anxieties about oil development.

An ADF&G social-effects survey administered by the Division of Subsistence Management in 1994 in Nuiqsut included questions on effects from OCS development. One question asked was "How do you think the off-shore development of oil and gas in this area would affect the following resources available for harvest? Would the resource decrease, not change, or increase?" Eighty percent of Nuiqsut respondents answered that fish resources would decrease, 86.7 percent said marine mammals would decrease, 43.3 percent said land mammals would decrease, and 55.0 percent said that birds would decrease; 66.7 percent were not in favor of the search for oil, and 41.7 percent believed the search for oil would have an adverse impact on subsistence; 68.3 percent were not in favor of the development and production of oil, and 51.7 percent believed that oil development and production would have an adverse impact on subsistence; 60.0 percent did not believe a small oil spill could be contained or cleaned up, and 80.0 percent did not believe a large oil spill could be contained or cleaned up. The overall study on 21 Alaskan communities concluded that impacts persist from the EVOS on subsistence use and the social and cultural system that subsistence activities support (Fall and Utermohle, 1995).

A study conducted by Picou et al. (1992) on the disruption to the community of Cordova by the EVOS demonstrated empirically that 18 months following the spill, residents of Cordova had experienced long-term negative social impacts that took the form of disruption to work roles and increased personal stress. Additionally, they observed that ". . .work disruption was correlated with intrusive stress. . .and fishermen experienced more work disruption than. . .other occupations. It may be possible that other natural resource community activities such as participation in subsistence harvests. . .may identify subpopulations more vulnerable to long-term negative social impacts" (Picou et al., 1992).

In the Social Indicators Study of Alaskan Coastal Villages, Volume VI. Analysis of the *Exxon Valdez* Spill Area, 1988-1992, the summary of findings section affirmed that immediately after the spill and continuing into early 1990, Natives decreased their harvests of wild resources and relied on preserved foods harvested before the spill. By the winter of 1991, Native harvesting activities had begun to resume to normal, but the proportions of wild foods in their diets remained below 1989 proportions. The study also demonstrated in its analysis that non-Natives and Natives "define the environment and resources within the environment very differently. Commodity valuation takes precedence" for non-Natives and "instrumental use and cultural and spiritual valuation take precedence" for Natives (Human Relations area Files, Inc., 1994).

Analysis of cultural values looks at those values shared by most members of a social group. Generally, these values are shared conceptions concerning what is desirable. They are ideals that members of a social group accept, explicitly or implicitly. Forces powerful enough to change the basic values of an entire society would include a seriously disturbing change in the physical conditions of life: a fundamental cultural change imposed or induced by external forces, such as when an incoming group induces acculturation of the residing group, or when a series of fundamental technological inventions change existing physical and social conditions. Such changes in cultural values can occur slowly and imperceptibly or suddenly and dramatically (Lantis, 1959). Cultural values on the North Slope include strong ties to Native foods, to the land and its wildlife, to the family, to the virtues of sharing the proceeds of the hunt, and to independence from institutional and political forces outside the North Slope (see Sec. III.C.3). A serious disruption of subsistence-harvest patterns could alter these cultural values. For the system of sharing to operate properly, some households must be able to produce, rather consistently, a surplus of subsistence goods; it is obviously more difficult for a household to produce a surplus than to simply satisfy its own needs. For this reason, sharing, and the supply of subsistence foods in the sharing network, could be more sensitive to harvest disruptions than the actual harvest and consumption of these foods by active producers.

b. Effects Agents: The agents associated with Sale 170 that could affect the sociocultural institutions and systems in communities in the sale area (described in Sec. III.C.3) are industrial activities, changes in population and employment, and effects on subsistence-harvest patterns.

(1) Industrial Activities: During the exploration phase, facilities at Prudhoe/Deadhorse would be used for air-support staging where personnel and air freight would be transferred to helicopters. One helicopter trip per day per drill unit is assumed for exploration. The existing facilities at these airports are adequate to handle the projected needs during exploration and development and production. During development and production, 87 to 111 production and service wells are assumed to be drilled from 3 to 5 production platforms in the Beaufort Sea. With

the use and upgrading of existing Prudhoe Bay/Deadhorse infrastructure for the staging of air support, contact with non-Native construction personnel in the villages of Nuiqsut and Kaktovik would not be expected to occur except under exceptional circumstances. Air traffic through Barrow might increase, but no significant staging of equipment or personnel would occur from the community.

(2) **Population and Employment:** Sale 170 is projected to affect the population of the North Slope Borough through two types of effects on regional employment: (1) more petroleum industry-related jobs as a consequence of Sale 170 exploration and development and production activities and (2) more NSB-funded jobs as a result of higher NSB operating revenues and expenditures (see Sec. IV.C.8.). Employment projections as a consequence of Sale 170 are provided in Section IV.C.8. Throughout the development and production phase, total petroleum-related employment would peak in 2008 at 1,411 to 1,709 jobs. Resident employment as a result of Sale 170 would peak at 63 to 100 in the year 2006. Most workers are expected to permanently reside outside of the North Slope. Sale 170 is projected to increase resident employment 4 to 6 percent during the development phase and 2 to 3 percent during the production phase above the declining existing-condition projections between 1998 and 2011 (see Tables IV.B.8-1 and IV.B.8-2).

Sale 170 is projected to increase the NSB population at an average of 0.7 percent per year, peaking at 2.2 percent above the existing-condition level in 2015. The Native proportion of the population is not expected to change much—approximately 70 to 77 percent Native. There may be some degree of sale-induced employment, but these changes, particularly as they translate into Native employment, historically have been and are expected to continue to be insignificant. Even though Native employment in oil-related jobs on the North Slope is low, Native leaders continue to push for programs and processes with industry that would encourage more Native hire. Employment generated from a possible oil-spill cleanup could generate the need for approximately 300 workers for 6 months in the first year, diminishing to zero in the fourth year of cleanup. The sudden employment increase could have sudden and significant effects, including inflation and displacing Natives from normal subsistence-harvest activities for hired Native spill workers. A good deal of cleanup-employment effects likely would be mitigated by the fact that cleanup administration and cleanup workers would be located in enclave facilities.

Nuiqsut residents clearly want an active role in any spill response and cleanup.

At a recent community meeting, the people of Nuiqsut expressed the desire to be part of a newly structured and formed village oil-spill-response team, so that they can positively contribute in an emergency situation (Dames and Moore, 1996e). Their involvement in the past has not always gone smoothly. At the same community meeting, two Nuiqsut men felt their skills and knowledge were not respected when asked to participated in an oil-spill-response drill in February 1991 on a rig near the Northstar project. They believed their skills and knowledge could have been better used by the command structure of the oil-spill-response team (Dames and Moore, 1996e). As early as 1983, Nuiqsut residents asked to be part of industry activities in the region. Mark Ahmakak stated: "I think that if you are going to go ahead with this sale that you should utilize Natives in. . .the areas affected by this lease sale; then utilize some of these Natives as monitors on some of your projects" (Ahmakak, 1983, as cited in USDOI, MMS, 1983a). The general consensus is some benefit to the community by nearby oil activities. Nuiqsut resident Joseph Ericklook expressed the community desire to see employment opportunities for local people result from development (Ericklook, 1990, as cited in USDOI, MMS, 1990d).

(3) **Subsistence-Harvest Patterns:** Subsistence is important to the Inupiat sociocultural system through sharing subsistence foods, creating community task groups and crew structures, and through the strengthening of social bonds (see Sec. III.C.2 for a detailed description). Effects could be expected on subsistence-harvest patterns in the Sale 170 area as a result of disturbance to Nuiqsut's subsistence harvests due to seismic activity, aircraft noise, supply vessel traffic, drilling noise, off- and onshore-construction, and oil spills.

(4) **Oil-Spill Cleanup:** Other industrial activities associated with oil development that could have an effect on sociocultural systems would be the result of cleanup if an oil spill did occur. In the event of a large spill contacting and extensively oiling coastal habitats, the presence of hundreds of humans, boats, and aircraft would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters.

Nuiqsut residents reiterated at a recent town meeting for the Northstar Project that they do not believe that the technology exists to clean up an oil spill under the ice; they believe it is a matter of *when* a spill will occur, not if it will occur. They want assurance against disaster and impact funds set aside for them in the event of such a disaster (Dames and Moore, 1996b). Earlier village comments expressed the same attitude. In 1979, Gordon Rankin from Kaktovik suggested that a compensation fund be set aside for villages in case there is a devastating oil spill (Rankin, 1979, as cited in USDOI, MMS, 1979b).

c. Effects on Barrow, Nuiqsut, and Kaktovik:

The relatively homogenous nature of the communities whose sociocultural systems may be affected by Sale 170—all are predominantly Inupiat—indicates that changes in the communities would be similar. The exception to this may be Barrow, which is larger, has a larger percentage of non-Natives, and already has experienced more change than the other two smaller Native communities. This section analyzes effects of industrial activities, population and employment changes, and subsistence-harvest-pattern impacts on North Slope social organization, cultural values, and other issues. This discussion focuses on the North Slope as a whole, with a discussion of each community where necessary.

(1) Social Organization: The social organization of communities that might be affected by Sale 170 includes typical features of Inupiat culture: kinship networks that organize much of a community's subsistence-harvest, consumption, and sharing activities; informally derived systems of respect and authority; strong extended families, although not always living in the same household; stratification between families focused on success in the subsistence harvest; and access to subsistence technology (see Sec. III.C.2). These non-Western elements of social organization could be altered to become less oriented toward the family, and changes would be exhibited in a breakdown of kinship networks as a result of OCS-induced social conditions. However, activities generated by Sale 170 are not likely to bring about these effects in the communities in question. Increased air traffic during exploration is unlikely to have a large effect on these communities, except possibly increases in noise disturbance to the community of Nuiqsut. Any increase in non-Natives in the community would be considerably less than the number of non-Native workers present in North Slope communities during the peak of the Capital Improvements Program construction years in the 1980's. Other OCS industrial activities (pipelines and pipeline landfalls) would occur nearest to the community of Nuiqsut but not within the actual community itself. Changes in population and employment would not be greater than those already experienced in the past by these communities. Social institutions in all three communities would experience little direct disturbance from the staging of personnel and air freight expected for Sale 170 exploration, development, and production; negligible effects would be expected to sociocultural systems, and no displacement of existing institutions would occur.

No disruptions are expected to the three community's social institutions as a result of increases in temporary or permanent population growth. The construction of winter ice roads near Nuiqsut could cause some disruptions to Nuiqsut social organization because of an increase of social interaction between residents and oil-industry workers. Traffic restrictions near exploration infrastructure along the Nuiqsut/Prudhoe Bay ice road already has created some friction in Nuiqsut, where considerable dependence has developed on this arterial for winter access to Prudhoe Bay and south to Fairbanks. Locally, this fear has been expressed by Nuiqsut residents as seismic and drilling activity has increased dramatically for offshore projects such as the Northstar development and seismic and drilling activities from the onshore Alpine field. The Sale 170 scenario stresses that staging will occur primarily from existing or enhanced facilities at the Prudhoe Bay, Kuparuk, and Endicott units, a situation that would significantly reduce disruption to nearby Native communities.

Other instances of increased interaction would occur if local residents were employed in oil-industry jobs but historically, the number of local Native hires is quite small. Some of the interactions of oil workers with the local Inupiat population are likely to be unpleasant and could lead to a growth in racial tension. Nuiqsut already has been exposed to oil workers due to its proximity to Prudhoe Bay, village travel to Prudhoe on the winter ice road that is maintained between the two communities, and increased seismic activity in the vicinity of the village. But it is not likely that the number of oil workers associating with local residents would increase much above the number that is already occurring. Social interaction of oil-industry workers with Nuiqsut residents could be long term, but there would not be a tendency toward displacement of their social institutions. Changes in population and employment are unlikely to cause disruption to sociocultural systems and would not displace existing institutions. Oil-spill employment could disrupt subsistence-harvest activities for an entire season (1 year) and create disruption to institutions and sociocultural systems, but likely would not displace existing institutions. Oil-spill-cleanup activity during the first year of a spill could disrupt subsistence harvest activities for an entire season (1 year) and create disruption to institutions and sociocultural systems but likely would not displace existing institutions.

Subsistence is a cyclical activity. It is expected that harvests would vary from year to year, sometimes substantially, as they have in the past. Numerous species are hunted to compensate for a reduced harvest of a particular resource in any one year, but there is no satisfactory replacement for bowhead whales. However, multiyear disruptions to even one resource, particularly one as important as the bowhead whale, could disrupt sharing networks and subsistence-task groups. Crew structures, particularly bowhead whale-hunting crews, could be disrupted, resulting in ramifications in the social organization through loss of status and kinship ties and threatening the importance of subsistence as a cultural value.

Other tensions could be caused by OCS activities perceived as a threat to subsistence resources, especially if oil-industry activities are visibly evident, and North Slope residents in the Sale 170 area do not perceive OCS development as a benefit to the Inupiat people. At the upper end of the resource range, onshore pipeline construction activities could occur to serve the Point Thompson unit, and a landfall could be constructed near Flaxman Island for the Badami and Kuvlum fields offshore. These activities potentially could interfere with Nuiqsut and Kaktovik's bowhead whale harvest. Traditionally, Nuiqsut and Kaktovik are communities that have not always gotten a bowhead whale and can cope with a zero harvest, yet residents might view a zero harvest differently if harvest interference resulted from oil-industry activities versus naturally occurring ecological, meteorological, or biological factors. A zero harvest that is perceived to be the fault of the oil industry is more likely to generate additional stress on the sociocultural system—with possible tendencies toward disruption of the sharing networks and task groups, something that also could disrupt the social organization of the community but would not be likely to displace the social institutions of whaling and sharing.

(2) **Cultural Values:** Cultural values and orientations (as described in Sec. III.C.2) can be affected by changes in the population, social organization and demographic conditions, economy, and alterations of the subsistence cycle. Of these, the only changes that could be expected to occur would be in Nuiqsut's social organization (see discussion above) and the subsistence cycle (see Sec. IV.C.9 and discussion above).

A trend toward displacement of the community social institutions could lead to a short-term decreased emphasis on the importance of the family, cooperation, sharing, and subsistence as a livelihood. Increasing offshore oil-development activity, when combined with the increasing encroachment of onshore development, could increase access to urban communities and cause more interaction with oil-industry workers, resulting in the introduction of new values and ideas as well as increased racial tensions and an increased availability of drugs and alcohol. Tensions would be created and could result in increased incidents of socially maladaptive behavior and family stress, potentially straining traditional Inupiat institutions' abilities to maintain social stability and cultural continuity. Cultural values and orientations can change slowly or suddenly (Lantis, 1959).

Long-term change depends on the relative weakening of traditional stabilizing institutions through prolonged stress and disruptive effects that could be exacerbated by activities accompanying those under Alternative I. These changes already are occurring to some degree on the North Slope as a result of onshore oil and gas development, more dependence on a wage economy, higher levels of education, improved technology, improved housing and community facilities, improved infrastructures, increased presence of non-Natives, increased travel outside of the North Slope, and the introduction of television and the Internet. Generally, NSB institutions, such as the school district that promotes teaching Inupiat language and culture, the AEWC that negotiates with industry to protect Inupiat subsistence whaling interests, the borough Dept. of Wildlife Management, and other regional and village Native corporations and organizations, work vigorously and quite successfully at preventing any weakening of traditional cultural institutions and practices.

Subsistence is considered the core value and central feature of Inupiat cultural values (see Sec. III.C.2). While a year-long disruption to only one subsistence resource likely would not cause long-term, chronic disruption or displacement of the sociocultural system, multiyear disruptions throughout the 30-year life of the project could begin affecting cultural values, with the potential for long-term sociocultural change and the displacement of existing institutions. When a group's identity is formed around being able to hunt, particularly the bowhead whale, and this hunt is not possible or not successful due to oil-industry activity, a considerable amount of social stress, tension, and anxiety are likely to occur (see the EVOS discussion [Sec. IV.B.10a]). Disturbance disruption on Nuiqsut's subsistence resources would render one or more important subsistence resources unavailable, undesirable for use, or available in reduced numbers or their pursuit more difficult for up to an entire season (1 year). Less substantial effects to subsistence-harvest patterns are expected in Barrow and Kaktovik as a result of disturbance effects on subsistence resources. Some subsistence resources in Barrow and Kaktovik could be affected for up to an entire season (1 year), but no resource would become unavailable, even though an oil spill affecting any portion of the bowhead whale migration route might create the perception that bowheads were undesirable for use (tainted) by subsistence hunters. Disturbance effects could disrupt subsistence-harvest activities for an entire season (1 year) and create disruption to institutions and sociocultural systems, but likely would not displace existing institutions.

At hearings in 1982, Mark Ahmakak from Nuiqsut stated that there should be economic benefits to Nuiqsut, such as cheaper diesel (Ahmakak, 1982, as cited in USDOI, MMS, 1982b). Barrow resident Charles Okakok said that subsistence users should be compensated by the oil industry in case of an oil spill (Okakok, 1995, as cited in USDOI, MMS, 1995c). This sentiment has been repeated often by Native resident of the North Slope. There are concerns about protecting traditional sites from development. Nannie Woods expressed her opposition to leasing in the Colville River Delta because of her concern for her husband's burial site that might be disturbed by

development (Woods, 1982, as cited in USDOI, MMS, 1982b). Recently, a Nuiqsut elder had her "home place" at Prudhoe Bay desecrated by an oil company. Her house was looted and built over. She emphasized that graves of family members are in the area and that she has been denied access there (Dames and Moore, 1996e). Village Coordinator for Kaktovik, Susie Akootchook, commented during MMS scoping meetings for Sale 170 in Nov. 1996, that traditional fishing and hunting sites need protection, and that a contingency plan needs to be developed to protect them (Burwell, 1996).

(3) **Social Health:** Effects on sociocultural systems often are evidenced in rising rates of mental illness, substance abuse, and violence. This has proven true for Alaskan Natives who have been faced since the 1950's with increasing acculturative pressures. The rates of these occurrences far exceed those of other American populations such as Alaskan non-Natives, American Natives, and other American minority groups. For the period 1980 through 1989, the rate for Alaskan Native deaths from suicides and homicides was 77.9 per 100,000 compared to the rate of 25.8 per 100,000 for non-Natives; half of these suicides are committed by 15 to 24 year old. The alcohol mortality rate for Alaskan Natives is three and one-half times higher than the rate for non-Natives (4.1/10,000 for Natives; 1.2/10,000 for non-Natives). The reports of harm from physical abuse, neglect, and sexual abuse translates into a rate of 94 alleged victims per 1,000 Native children as compared to 55 per 1,000 children in non-Native communities. Although the Native population of Alaska represents 16 percent of the total Alaskan population, a 1991 study reported that for persons under the age of 18 arrested in Alaska, of those arrested for rape, 50 percent were Native; for aggravated assault, 30.7 percent were Native; for burglary, 37.1 percent were Native; for arson, 37.5 percent were Native; and for alcohol-related offenses, 39.8 percent were Native, (Alaska Natives Commission, 1994; Middaugh et al., 1991; Kraus and Buffler, 1979). While such behaviors are individual acts, the rates at which they occur vary among different groups and through time. These changing rates are recognized as the results of a complex interaction of interpersonal, social, and cultural factors (Kraus and Buffler, 1979; see also Kiev, 1964; Murphy, 1965; Inkeles, 1973); however, rates of mental illness are higher ". . .in larger rural Native towns than in the more traditional Native villages" (Foulks and Katz, 1973; Kraus and Buffler, 1979). Traditional Native communities help buffer the individual by providing a sense of continuity and control.

Increases in social problems—rising rates of alcoholism, drug and alcohol abuse, domestic violence, wife and child abuse, rape, homicide, and suicide—also are issues of direct concern in this analysis of sociocultural systems (see Sec. III.C.3). Local residents participating in the cleanup of the EVOS in Prince William Sound in 1989 tended to: (1) not participate in subsistence activities, (2) have a surplus of cash to spend on material goods as well as drugs and alcohol, and (3) not seek or continue employment in other jobs in the community (because oil-spill-cleanup wages typically were higher than those earned in the community). Studies indicate that the sudden, dramatic increase in income as a result of working on the oil-spill cleanup, as well as being unable or unwilling to pursue subsistence harvests because of the EVOS, caused considerable social dislocation—particularly seen in increases in depression, violence, and substance abuse (Fall and Utermohle, 1995; Cohen, 1993; Picou and Gill, 1993; Picou et al., 1992; Fall, 1992; Impact Assessment, Inc., 1990e).

Although the oil industry strictly forbids the consumption of alcohol and drugs by camp workers, many such events frequently occur in Prudhoe Bay and Kuparuk. In Prudhoe Bay, it is often the service industries that have not complied with enforcing the ban on alcohol. The increased availability of drugs and alcohol in Nuiqsut and Kaktovik as a result of increased traffic through the airport, visitors in town, and shore-base workers associating with local residents could be disruptive to the social well-being of these communities. These problems already have occurred in Nuiqsut, which is within 56 km (35 mi) of Kuparuk and 105 km (65 mi) of Prudhoe Bay. Although not accessible by road year-round, Nuiqsut is connected to the Prudhoe Bay/Kuparuk industrial complex by a winter road and by air. An increase in social problems (consumption of alcohol and drugs, sexual abuse, domestic violence) in Nuiqsut at a rate slightly higher than in other North Slope communities has been observed (Armstrong, 1985).

Although there may be additional reasons for differences in social problems in Nuiqsut, it is clear that the proximity to industrial enclaves enables residents easier access to drugs and alcohol, thereby affecting the social health of the community, a situation that also could intensify in Nuiqsut as a result of this lease sale. Any effects on social health would have ramifications in the social organization, but NSB Native communities have, in fact, proven quite resilient to such effects with the NSB's continued support of Inupiat cultural values and its strong commitment to health, social service, and other assistance programs.

Several salient points in the evaluation of possible sociocultural effects from oil-related developments due to this lease sale should be made:

1. Change itself, even though induced primarily by forces outside the communities, does not necessarily cause the levels of psychic stress that lead to pathology, but technological disasters, as opposed to natural disasters, have been shown to produce more long-term stresses on affected communities (Picou et al., 1992; Inkeles, 1973).

2. Related to the first point is the fact that not all sociocultural change (directly or indirectly related to oil development) may be negative. Higher levels of employment, better health programs, and improved public services must be viewed as possible positive sociocultural effects from oil development on the North Slope. Additionally, income from oil-industry revenue and employment could improve living conditions, although major dependence on a nonrenewable-resource-based economy could cause long-term social disruption at the time of resource depletion.
3. What drives the disruption of sociological change ". . .is the manner in which changes occur" (Murphy, 1965).
4. The conditions that make sociocultural change stressful must be viewed as ongoing. If the stressful conditions alter, the society can make successful adjustments to the changes that have occurred; and the rates of violence, suicide, and substance abuse will drop.

Nuiqsut is the most likely community in the region to experience additional sale-related effects in social health and well-being above those effects already experienced as a result of NSB CIP employment and the indirect effects from current oil development. These effects on social health could have direct consequences on the sociocultural system but would not have a tendency toward displacement of existing institutions above the displacement that already has occurred with the current level of development. Effects on the institutions and sociocultural systems in Barrow and Kaktovik would be periodic and not displace existing institutions.

In a 1996 public meeting for the Northstar project, a Nuiqsut elder stated that she wanted potential human-health issues that could result from the project looked into beforehand. These issues could be found in information from other projects. She specifically expressed concern about cancers, health problems related to air pollution, and shortened lifespans (Dames and Moore, 1996e).

Effectiveness of Mitigating Measures: Mitigating measures are assumed to be in place for Alternative I, and effects levels reflect this assumption. Mitigation that would apply to subsistence-harvest patterns includes the stipulations on the Orientation Program, the Industry Site-Specific Bowhead Whale-Monitoring Program, and Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities. The Orientation Program stipulation requires the lessee to conduct a program that educates personnel working on exploration or development and production activities about the environmental, social, and cultural concerns that relate to the area and area communities. The program is expected to increase personnel sensitivity and understanding of local Native community values, customs, and lifestyles and to prevent any conflicts with subsistence activities. The Industry Site-Specific Bowhead Whale-Monitoring Program stipulation requires industry to conduct a whale-monitoring program, if exploratory drilling or seismic activity are conducted during the bowhead whale migration to assess the behavioral effects on bowheads from these activities. The monitoring plan is subject to the review of the NSB and the AEWC, invites NSB and AEWC representatives to serve as observers, and requires the plan be independently peer reviewed. The stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities requires industry to conduct operations in a manner that prevents unreasonable conflict with subsistence activities, especially the bowhead whale hunt. Prior to submitting a plan, the lessee must consult with potentially affected subsistence communities of Barrow, Nuiqsut, and Kaktovik; the NSB; and the AEWC about the operations proposed to ensure that they minimize any potential siting and timing conflicts with subsistence whaling and other subsistence harvest activities. When an operations plan is submitted to MMS, the AEWC will participate in a concurrent review of the plan. If conflicts between industry and subsistence whalers arise over planned exploration or development and production activities, any of the affected parties can request that MMS convene a conflict-resolution panel composed of members from industry, the subsistence communities, the NSB, the AEWC, and NMFS. Only after this group has convened will MMS make a final decision on the adequacy of measures taken to prevent unreasonable conflicts to subsistence-hunting activities. Lease-related use will be restricted, if it is determined necessary to prevent such conflicts with subsistence hunting. Subsistence whalers and industry have established a history for negotiating agreements that work for both parties. A recent agreement coordinating the timing of seismic activity for the Northstar project and the subsistence whale hunt was successfully negotiated by BP Exploration and the NSB, the AEWC, and the city of Nuiqsut.

The Orientation Program, Industry Site-Specific Bowhead Whale-Monitoring Program, and Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities stipulations would serve collectively to mitigate disturbance effects on Native lifestyles and subsistence practices. If these mitigation measures were not in place, increased disturbance effects would not raise overall effects levels above those already assessed for Alternative I.

d. Environmental Justice: Environmental justice is an initiative that originated with President Clinton's February 11, 1994, Executive Order (E.O.) 12898 addressing "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" and an accompanying Presidential memorandum. The E.O. requires each Federal agency to make environmental justice part of its mission by

identifying and addressing potential disproportionate high and adverse human health and environmental effects of its programs, policies and activities on minority and low-income populations in the U.S. (U.S. Department of Energy (USDOE), 1997). The intent is to promote the fair treatment of people of all races so no person or group of people shoulders a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign programs. The USEPA defines environmental justice as the "equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status from environmental hazards" (Envirosense, 1997).

(1) Demographics:

(a) Race: In 1993, the NSB conducted the North Slope Borough Census of Population and Economy. It found that of the 6,538 Borough residents, 4, 941 identified themselves as Native and 1,597 identified themselves as non-Native. Of the Native population, 97.71 percent or 4,828 were Inupiat Eskimo, 93 were identified as "other Alaskan Natives," and 20 were American Indians. For the NSB as a whole, the population is 73.9 percent Inupiat and 26.1 percent non-Inupiat. Of the Inupiat population, 49.2 percent lived in Barrow and 50.8 percent lived in the other seven villages that comprise the NSB. Sixty-nine percent of the NSB population resides in the three communities of Barrow, Nuiqsut, and Kaktovik and are adjacent to potential Sale 170 lease-sale activity (NSB, 1994).

(b) Income: According to the USDOC, the average household income in 1993 for the State of Alaska was $64,652 and the average State per capita income was $23,000. Based on USDOC data, the Alaska Department of Labor has portrayed the NSB as having one of the highest per capita incomes in the State; but data collected by the NSB 1993 Census of Population and Economy take exception to these figures based primarily on different methods used in data collection. Federal data uses a sampling procedure, but the NSB conducts house-to-house household surveys. Also, Federal figures include "transfer payments" such as unemployment, welfare, Social Security, and Medicare/Medicaid payments. The NSB survey includes all income reported to the Internal Revenue Service, including Alaska Permanent Fund and ANCSA corporation dividends. The NSB figures determined an average household income of $54,645 and a per capita income of $15,218 in 1993. When figured for ethnicity, the average Inupiat household income was $44,551 and for non-Inupiat it was $74,448. The average Inupiat per capita income was $10,765 and the non-Inupiat per capita income was $29, 525. Of all the households in the NSB surveyed, 23 percent qualified as very-low income households, and another 10 percent qualified as low-to-moderate income households. As 66 percent of the total households surveyed were Inupiat, it would appear that a substantial portion of the households falling in the very-low- to low-income range are Inupiat. Poverty-level families in the NSB numbered 88, or 6 percent of all households (NSB, 1994).

(2) Subsistence Consumption of Fish and Game: As defined by the NSB Municipal Code, subsistence is "an activity performed in support of the basic beliefs and nutritional need of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities" (State of Alaska, DNR, 1997). This definition gives only a glimpse of the importance of the practice of the subsistence lifeway in Inupiat culture, but it does underscore that it is a primary cultural and nutritional activity on which Native residents of the North Slope depend. For a more complete discussion of subsistence and its cultural and nutritional importance, see Section III.C.2., Subsistence-Harvest Patterns.

There is a likelihood for disproportionately adverse effects on Alaskan Natives as a result of Alternative I. Effects are expected to be focused on the Inupiat communities of Barrow, Nuiqsut, and Kaktovik within the NSB. The sociocultural and subsistence activities of these Native communities could be affected by routine development and accidental oil spills. Possible oil-spill contamination of subsistence foods is the primary concern regarding potential human-health effects on Natives. Based on surveys and the findings of the EVOS studies, it is noted that Natives in the affected communities largely avoided using subsistence foods as long as the oil remained in the environment. Testing of subsistence foods for hydrocarbon-contamination from 1989 to 1994 revealed very low concentrations of petroleum hydrocarbons in most subsistence foods, and the U.S. Food and Drug Administration concluded that eating food with such low levels of hydrocarbons posed no significant risk to human health (*Exxon Valdez* Oil Spill Trustee Council, 1996). Only shellfish, because of their hydrocarbon accumulation capacity, were recommended to be avoided. Human health could be threatened in oil-spill-affected areas, but these risks can be mitigated to an extent through timely warnings about a spill occurrence, forecasts about which areas may be affected and, if necessary, minimizing possible exposure by evacuation and avoidance of marine and terrestrial foods that may be affected. Federal and State agencies with health-care responsibilities would have to sample the food sources and test for possible contamination. Whether such tested foods are used by subsistence users is another question that involves a cultural "confidence" in the purity of these foods. Perceptions of food tainting and avoidance of use remained (and remain today) in Native communities impacted by the EVOS, even when agency testing maintained consumption posed no risk to human health (ADF&G, 1995b).

Alaska Inupiat Natives, a recognized minority population, are the predominant residents of the NSB, the area potentially most affected by Alternative I. Inupiat Natives may be disproportionately affected because of their reliance on subsistence foods, and activities under Alternative I may affect subsistence resources and harvest practices. Measures incorporated into Alternative I to protect subsistence resources and harvest practices are Stipulations 1, Protection of Biological resources; 2, Orientation Program; 4, Industry Site-Specific Bowhead Whale-Monitoring Program; and 5, Conflict Avoidance Mechanisms to Protect Subsistence Whaling and other Subsistence Activities, as well as Stipulations 6, Permanent Facility Siting in the Vicinity of Cross Island; 7, Planning Activities Offshore the Arctic National Wildlife Refuge; 8, OCS Pipelines Offshore the Arctic National Wildlife Refuge; and 9, Polar Bear Protection Offshore the Arctic National Wildlife Refuge from Proposed Development (Stipulations 6-9 are special mitigating measures developed to protect biological and subsistence resources. They are analyzed in the final EIS but have not been adopted by the Secretary of the Interior.)

Mitigating measures are assumed to be in place for Alternative I, and effects levels reflect this assumption. Mitigation that would apply to subsistence-harvest patterns includes the stipulations on the Orientation Program, the Industry Site-Specific Bowhead Whale-Monitoring Program, and Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities. The Orientation Program stipulation requires the lessee to conduct a program that educates personnel working on exploration or development and production activities about the environmental, social, and cultural concerns that relate to the area and area communities. The program is expected to increase personnel sensitivity and understanding of local Native community values, customs, and lifestyles and to prevent any conflicts with subsistence activities. The Industry Site-Specific Bowhead Whale-Monitoring Program stipulation requires industry to conduct a whale-monitoring program, if exploratory drilling or seismic activity are conducted during the bowhead whale migration to assess the behavioral effects on bowheads from these activities. The stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities requires industry to conduct operations in a manner that prevents unreasonable conflict with subsistence activities, especially the bowhead whale hunt. The stipulation on Protection of Biological Resources can protect special biological resources by relocating operations sites, by establishing that operations will not have significant adverse effects on special biological resources through site-specific surveys, by specifying operating times for operations to avoid conflicts with biological resources, and by potentially modifying operations that could affect significant biological populations. The Stipulation on Permanent Facility Siting in the Vicinity of Cross Island prohibits production facility siting within a 10-mi radius of Cross Island to prevent any conflicts with reasonable access to subsistence whaling. Stipulations 7, Planning for Activities Offshore the Arctic National Wildlife Refuge and 8, OCS Pipelines Offshore the Arctic National Wildlife Refuge prevent the locating and staging of oil spill response equipment on the ANWR or the construction of a pipeline offshore the ANWR to protect the natural and biological habitats of the ANWR. Stipulation 9, Protection of Polar Bears From Proposed Development Offshore the Arctic National Wildlife Refuge would protect bear habitat and denning areas by requiring lessees to provide data on bear distribution, denning, habitat and potential effects from development activities and oil spills and require industry to specify measures to be taken to minimize such effects, including possible project-specific surveys.

Collectively, Stipulations 1, 2, 4, 5, 6, 7, 8, and 9 would prevent interference with the bowhead whale migration by preventing disturbance, would prevent conflicts to the bowhead whale hunt by assuring hunter access, and would mitigate against disturbance and contamination to onshore habitats and other subsistence resources such as caribou and polar bear. These effects to subsistence resources and subsistence harvests are expected to be mitigated substantially though not eliminated. No significant impacts are expected from Alternative I, but some less-than-significant impacts could occur to subsistence resources and subsistence and sociocultural activities.

Summary: Effects on the sociocultural systems of communities in the Sale 170 area are likely to occur as a result of disturbance from industrial activities (seismic activity, aircraft noise, supply-vessel traffic, drilling noise, off- and onshore construction, oil-spill cleanup, and oil spills); changes in population and employment; and effects on subsistence-harvest patterns. These effect agents could affect the social organization, cultural values, and social health of the communities.

Social institutions in all three communities would experience little direct disturbance from the staging of personnel and air freight expected for Sale 170 exploration, development, and production; negligible effects would be expected to sociocultural systems, and no displacement of existing institutions would occur.

Social interaction of oil-industry workers with Nuiqsut residents could be long term, but there would not be a tendency toward displacement of their social institutions. Changes in population and employment are unlikely to cause disruption to sociocultural systems and would not displace existing institutions. Oil-spill employment could disrupt subsistence-harvest activities for an entire season (1 year) and create disruption to institutions and sociocultural systems, but likely would not displace existing institutions.

Oil-spill-cleanup activity during the first year of a spill could disrupt subsistence-harvest activities for an entire season (1 year) and create disruption to institutions and sociocultural systems, but likely would not displace existing institutions. In the event of a large spill contacting and extensively oiling coastal habitats, the presence of hundreds of humans, boats, and aircraft would increase the displacement of subsistence species and alter or reduce access to subsistence species by subsistence hunters.

Traditionally, Nuiqsut and Kaktovik are communities that have not always gotten a bowhead whale and can cope with a zero harvest, yet residents might view a zero harvest differently if harvest interference resulted from oil-industry activities versus naturally occurring ecological, meteorological, or biological factors. A zero harvest that is perceived to be the fault of the oil industry is more likely to generate additional stress on the sociocultural system—with possible tendencies toward disruption of the sharing networks and task groups, something that also could disrupt the social organization of the community but would not be likely to displace the social institutions of whaling and sharing. Disturbance disruption on Nuiqsut's subsistence resources would render one or more important subsistence resources unavailable, undesirable for use, or available in reduced numbers or their pursuit more difficult for up to an entire season (1 year). Less substantial effects are expected in Barrow and Kaktovik to subsistence-harvest patterns as a result of disturbance effects on subsistence resources. Some subsistence resources in Barrow and Kaktovik would be affected for up to an entire season (1 year) but no resource would become unavailable, even though an oil spill affecting any portion of the bowhead whale migration route might create the perception that bowheads were undesirable for use (tainted) by subsistence hunters. Disturbance effects could disrupt subsistence-harvest activities for an entire season (1 year) and create disruption to institutions and sociocultural systems, but likely would not displace existing institutions.

Any effects on social health would have ramifications in the social organization, but NSB Native communities have, in fact, proven quite resilient to such effects with the NSB's continued support of Inupiat cultural values and its strong commitment to health, social service, and other assistance programs. Nuiqsut is the most likely community in the region to experience additional sale-related effects in social health and well-being above those effects already experienced as a result of NSB CIP employment and the indirect effects from current oil development. These effects on social health could have direct consequences on the sociocultural system but would not have a tendency toward displacement of existing institutions above the displacement that has already occurred with the current level of development. Effects on the institutions and sociocultural systems in Barrow and Kaktovik would be periodic and not displace existing institutions.

Conclusion: Effects from Alternative I likely would result from industrial activities and changes in population and employment. Effects on subsistence-harvest patterns and effects from possible oil-spill cleanup are expected to disrupt sociocultural systems. Disturbance effects could disrupt sociocultural systems for an entire season (1 year) and create disruption to institutions and sociocultural systems; but these disruptions are not expected to displace ongoing sociocultural institutions; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources.

11. Archaeological Resources: The analysis contained in this section is based on a development scenario located in Section IV.A.1 and Appendix A of this EIS. The reader is referred to these sections for a discussion of resource recovery rates and quantities, timing of the infrastructure development, platform emplacement, wells drilled, and resource-production timeframes and other information relevant to the development of the resources of Alternative I.

The Prehistoric Resource Analysis included in Section III.C.4 concludes that there is potential for preserved prehistoric archaeological sites to occur within the Sale 170 area. The greatest effects on submerged prehistoric sites would result from any bottom-disturbing activity, such as pipeline construction, platform installation, or the anchoring of drilling vessels. Regulations at 30 CFR 250.26 replace the former Archaeological Lease Stipulation and allow the Regional Director to require that an archaeological report based on geophysical data be prepared, if there are indications that a significant archaeological resource may be present within a lease area. Because there are insufficient data to evaluate the prehistoric site potential of each tract within the Sale 170 area, the geophysical survey data from all blocks leased in this sale will be reviewed, and an archaeological report will be prepared to address whether the data show any evidence of areas having prehistoric site potential. Based on the results of this analysis, the MMS will require that any areas of prehistoric site potential either be investigated further to determine conclusively whether a site exists at the location, or that the area of the potential site be avoided by all bottom-disturbing activities.

As a result of scenario activities associated with Alternative I, the greatest effects on shipwreck sites would result from any bottom-disturbing activity, such as pipeline construction, platform installation, or the anchor pattern from drilling vessels. The two known shipwrecks within the Sale 170 area were derived from literature sources and have not yet been ground-truthed; therefore, the precise locations of these shipwrecks are uncertain. Regulations at 30 CFR 250.26 replace the former Archaeological Lease Stipulation and allow the Regional Director to require that an archaeological report based on geophysical data be

prepared, if there are indications that a significant archaeological resource may be present within a lease area. Because the locational information on the two known shipwrecks within the Sale 170 area is insufficient to assign the shipwrecks to specific lease blocks, the geophysical survey data from all blocks leased in this sale will be reviewed, and an archaeological report will be prepared to address whether the data show any evidence of a shipwreck within a lease area. If the geophysical data do show evidence of a potential shipwreck within a lease area, MMS will require that the location of the potential shipwreck either be avoided by all lease activities or that further investigation be conducted to determine the identity of the seafloor object.

The greatest effects to onshore archaeological sites would be from accidental oil spills. The most important understanding obtained from past large oil-spill cleanups is that archaeological resources generally were not directly affected by the spilled oil (Bittner, 1993). The State University of New York at Binghamton conducted a study to evaluate the extent of petrochemical contamination of archaeological sites as a result of the EVOS (Dekin, 1993). The study concluded that the three main types of damage to archaeological deposits were oiling, vandalism, and erosion. However, data from the EVOS indicate that <3 percent of the resources within a spill would be significantly affected.

Following the EVOS, the greatest effects came from vandalism, because more people knew about the locations of the resources and were present at the sites. This type of damage increases as the population and activities increase during the cleanup process. Direct physical disturbance of archaeological sites during cleanup work also was identified as an effect-causing factor. However, the effects of the EVOS cleanup were slight, because the work plan for cleanup was constantly reviewed and cleanup techniques were changed as needed to protect archaeological and cultural resources (Bittner, 1993). Various mitigating measures used to protect archaeological sites during oil-spill cleanup are avoidance (preferred), site consultation and inspection, onsite monitoring, site mapping, artifact collection, and cultural resource-awareness programs (Haggarty et al., 1991).

Two studies of the numbers of archaeological sites damaged by the EVOS came to similar findings. In the first study by Mobley et al. (1990), of 1,000 archaeological sites in the area affected by the EVOS, about 24 sites, or <3 percent, were damaged. In the second study by Wooley and Haggarty (1993), of 609 sites studied, 14 sites, or 2 to 3 percent of the total, suffered major effects.

However, in determining the effect of damage to archaeological sites, it is not necessarily the numbers of sites that are disturbed that is important but the significance of the site that is affected. For example, the effect of disturbing 20 archaeological sites that do not contain significant or unique information may not be as great as the effect of disturbing one very significant site. Because there has not been a complete and systematic inventory and evaluation of the archaeological resources in the coastal region of the sale area, the potential for significant effects, should an oil spill occur, cannot be determined. However, it should be noted that during the emergency situation created by the EVOS, the Advisory Council on Historic Preservation declared that all archaeological sites were to be treated as if they were significant and eligible for the National Register of Historic Places (Mobley et al., 1990).

Effectiveness of Mitigating Measures: Mitigating measures are assumed to be in place for the analysis of Alternative I, and effects levels reflect this assumption. None of the mitigating measures regard the protection of archaeological resources, therefore they will have no effect on this resource.

Conclusion: The expected effect on inundated prehistoric archaeological sites and historic shipwrecks as a result of Sale 170 is low because of the requirement for review of geophysical survey data and investigation or avoidance of potential archaeological resources prior to any lease activities. Although oil-spill effects on onshore archaeological resources are uncertain, data from the EVOS indicate that few onshore archaeological resources (<3%) are likely to be significantly affected by an oil spill.

12. Air Quality: This discussion analyzes the potential degrading effects on air quality by the activities and developments induced by Alternative I. Supporting materials and discussions are presented in Section III.A.2.b (description of Air Quality).

The following air pollutants will be produced during activities conducted as a result of Sale 170: Nitrogen oxides (NO_x), Carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM), and volatile organic compounds (VOC). A discussion of the formation and effects of these materials is contained in Section 4.12.1 of the Sale 144 Final EIS (USDOI, MMS, 1996a) and is herein incorporated by reference. A discussion of the types and amounts of air pollutants also is contained in the Sale 144 FEIS.

The type and relative amounts of air pollutants generated by offshore operations vary according to the phase of activity. There are basically three phases: exploration, development, and production. For a more detailed discussion of emission sources associated with each phase, refer to "Air Quality Impact of Proposed OCS Lease Sale No. 95" (Jacobs Engineering Group, Inc., 1989). Significant emission sources are summarized below.

For the exploration phase, emissions would be produced by (1) diesel-power-generating equipment needed for drilling exploratory and delineation wells; (2) tugboats, supply boats, icebreakers, and crew boats in support of drilling activities; and (3) intermittent operations such as mud degassing and well testing. Pollutants generated primarily would consist of NO_X (these would consist of NO and NO_2 [nitrogen dioxide] ambient air standards are set only for NO_2), CO, and SO_2.

For the development phase, the primary offshore-emission sources would be (1) piston-driven engines or turbines used to provide power for drilling; (2) heavy construction equipment used to install platforms and pipelines; and (3) tugboats, ice breakers, and support vessels. The principal development-phase emissions would consist of NO_2 with lesser amounts of SO_2, CO, and PM.

For the production phase, the primary source of offshore emissions would be from power generation for oil pumping and water injection. The emissions would consist primarily of NO_2 with smaller amounts of CO and PM. Another source of air pollutants would be evaporative losses (VOC) from oil/water separators, pump and compressor seals, valves, and storage tanks. Venting and flaring could be an intermittent source of VOC and SO_2.

Other sources of pollutants related to OCS operations are accidents such as blowouts and oil spills. Typical emissions from OCS accidents consist of hydrocarbons; only fires associated with blowouts or oil spills produce other pollutants.

a. Air-Quality Regulation and Standards: Federal and State statutes and regulations define air-quality standards in terms of maximum allowable concentrations of specific pollutants for various averaging periods (see Table III.A.2-1). These maxima are designed to protect human health and welfare. However, one exceedance per year is allowed except for standards based on an annual averaging period. The standards also include Prevention of Significant Deterioration (PSD) provisions for NO_x, SO_2, and PM-10 to limit deterioration of existing air quality that is better than that otherwise allowed by the standards (an attainment area). Maximum allowable increases in concentrations above a baseline level are specified for each PSD pollutant. There are three classes (I, II, and III) of PSD areas, with Class I allowing the least degradation. Class I also restricts degradation of visibility. The areas adjacent to the sale area are Class II, which allows for an incremental decrease in the air quality of the area. Baseline PSD pollutant concentrations and the portion of the PSD increments already consumed are established for each location by the USEPA and the State of Alaska prior to issuance of air-quality permits. Air-quality standards do not directly address all other potential effects such as acidification of precipitation and freshwater bodies or effects on nonagronomic plant species.

With the enactment of the Clean Air Act Amendments of 1990, the USEPA has jurisdiction for air quality over blocks leased under this lease sale. The lease operators shall comply with the requirements promulgated by USEPA for OCS sources, including the provisions of Title I, Part C, of the Clean Air Act (Prevention of Significant Deterioration of Air Quality). Section 328 states that for a source located within 25 mi of the seaward boundary of a State, requirements would be the same as those that would be applicable if the source were located in the corresponding onshore area.

The State of Alaska shall have jurisdiction over the blocks leased, once the State of Alaska has promulgated, with USEPA concurrence, regulations to implement and enforce the requirements of Section 328 of the Clean Air Act.

The impact of activities conducted as a result of this sale will be reduced with respect to the impacts analyzed in the Sale 144 Final EIS (USDOI, MMS, 1996a). That document analyzed a scenario for the peak-year production and transportation of 101 MMbbl of oil. The Sale 170 development scenario concludes that peak-year production for this sale would be between 39 and 65 MMbbl. This is an approximate decrease of between 35 to 60 percent of production from the previous sale analysis. This will correspond to a decrease in the number of well drilled and platforms needed for the production of resources. Based on this apparent decrease, a corresponding decrease in the amount of pollutants produced during the development phase of Sale 170 is expected.

b. Other Effects on Air Quality: Other effects of air pollution from OCS activities and other sources on the environment not specifically addressed by air-quality standards include the possibility of damage to vegetation and acidification of coastal areas. Effects may be short term (hours, days, or weeks), long term (seasons or years), regional (Arctic Slope), or local (nearshore only).

A significant increase in ozone concentrations onshore is not likely to result from the exploration, development, or production scenario associated with Alternative I. Photochemical pollutants such as ozone are not emitted directly but rather form in the air from the interaction of other pollutants in the presence of sunshine and heat. Although sunshine is present in the sale area most of each day during the summer, temperatures remain relatively low (Brower et al., 1988). Also, activities occurring as a result of the field-development scenario Alternative I are offshore and separated from each other, diminishing the combined effects from sale-related activities and greatly increasing atmospheric dispersion of pollutants before they reach shore.

Olson (1982) reviewed susceptibility of fruticose lichen, an important component of the coastal tundra ecosystem, to sulfurous pollutants. There is evidence that SO_2 concentrations as low as 12.0 micrograms per cubic meter ($\mu g/m^3$) for short periods of time can depress photosynthesis in several lichen species, with damage occurring at 60 $\mu g/m^3$. Also, the sensitivity of lichen to sulfates is increased in the presence of humidity or moisture, conditions that are common on coastal tundra. However, because of the small size and number of sources of SO_2 emissions, the ambient concentrations at most locations may be assumed to be near the lower limits of detectability. Because of the distance of the proposed activities from shore, attendant atmospheric dispersion, and low existing levels of onshore pollutant concentrations, the effect on vegetation resulting from Alternative I is expected to be minimal.

c. **Effects of Accidental Emissions:** Accidental emissions result from gas blowouts, evaporation of spilled oil, and burning of spilled oil. The number of OCS blowouts, almost entirely gas and/or water, has averaged 3.3 per 1,000 wells drilled since 1956 (Fleury, 1983). The data show no statistical trend of a decreasing rate of occurrence. The blowout rate actually has averaged somewhat higher since 1974, at 4.3 per 1,000 wells drilled; but the difference between the post-1974 period and the longer 1956 to 1982 record is statistically insignificant. A discussion of the effects of a gas blowout or oil fire associated with an accidental spill are contained in Section 4.12.3 of the Sale 144 FEIS. Soot from a fire is considered to be the major contributor to pollution from a fire event. This soot, which would be deposited on plant materials in the vicinity of the fire, would tend to slump and wash off vegetation in subsequent rains, limiting any health effects. Accidental emissions, therefore, are expected to have a minimal effect on onshore air quality.

Effectiveness of Mitigating Measures: Mitigating measures are assumed to be in place for the analysis of Alternative I, and effects levels reflect this assumption.

Summary: The effects on onshore air quality from Alternative I should result in air emissions that are expected to be below the maximum allowable PSD Class II increments. The concentrations of criteria pollutants in the onshore ambient air would remain well within the air-quality standards. Consequently, a minimal effect on air quality with respect to standards is expected. Principally, because of the distance of emissions from land, the other effects of air-pollutant concentrations at the shore due to exploration and development and production activities or accidental emissions would not be sufficient to harm vegetation. A light, short-term coating of soot over a localized area could result from oil fires.

Conclusion: Activity associated with Alternative I would result in a small, localized increase in the concentrations of criteria pollutants. Concentrations would be within the PSD Class II limits and National Air Quality Standards. Therefore, effects from Alternative I would be low.

13. Land Use Plans and Coastal Management Programs:

Onshore activities and some offshore activities resulting from Sale 170 would be subject to the NSB Comprehensive Plan and Land Management Regulations (LMR's) and the Alaska Coastal Management Program (ACMP), as amended by the NSB CMP. The NSB LMR's are applied to all developments occurring on private and State lands. In the Sale 170 resource-estimate scenario, these developments would include portions of road/pipeline corridors, including the offshore portions within the NSB boundary. All development that occurs within the coastal management boundaries identified in the approved NSB CMP or affected uses of the coastal zone, including activities described in Exploration Plans and Development and Production Plans, would be subject to the Statewide standards and NSB district policies of the ACMP. The policies of the LMR's and the ACMP are examined for potential conflicts with the potential effects identified in Sections IV.B.1 through IV.B.12.

Development on the coastal plain of the ANWR still has not been authorized by Congress. None of the pipeline route is assumed to traverse the refuge; no conflict with ANWR policy is inherent in the scenario.

a. **NSB Comprehensive Plan and Land Management Regulations:** During exploration, most onshore support would be based in existing facilities in the Prudhoe Bay area. Any permits that are requested probably would be conditional-use permits for specific temporary activities; these are permissible in the Conservation District. The extensive and more permanent development associated with production would require that a master plan be prepared describing anticipated activities, and non-Federal land be rezoned from the Conservation District to the Resource Development District or Transportation Corridor.

Areawide policies in the revised LMR's are the same as those for the NSB CMP policies. The primary difference would be the process used for implementation and the geographic areas covered. The LMR's have been applied to all lands within the NSB that are not in Federal ownership. Policies in the ACMP cover only activities within the coastal zone but can be applied to Federal lands in many instances (see Sec. IV.B.13(b)). Therefore, development assumed to occur following this lease sale usually would be subject both to the LMR's areawide policies and the ACMP policies. To avoid a redundant analysis, potential conflicts with the LMR's areawide

policies are included with the NSB CMP policies in the analysis of the ACMP rather than here.

Policies considered in this section are those in the other LMR policy categories: Villages, Economic Development, Offshore Development, and Transportation Corridors. Potential conflict with these policies is limited to some extent by the locations assumed for the development that accompanies this lease sale.

No development is anticipated to occur within village boundaries; therefore, the four policies directly related to developing within NSB communities would not be applicable.

Economic Development policies afford special consideration for projects during land use reviews that have features the NSB considers beneficial impacts (NSBMC [NSB Municipal Code] 19.70.030[A] through [G]). Economic Development policies foster hiring practices favorable to NSB businesses and residents, including special work schedules for those who pursue subsistence activities, and generate excess tax revenues over demand for expenditures.

Offshore Development policies are intended to guide the approval of development and uses in the portion of the Beaufort Sea within the NSB. Policy 19.70.040.E is the only one of these that applies to activities other than drilling. This policy requires that "(a)ll nonessential boat, barge and air traffic associated with drilling activity. . .occur prior to or after the period of whale migration through the area." Moreover, essential traffic is required to avoid disrupting the migration and subsistence activities and be coordinated with the AEWC. This policy will be especially applicable during development.

The last category of policies covers the Transportation Corridor. New offshore pipelines will be routed to connect to existing onshore pipelines. Existing landfalls are available at Oliktok Point, at West Dock near Point McIntyre, and at Endicott. Two additional pipeline segments and landfall sites are assumed for Oliktok Point and Point McIntyre; however, these will tie into existing infrastructure and result in minimal additions to existing pipeline corridors. Eventually, a pipeline may be built onshore to serve fields in the Point Thomson unit. This pipeline would have a landfall near Flaxman Island, serving fields in the eastern Beaufort Sea. It is assumed that if a pipeline corridor were built from Point Thomson to the TAPS, (1) the area would become zoned as a Transportation Corridor, and (2) these policies would apply as the pipeline crossed land subject to NSB LMR's. Conflict with policies for transportation corridors is not inherent in the scenario, but developers would be held responsible for minimizing airport use, ensuring proper sand and gravel extraction and reclamation, buffering stream banks, locating away from active floodplains, avoiding sensitive habitats, and identifying and documenting archaeological sites prior to construction (NSBMC 19.70.060.C, D, E, F, G, H, I, and J, respectively).

In conducting reviews for other development projects in the NSB that have some features comparable to those anticipated for the pipeline corridor, the NSB has established special conditions to ensure conformance with several land use policies. Policy areas of concern in the past related to deposition of toxic materials and untreated solid wastes, emissions, subsistence resources, sensitive areas, pollution, habitat changes and disturbance, and permafrost.

b. ANWR Land Use Plans, Policies, and Controls: The land use plans for ANWR include the National Wildlife Refuge System Administration Act, the Alaska National Interest Lands Conservation Act (ANILCA), and the Comprehensive Conservation Plan (CCP). The CCP provides for the following management directions:

- maintenance of the refuge in an undeveloped state;
- emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats;
- maintain traditional access opportunities;
- provide for continued subsistence use of the refuge resources;
- maintain opportunities for trapping, sport hunting and fishing, and nonconsumptive recreational activities;
- permit guides and outfitters to operate in the refuge;
- permit oil and gas studies where compatible with refuge purposes; and
- propose no additional areas for wilderness designation.

This analysis will address the first four management directives: Maintenance of the refuge in an undeveloped state; emphasize the maintenance of the refuge's natural diversity and key fish and wildlife populations and habitats; maintain traditional access opportunities; and provide for continued subsistence use of the refuge resources. Alternative I is not related to potential effects on the remaining four management directives.

The ultimate land status of the northwestern coastal plain, the "1002 area," has not been finalized. The ANILCA identified this 1.5-million-acre area as having high oil and gas potential and set it aside for further evaluation. Under the provisions of the CCP, the FWS currently is managing this area as a "minimal management area." Until Congress takes action on the future of the 1002 area, it will continue to be managed under the minimal management category. Minimal management is directed at maintaining the existing conditions of areas that have high fish and wildlife values or other resource values. The northeastern coastal

plain is under the "wilderness management" category. Wilderness management is directed at maintaining the wilderness resources and values, preservation of the wilderness character of the biological and physical features, and the continued opportunities for research, subsistence, and wildlife-oriented recreation. Approximately 42 percent, 3.2 million ha (8 million acres) of the refuge are designated as wilderness and are managed as such under the Wilderness Act of 1964. The analysis of effects in the EIS is based on no facilities being placed, and no associated activities occurring inside the boundaries of the ANWR.

Alternative I does not conflict with the management directive to maintain the refuge in an undeveloped state. No facilities will be located within the ANWR; and exploration and/or production facilities will be located seaward of the lagoons and bays.

The CCP directive to maintain the refuge's natural diversity and key fish and wildlife populations and habitats is not jeopardized by the proposed activities. Impacts from routine anticipated activities on fish and their habitats would be minimal. In the unlikely event of a 7,000-bbl oil spill, it is expected some fish may die, but recovery of the species would be expected within their lifespan. Effects on other species as a result of routine anticipated activities also is expected to be short term and local, affecting individual members and having no significant effect on population levels. Although losses are expected in the event of a ≥7,000-bbl oil spill, the recruitment levels do not exceed the lifespan of any of the species and, in most cases, is much shorter.

The management objectives that provide for continued subsistence use of the refuge resources and maintenance of traditional access opportunities are not compromised by Alternative I. The most important species for Kaktovik subsistence hunters are caribou, the bowhead whale, and fish. However, polar bear, seals, walruses, birds, and other species are also subsistence resources for Kaktovik. Effects from activities anticipated as a result of Sale 170 are expected to be periodic and short term and have no apparent effects on subsistence harvests. In the unlikely event of an oil spill contacting and extensively oiling coastal subsistence habitats, the spill-cleanup activities could result in temporary displacement of subsistence species and temporarily reduced access, thereby altering or extending Kaktovik's normal subsistence hunt, but would not substantially alter the subsistence use of refuge resources. The potential for displacement and reduced access would not make the resources unavailable and the potential effects would be short term.

c. Alaska Coastal Management Program:

Section 307 (c)(3)(B) requires lessees to certify that each activity that is described in detail in the lessee's exploration and development and production plans that affects any land use or water use in the coastal zone complies with, and will be implemented consistent with, the State's coastal program. The State has the responsibility to concur with or object to the lessees' certification. Activities within the coastal zone include the pipeline landfalls, the offshore pipeline within 3 mi of the coast, and transportation facilities. In addition, the State reviews all exploration and development and production plans to certify that activities that could affect the use of the coastal zone are consistent with the ACMP.

Standards of the ACMP are related to the scenario and to potential effects identified in other sections of this EIS. Policies of the NSB CMP are assessed in conjunction with the most closely associated Statewide standard. As noted in Section IV.B.13.a, the NSB CMP policies have been incorporated into the LMR's. Therefore, the corresponding LMR policy number is listed following that of the NSB CMP policy.

This analysis is not a consistency determination pursuant to the Coastal Zone Management Act of 1972, as amended, nor should it be used as a local planning document. It is highly unlikely that all the events that are hypothesized will occur as assumed in this EIS. Changes made by lessees as they explore, develop, and produce petroleum products from leases offered in this sale could affect the accuracy of this assessment.

(1) Coastal Development (6 AAC 80.040):

Water dependency is a prime criterion for development along the shoreline (6 AAC 80.040 [a]). The intent of this policy is to ensure that onshore developments and activities that can be placed inland do not displace activities dependent upon shoreline locations. The only OCS developments or activities hypothesized in the scenario that require a shoreline location are the landfall sites for the pipelines. It is unlikely that the hypothetical development would conflict with this policy.

State standards also require that the placement of structures and discharges of dredged material into coastal waters comply with the regulations of the U.S. Army COE (6 AAC 80.040 [b]). All offshore and much of the onshore development hypothesized in the scenario would be subject to the COE regulations. Hypothetical developments along the Beaufort Sea coast that would require COE permits include constructing a berm for the shoreline approaches for the pipelines, dredging and possibly burying offshore pipelines, and placing pipelines and associated roads onshore. None of these projects necessarily is allowed or disallowed under the provisions of the COE regulations. Site-specific environmental changes pursuant to such development would be assessed, as they were for the Endicott and Lisburne projects, and permitted depending on the attendant effects.

(2) Geophysical Hazard Areas (6 AAC 80.050): This Statewide standard requires coastal districts and State agencies to identify areas in which geophysical hazards are known and in which there is a substantial probability that geophysical hazards may occur. Development in these areas is prohibited until siting, design, and construction measures for minimizing property damage and protecting against the loss of life have been provided.

Several hazards are evident in the lease area. Sea ice is the principal physical hazard in the development of the oil and gas resources in the lease-sale area of the Beaufort Sea. However, drilling and completing wells in the Arctic is possible with existing technology (Sec. IV.A.6). In the EIS, permafrost, storm surges, faults and earthquakes, hydrates and shallow gases, and factors affecting the geotechnical characteristics of the seafloor sediments are related specifically to offshore activities. The summary in Section IV.A.6 identifies three measures that can be taken to lessen the effects of these hazards. These include scheduling activities appropriately, conducting surveys for best locations, and designing facilities to withstand a range of environmental forces. Through these strategies and conformance with the MMS regulations of 30 CFR 250, Oil and Gas and Sulphur Operations in the OCS, hazards can be addressed.

The MMS regulations, including the platform verification program, regulate lessees to ensure that geophysical hazards, such as those identified, are accommodated in the exploration and development and production plans that must be approved before lessees may commence activities. Conformance with these regulations also should alleviate conflict that could occur with respect to two NSB CMP policies. Policy 2.4.4(b) (NSBMC 19.70.050. I.2) requires that "offshore structures must be able to withstand geophysical hazards and forces which may occur while at the drill site." These structures also "must have monitoring programs and safety systems capable of securing wells in case unexpected geophysical hazards or forces are encountered." Policy 2.4.4(h) (NSBMC 19.70.050.I.8) requires that "Offshore oil transport systems (e.g., pipelines) must be specially designed to withstand geophysical hazards, specifically sea ice."

Onshore development and some offshore development will be sited in areas of permafrost. Development in these areas must "maintain the natural permafrost insulation quality of existing soils and vegetation" (NSB CMP 2.4.6[c] and NSBMC 19.70.050.L.3). More than likely, some of the onshore development (e.g., pipelines) will be located in wetlands, in floodplains subject to a 50-year recurrence level, and in geologic-hazard areas identified on Map 22 of the NSB CMP Resource Atlas. These last two areas are specifically identified in the NSB CMP policies (NSB CMP 2.4.5.1[k] and NSBMC 19.70.050.J.11). For developments to proceed in these areas, there would have to be a significant public need, no feasible and prudent alternatives, and all feasible and prudent steps taken to avoid the adverse effects the policy is intended to prevent. A final requirement is that development in floodplains, shoreline areas, and offshore areas be "sited, designed, and constructed to minimize loss of life or property" due to geologic forces (NSB CMP 2.4.6[f] and NSBMC 19.70.050.L.6). Safeguards offered by these policies are enforced at the time an activity or project is proposed; there is no inherent conflict with these policies prior to that time.

(3) Energy Facilities (6 AAC 80.070): The State CMP requires that decisions on the siting and approval of energy-related facilities be based, to the extent feasible and prudent, on 16 standards. No conflict with these policies is anticipated under the exploration only scenario.

The ACMP standards require that facilities be sited to (1) minimize adverse environmental and social effects while satisfying industrial requirements and (2) be compatible with existing and subsequent uses (6 AAC 80.070 [1] and [2]). The pipeline landfalls along the Beaufort Sea coast at Oliktok Point and Point McIntyre are expected to tie into existing nearby production lines and to use the existing support infrastructures located at Kuparuk and Prudhoe Bay. The landfall assumed at Flaxman Island would use infrastructure planned for future development in the Point Thomson area. Flaxman Island, commonly used by subsistence hunters for their base camp, is offshore of the landfall. It is likely that construction activities would occur during the whaling season. However, disturbance from these construction activities probably would result in only periodic and short-term avoidance (Sec. IV.B.6). The bowhead whale harvest would not become locally unavailable or reduced in harvest numbers (Sec. IV.B.10).

Other ACMP standards require that facilities be consolidated and sited in areas of least biological productivity, diversity, and vulnerability (6 AAC 80.070 [3]). The NSB CMP also requires that "transportation facilities and utilities must be consolidated to the maximum extent possible" (NSB CMP 2.4.5.2[f] and NSBMC 19.70.050. K.6). Onshore activities hypothesized for Alternative I are consolidated at Oliktok Point, Point McIntyre, and Point Thomson, where the pipelines come onshore. Existing facilities can accommodate the support services, thereby conforming with another standard (6 AAC 80.070 [7]). These locational decisions conform to NSB CMP policy 2.4.5.2(c) (NSBMC 19.70.050.K.3) that requires facilities not absolutely required in the field be located in designated compact service bases that are shared to the maximum extent possible.

Facilities must be designed to permit free passage and movement of fish and wildlife with due consideration for

historic migratory patterns (6 AAC 80.070 [12], NSB CMP 2.4.4 [i], and NSBMC 19.70.050.I.9). As is evidenced by the Endicott development, this standard does not preclude causeways or berms, but it does require careful consideration of the effects on circulation and fish populations before approval can be obtained. The projected short length of shore-approach berms or causeways for Alternative I may result in localized, short-term effects on the movement and migration of fish populations (Sec. IV.B.3). Offshore pipelines should pose no barriers to migrating fish and wildlife. Conflict is not anticipated.

Finally, the Statewide standard requires that facilities be sited "so as to minimize the probability, along shipping routes, of spills or other forms of contamination which affect fishing grounds, spawning grounds, and other biologically productive or vulnerable habitats. . ." (6 AAC 80.070 [b][11]). The sites selected as landfall sites appear to conform with this requirement. For example, oil spills pose the greatest threat of all possible effect agents; however, the analysis in Section IV.B.10 (Subsistence-Harvest Patterns) does not indicate that these sites accentuate the potential for adverse effects from an oil spill.

The NSB CMP has two additional requirements associated with this standard (State of Alaska, 1985). Policy 2.4.4(f) (NSBMC 19.70.050.I.6) requires that plans for offshore drilling include "a relief well drilling plan and an emergency countermeasure plan" and describes the content of such plans. Policy 2.4.4(g) (NSBMC 19.70.050.I.7) requires "offshore drilling operations and offshore petroleum storage and transportation facilities. . .to have an oilspill control and clean-up plan" and describes what the plan should contain. Because these policies are not intended to establish new regulations for offshore facilities, conformance is assured through the implementation of MMS regulations.

Construction associated with energy-related facilities resulting from Sale 170 also must comply with siting standards that apply to all types of development. These more general standards are discussed under (g) Habitats and (h) Air, Land, and Water Quality.

(4) Transportation and Utilities (6 AAC 80.080): This Statewide standard requires that routes for transportation and utilities be compatible with district programs and sited inland from shorelines and beaches. Assuming that after an offshore pipeline crossed the beach it would continue inland of the beaches, conformance with this policy is possible. No conflict with these policies is anticipated for the exploration only scenario.

The NSB CMP contains several additional policies related to transportation that are relevant to this analysis. All but one of the policies are "best-effort policies" and subject to some flexibility if (1) there is a significant public need for the proposed use and activity, (2) all feasible and prudent alternatives have been rigorously explored and objectively evaluated, and (3) all feasible and prudent steps have been taken to avoid the adverse effects the policy was intended to prevent. "Transportation development, including pipelines, which significantly obstructs wildlife migration" is subject to the three criteria (NSB CMP 2.4.5.1[g] and NSBMC 19.70.050.J.7). Section IV.B.7 indicates that interference with caribou movements would be temporary and brief; caribou migrations and overall distribution are not expected to be affected. Conflict with this policy is not anticipated.

As noted in the previous standard for energy facilities, transportation facilities are expected to be consolidated to the maximum extent possible. Therefore, there should be no conflict with either NSB CMP 2.4.5.1(i) (NSBMC 19.70.050.J.9), which discourages duplicative transportation corridors from resource-extraction sites, or NSB CMP 2.4.5.2(f) (NSBMC 19.70.050.K.6), which requires that transportation facilities and utilities be consolidated to the maximum extent possible. Although the NSB CMP limits support facilities for tankering oil to market, the scenario indicates that pipelines will be used; therefore, the policy is not relevant.

The final policy falls under the category of "Minimization of Negative Impacts." NSB CMP 2.4.6(b) (NSBMC 19.70.050.L.2) requires that alterations to shorelines, water courses, wetlands, and tidal marshes and significant disturbance to important habitat be minimized. In the discussion of habitats, it is recognized that alterations to wetland habitat and ponds and lakes will occur and birds could be disturbed during construction. This policy also requires that periods critical for fish migration be avoided. These requirements identify constraints for the siting, design, construction, and maintenance of transportation and utility facilities; conflict with these is not inherent in the assumed activities.

(5) Mining and Mineral Processing (6 AAC 80.110): Extraction of sand and gravel is a major concern on the North Slope. Gravel resources are needed for construction pads for all onshore development to protect the tundra, including roadbeds, berms or causeways, and docks. The ACMP Statewide standards require that mining and mineral processing be compatible with the other standards, adjacent uses and activities, State and national needs, and district programs (6 AAC 80.110 [a]). Sand and gravel may be extracted from coastal waters, intertidal areas, barrier islands, and spits when no feasible and prudent noncoastal alternative is available to meet the public need (6 AAC 80.110 [b]). Substantial alteration of shoreline dynamics is prohibited (NSB CMP 2.4.5.1[j] and NSBMC 19.70.050.J.10). Constraints may be placed on

extraction activities to lessen environmental degradation of coastal lands and waters and to ensure floodplain integrity (NSB CMP 2.4.5.2[a] and [d] and NSBMC 19.70.050.K.1 and 4). Although industry's preferences for gravel sources and removal procedures and the Statewide standards and NSB CMP policies may diverge on occasion from those that are deemed consistent, conflict is not inherent in the scenario.

(6) **Subsistence (6 AAC 80.120):** The Statewide standard for subsistence guarantees opportunities for subsistence use of coastal areas and resources. Subsistence uses of coastal resources and maintenance of the subsistence way of life are primary concerns of the residents of the NSB. Potential conflicts with this Statewide standard and the supporting district policies are based on the analysis of effects of activities assumed for Alternative I on subsistence in the NSB (Sec. IV.B.10). Conflicts with some of these policies are possible during both the exploration and development and production phases.

Policy 2.4.3(d) (NSBMC 19.70.050.D) requires that development not preclude reasonable subsistence-user access to a subsistence resource. Onshore pipelines constructed to the Point Thomson field and an associated landfall at Flaxman Island could cause disruptions to Kaktovik's subsistence seal harvest from access conflicts; and if construction occurred during the peak harvest periods (June and July), Kaktovik's harvest of bearded and ringed seals could be affected. However, the long seal-harvest period would enable residents to harvest seals during other times of the year. Construction of the Point Thomson pipeline and the associated landfall could cause disruptions to Kaktovik's subsistence caribou harvest from access conflicts, but effects are expected to be short term. Where access is reduced or restricted, development can occur only if no feasible or prudent alternative is available, and then it is subject to the conditions of best-effort policies. Conflict with these standards and policies is possible.

Several important NSB CMP policies relate to adverse effects to subsistence resources. The NSB CMP policy 2.4.3(a) (NSBMC 19.70.050.A) relates to "extensive adverse impacts to a subsistence resource" that "are likely and cannot be avoided or mitigated." In such an instance, "development shall not deplete subsistence resources below the subsistence needs of local residents of the Borough." Policy 2.4.5.1(a) (NSBMC 19.70.050.J.1) relates to "development that will likely result in significantly decreased productivity of subsistence resources or their ecosystems." Temporary reductions in subsistence resources and changes in subsistence resource-distribution patterns could occur as a result of disturbance from seismic surveys, aircraft and vessel traffic, drilling activities, and construction activities that include offshore dredging; pipeline construction; and structure placement and onshore pipelines, support-base, pump-station, and road construction. Landfall construction at Oliktok Point and Point McIntyre could disturb Nuiqsut's bowhead whale harvest, but Nuiqsut's harvest would not become locally unavailable or reduced in harvest numbers. Given the limited number of years involved at each location, and the generally intermittent nature of the activities, conflict is more likely to occur with the best-effort policy addressing reduced or restricted access (NSB CMP 2.4.5.1[b] and NSBMC 19.70.050.J.2).

During development and production, the OSRA estimates a 46- to 70-percent chance of one or more spills ≥1,000 bbl occurring. The average size of such a spill is 7,000 bbl. Although it is possible that an oil spill might reduce or eliminate the bowhead whale harvest for one season, it is more likely that a spill would force hunters to move to new harvest locations. The forced move would shorten the whaling season for certain communities and could decrease the number of whales harvested—an effect that is most likely to occur in the Nuiqsut subsistence-harvest area, but could also have an affect on the communities of Barrow and Kaktovik. If a spill contacted the Colville River fish overwintering areas, subsistence fish resources would be undesirable and unavailable for an entire season. In addition, if a spill did occur during the open-water season, it could affect sealing, whaling (belukha), walrus hunting, and bird hunting. However, it is not likely that the entire subsistence harvest of these species would be affected.

Oil-spill-cleanup activity would exacerbate and increase disturbance effects to all subsistence species; could result in the displacement of subsistence species; and could alter or reduce access to subsistence species by subsistence hunters, thereby potentially altering or extending normal subsistence hunts.

Conflict with these policies is possible during both the exploration and the development and production phases, but is more likely during the development and production phase, and increases in the unlikely event of an oil spill and associated oil-spill-cleanup activities.

(7) **Habitats (6 AAC 80.130):** The Statewide standard for habitats contains an overall standard policy plus policies specific to eight habitat areas: offshore areas; estuaries; wetlands and tideflats; rocky islands and seacliffs; barrier islands and lagoons; exposed high-energy coasts; rivers, streams, and lakes; and important upland habitat (6 AAC 80.130 [a], [b], and [c]). Activities and uses that do not conform to the standards may be permitted if there is significant public need and no feasible prudent alternatives to meet that need, and all feasible and prudent measures are incorporated to maximize conformance (6 AAC 80.030 [d]). The NSB CMP contains a district policy that reiterates the applicability of the Statewide standard

(NSB CMP 2.4.5.2[g] and NSBMC 19.70.050.K.7), plus several others that augment the overall policy or can be related to activities within a specific habitat. No conflicts are anticipated for the exploration-only scenario.

The ACMP Statewide standard for all habitats in the coastal zone requires that habitats "be managed so as to maintain or enhance the biological, physical, and chemical characteristics of the habitat which contribute to its capacity to support living resources" (6 AAC 80.130 [b]). This overall policy is supported by an NSB CMP district policy requiring development "to be located, designed, and maintained in a manner that prevents significant adverse impacts on fish and wildlife and their habitat, including water circulation and drainage patterns and coastal processes" (NSB CMP 2.4.5.2[b] and NSBMC 19.70.050.K.2). In addition, "vehicles, vessels, and aircraft that are likely to cause significant disturbance must avoid areas where species that are sensitive to noise or movement are concentrated at times when such species are concentrated" (NSB CMP 2.4.4 [a] and NSBMC 19.70.050.I.1). Some disturbances associated with exploration and development would be mitigated by the Stipulation on Protection of Biological Resources and the ITL clauses concerning Bird and Marine Mammal Protection and Areas of Biological and Cultural Sensitivity (Sec. II.E). The analyses in Sections IV.B.2 through 7 indicate that resources would not be subject to significant disturbance from these activities. If they are, however, the policy requires that, consistent with human safety, horizontal and vertical buffers will be required where appropriate. Although there are no inherent conflicts with the assumed activities at this point, some that may appear as specific proposals are brought forward at the time of development.

Activities may affect several of the habitats identified in the Statewide standard, including offshore; barrier islands and lagoons; wetlands; and rivers, lakes, and streams. Potential effects in each habitat are related to the applicable policies in the following paragraphs.

The offshore habitat is designated a fisheries conservation zone (6 AAC 80.130. [c][1]). In the Arctic, marine mammals are an important offshore resource and are included in the analysis of the offshore habitat. Some effects in the offshore habitat can be expected in the unlikely event that an oil spill occurred in a sensitive area, or in specific coastal areas during critical periods for several fishes. Effects identified in Sections IV.2 through IV.6 would not preclude offshore development, assuming the developer has undertaken all feasible and prudent steps to maximize conformance. Offshore seismic exploration is subject to specific constraints; NSB CMP 2.4.6 (g) (NSBMC 19.70.050.L.7) requires that seismic exploration be conducted in a manner that minimizes its impact on fish and wildlife. Conflict with this district policy is not anticipated.

Barrier islands and lagoons characterize the Beaufort Sea coast where some of the development associated with this lease sale is assumed to occur (NSB CMP Map 16). These habitats are managed to ensure sediment and water conditions are maintained so neither infilling of lagoons nor erosion of barrier islands occurs. Activities that might decrease the use of the barrier islands by coastal species, including polar bears and nesting birds, are discouraged (6 AAC 80.130 [c][5]). Although disruptive activities could occur in this habitat during the laying of the pipeline and construction of the landfall site, effects of offshore construction on birds and marine mammals, potential effects on abundance and distribution of a population or portion of a population would be localized and would last for only a short period of time. Consequently, no substantial conflict with this habitat policy is anticipated.

Much of the uplands in the NSB are considered wetlands. Therefore, onshore development would need to be designed and constructed to avoid (1) adverse effects to the natural drainage patterns, (2) destruction of important habitat, and (3) the discharge of toxic substances (6 AAC 80.130 [c][3]). Pipelines and roadways would transect this habitat both to the east and to a very limited extent to the west of the TAPS. Water impoundments created by the pipeline/road corridor would carry both positive and negative effects. They would benefit some waterfowl but displace some nesting shorebirds in localized areas near the pipeline-road complex (Sec. IV.B.5). Caribou could be disturbed temporarily during construction but are expected to habituate to the traffic following construction (Sec. IV.B.7). This conclusion is based partially on the established policy that roads and pipelines are constructed to provide for unimpeded wildlife crossings. The NSB CMP policy 2.4.6(e) (NSBMC 19.70.050.L.5) emphasizes this practice and provides a set of guidelines and an intent statement specifically to implement the policy. There is no inherent conflict between the crossing requirements and the assumed activities. If a spill occurred as a result of Alternative I, it is expected to result in the loss of no more than a small number of caribou, with recovery expected within about a year. (Sec. IV.B.7). Restrictions on storing toxic substances are covered more completely by policies related to the following topics: air, land, and water quality.

Rivers, lakes, and streams are managed to protect natural vegetation, water quality, important fish or wildlife habitat, and natural water flow (6 AAC 80.130 [c][7]). The probability of an oil spill occurring and contacting the nearshore waters of the river deltas is small. However, pipeline/road construction, including gravel extraction, also could affect these waterways and would need to be conducted in a manner that ensures the protection of riverine habitat and fish resources. Gravel extraction also

is regulated under policies that are described in the section on mining.

(8) Air, Land, and Water Quality (6 AAC 80.140): The air-, land, and water-quality standard of the ACMP incorporates by reference all the statutes pertaining to, and regulations and procedures of, the Alaska Department of Environmental Conservation. The NSB reiterates this standard in its district policies and emphasizes the need to comply with specific water- and air-quality regulations in several additional policies.

Water quality can be affected by oil spills, causeways, dredging, deliberate discharges and emissions, gravel operations, and solid-fill artificial-island removal. For analytic purposes, it is has been estimated that there is a 46- to 70-percent chance of one spill of at least ≥1,000 bbl occurring as a result of this lease sale, and more chronic, smaller spills also are likely. The OSRA estimates that if a spill occurs from a pipeline or platform, its average size would be 7,000 bbl. Although decomposition and weathering processes for oil are much slower in the arctic OCS than in temperate OCS waters, hydrocarbon contamination is very unlikely to cause regional, long-term degradation of water quality above State and Federal standards (Sec. IV.B.1). As a precaution against accidental spills, the NSB CMP requires the use of impermeable lining and diking for fuel-storage units with a capacity >660 gallons (NSB CMP 2.4.4[k] and NSBMC 19.70.050.I.11). In addition, development within 1,500 ft of the shoreline of the coast, lake, or river "that has the potential of adversely impacting water quality (e.g., landfills, or hazardous materials storage areas, dumps, etc.)" must comply with the conditions of the best-effort policies (NSB CMP 2.4.5.1[e] and NSBMC 19.70.050.J.4). These conditions are: (1) there must be a significant public need, (2) the developer has rigorously explored and objectively evaluated all feasible and prudent alternatives and cannot comply with the policy, and (3) all feasible and prudent steps have been taken to avoid the adverse effects the policy was intended to prevent. There is no inherent conflict between this policy and the assumptions used for Alternative I.

Four landfalls are assumed under Alternative I. Existing landfalls are available at Oliktok Point, West Dock near Point McIntyre, and Endicott—three access points. A fourth landfall near Flaxman Island to serve the Point Thomson unit may be available by the time of Sale 170 development (Appendix A).

Effects of dredging are expected to be short term and local. No conflict with either the Statewide standard or the district policies is anticipated.

Some discharges and emissions would occur during exploration and development, and the NSB CMP policy 2.4.4(c) (NSBMC 19.70.050.I.3) requires that "development resulting in water or airborne emissions. . .comply with all state and federal regulations." This is consistent with the Statewide standard.

Discharges of muds, cuttings, and drilling fluids are regulated closely. Given the rate of discharge, changes in water quality during exploratory drilling would be local and temporary (only during active discharges) and remain within an area of 0.03 km². During development, effects from muds and cuttings would be local and short term. Formation waters produced from the wells along with the oil are regulated through a USEPA permit and, depending on the conditions of the permit, may be disposed of above or below ground. To date, for exploration in the Beaufort Sea, the USEPA has prohibited discharge of formation waters into waters <10 m deep; reinjection and injection projects have been the standard. If formation waters were discharged in the water, the effect on water quality would be local and would be regulated by USEPA NPDES permit. If formation waters were reinjected or injected into a different formation, as is expected, no discharge of formation waters would occur and no effect would occur.

Offshore disposal of solid wastes also is regulated through Federal permits and restrained further by Annex V of the MARPOL Convention approved in 1988 by the United States Congress. Because these discharges are so carefully regulated, no conflict is anticipated with the Statewide standard or NSB CMP policy 2.4.4(d) (NSBMC 19.70.050.I.4), which requires that "industrial and commercial development. . .be served by solid waste disposal facilities which meet state and federal regulations." Onshore development associated with this sale also must meet the Statewide standard and the district policy related to solid-waste disposal. Assuming the regulations are implemented properly, there is no inherent conflict between the proposed activities and the ACMP water-quality provisions.

The district CMP also contains a policy that requires development without a central sewage system to impound and process effluent to meet State and Federal standards (NSB CMP 2.4.4[e] and NSBMC 19.70.050.I.5). This is the current practice aboard drilling vessels and production platforms; there is no inherent conflict with this district policy. This also has been the practice of the major developments on the North Slope.

Sand and gravel may be extracted from coastal waters, intertidal areas, barrier islands, and spits when no feasible and prudent noncoastal alternative is available to meet the public need (6 AAC 80.110 [a]). Solid-fill islands may be constructed and used for shallow-water development. Island construction could be completed within one to two summers, and effects on water quality would be short term

and local, lasting only while the activity persisted (Sec. IV.B.1). Conflict is not inherent under Alternative I.

Air quality also must conform with Federal and State standards (6 AAC 80.140, NSB CMP 2.4.3[i] and 2.4.4[c], and NSBMC 19.70.050.H and I.3). The analysis in Section IV.B.12 indicates that conformance is anticipated, and no conflict between air quality and coastal policies should occur.

(9) Statewide Historic, Prehistoric, and Archaeological Resources (6 AAC 80.150): The ACMP Statewide standard requires that coastal districts and appropriate State agencies identify areas of the coast that are important to the study, understanding, or illustration of national, State, or local history or prehistory.

The NSB developed additional policies to ensure protection of its heritage. The NSB CMP 2.4.3(e) (NSBMC 19.70.050.E) requires that development that is "likely to disturb cultural or historic sites listed on the National Register of Historic Places; sites eligible for inclusion in the National Register; or sites identified as important to the study, understanding, or illustration of national, state, or local history or prehistory shall (1) be required to avoid the sites; or (2) be required to consult with appropriate local, state and federal agencies and survey and excavate the site prior to disturbance." The NSB CMP 2.4.3(g) (NSBMC 19.70.050.G) goes on to require that "development shall not cause surface disturbance of newly discovered historic or cultural sites prior to archaeological investigation." These NSB CMP policies establish clearly what is required. In the unlikely event such a site is encountered, there is no inherent reason to assume conflict with these policies.

Traditional activities at cultural or historic sites also are protected under the NSB CMP 2.4.3(f) (NSBMC 19.70.050.F) and 2.4.5.2(h) (NSBMC 19.70.050.K.8). As noted in the discussion of policies related to subsistence, the latter is a best-effort policy that requires protection for transportation to subsistence-use areas as well as cultural-use sites. There is no inherent reason to assume conflict with these policies.

Effectiveness of Mitigating Measures: Mitigating measures are assumed to be in place for the analysis of Alternative I, effects levels reflect this assumption. Mitigation that would apply to subsistence-harvest activities include the Orientation Program stipulation, the Industry Site-Specific Bowhead Whale-Monitoring Program stipulation, and the stipulation on Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities.

The Orientation Program stipulation requires the lessee to conduct a program that educates personnel working on exploration or development and production activities about the environmental, social, and cultural concerns that relate to the area and area communities. The program is expected to increase personnel sensitivity and understanding of local Native community values, customs, and lifestyles and to prevent any conflicts with subsistence activities.

The Industry Site-Specific Bowhead Whale-Monitoring Program stipulation requires industry to conduct a whale monitoring program if exploratory drilling or seismic activity are conducted during the bowhead whale migration to assess the behavioral effects on bowheads from these activities. The monitoring plan is subject to the review of the NSB and the AEWC, invites NSB and AEWC representatives to serve as observers, and requires the plan be independently peer reviewed.

The stipulation on Conflict Avoidance Mechanisms to Protection Subsistence Whaling and Other Subsistence Activities requires industry to conduct operations in a manner that prevents unreasonable conflict with subsistence activities, especially the bowhead whale hunt. Prior to submitting a plan, the lessee must consult with potentially affected subsistence communities of Barrow, Nuiqsut, and Kaktovik; the NSB; and the AEWC about the operations proposed to ensure that they minimize any potential siting and timing conflicts with subsistence whaling and other subsistence-harvest activities. When an operations plan is submitted to MMS, the AEWC will participate in a concurrent review of the plan. If conflicts between industry and subsistence whalers arise over planned exploration or development and production activities, any of the affected parties can request that MMS convene a conflict-resolution panel composed of members from industry, the subsistence communities, the NSB, the AEWC, and NMFS. Only after this group has convened will MMS make a final decision on the adequacy of measures taken to prevent unreasonable conflicts to subsistence-hunting activities. Lease-related use will be restricted if it is determined necessary to prevent such conflicts with subsistence hunting. Subsistence whalers and industry have established a history for negotiating agreements that work for both parties. A recent agreement coordinating the timing of seismic activity for the Northstar Project and the subsistence whale hunt was successfully negotiated by BP Exploration and the NSB, the AEWC, and the city of Nuiqsut.

The stipulation on Planning for Activities Offshore the Arctic National Wildlife Refuge, emphasizes the restrictions on activities within and adjacent to the ANWR. It requires that plans must contain a description of proposed staging areas, infrastructure, and other related activities and a description of the ability to stage and mobilize equipment, including oil-spill-response equipment from locations other than the ANWR.

The stipulation on OCS Pipelines Offshore the Arctic National Wildlife Refuge emphasizes that production from an OCS facility offshore the ANWR will not be allowed until a subsea pipeline has been constructed in other offshore areas of the Beaufort Sea or area with similar arctic conditions. It requires any proposal to construct a pipeline to address the methods for construction, maintenance, monitoring, and repair under limiting seasonal conditions and restricted access from the ANWR.

The stipulation on Protection of Polar Bears from Proposed Development Offshore the Arctic National Wildlife Refuge requires lessees to provide information on measures to be taken to minimize effects to polar bears as part of the DPP and informs them that they may be required to conduct site-specific surveys related to polar bears.

These stipulations will serve collectively to mitigate disturbance effects on Native lifestyles and subsistence practices and to avoid conflict with the land use provisions of the CCP for the ANWR.

Summary: Potential conflict between activities assumed for this lease sale and the NSB LMR's and the Statewide standards and the NSB district policies of the ACMP is evident in two main areas:

- The first area where conflict with ACMP Statewide standards and district policies may arise is the potential for user access conflicts during the construction of an onshore pipeline to Point Thomson and the associated landfall at Flaxman Island during a portion of Kaktovik's subsistence seal-harvest periods. However, the long harvest period would enable residents to harvest seals during other times of the year. Construction of this pipeline could cause access conflicts to Kaktovik's subsistence caribou harvests, but effects are expected to be short term. The Statewide standard for subsistence guarantees opportunities for subsistence use of coastal areas and resources (6 AAC 80.120). Conflict also is possible with two policies of the NSB. The first NSB policy relates to subsistence: NSB CMP 2.4.5.1[b] (NSBMC 19.070.050.J.2) requires development that restricts subsistence-user access to a subsistence resource meet three criteria: (1) there is a significant public need, (2) all feasible and prudent alternatives have been rigorously explored and objectively evaluated and cannot comply with the policy, and (3) all feasible and prudent steps have been taken to avoid the adverse effect the policy was intended to prevent. The second NSB CMP policy relates to both subsistence and cultural resource areas: NSB CMP 2.4.5.2(h) (NSBMC 19.70.050.K.8) requires development to be located, designed, and maintained so as not to interfere with the use of a site that is important for significant cultural uses or essential for transportation to subsistence-use areas; again, subject to the three criteria identified above.

- The second area where conflict with district policies may arise is the potential for adverse effects to subsistence resources. The NSB CMP policy 2.4.3(a) (NSBMC 19.70.050.A) relates to "extensive adverse impacts to a subsistence resource" that "are likely and cannot be avoided or mitigated." In such an instance, "development shall not deplete subsistence resources below the subsistence needs of local residents of the Borough." Policy 2.4.5.1(a) (NSBMC 19.70.050.J.1) relates to "development that will likely result in significantly decreased productivity of subsistence resources or their ecosystems." Although it is possible that an oil spill might reduce or eliminate the bowhead whale harvest for one season, it is more likely that a spill would force hunters to move to new harvest locations. The forced move would shorten the whaling season for certain communities and decrease the number of whales harvested—an effect that is most likely to occur in the Nuiqsut subsistence-harvest area, but also could have an affect on the communities of Barrow and Kaktovik. If a spill contacted the Colville River fish overwintering areas, subsistence fish resources would be undesirable and unavailable for an entire season. In addition, if a spill did occur during the open-water season, it could affect sealing, whaling (belukha), walrus hunting, and bird hunting. However, it is not likely that the entire subsistence harvest of these species would be affected. Oil-spill-cleanup activity would exacerbate and increase disturbance effects to all subsistence species; could result in the displacement of subsistence species; and could alter or reduce access to subsistence species by subsistence hunters, thereby potentially altering or extending normal subsistence hunts.

No facilities will be placed inside the boundaries of the ANWR. Based on the analyses of potential effects as presented in this EIS, no conflicts are anticipated with the land use plans, policies, and controls in place for areas within the boundaries of the refuge.

Conclusion: For Alternative I, conflicts could occur with specific Statewide standards and NSB CMP policies related to the potential for user conflicts between development activities and access to subsistence resources. Conflicts are possible with the NSB CMP policy related to adverse effects on subsistence resources. These effects would occur in the unlikely event of spilled oil contacting subsistence resources and habitats and the activities associated with oil-spill cleanup. No conflicts are anticipated for an exploration-only scenario. No conflicts are anticipated with the land use plans, policies, and controls in place for areas within the boundaries of the ANWR.

C. EFFECTS OF ALTERNATIVE II, NO LEASE SALE:

Under Alternative II, the USDOI would cancel Sale 170. Therefore, the oil expected from this sale would remain undiscovered and undeveloped. The environmental effects of Alternative I also would not occur. However, the economy would substitute energy from alternative sources for the lost oil production. This section briefly discusses the most likely alternative sources, the quantities of each expected to be consumed, and the environmental impacts associated with production of the alternatives. The discussion is based on material from the Proposed Final Outer Continental Shelf Oil and Gas Leasing Program: 1997-2002, Decision Document (USDOI, MMS, 1996e; Outer Continental Shelf Oil and Gas Leasing Program: 1997-2002, FEIS (USDOI, MMS, 1996c); and Energy Alternatives and the Environment (OCS Report, MMS 96-0049, USDOI, MMS, 1996f. These sources are incorporated into this document by reference.

1. The Most Important Substitutes for Production Lost Through No Lease Sale:

Energy Alternatives and the Environment (USDOI, MMS, 1996f) discusses a long list of potential alternatives to oil and natural gas. However, most substitutes for Sale 170 oil will come from four sources:

- Additional oil imports
- Conservation
- Additional domestic oil production (both onshore and offshore)
- Fuel switching, primarily to natural gas

Additional domestic production and imports will augment oil supply, while conservation and switching to alternative fuels shift oil demand downward. Table IV.C.1 shows the percentage and range of quantities we expect will substitute for the lost oil production. The quantities for conservation and fuel switching are in barrels of oil equivalent.

Table IV.C.1 Substitutes for Oil Lost Because of No Lease Sale

Source	% of Lost Production	Range of Quantity (MMbbl)
Additional Oil Imports	88%	308.0 – 589.6
Conservation	5%	17.5 – 33.5
Additional Domestic Production	4%	14.0 – 26.8
Fuel Switching	3%	10.5 – 20.1
Total Production Lost Through No Sale	100%	350 – 670

2. Environmental Impacts from the Most Important Substitutes:

a. **Additional Oil Imports:** Significant environmental impacts from an increase in oil imports include:

- generating greenhouse gases and air pollutants from both transport and dockside activities (emissions of NO_x, SO_x, and VOC's have an impact on acid rain, tropospheric-ozone formation, and stratospheric-ozone depletion)
- degrading water quality because of oil spills from either accidental or intentional discharges or tanker casualties
- destroying flora and fauna and recreational and scenic land and water areas because of oil spills
- increasing public fear of oil spills.

Of these, the most significant impacts may be from oil spills. Imported oil also may impose negative environmental impacts in producing countries and in countries along trade routes.

b. **Conservation:** Conservation is composed of two major components:

- substituting energy-saving technology, often embodied in new capital equipment, for energy resources (e.g., adding to home insulation)
- consuming less of an energy-using service (e.g., turning down the thermostat in an office during the winter)

Consuming less of an energy service is positive from an environmental perspective. Substituting energy-saving technology will tend to result in positive net gains to the environment. The amount of gain will depend on the extent of negative impacts from capital-equipment fabrication.

c. **Additional Domestic Production:** Onshore oil production has notable negative impacts on surface water, groundwater, and wildlife. It also can cause negative impacts on soils, air quality, vegetation, noise, and odor.

Offshore oil production imposes the risk of oil spills affecting water quality, localized degradation of air quality, potential impacts on coastal wetlands- dependent wildlife, and shoreline erosion from additional supply-boat traffic. Offshore activities also may have negative impacts on social, cultural, and economic measures such as subsistence activities, recreation, and tourism.

d. **Fuel Switching:** Consumers probably will switch to natural gas more than any other fuel in response to a decreased supply of Alaskan oil. Production of natural gas leads to similar environmental impacts as oil production does. Other alternative transportation fuels may constitute part of the fuel-substitution mix. The mix depends on future technical and economic advances. No single alternative fuel appears to have an advantage at this time.

Every fuel alternative imposes its own negative environmental effects.

3. Other Substitutes: Government could also impose other substitutes for oil. The most likely sectors to target would be transportation, electricity generation, or various chemical processes. The possibilities are many. Energy Alternatives and the Environment (USDOI, MMS, 1996f) discusses many of the alternatives at a level of detail unnecessary here.

Conclusion: Canceling Sale 170 would eliminate the effects described for Alternative I. However, other sources of energy would substitute for the lost oil production. Principal substitutes would be additional oil imports, conservation, additional domestic production, and switching to other fuels. These alternatives, except conservation, have significant negative environmental impacts of their own.

D. EFFECTS OF ALTERNATIVE III - KAKTOVIK DEFERRAL ALTERNATIVE:

Alternative III comprises 278 blocks and 519,419 ha (1.3 million acres) of submerged lands (Fig. II.C-1). This alternative is 85 blocks and 168,581 ha (416,564 acres) smaller than Alternative I. The area deleted by this deferral alternative is in the easternmost part of the Alternative I area. Resources estimated for this alternative are approximately 30 percent less than Alternative I (about 240-480 MMbbl). Accordingly, the resource-development timeframes are not different from those of Alternative I. Table IV.A.1-1 and Table A-4 in Appendix A show the essential developmental timeframes for platforms and well numbers as well as other infrastructure requirements relevant for Alternative III.

The area that would be deferred under Alternative III includes blocks used for subsistence activities by the residents of the community of Kaktovik. This alternative also would ensure that no exploration and development drilling would occur in the deferred blocks, which may encompass a whale-feeding area; the potential for oil spills or use conflicts originating from the unoffered portion of the planning area would be reduced accordingly. Deferring this area was supported by the FWS and Native groups during the scoping process for Sale 170.

1. Water Quality: The agents associated with petroleum exploitation that are most likely to affect water quality are the permitted discharges from exploration drilling units and production platforms, turbidity from construction activities, and hydrocarbons from oil spills. For the Kaktovik Deferral Alternative, there is a 13- to 19-percent reduction in the estimated oil production, and this decrease results in some reductions in the estimated level of activities (Table IV.A.1-1). For the permitted discharges, the basic unit area in the receiving waters that would be affected by the discharges from well drilling or production activities is the same as those defined for Alternative I in Section IV.B.1.a; also estimated in this section is the amount of time the waters would be affected. With the reduced resource estimate, there potentially is a 17- to 33-percent reduction in the number of areas where permitted discharges might occur; 10 to 12 exploration/delineation wells and 2 to 4 production platforms (Table IV.A.1-1).

Water quality within an area of about 0.03 km^2 (100-m radius) around each exploratory drilling unit or production platform would be temporarily degraded during active discharge of drilling muds and cuttings. The toxicity of the drilling muds generally is low, and the concentrations of the bulk constituents become nontoxic at the dilutions reached shortly after discharge. For the Kaktovik Deferral Alternative as compared to Alternative I, there is an estimated (1) 17- to 25-percent reduction in the number of exploration/delineation wells drilled and weight of muds (6,300-7,560 short tons) and cuttings (8,200-9,480 short tons) discharged and (2) a 15-percent reduction in the number of production/service wells drilled (74-94 wells) and weight of muds (11,100-63,920 short tons) and cuttings (87,320-110,920 short tons) discharged (Table IV.A.1-1).

If produced waters are discharged into the Beaufort Sea, the water quality in an area of several square kilometers would be degraded. The toxicity of produced waters mainly is caused by hydrocarbons that include nonvolatile hydrocarbons (EPA oil and grease) and aromatic hydrocarbons. Oil and grease concentrations in formation waters discharged into the Arctic marine environment would be limited to a 29 mg/l (29 ppm) monthly average by the current Arctic NPDES General Permit. Assuming the water-to-oil ratio is between 0.35 and 0.62, the production of formation waters over the 20 years of production is estimated to range from about 107 to 338 MMbbl. The quantity of produced waters discharged over the life of the fields would be reduced by about 13 to 19 percent compared to similar activities associated with Alternative I; and this also decreases the amount of toxic substances, oil and grease, and aromatic hydrocarbons that might be discharged into the Beaufort Sea.

The turbidity associated with each type of offshore-construction activity would be increased in an area of about 4 km^2 at any one time. The decrease in the number of exploration/delineation wells (17-25%) and length (48-80 km) of offshore pipeline (17-25%) indicates a potential reduction in the number of areas that might be temporarily affected by an increase in the concentration of suspended particulate matter in the water column.

Small spills (<1,000 bbl) associated with exploration and production activities would result in local, chronic contamination of the waters with the margins of the fields. The instances of small spills (59-118) would be reduced by about 28 to 31 percent, and the volume of oil spilled (610-1,371 bbl) would be reduced by about 28 to 31 percent compared to Alternative I (Table IV.A.2-3).

The effects of a ≥1,000-bbl spill would be the same as described for Alternative I (Sec. IV.B.1.c). A spill of 7,000 bbl could, for about a month, temporarily contaminate water in an estimated area of <400 km^2, with hydrocarbons above the chronic criterion of 0.015 ppm. There is a 35- to 57-percent chance of a spill ≥1,000 bbl occurring, and this is slightly less than the chance estimated for Alternative I (Table IV.A.2-1). Concentrations above the 1.5-ppm-acute criterion may occur in an area <75 km^2 during the first several days of a spill. Regional, long-term degradation of water quality to levels above State and Federal criteria because of hydrocarbon contamination is very unlikely.

For this alternative, petroleum exploration and development and production would not occur in the deferred (not available for oil and gas leasing) area. Thus, there would be no direct discharges of any permitted substances into the waters of the deferred area. The number of exploration and delineation wells that might have been drilled in the deferred area is estimated to be 2 to 4. The amount of muds and cuttings associated with these wells is estimated to be about 1,260 to 2,520 and 1,640 to 3,280 short tons, respectively—about a 17- to 25-percent reduction from Alternative I.

It is estimated that one production facility could have been installed in the deferred area. The number of production and service wells associated with this facility is estimated to range from 13 to 17. Drilling these wells would have used 1,950 to 11,560 short tons of drilling muds and produced 15,340 to 20,060 short tons of cuttings—about 15 percent of both the muds and cuttings associated with Alternative I. Produced waters from the production facility would range from 15 to 77 MMbbl—about 12 to 19 percent of the amount associated with Alternative I. The decrease in produced waters also represents a reduction in the amount of toxic substances, oil and grease, and aromatic hydrocarbons that might be discharged into the waters off the ANWR.

Reducing the number of exploration and delineation well sites, production facility sites, and length of offshore pipeline reduces the number of areas that temporarily might be affected by an increase in the concentration of suspended particulate matter in the waters column by 17 to 33 percent as compared to Alternative I.

It is unlikely there would be any oil spills in the deferred area. Petroleum exploitation in the deferred area could have resulted in an estimated 26 to 46 spills ≥ 1 and <1,000 bbl for a total of 280 to 534 bbl for the life of the field(s). The number of spills and the amount of oil spilled represents about 28 to 31 of both the number of spills and the amount spilled that are estimated for Alternative I.

However, substances that enter the water column as a result of activities in other areas that could be open to oil and gas leasing could be transported into the waters of the deferred area—depending on the time of year and the direction of the winds and currents. Some areas that have been leased for oil and gas development lie adjacent to the deferred area. The concentration of the substances entering the waters of the deferred area would depend on the amount discharged or spilled, the distance the source is from the deferred area, and the amount of mixing and dispersion—which are functions of the waves and currents.

Conclusion: In comparison to Alternative I, the reductions in the permitted discharge quantities and areas affected by increased turbidity from offshore construction activities might range from about 13 to 25 percent and 17 to 25 percent, respectively.

2. Lower Trophic-Level Organisms: Activities that may affect lower trophic-level organisms include drilling discharges, seismic surveys, construction, and those associated with an accidental oil spill. The effects of these activities and the agents associated with them already have been discussed for Alternative I. This analysis considers differences in the amount of exposure lower trophic-level organisms would have to these activities/agents for Alternative III as compared to those of Alternative I. It then estimates the resulting effect of these differences on lower trophic-level organisms.

Alternative III involves fewer drilling discharges, seismic surveys, and construction-related activities than Alternative I. However, there is not enough difference in their number or magnitude to make a measurable difference in the expected effect of these activities on lower trophic-level organisms. Concerning the potential effect of an accidental oil spill, Alternative III deletes about 25 percent of the eastern portion of the Alternative I sale area. This would eliminate any OCS activity in the deferral area and would eliminate it as an area where a platform or pipeline oil spill could originate. Due to the normal westward pattern of wind and water currents in this area, any platform or pipeline oil spill occurring to the west of the deferral area is not likely to contact it. But if the wind and water currents shifted eastward, the deferral area is likely to be contacted. Hence, Alternative III offers little advantage over Alternative I for an oil spill occurring to the west of the deferral area. However, if it is assumed that wind and water currents are moving westward following an oil spill, Alternative III is likely to reduce the probability of oil contacting the deferral area by eliminating platforms and pipelines from that area. This would reduce the adverse effects on lower trophic-level organisms estimated for Alternative I (lethal and sublethal effects on <1 percent of the plankton and invertebrate larva and <5 percent of the epontic community [assuming a winter spill] in the sale area). However, because the estimated effects of Alternative I are so low, Alternative III is not expected to measurably benefit lower trophic-level organisms in the sale area. Hence, Alternative III is expected to have essentially the same effect on lower trophic-level organisms as Alternative I.

Regarding the Kaktovik Deferral, the effects on lower trophic-level organisms within the deferral area would be as follows: It eliminates or reduces the estimated adverse effects of drilling discharges, seismic surveys, and construction-related activities on lower trophic-level organisms within deferral area, which were estimated for Alternative 1 as lethal and sublethal effects on <1 percent of the benthic organisms in the sale area. If wind and water currents are moving westward following an oil spill,

Alternative III would reduce the probability of oil contacting the deferral area by eliminating platforms and pipelines from that area. This would reduce or eliminate the adverse effects of oil on lower trophic-level organisms within the deferral area, estimated for Alternative I as lethal and sublethal effects on <1 percent of the plankton and invertebrate larva and <5 percent of the epontic community in the sale area. However, if wind and water currents are moving eastward following an oil spill, the deferral area probably also would be contacted, and Alternative III would not reduce or eliminate adverse effects in the deferral area. Alternative III also wouldeliminate all of the beneficial effects of platform placement within the deferral area, which otherwise would have been colonized by lower trophic-level organisms requiring a hard substrate for attachment.

Conclusion: Alternative III is expected to have essentially the same effect on lower trophic-level organisms as Alternative I.

3. Fishes: The Kaktovik Deferral, Alternative III, removes approximately 25 percent of the proposed Sale 170 area from oil and gas exploration and development/ production. This alternative defers an offshore area west of Barter Island. Decreasing the size of the Sale 170 area would decrease the effects to fishes located in and/or migrating through the deferred area. This would include disturbances as a result of discharges; noise and disturbances from seismic surveys; and noise and disturbances from aircraft, vessel, drilling, and construction activities (see Table IV.A.1-1). However, leases from previous Federal sales are located adjacent to the deferred area. Aircraft and vessel traffic may travel though the deferred area en route to these leased areas. These activities may disturb some fishes. Disturbances from seismic surveys within the previously leased areas could be transmitted into the deferred area. However, the intensity of the seismic-survey disturbance would be reduced and unlikely to significantly affect fishes. In the area being offered for leasing under this alternative, the types of effects to fishes would be as described for Alternative I.

The reduction in the magnitude of the effects results from decreases in activities and/or events associated with Alternative III. The number of exploration wells would decrease to 5 to 6 under Alternative IIII from the 6 to 8 under Alternative I. Shallow-hazard surveys would cover only 115 to 138 km^2 for Alternative III, whereas these surveys for Alternative I would cover 138 to 184 km^2. Drilling discharges for Alternative III would be reduced from 260 to 2,520 short tons (dry weight) for drilling muds and 1,640 to 3,280 short tons (dry weight) for cuttings from Alternative I. The number of support activities (helicopter flights and supply-boat trips) also would be reduced (Table IV.A.1-1). These reductions would decrease the adverse effects to fishes from noise and disturbances.

Oil-spill risks to fishes would be reduced only slightly as compared to Alternative I. The range of resources would be reduced to 305 to 545 MMbbl from the 350 to 670 MMbbl in Alternative I. The OSRA model estimates a 35- to 57-percent probability for the occurrence of one or more oil spills ≥ 1,000 bbl over the assumed production life of Alternative III versus a 46- to 70-percent probability for Alternative I. The OSRA model for combined probabilities estimates a 3- to 10-percent chance of one or more spills ≥ 1,000 bbl occurring and contacting I/SS's 7 through 9 within 30 days over the production life of Alternative III. The probability of contact in I/SS's 8 and 9 is estimated at 5 to 10 percent and 4 to 7 percent, respectively. This is a slight reduction from Alternative I. If spilled oil contacted fish habitat, the results would be the same as discussed in Section IV.B.3. Fishes could experience one or more of the following as a result of oil-spill contact: skin contact, respiratory distress from gill fouling, localized reduction in food resources, consumption of contaminated prey, displacement from migratory routes, and temporary displacement from local habitat. In winter, fishes in critical and scarce overwintering nearshore habitats likely would suffer the most lethal effects due to their dependency on these habitats and their inability to avoid the spill by moving out of the spill area. These affected fish populations could take many generations to recover, depending on the recruitment into the population. Otherwise, fishes likely would suffer nonlethal effects from an oil spill.

Regarding the Kaktovik Deferral, the reduction of effects to fishes under Alternative III would be as follows: Fewer fishes would be exposed to noise from oil and gas activities under the deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted. Fishes would be exposed to fewer disturbances as a result of these activities and a decrease in drilling discharges, which also would reduce alterations to fish habitat. Effects to fishes from support activities also would be reduced. However, fishes located in the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur inside and/or outside the deferred area. This would result from leases from previous Federal sales being granted adjacent to and within this alternative's area. Fewer fishes would be exposed to the types of effects from oil and gas activities under this deferral than under Alternative I.

Conclusion: The level (magnitude) of disturbance in the deferred area would be reduced from that of Alternative I. The types of effects fish resources are exposed to from Alternative III likely would be similar to those expected under Alternative I and its resource-development scenario.

4. Endangered and Threatened Species: The Kaktovik Deferral Alternative (Alternative III) would

remove approximately 20 percent of the proposed sale area, deferring an offshore area west of Barter Island from petroleum exploration and development/production (Fig. II.C-1). The resource estimate and development scenario for Alternative III would provide a potential reduction in oil-spill effects on endangered and threatened species and their habitats west of Barter Island.

a. Effects on the Bowhead Whale: This alternative would defer an area used by bowhead whales for migration and occasionally for feeding during the late summer and fall and slightly reduce the potential for adverse effects from noise, disturbance, and oil spills as a result of exploration and development and production activities.

Any potential effects to bowhead whales feeding in and migrating through the sale area as a result of discharges, noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and construction activities would be reduced somewhat compared to the development scenario of Alternative I, because these activities would not take place within the deferred area. An estimate of these activities is provided in Table IV.A.1.1.

Noise from drilling and seismic activities has the most potential to affect bowhead behavior. It is estimated that the number of exploration wells drilled would be reduced from six to eight wells under Alternative I to five to six wells as a result of the deferral, and the number of delineation wells would be reduced from six to eight wells to five to six wells. The area included in shallow-hazards site surveys would be reduced from an estimated 138 to 184 km^2 under Alternative I to an estimated 115 to 138 km^2 as a result of the deferral. Bowhead whales exposed to noise from exploration and development and production activities may experience temporary, nonlethal effects. Some bowheads may avoid areas near the activities. It is likely that fewer whales would be exposed to noise from these activities under the deferral than under Alternative I. However, with or without the deferral, the overall migration is not likely to be affected, and the overall effect on the population is likely to be essentially the same as under Alternative I.

Oil-spill risks to bowhead whales would be reduced as compared to Alternative I. The range of resources would be reduced to 305 to 545 MMbbl as compared to 350 to 670 MMbbl for Alternative I. During development/ production activities, the OSRA estimates a 35- to 57-percent chance of one or more spills ≥1,000 bbl occurring compared to a 46- to 70-percent chance under Alternative I (Table IV.A.2-1). For combined probabilities, the OSRA model estimates a 3- to 10-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 through 9, where bowheads may be present during the fall migration within 30 days over the production life of Alternative III. The probability of contact in I/SS's 8 and 9, the areas of highest probability of contact, is estimated at 5 to 10 percent and 4 to 7 percent, respectively. This is a slight reduction in oil-spill risk for this alternative as compared to Alternative I, where the probability of contact in I/SS's 8 and 9 is estimated at 6 to 12 percent and 8 to 15 percent, respectively. If spilled oil were to contact a whale-habitat area, resulting effects would be as discussed under Alternative I (Sec. IV.B.4). Some bowhead whales could experience one or more of the following: skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of contaminated prey items, and perhaps temporary displacement from some feeding areas. Some individuals might be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals so affected is expected to be small. Overall, exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, with the population recovering to prespill population levels within 1 to 3 years. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects. Effects on bowheads expected for this alternative would be similar to the effects expected under Alternative I.

Regarding the Kaktovik deferral, the effects on bowhead whales within the deferred area are as follows: It is likely that fewer whales would be exposed to noise from these activities under the deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted with the area deferred. However, bowhead whales within the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur both inside and outside the deferral area. It should be noted that these activities may occur in the deferral area without additional leasing, because leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales. Drilling operations and seismic surveys may be conducted on these leases and aircraft and vessel traffic may cross the area en route to these leased blocks. These activities could disturb low numbers of bowheads and cause some bowheads to avoid areas near the activities. In addition, noise from seismic surveys or drilling operations within leased blocks outside of the deferral area could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels and would be unlikely to significantly displace feeding or migrating whales. The effect of noise on bowheads, with or without the deferral, would be as described for Alternative I, with whales avoiding vessels, seismic surveys, drilling units, and production platforms at varying distances. It is likely that fewer whales would be exposed to noise from these activities under the deferral than under Alternative I. Exposure of bowhead whales to noise-producing activities, whether inside or outside the deferral

area, is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects.

Likewise, any oil spill that may occur either on leases outside the deferral area or on leases within the deferral area has the potential to be present within the deferral area.

Conclusion: Effects on bowheads expected from Alternative III would be similar to the effects expected under Alternative I. While fewer whales may be exposed to oil and gas activities under the deferral than under Alternative I, the extent and nature of the effects and the overall effect on the population is likely to be essentially the same as under Alternative I.

b. **Effects on the Spectacled Eider:** Spectacled eiders are uncommon east of the Sagavanirktok River and rare east of the Canning, where probability of contact by an oil spill originating in the deferred eastern sale area (from launch boxes L7 and L8 and pipeline segment P4, Fig. IV.A.2-1) is greatest (I/SS 9 and eastward; Fig. IV.A.2-2). Also, little reduction in spill-contact probability in areas potentially used by this species results from this alternative (maximum 8% decrease; maximum 2% decrease if chance of a spill occurring is considered; Anderson et al., 1997, Tables 5 and 12, respectively). As a result, the Kaktovik deferral (Alternative III) would result in no significant reduction of the effects determined under Alternative I (Sec. IV.B.4). These include no significant effects from routine activities and relatively low mortality if there were an oil spill (<300 individuals); however, unless mortality is near the lower end of this range (e.g.,<25), recovery from spill-related losses is not expected to occur if numbers on the breeding grounds continue to decline and the relatively low reproductive rate persists.

The rarity of spectacled eiders in the vicinity of the ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: The Kaktovik Deferral Alternative (Alternative III) would produce no significant reduction of routine activity or oil-spill effects on spectacled eiders from that expected under Alternative I. Effects are expected to be minimal, affecting <2 percent of the population; however, recovery from even minimal mortality is unlikely to occur while the current uncertain population status persists.

c. **Effects on the Steller's Eider:** The only substantial occurrence of Steller's eiders in Alaska during the nesting season is in the Barrow area (they are rare east of Point Barrow). Because there would be almost no reduction in spill-contact probability (Anderson et al., 1997, Table 5) in the areas potentially used by this species (I/SS 4, LS's 20-25, Elson Lagoon, C2; Figs. IV.A.2-2, -3, -6), Alternative III would result in no significant reduction of effects determined under Alternative I (Sec. IV.B.4). These include no significant effects from routine activities and relatively low mortality from an oil spill (<100 individuals); however, unless mortality is near the lower end of this range (e.g.,<25), recovery from spill-related losses is not expected to occur if numbers on the breeding ground continue to decline and the relatively low reproductive rate persists.

The rarity of Steller's eiders in the vicinity of the ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: The Kaktovik Deferral Alternative (Alternative III) would produce no significant reduction of routine activity or oil-spill effects on Steller's eiders from that expected under Alternative I. Effects are expected to be minimal, affecting <2 percent of the population; however, recovery from even minimal mortality is unlikely to occur while the current uncertain population status persists.

d. **Effects on the Arctic Peregrine Falcon:** Because arctic peregrines primarily nest inland 32 km (20 mi) or more from the coast, deferral of this area would result in no demonstrable reduction of effects determined under Alternative I (Sec. IV.B.4). These include disturbance (rarely) by distant support aircraft, construction of onshore gathering pipelines, gravel mining, and potential contact with oil either directly or through contact with oiled prey. Neither disturbance nor oiling of peregrines is considered a likely result of Alternative I (<5 percent of the population exposed to potentially adverse factors), because activities involving these adverse factors generally are far removed from primary areas of falcon activity. Exposure of peregrines to oiled prey, likely to be infrequent in any case, is not expected to decrease significantly under this alternative, because the decreased number of projected spills does not result in significantly decreased shoreline contact by oil. No mortality is expected to result from this alternative.

The rarity of arctic peregrine falcons in the vicinity of coastal ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: Routine and spill-related effects of the Kaktovik Deferral Alternative on the arctic peregrine falcon are expected to be minimal. Because exposure of falcons to adverse factors is expected to be insignificant under both Alternative I and this alternative, reduction of adverse effects also is expected to be insignificant.

5. Marine and Coastal Birds: Alternative III, the Kaktovik Deferral Alternative, would delete about 25 percent of the area from proposed Sale 170 west of Barter Island, reducing the number of exploration wells drilled from six to eight to five to six, the number of production platforms from three to five to two to three, and the activities associated with each. These reductions would reduce disturbance and potential oil-spill effects in marine and coastal bird habitats in this area.

As a result of this level of activity reduction, local disturbance of marine and coastal birds by support traffic and operations would be reduced substantially in this area from that expected under Alternative I (effects under Alternative I include short-term displacement of birds from the vicinity of vessels or routinely used air and vessel corridors to platforms, lasting a few minutes to <1 day; and/or long-term displacement from the vicinity of platforms or onshore facilities). The potential for seismic operations and emergency traffic in the deferred area would remain. Because disturbance is not expected to have population-level effects under Alternative I, this reduction would be considered minor.

Deferral of leasing in this area under Alternative III reduces the combined probabilities (expressed as a percent chance) of one or more ≥1,000-bbl spills occurring and contacting important habitats for marine and coastal birds within 30 days of spill occurrence to Jago Lagoon (Fig. IV.A.2-6) from 1 to 2 percent under Alternative I to 0 to 1 percent under Alternative III, and to Gwydyr Bay from 2 to 4 percent under Alternative I to 2 to 3 percent under Alternative III. The chance of spill occurrence and contact with offshore marine habitats of birds from Mackenzie Bay (Canada) west to Prudhoe Bay (represented by I/SS's 8-13, Fig. IV.A.2-2) also is reduced under Alternative III, particularly in the area offshore Camden Bay. However, the chance of spill occurrence and contact with other offshore habitats west of Prudhoe Bay (represented by I/SS's 4-7) is the same under Alternatives I and III. The chance of spill occurrence and contact with coastal-shoreline habitats (represented by LS's 28-41, Fig. IV.B.7-1) is slightly reduced under Alternative III (1% at several segments) as compared to Alternative I; elsewhere there is no change (Anderson et al., 1997; Tables 10, 11,14,15).

Areas where the probability of contact to marine and coastal birds by spilled oil originating in the deferred eastern sale area is greatest (from launch boxes L7 and L8, pipeline segment P4, Fig. IV.A.2-1), include Camden Bay and Barter Island (LS 38-41; I/SS's 9-10, resource area C5, Figs. IV.A.2-2, -3, -6). Under this alternative, reduction in spill-contact probability for the ice/sea segments ranges from 0 to 26 percent; for land segments, 0 to 99 percent; and for the resource area, 2 to 9 percent (Anderson, et al., 1997; Tables 4, 8). Greatest reduction occurs in the Camden Bay area, although contact probability remains as high as 44 percent from launch box L5. Potential contact in most of these areas is reduced <6 percent. Thus, the Kaktovik deferral would reduce the probability of occurrence of the relatively low spill-related mortality determined under Alternative I (Sec. IV.B.5). Probability of contact with birds in offshore habitats west of Camden Bay and nearshore habitats west of Gwydyr Bay would not be reduced under Alternative III, but offshore and west of Harrison Bay and nearshore west of Simpson Lagoon the probabilities are quite low (≤6%).

Any spill-related losses of marine and coastal birds still may include up to several thousand birds, but the chance of occurrence of such losses is reduced from Alternative I by this alternative, and a spill may occur when few birds are present. There still remains a substantial probability of spill contact with areas offshore of Camden Bay (44%). The effect of such losses is expected to be minor at the population level and may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Under Alternative III, overall disturbance effects in the deferral area, such as reduced fitness of individuals displaced from traditional marine foraging areas, that may be experienced by bird populations seasonally occupying the ANWR and the Barter Island area are likely to be negligible. This is because deferral of leasing in the proposed eastern sale area would eliminate from the area offshore of Camden Bay nearly all potential sources of bird disturbance associated with exploration or development and production activities, including transport, exploration rig operation, and construction and operation of platforms. Seismic operations and emergency traffic, although not expected to cause significant disturbance, would remain as potentially disturbing activities. Although the probability of spilled oil contacting areas offshore of Camden Bay, where birds that have nested in the ANWR may forage and stage prior to migration, remains substantial (44%) under this alternative, the chance of nearshore or shoreline contact is reduced to <6 percent. More importantly, the probability of a spill occurring and contacting ice/sea segments offshore of Jago Lagoon and shoreline to the west are reduced to <8 and <3 percent, respectively, and a spill may occur when few birds are present or be weathered and dispersed by the time they are. As a result, although any spill-related losses of marine and coastal birds still may include up to several thousand birds, the chance of such losses occurring is quite low under this alternative. The effects of any such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Conclusion: Under Alternative III, disturbance of marine and coastal birds in the deferral area is expected to be negligible; in the remainder of the proposed sale area it

would remain the same as that discussed under Alternative I. Because the chance of spill occurrence and contact with habitats from Gwydyr Bay eastward is reduced from Alternative I, risk of oil-spill effects on birds and their habitats also is reduced to a relatively low level. Risk of oil-spill contact remains substantial offshore of Camden Bay, so birds from nesting areas in the ANWR that enter this area when oil is present are expected to sustain spill-generated losses equivalent to those discussed for Alternative I (up to several thousand individuals). The effects of any such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the population and survey methods/data available.

6. Pinnipeds, Polar Bears, and Belukha Whales: Effects associated with Alternative III essentially would be the same, at least qualitatively, as those analyzed for Alternative I (Sec. IV.B.6). The magnitude of effects could vary, depending on the population status of affected marine-mammal species at the time when adverse effects could occur. For Alternative III, noise and disturbance; habitat alterations from drill-platform installation, pipeline laying, and other construction; and oil spills could have some adverse effects on pinnipeds, polar bears, and belukha whales found in the sale area.

Under the development scenario for Alternative III, the amount of helicopter and supply-boat support traffic would be reduced somewhat from that expected under the scenario for Alternative I (see Table IV.A.1-1). Helicopter trips (1 round trip/day to each of 2-4 drilling platforms vs. the same amount of traffic to each of 3-5 platforms under Alternative I) and supply-boat traffic (128-150 or 1/week/drill platform vs. 150-205 vessel trips under Alternative I) could disturb some hauled out ringed, bearded, and spotted seals and walruses, causing them to panic and charge into the water, resulting perhaps in the injury or death of some seal pups. Aircraft disturbance of seals, walruses, and polar bears is likely to be short-term displacement (a few minutes to less than a few days) of small numbers of these animals (less than a few hundred) within 1 to 3 km of the helicopter. Vessel traffic associated with the two exploration-drilling units and two to four production units and seismic vessels operating during the open-water season temporarily could displace or interfere with marine mammal migration and change local distribution for a few hours to a few days. Such short-duration and local displacement (within 1-3 km of the traffic) is expected to have about the same level of short-term (less than a few days) effect on the distribution of pinnipeds, polar bears, and belukha whales as described for Alternative I.

The installation of two to three (vs. 3-4 under Alternative I) production platforms and the laying of 48 to 80 km (vs. 64-96.5 km under Alternative I) of offshore pipelines with about 1 to 5 km of benthic habitat altered are likely to have a short-term and local effect on these marine mammals.

There is a 35- to 57-percent chance of one or more oil spills ≥ 1,000 bbl occurring during exploration and development under Alternative III (vs. 46-70% chance under Alternative I). If an oil spill occurred, it would pose the greatest risk of contact to all marine mammals from the Camden Bay offshore area (I/SS 9) to ice-flaw-zone habitats located west to Cape Halkett (I/SS 6) (Fig. IV.B.6-1). Under Alternative III, lease blocks offshore of eastern and central parts of Camden Bay would not be leased, therefore reducing the risk of a spill occurring in this area (see Fig. II.C-1). However, blocks immediately west in Camden Bay and west to offshore of about Oliktok Point still would be leased under Alternative III. If an oil spill occurred in this area, nonendangered marine mammals—pinnipeds, polar bears, and belukha whales—still would be about equally at risk from contact with the spill, and the effect is expected to be about the same. The combined effect of noise and disturbance, habitat alterations, and oil spills under the Alternative III developmental scenario is expected to be about the same as under Alternative I.

Regarding the area offshore of Kaktovik, the removal or reduced effects to the Kaktovik area on pinnipeds, polar bears, and belukha whales are as follows: There would be no oil spills (7,000 bbl), noise and disturbance (aircraft and vessel traffic, including seismic operations), or habitat alterations (installation of 1 or 2 exploration and production platforms and the laying of 16.5 km pipelines) within the area from this alternative. This would represent one to two fewer exploration and production platforms and 16.5 fewer offshore pipeline kilometers as compared to Alternative I. There is about an 11- to 13-percentage-point reduction in the chance of one or more oil spills ≥ 1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur in the area offshore of Kaktovik. The potential loss of small numbers of seals and belukha whales is not expected to occur offshore of Kaktovik, and the loss of an estimated 20 to 40 polar bears on or near the coast of Kaktovik would not occur. However, such losses still are expected to occur to the polar bear population (which includes some of the bears that occur in the Kaktovik area), if the 7,000-bbl spill contacts other polar bear concentrations at whale carcass sites such as at Cross Island, Barrow, or other locations where whales die and end up on the shore. The effect of the 7,000-bbl spill on seals and belukha whales west of the area offshore of Kaktovik is expected to be the same. Potential noise and disturbance from aircraft and vessel traffic, including seismic operations, and habitat alteration from platform and pipeline installation would not occur in the area offshore of Kaktovik; but these effects were expected to be short term and not affect pinniped, polar bear, and belukha whale

populations. Therefore, the removal of exploration and development offshore of Kaktovik is not expected to reduce the overall effect on pinniped, polar bear, and belukha whale populations as described under Alternative I.

Conclusion: The effect of Alternative III is expected to be similar to the effects of Alternative I, but with effects potentially reduced in the Kaktovik area.

7. Caribou: Effects associated with Alternative III (Kaktovik Deferral) would be the same, at least qualitatively, as those analyzed for Alternative I (Sec. IV.B.7). However, the magnitude of effects could vary, depending on the population status of the affected caribou herds (CAH and PCH) when adverse effects could occur.

The primary source of disturbance to caribou is vehicle traffic (perhaps as much as several hundred vehicles/day) that could be associated with onshore transportation of oil from offshore leases west of central-Camden Bay (see Fig. II.C.1). Disturbance of caribou along the pipelines and roads from Point McIntyre, Oliktok Point, and Point Thomson to the TAPS though existing facilities in the Prudhoe Bay and adjacent oilfields would be most intense during the construction period (perhaps 6 months), when motor-vehicle traffic is highest, but would subside after construction is complete. Caribou are likely to successfully cross the pipeline corridor within a short period of time (a few minutes to a few days) during breaks in the traffic flow, even during high traffic periods, with little or no restriction in movement. However, a local reduction in cow-calf distribution within about 3 to 4 km (1.86-2.48 mi) along pipeline-road corridors may be expected, if the corridors cross main CAH calving habitats.

The field-development scenario for Alternative III forecasts the construction of 32 to 48 km (vs. 32-161 km under the Alternative I scenario) of onshore pipeline, and potential adjacent roads are expected to be constructed (see Table IV.A.1-1). This reduction in pipeline kilometers and reduction in potential adjacent roads and vehicle traffic is expected to reduce the amount and duration of displacement of CAH and PCH caribou from habitats within 4 km (2.48 mi) the pipeline-road corridors east of the Prudhoe Bay oilfield. These pipelines are expected to be short (32-48 km total length) and connect to existing transportation facilities along the coast and not cross main calving areas of the PCH.

There is a 35- to 57-percent chance of one or more oil spills ≥1,000 bbl occurring during exploration and development under the development scenario for Alternative III versus a 46- to 70-percent chance under the scenario for Alternative I. If one or more oil spills (≥1,000 bbl) occurred under Alternative III during the open-water season, caribou of the CAH or the PCH that frequent coastal habitats from Cape Halkett (LS 28) to Barter Island (LS 41) possibly could be directly exposed to and contaminated by the spill along the beaches and in shallow waters during periods of insect-pest-escape activities (Fig. IV-B-7-1). However, even in a severe situation, a comparatively small number of animals (perhaps a few hundred CAH caribou to 1,500-3,000 PCH caribou) is likely to be directly exposed to the oil spill and die as a result of toxic hydrocarbon inhalation and absorption. These respective losses would be small for the two caribou herds, with recovery of the populations expected within about 1 year. For the most part, the effect of onshore oil spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline; these spills would not be expected to significantly contaminate or alter caribou range within the pipeline corridors. This alternative is expected to greatly reduce any potential development effects (from an oil spill, surface traffic-roads, and other activities) on PCH caribou.

Regarding the area offshore of Kaktovik, the removal of or reduced effects to the Kaktovik area on caribou are as follows: There would be no oil spills (7,000 bbl) within the Kaktovik area from this alternative. There is about an 11- to 13-percentage-point reduction in the chance of one or more oil spills ≥1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur in the area offshore of Kaktovik. The potential loss of a an estimated 1,500 to 3,000 PCH caribou would not occur along the coast of the Kaktovik area. Potential effects of an oil spill on PCH caribou could be reduced within the deferred area under Alternative V.

Conclusion: The effect of Alternative III on PCH caribou is expected to be reduced somewhat from that under Alternative I however, the overall effect on CAH caribou is expected to be about the same as under Alternative I (local displacement of cow-calf groups within about 3 to 4 km along onshore pipelines with roads, with this local effect persisting for more than one generation and the loss of a small number of caribou and relatively small area of habitat contamination assuming one oil spill of 7,000 bbl).

8. Economy of the North Slope Borough: Increased revenues and employment are the most significant economic effects that would be generated by Alternative III, the Kaktovik Deferral. The effect on NSB revenues and expenditures and employment is about 30 to 40 percent less than for Alternative I. Increased property tax revenues and new employment would be created with the construction, operation, and servicing of facilities associated with OCS activities. This reduction in effect is based on the fact that key elements of facilities associated with OCS activities for Alternative III are 30 to 40 percent less than Alternative I. These facilities are described in Table IV.A.1-1 and are summarized as follows. For exploration and development and production, four to six

exploration and three to five delineation wells would be drilled during the exploration phase between 1998 and 2006. During the development and production phase between 2004 and 2010, 61 to 66 production and service wells would be drilled and 2 to 3 platforms and 32 to 80 km of offshore pipeline would be installed. The number of workers needed to operate the infrastructure is determined by the scale of the infrastructure and not the amount of oil produced. A wide range of production volume can be handled by a given level of infrastructure. Once the infrastructure is constructed, the number of workers needed to operate it does not depend on the amount of product flowing through it. Some temporary employment may be generated in the event of oil spills. Analysis of economic effects resulting from proposed Sale 170 is limited to effects on the NSB. Potential effects on other parts of the State or on the State as a whole are considered to be negligible.

a. North Slope Borough Revenues and Expenditures: Total property taxes in the NSB and NSB revenues are anticipated to decline without Sale 170. These revenues will be determined by several different factors and, therefore, the revenue projections should be considered with the understanding that many uncertainties exist. For Alternative III, exploration, development, and production are projected to generate increases in property taxes above the levels without the sale starting in 1998 and averaging about 0.67 to 1.2 percent above the level without the sale each year through the production period. The two expenditure categories that affect employment—operations and the CIP—are projected to decline without Sale 170. Of these two categories, it is assumed that only expenditures on operations would be affected by the proposed sale's effects on taxable property value. Those CIP expenditures that have generated many high-paying jobs for residents would not be changed by Sale 170.

b. Employment: The gains from Alternative III in direct employment would include jobs in petroleum exploration, development, and production and jobs in related activities For exploration, development, and production, direct employment is anticipated to peak in the range of 980 to 1,080 jobs during the development phase, decline to a level in the range of 600 to 1,050 in 2011 to 2022, and then decline further to the range of 350 to 720 by 2027. All of these jobs would be filled by commuters who would be present at the existing enclave-support facilities in and near the Prudhoe Bay complex approximately half of the days in any year. Most workers would commute to permanent residences in Southcentral Alaska, Fairbanks and, to a much lesser extent, the North Slope. Some workers would commute from the enclaves to permanent residences outside of Alaska, especially during the exploration phase. Because economic effects in other parts of Alaska would be insignificant, only employment increases in the North Slope region are discussed.

Because of the development of facilities or the continued use of facilities onshore that are taxable by the NSB, the NSB will have additional revenues available that most likely will be used for its ongoing operations. This in turn results in jobs working directly for the NSB government.

For exploration, development, and production, total resident employment is anticipated to increase in the range of 44 to 60 jobs in the peak of production and level off to 19 to 25 in the production phase after 2011. The peak increase during development is about 2.8 to 3.6 percent greater than resident employment without Sale 170 and about 1.2 to 1.8 percent greater during the production phase. The increase in employment opportunities may partially offset declines in other job opportunities and delay expected emigration. Increases in resident population will correspond to the resident employment increase.

The employment and population forecasts were calculated using the MMS Manpower Model and the RAM for the NSB, created and updated by UAA, ISER (Tables IV.D.8-1 and IV.D.8-2). Using the assumptions in Table IV.A.1-1, the number of wells, platforms, shore bases, and kilometers of pipeline are input to the Manpower Model. The Manpower Model predicts the number of direct oil industry workers. These data are input to the RAM. Among other variables, the RAM predicts the resident workers and resident population. The term "job" or the term "employee" is used in this section to mean one full-time-equivalent worker working for 1 year. A "resident worker" is defined as a resident of the NSB.

Jobs working directly for the oil industry in activities associated with Alternative III also will be available. However, the number of NSB Native residents working directly for oil companies in and near Prudhoe Bay historically has been low, approximately 60 out of more than 6,000 workers or about 1 percent of the total (UAA, ISER, 1993). While the proposed sale is projected to generate a large number of direct oil-industry jobs in the region, the number of jobs filled by permanent Native residents of the region is not projected to be large. It is assumed NSB resident Natives will hold approximately 1 percent of the oil-industry jobs, based on historical experience.

Employment generated in the event of oil-spill-cleanup activities also would have economic effects. The most relevant historical experience of a spill in Alaskan waters was the EVOS in 1989, which spilled 240,000 bbl. This spill generated enormous employment that rose to the level of 10,000 workers directly doing cleanup work in relatively remote locations. Smaller numbers of cleanup workers returned in the warmer months of each year following 1989 until 1992. Numerous local residents quit their jobs to work on the cleanup at often significantly higher wages. This generated a sudden and significant inflation in the

local economy (Cohen, 1993). Similar effects on the NSB would be mitigated due to the likelihood that cleanup activities, including administrative personnel and spill-cleanup workers, would be located in existing enclave-support facilities.

The number of workers actually used to clean up a possible two 7,000-bbl oil spills associated with Sale 170 would depend to a great extent on what procedures were called for in the oil-spill-contingency plan, how well prepared with equipment and training the entities responsible for cleanup were, how efficiently the cleanup was executed, and how well coordination of the cleanup was executed among numerous responsible entities. Activities associated with Sale 170 could generate cleanup work for about 3 percent of the workers associated with the EVOS—or 300 cleanup workers for 6 months in the first year, declining to zero by the fourth year following the spill.

c. Effects of Subsistence Disruptions on the North Slope Borough Economy: Disruptions to the harvest of subsistence resources could affect the economic well-being of NSB residents primarily through the direct loss of subsistence resources. See Section IV.D.9 for effects on the subsistence-harvest patterns.

Summary: For Alternative III, exploration, development, and production is projected to generate increases in property taxes above the levels without the sale starting in the year 1998 and average about 0.8 to 1.6 percent above the level without the sale each year through the production period. This is about 20 percent less than Alternative I.

Direct oil-industry employment in an enclave is anticipated to peak in the range of 1,300 to 1,600 jobs during the development phase, decline to a level in the range of 600 to 1,050 in 2011 to 2022, and then decline further to the range of 400 to 1,050 by 2027. Of these direct oil-industry jobs, 1 percent is anticipated to be held by resident NSB Natives. This is about 10 to 20 percent less than Alternative I.

Total resident employment is anticipated to increase in the range of 65 to 85 jobs in the peak of production and level off to 21 to 38 in the production phase after 2011. The peak increase during development is about 4 to 5 percent greater than resident employment without the development of Alternative III resources and about 1.5 to 3 percent greater during the production phase. This is about 20 percent less than Alternative I.

The cleanup operation of an oil spill would generate jobs for up to 300 cleanup workers for 6 months in the first year, declining to zero by the fourth year following the spill. This is the same as for Alternative I.

Disruptions to the harvest of subsistence resources could affect the economic well-being of NSB residents primarily through the direct loss of subsistence resources. See Section IV.D.9 for conclusions on the effects on the subsistence-harvest patterns.

Regarding the Kaktovik Deferral, the change in economic effects to the area deferred is zero. The economic effects (on property tax, direct oil-industry employment, and resident employment) are external to the area deferred.

Conclusion: Alternative III exploration, development, and production would generate increases that are less than those for Alternative I by 10 to 20 percent for property tax, direct oil-industry employment, and resident employment. Alternative III cleanup operation for an oil spill would generate employment the same as for Alternative I.

9. Subsistence Harvest Patterns: An oil spill in the midst of this area of intensive subsistence activity would disrupt subsistence harvests more than an oil spill that might originate in another part of the sale area. Under this alternative, the OSRA estimates a 35- to 57-percent chance of one or more spills ≥1,000 bbl occurring, a slight reduction in oil-spill risks from Alternative I. Land Segments 36 through 45 include much of the area used by Kaktovik subsistence hunters to harvest marine mammals. The OSRA model estimates a 1- to 4-percent chance of one or more spills ≥1,000 bbl occurring and contacting LS's 36 (Sagavanirktok [Sag] Delta/Bullen Point/Mikkelsen Bay) through 41 (Barter Island) within 180 days over the assumed production life of Beaufort Sea Sale 170. Combined probabilities do not indicate a >5-percent chance of occurrence and contact in any of these land segments. This means a minimal chance of oil-spill occurrence and contact to land segments from the Sag Delta area all the way to Barter Island and a <0.5-percent chance of occurrence and contact to land segments from Barter Island to Demarcation Bay. Oil-spill contact in winter could affect polar bear hunting and sealing. Bird hunting, sealing, and whaling, as well as the ocean netting of fish, could be affected by a spill during the open-water season.

Noise and disturbance also would affect Kaktovik's subsistence activities. While this deferral alternative would not substantially change biological effects to populations of subsistence species, it would eliminate blocks in a large portion of Kaktovik's marine and coastal subsistence-harvest area and, thus, may offer some mitigation from noise and traffic disturbance to this community's hunters. However, aircraft and vessel traffic and noise from seismic activity in previously leased areas within the deferred area would be expected to continue. Effects to bowhead and belukha whales, seals, polar bears, and fishes, from the slight reductions of noise and construction disturbance, oil-spill cleanup, and oil-spill risks under Alternative III would remain essentially similar to the effects under Alternative I. Under Alternative III, disturbance and oil-spill effects on caribou are expected to

be reduced (as the miles of onshore pipeline and accompanying effects would be reduced). Effects to marine and coastal birds and their habitats east and offshore of Barter Island and Camden Bay could be reduced as well.

Regarding the Kaktovik Deferral, fewer fishes would be exposed to noise from oil and gas activities under the deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted. Fishes would be exposed to fewer disturbances as a result of these activities and a decrease in drilling discharges, which would also reduce alterations to fish habitat. Effects to fishes from support activities also would be reduced. Overall, the magnitude of disturbance to fishes in the deferred area would be reduced from that of Alternative I. It is likely that fewer bowhead whales would be exposed to noise and disturbance under this deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted with the area deferred. However, bowhead whales within the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur both inside and outside the deferral area. It should be noted that these activities may occur in the deferral area without additional leasing, because leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales. Exposure of bowhead whales to noise-producing activities, whether inside or outside the deferral area, is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects. Likewise, any oil spill that may occur either on leases outside the deferral area or on leases within the deferral area has the potential to be present within the deferral area. Expected effects on bowheads from Alternative III would be similar to the effects expected under Alternative I. While fewer whales may be exposed to oil and gas activities under the deferral than under Alternative I, the extent and nature of the effects and the overall effect on the population is likely to be essentially the same as Alternative I. Under Alternative III, nearly all sources of disturbance to marine and coastal birds would be eliminated from the area offshore of Camden Bay; elsewhere, no reduction is expected in the minor disturbance effects resulting from Alternative I. The chance of spill occurrence and contact with habitats from Gwydyr Bay eastward, particularly in the area offshore Barter Island, is reduced from Alternative I to a variable extent, thereby reducing risk of oil-spill effects on birds and their habitats. However, risk of oil-spill contact remains substantial in the ice/sea segment offshore of Camden Bay; postnesting birds that enter this area in the presence of spilled oil are expected to sustain spill-generated losses as discussed for Alternative I (up to several thousand individuals). The effects of any such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the population and survey methods/data available. The potential loss of small numbers of seals and belukha whales from oil spills is not expected to occur offshore of Kaktovik, and the loss of an estimated 20 to 40 polar bears on or near the coast of Kaktovik would not occur. However, such losses are still expected to occur to the polar bear population (which includes some of the bears that occur in the Kaktovik area), if the 7,000-bbl spill contacts other polar bear concentrations at whale carcass sites at Cross Island, Barrow, or other locations where whales die and end up onshore. The effect of the 7,000-bbl spill on seals and belukha whales west of the area offshore of Kaktovik is expected to be similar. Potential noise and disturbance from aircraft and vessel traffic including seismic operations and habitat alteration from platform and pipeline installation would not occur in the area offshore of Kaktovik but, even without the deferral, these effects were expected to be short-term and not affect pinniped, polar bear, and belukha whale populations. Therefore, the removal of exploration and development offshore of Kaktovik is not expected to reduce the overall levels of effect on pinniped, polar bear and belukha whale populations over those described under Alternative I. Regarding the reduced effects to the Kaktovik area on caribou, the 7,000-bbl spill would not occur in the area offshore of Kaktovik, and the potential loss of an estimated 1,500 to 3,000 PCH caribou would not occur along the coast. The effect of Alternative III on PCH caribou is expected to be reduced somewhat from that of Alternative I; however, the overall effect on CAH caribou is expected to be about the same: local displacement of cow-calf groups along onshore pipelines, with this local effect persisting for more than one generation and the loss of a small number of caribou and a relatively small area of habitat contamination from oil spills. Regarding the area offshore of Kaktovik, reduced effects to subsistence-harvest patterns in the community of Kaktovik would come from reduced effects described above from noise and disturbance and oil spills on subsistence fish, bowhead whale, bird, marine mammal, and caribou populations. Decreased disturbance to subsistence species, habitats, harvests, and access from oil-spill-cleanup activity would be expected, as potentially spilled oil would contact shoreline areas after a longer period of weathering. Even with these effects reductions, effects would be essentially those expected for Alternative I with subsistence resources affected for up to an entire season (1 year), but with no resource becoming unavailable, undesirable for use, or experiencing overall population reductions.

Conclusion: Under Alternative III, effects as a result of disturbance and oil spills on subsistence-harvest patterns in the community of Kaktovik are expected to be slightly reduced from those expected from Alternative I. Effects would be expected to affect subsistence resources for up to an entire season (1 year), but no resource would become

unavailable, undesirable for use (although an oil spill affecting any portion of the bowhead whale-migration route might taint resources or create the perception of tainting that would affect the subsistence hunt), or experience overall population reductions. The effects from the Kaktovik Deferral Alternative on the subsistence-harvest patterns for Barrow and Nuiqsut would be the same as for Alternative I.

10. Sociocultural Systems: Alternative III, the Kaktovik Deferral, would reduce slightly the onshore industrial activities and population and employment projections for this sale, because the resource estimate for this alternative is lower, reduced from 350 to 670 MMbbl to 240 to 480 MMbbl; basic exploration, development and production, and transportation assumptions would be reduced accordingly from those expected for Alternative I. Under this alternative, the OSRA estimates a 35- to 57-percent chance of one or more spills ≥1,000 bbl occurring, a slight reduction in oil-spill risk from Alternative I. Land Segments 36 through 45 include much of the area used by Kaktovik subsistence hunters to harvest marine mammals. The OSRA model estimates a 1- to 4-percent chance of one or more spills ≥1,000 bbl occurring and contacting LS's 36 (Sag Delta/Bullen Point/Mikkelsen Bay) through 41 (Barter Island) within 180 days over the assumed production life of Beaufort Sea Sale 170. Combined probabilities do not indicate a >5 percent-chance of occurrence and contact in any of these land segments. This means a minimal chance of oil-spill occurrence and contact to land segments from the Sag Delta area all the way to Barter Island and a <0.5-percent chance of occurrence and contact to land segments from Barter Island to Demarcation Bay. Effects to subsistence resources from disturbance and oil spills would remain essentially the same as those for Alternative I. Employment is expected to be reduced 20 percent from Alternative I, but local employment changes in the community of Kaktovik would be slight.

Regarding the Kaktovik Deferral, effects on sociocultural systems from changes in population and employment, effects on subsistence-harvest patterns, and effects from possible oil spills and oil-spill cleanup in the community of Kaktovik are expected to be slightly reduced but are expected to produce the same levels of effect as Alternative I. Potential disturbance effects could disrupt sociocultural systems for an entire season (1 year) and create disruption to institutions and sociocultural systems, but these disruptions are not expected to displace ongoing sociocultural institutions; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources.

Conclusion: Under Alternative III, effects on sociocultural systems resulting from industrial activities, changes in population and employment, effects on subsistence-harvest patterns, and effects from possible oil spills and oil-spill cleanup are expected to disrupt sociocultural systems. The effects from the Kaktovik Deferral Alternative on the sociocultural systems in the community of Kaktovik are expected to be slightly reduced form those expected for Alternative I due to decreases in oil-spill risks and construction and oil-spill-cleanup disturbance. Effects to sociocultural systems in the communities of Barrow and Nuiqsut would be the same as for Alternative I.

11. Archaeological Resources: Under Alternative III, the effects to archaeological resources would be similar to those under the Alternative I analysis in Section 4.B.11. The expected effect on archaeological resources should be low because of the requirement for review of geophysical data prior to any lease activities. Although oil-spill effects on onshore archaeological resources are uncertain, data from the EVOS indicate that few onshore archaeological resources (<3%) are likely to be significantly affected by an oil spill.

Therefore, the removal of exploration and development offshore of Kaktovik is not expected to reduce the overall effect on archaeological resources as described under Alternative I.

Conclusion: The effects from the Kaktovik Deferral Alternative (Alternative III) would be the same as for Alternative I.

12. Air Quality: The exploration and development and production scenario for Alternative III is nearly the same as for Alternative I; the only difference is that an area along the coast of the Beaufort Sea immediately north and east of Kaktovik would not be leased. This would not significantly affect the activities under the scenario and, consequently, the effect on air quality is expected to be low (see Sec. IV.B.12).

Regarding the area immediately north and east of Kaktovik, the removal of or reduced effects to area immediately north and east of Kaktovik on air quality are as follows: There would be no exploration or development to directly produce emissions in the area immediately north and east of Kaktovik. The potential to effect air quality would not occur in the area immediately north and east of Kaktovik.

Conclusion: The effects of Alternative III on air quality are expected to be the same as for Alternative I.

13. Land Use Plans and Coastal Management Programs: Under this alternative, the OSRA estimates a 35- 57-percent chance of one or more spills ≥1,000 bbl occurring (compared to a 46-70% chance for Alternative I), resulting in a reduction of risks of occurrence and contact from the Sag River Delta area to Demarcation Point. This deferral alternative would not substantially change

biological effects to populations of subsistence species; it would eliminate blocks in a large portion of Kaktovik's marine and coastal subsistence-harvest area and, thus, may offer some mitigation from noise and traffic disturbance to this community's hunters. However, aircraft and vessel traffic and noise from seismic activity in previously leased areas within the deferred area would be expected to continue. Effects to bowhead and belukha whales, seals, polar bears, and fishes, from the slight reductions of noise and construction disturbance, oil-spill cleanup, and oil-spill risks under Alternative III would remain essentially similar to the effects under Alternative I. Under Alternative III, disturbance and oil-spill effects on caribou are expected to be reduced (as the miles of onshore pipeline and accompanying effects would be reduced). Effects to marine and coastal birds and their habitats east and offshore of Barter Island and Camden Bay could be reduced as well. However, overall effects would be essentially those expected for Alternative I with subsistence resources affected for up to an entire season (1 year), but with no resource becoming unavailable, undesirable for use, or experiencing overall population reductions (Sec.IV.D.9, Subsistence-Harvest Patterns).

Regarding the Kaktovik deferral, there would be a slight reduction in the probability of an oil spill contacting Kaktovik's subsistence-harvest areas as well as a reduction of noise and disturbance levels in the western portion of Kaktovik's subsistence-harvest area. However, aircraft and vessel traffic and noise from seismic activity in previously leased areas within the deferred area would be expected to continue. Even with these effects reductions, effects would be essentially those expected for Alternative I with subsistence resources affected for up to an entire season (1 year), but with no resource becoming unavailable, undesirable for use, or experiencing overall population reductions (Sec.IV.D.9, Subsistence-Harvest Patterns).

Conclusion: For Alternative III, the effects of potential conflicts on land use plans and coastal management programs are expected to be the same as for Alternative I: conflicts could occur with specific Statewide standards and NSB CMP policies related to the potential for user conflicts between development activities and access to subsistence resources. Conflicts are possible with the NSB CMP policy related to adverse effects on subsistence resources. These effects would occur in the unlikely event of spilled oil contacting subsistence resources and habitats, and the activities associated with oil-spill cleanup. No conflicts are anticipated for the exploration-only situation, with the exception that the Kaktovik Deferral Alternative would reduce the possibility of conflicts with the Kaktovik subsistence-harvest area by reducing the possibility of noise-related disturbances affecting the harvest area.

E. ALTERNATIVE IV - CROSS ISLAND AREA:

The Cross Island Area being considered under Alternative IV is a "special area" consisting of 43 blocks defined by a 10-mi radius around Cross Island (Fig. II.D.1). This is a special area viewed by the community of Nuiqsut as their primary staging and harvest area for the bowhead whale and other marine mammals. Alternative IV is examined in this EIS as two options: option IV.a. analyzes a deferral of the defined Cross Island Area designed to provide a buffer around Cross Island, and option IV.b. analyzes the application of special mitigation to protect the area in lieu of deferral.

Alternative IV.a (deferral) would result in the offering of 320 blocks or 636,749 ha (1.57 million acres), approximately 93 percent of the lease area of Alternative I (Fig. II.D-1). The area that would be deferred under Alternative IV.a includes 43 blocks covering 51,251 ha (126,641 acres), reducing the possibility of space-use conflicts and minimizing noise disturbance to migration routes of bowhead whales and subsistence-harvest areas by the residents of Nuiqsut in the vicinity of Cross Island.

Alternative IV.b analyzes the effects of special mitigation developed to protect the defined area around Cross Island in lieu of deferral. A new special stipulation was developed for Alternative IV.b, the Cross Island Area. Stipulation 6, Permanent Facility Siting in the Vicinity of Cross Island, prohibits permanent OCS production facility siting within a defined 10-mi radius around Cross Island, unless the lessee can demonstrate that permanent facility siting will not preclude reasonable subsistence access for hunting bowhead whales. This stipulation requires lessees to follow a defined process and requirements for consultation with the AEWC and NSB to mitigate unreasonable conflicts established under Stipulation 5, Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities.

The resource estimates forecast for the Alternative IV area range from 280 MMbbl at the $18-per-barrel level to 550 MMbbl at the $30-per-barrel level. This resource level is about 80 percent of the forecasted resources of Alternative I. For Alternative IV.a, there would be a general across-the-board decline of 10 to 25 percent in associated infrastructure (wells, platforms, and pipeline miles). However, no pipeline landfalls would be eliminated. Resource-development timeframes are not different from those of Alternative I. Table IV.A.1-1 and Table A-4 in Appendix A show the essential developmental timeframes for platforms and well numbers and other infrastructure requirements relevant for Alternative IV.a. The addition and analysis of this deferral in this document was supported by the city of Nuiqsut, the North Slope Borough, the Arctic Slope Native Association, and the Alaska OCS Advisory Committee.

In the following analyses of impacts on environmental and socioeconomic resources, the effects of area deferral (Alternative IV.a) are considered first and then followed by an analysis of effects of applying the special mitigation identified above for option IV.b in lieu of deferral.

1. Water Quality:

a. Effects of the Deferral: The agents associated with petroleum exploitation that are most likely to affect water quality are the permitted discharges from exploration drilling units and production platforms, turbidity from construction activities, and hydrocarbons from oil spills. For Alternative IV.a, there is an 18- to 20-percent reduction in the estimated oil production, and this decrease results in some reductions in the estimated level of activities (Table IV.A.1-1). For the permitted discharges, the basic unit area in the receiving waters that would be affected by the discharges from well drilling or production activities is the same as those defined for Alternative in Section IV.B.1.a; also estimated in this section is the amount of time the waters would be affected. With the reduced resource estimate, there potentially is a 20- to 33-percent reduction in the number of areas where permitted discharges might occur; 9 to 12 exploration/delineation wells, and 2 to 4 production platforms (Table IV.A.1-1).

Water quality within an area of about 0.03 km^2 (100-m radius) around each exploratory drilling unit or production platform would be temporarily degraded during active discharge of drilling muds and cuttings. The toxicity of the drilling muds generally is low, and the concentrations of the bulk constituents become nontoxic at the dilutions reached shortly after discharge. For Alternative IV.a, as compared to Alternative I, there is an estimated (1) 25-percent reduction in the number of exploration/delineation wells drilled and weight of muds (5,670-7,560 short tons) and cuttings (7,380-9,840 short tons) discharged and (2) about a 20-percent reduction in the number of production/service wells drilled (70-89 wells) and weight of muds (10,500-60,520 short tons) and cuttings (82,600-105,020 short tons) discharged (Table IV.A.1-1).

If produced waters are discharged into the Beaufort Sea, the water quality in an area of several square kilometers would be degraded. The toxicity of produced waters mainly is caused by hydrocarbons that include nonvolatile hydrocarbons (EPA oil and grease) and aromatic hydrocarbons. Oil and grease concentrations in formation waters discharged into the Arctic marine environment would be limited to a 29 mg/l (29 ppm) monthly average by the current Arctic NPDES General Permit. Assuming the water-to-oil ratio is between 0.35 and 0.62, the production of formation waters over the 20 years of production is estimated to range from about 98 to 341 MMbbl. The quantity of produced waters discharged over the life of the fields would be reduced by about 18 to 20

percent compared to similar activities associated with Alternative I; and this also decreases the amount of toxic substances, oil and grease, and aromatic hydrocarbons that might be discharged into the Beaufort Sea.

The turbidity associated with each type of offshore-construction activity would be increased in an area of about 4 km^2 at any one time. The decrease in the number of exploration/delineation wells (25%) and length (48-80 km) of offshore pipeline (17-25%) indicates a potential reduction in the number of areas that might be temporarily affected by an increase in the concentration of suspended particulate matter in the water column.

Small spills (<1,000 bbl) associated with exploration and production activities would result in local, chronic contamination of the waters within the margins of the fields. The instances of small spills (70-135) would be reduced by about 17 to 18 percent, and the volume of oil spilled (829-1,454 bbl) would be reduced by about 7 to 24 percent compared to Alternative I (Table IV.A.2-3).

The effects of a ≥1,000-bbl spill would be the same as described for Alternative I (Sec. IV.B.1.c). A spill of 7,000 bbl could, for about a month, temporarily contaminate water in an estimated area of <400 km^2, with hydrocarbons above the chronic criterion of 0.015 ppm. There is a 39- to 62-percent chance of a spill ≥1,000 bbl occurring, and this is slightly less than the chance estimated for Alternative I (Table IV.A.2-1). Concentrations above the 1.5-ppm-acute criterion may occur in an area <75 km^2 during the first several days of a spill. Regional, long-term degradation of water quality to levels above State and Federal criteria because of hydrocarbon contamination is very unlikely.

For the deferral alternative, petroleum exploration and development and production would not occur in the deferred (not available for oil and gas leasing) area. Thus, there would be no direct discharges of any permitted substances into the waters of the area. The number of exploration and delineation wells that might have been drilled in the deferred area is estimated to be 3 to 4. The amount of muds and cuttings associated with these wells is estimated to be about 1,890 to 2,520 and 2,460 to 3,280 short tons, respectively—about a 25-percent reduction from Alternative I.

It is estimated that one production facility could have been installed in the deferred area. The number of production and service wells associated with this facility is estimated to range from 17 to 22. Drilling these wells would have used 2,550 to 14,960 short tons of drilling muds and produced 20,020 to 25,960 short tons of cuttings—about 20 percent of both the muds and cuttings associated with Alternative I. Produced waters from the production facility would range from 24 to 74 MMbbl—about 18 to 24 percent of the amount associated with Alternative I. The decrease in produced waters also represents a reduction in the amount of toxic substances, oil and grease, and aromatic hydrocarbons that might be discharged into the waters off the ANWR.

Reducing the number of exploration and delineation well sites, production facility sites, and length of offshore pipeline reduces the number of areas that might be temporarily affected by an increase in the concentration of suspended particulate matter in the waters column by 25 to 50 percent as compared to Alternative I.

It is unlikely there would be any oil spills in the deferred area. Petroleum exploitation in the deferred area could have resulted in an estimated 15 to 29 spills ≥1 and <1,000 bbl, for a total of 61 to 451 bbl for the life of the field(s). The number of spills and the amount of oil spilled represents about an 18 and 7 to 24 percent, respectively, of the number of spills and the amount spilled that are estimated for Alternative I.

However, substances that enter the water column as a result of activities in other areas that could be open to oil and gas leasing could be transported into the waters of the deferred area—depending on the time of year and the direction of the winds and currents. Some areas that have been leased for oil and gas development lie adjacent to the deferred area. The concentration of the substances entering the waters of the deferred area would depend on the amount discharged or spilled, the distance the source is from the deferred area, and the amount of mixing and dispersion—which are functions of the waves and currents.

Conclusion: In comparison to Alternative I, the reductions in the permitted discharge quantities and areas affected by increased turbidity from offshore construction activities might range from about 18 to 25 percent and 17 to 25 percent, respectively.

b. Effects of Special Mitigating Measures: There are no special mitigating measures that apply to water-quality resources for this alternative.

Conclusion: Special mitigating measures would have no effect in this alternative.

2. Lower Trophic-Level Organisms:

a. Effects of the Deferral: Activities that may affect lower trophic-level organisms include drilling discharges, seismic surveys, construction, and those associated with an accidental oil spill. The effects of these activities and the agents associated with them already have been discussed for Alternative I . This analysis for Alternative IV.a considers differences in the amount of exposure lower trophic-level organisms would have to

these activities/agents for as compared to those of Alternative I. It then estimates the resulting effect of these differences on lower trophic-level organisms.

Alternative IV.a involves fewer drilling discharges, seismic surveys, and construction-related activities than Alternative I (Table IV.A.1-1). However, there is not enough difference in their number or magnitude to alter the expected effect of these activities on lower trophic-level organisms. Concerning the potential effect of an accidental oil spill, Alternative IV.a deletes about 6 percent of the eastern portion of the Alternative I sale area. This would eliminate any OCS activity in the deferral area and would eliminate it as an area where a platform or pipeline oil spill could originate. However, due to the normal westward pattern of wind and water currents in this area, any platform or pipeline oil spill occurring to the east of the deferral area is likely to contact it as well. Further, any spill occurring to the west is likely to contact the deferral area if the wind and/or water currents shifted eastward. Hence, Alternative IV.a offers little advantage over Alternative I regarding contact with a potential oil spill. However, if the wind and water currents were moving westward following an oil spill, and if that spill originated in the vicinity of the deferral area, Alternative IV.a would reduce the probability of it contacting the deferral area by eliminating platforms and pipelines from that area. This would slightly reduce the oil related adverse effects on lower trophic-level organisms estimated for Alternative I (lethal and sublethal effects on <1 percent of the plankton and invertebrate larva and <5 percent of the epontic community [assuming a winter spill] in the sale area). However, because the estimated effects of Alternative I are so low, Alternative IV.a is not expected to measurably benefit lower trophic-level organisms in the sale area. Hence, Alternative IV.a is expected to have essentially the same effect on lower trophic-level organisms within the sale area as Alternative I.

Alternative IV would affect lower trophic-level organisms within the deferral area as follows: It eliminates or reduces the estimated adverse effects of drilling discharges, seismic surveys, and construction-related activities on lower trophic-level organisms within deferral area, which were estimated for Alternative 1 as lethal and sublethal effects on <1 percent of the benthic organisms in the sale area. If wind and water currents are moving westward following an oil spill, Alternative IV would reduce the probability of oil contacting the deferral area by eliminating platforms and pipelines from that area. This would reduce or eliminate the adverse effects of oil on lower trophic-level organisms within the deferral area, estimated for Alternative 1 as lethal and sublethal effects on <1 percent of the plankton and invertebrate larva and <5 percent of the epontic community in the sale area. However, if wind and water currents are moving eastward following an oil spill, the deferral area probably would be contacted as well, and Alternative IV would not reduce or eliminate adverse effects in the deferral area. Alternative IV also would eliminate all of the beneficial effects of platform placement within the deferral area, which otherwise would have been colonized by lower trophic-level organisms requiring a hard substrate for attachment.

Conclusion: Alternative IV.a is expected to have essentially the same effect on lower trophic-level organisms as Alternative I.

b. **Effects of Special Mitigating Measures:** In addition to the standard stipulations, Stipulation 6 is analyzed for Alternative IV.b, which prohibits permanent OCS production siting within a 10-mi radius around Cross Island. Because permanent OCS production siting outside this 10-mi radius is equally likely to adversely affect lower trophic-level organisms within the sale area, the implementation of this additional stipulation is not expected to benefit lower trophic-level organisms, or to alter the expected effect of Alternative IV on lower trophic-level organisms.

Conclusion: The special mitigation measure for Alternative IV.b is not expected to benefit lower trophic-level organisms.

3. Fishes:

a. **Effects of the Deferral:** For Alternative IV.a, the types of effects to fishes would be similar to those in Alternative I, except that the magnitude of the effects would be decreased.

The decreased magnitudes of the effects would include the disturbances as a result of discharges; noise and disturbances from seismic surveys; and noise and disturbances from aircraft, vessel, drilling, and construction activities. The number of exploration wells would decrease under Alternative IV to five to six from the six to eight under Alternative I. Shallow-hazard surveys would cover only 115 to 138 km^2 for Alternative IV, whereas theses surveys for Alternative I would cover 138 to 184 km^2. Drilling discharges for Alternative IV would be reduced from 1,890 to 2,520 short tons (dry weight) for drilling muds and 2,660 3,280 short tons (dry weight) for cuttings from Alternative I. The numbers of support activities (helicopter flights and supply-boat trips) also would be reduced (Table IV.A.1-1).

Because of previous Federal lease sales located near the Cross Island area, it is likely that the removal of these blocks would not significantly decrease the aircraft and vessel traffic through or near the Cross Island area. Disturbances from seismic surveys within previously leased areas could be transmitted into the Alternative IV area. However, the intensity of the seismic survey

disturbances would be reduced and unlikely to significantly affect fishes. Under this alternative all seismic surveys are not precluded from being conducted in the Cross Island area. Should seismic surveys be conducted in the area the effects to fishes would be the same as those discussed for Alternative I.

Oil-spill risks would be reduced from those for Alternative I. The range of resources for the Cross Island Area is 280 to 550 MMbbl. This is reduced from the 350 to 670 MMbbl for Alternative I. The OSRA model estimates a 39- to 62-percent probability for the occurrence of one or more oil spills of ≥1,000 bbl over the assumed production life of Alternative I. The OSRA model for combined probabilities estimates a 2- to 14-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 through 10 and Gwydyr Bay (only for July through September) (Fig. IV.A.2-2), depending on whether or not fishes are located in these areas, within 30 days over the production life of Alternative I. Except for I/SS's 8 and 9, which have probabilities of 4 to 9 percent and 8 to 14 percent, respectively, the aforementioned segments have probabilities of contact ≤5 percent. This is a reduction of 2 to 3 percent for I/SS 8 and 1 percent for I/SS 9 from the combined probabilities for Alternative I. If spilled oil contacted fish habitat, the results would be the same as discussed in Section IV.B.3. As with oil spills under the other alternatives, except the no-sale alternative, fishes could experience any of the following as a result of an oil spill: skin contact, respiratory distress from gill fouling, localized reduction in food resources, consumption of contaminated prey, displacement from migratory routes, and temporary displacement from local habitat. In winter, fishes in critical and scarce overwintering nearshore habitats likely would suffer the most lethal effects due their dependency on these habitats and their inability to avoid the spill by moving out of the spill area. These affected fish populations could take many generations to recover, depending on the recruitment into the population. Otherwise, fishes likely would suffer nonlethal effects from an oil spill.

Regarding the Cross Island Deferral, the reduction of effects to fishes are as follows: Fewer fishes would be exposed to noise and disturbance from oil and gas activities under the deferral than under Alternative I. The reduction in the magnitude of the effects would result from fewer wells being drilled, less seismic activity being conducted, and less drilling muds and cuttings being discharged. A decrease in drilling discharges also would reduce alterations to fish habitat. However, fishes located in the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur inside and/or outside the deferred area. This could result from lease activities from previous Federal lease sales being granted adjacent to and within this alternative's area. Fewer fishes would be exposed to the types of effects from oil and gas activities under the deferral than under Alternative I.

Conclusion: The level of disturbance for Alternative IV.a would be reduced from that of Alternative I. The types of effects fish resources are exposed to from Alternative IV.a likely would be similar to those expected under Alternative I and its resource-development scenario.

b. Effects of Special Mitigating Measures:

Stipulations 1 and 5 described under Alternative I afford protection to fish resources in the Sale 170 area. Alternative IV.b has Stipulation 6 as a special mitigating measure. This stipulation states that no permanent OCS production facility will be sited within a defined 10-mi radius around Cross Island, unless the development will not preclude reasonable subsistence access to whales. This special mitigating measure does not include the construction of undersea pipelines in the Cross Island area.

Conclusion: The special mitigating measure does not provide any additional protection to the fish resources in the Cross Island Area, especially since undersea pipelines can be constructed in and through the area.

4. Endangered and Threatened Species:

a. Effects of the Deferral:

(1) The Bowhead Whale: The Cross Island Deferral Alternative (Alternative IV.a) would remove approximately 6 percent of the overall Sale 170 proposal area, providing a buffer (10-mi radius) around Cross Island to minimize conflicts between petroleum activities and subsistence whaling by the residents of Nuiqsut (Fig. II.C-1). The resource estimate and development scenario for Alternative IV.a would provide a potential reduction in oil-spill effects on endangered and threatened species and their habitats in the Cross Island area.

Alternative IV.a may reduce slightly the potential for adverse effects to bowhead whales as a result of discharges, noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and construction activities and oil spills as a result of exploration and development and production activities, as compared to the scenario presented in Alternative I, because additional leasing would not take place within the area of this alternative. An estimate of these activities is provided in Table IV.A.1.1.

Noise from drilling and seismic activities has the most potential to affect bowhead behavior. It is estimated that the number of exploration wells drilled would be reduced from six to eight wells under Alternative I to five to six wells as a result of the deferral, and the number of delineation wells would be reduced from six to eight wells

to four to six wells. The area included in shallow-hazards seismic surveys would be reduced from an estimated 138 to 184 km^2 under Alternative I to an estimated 115 to 138 km^2 as a result of the deferral. Bowhead whales exposed to noise from exploration and development and production activities may experience temporary, nonlethal effects. Some bowheads may avoid areas near the activities. It is likely that fewer whales would be exposed to noise from these activities under Alternative IV.a than under Alternative I. However, with or without the deferral, the overall migration is not likely to be affected, and the overall effect on the population is likely to be essentially the same as under Alternative I.

Oil-spill risks to bowhead whales would be reduced compared to Alternative I. The range of resources would be reduced to 280 to 550 MMbbl as compared to 350 to 670 MMbbl for Alternative I. During development/ production activities, the OSRA estimates a 39- to 62-percent chance of one or more spills ≥1,000 bbl occurring compared to a 46- to 70-percent chance under Alternative I (Table IV.A.2-1). For combined probabilities, the OSRA model estimates a 2- to 14-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 through 9, where bowheads may be present during the fall migration within 30 days over the production life of Alternative I. The probability of contact in I/SS's 8 and 9, the areas of highest probability of contact, is estimated at 4 to 9 percent and 8 to 14 percent, respectively. This is a reduction in oil-spill risk for this alternative as compared to Alternative I, where the probability of contact in I/SS's 8 and 9 is estimated at 6 to 12 percent and 8 to 15 percent, respectively. If spilled oil were to contact a whale-habitat area, resulting effects would be as discussed under Alternative I (Sec. IV.B.4). Some bowhead whales could experience one or more of the following: skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of contaminated prey items, and perhaps temporary displacement from some feeding areas. Some individuals might be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals so affected is expected to be small. Overall, exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, with the population recovering to prespill population levels within 1 to 3 years. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects. Effects on bowheads expected for this alternative would be similar to the effects expected under Alternative I.

Regarding the Cross Island deferral, the effects on bowhead whales within the deferred area are as follows: It is likely that fewer whales would be exposed to noise from these activities under the deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted with the area deferred. However, bowhead whales within the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur both inside and outside the deferral area. It should be noted that these activities may occur in the deferral area without additional leasing, because leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales. Drilling operations and seismic surveys may be conducted on these leases and aircraft and vessel traffic may cross the area en route to these leased blocks. These activities could disturb low numbers of bowheads and cause some bowheads to avoid areas near the activities. In addition, noise from seismic surveys or drilling operations within leased blocks outside of the deferral area could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels and would be unlikely to significantly displace feeding or migrating whales. The effect of noise on bowheads, with or without the deferral, would be as described for Alternative I, with whales avoiding vessels, seismic surveys, drilling units, and production platforms at varying distances. Exposure of bowhead whales to noise-producing activities, whether inside or outside the deferral area, is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects.

Likewise, any oil spill that may occur either on leases outside the deferral area or on leases within the deferral area has the potential to be present within the deferral area.

Conclusion: Effects on bowheads expected from Alternative III would be similar to the effects expected under Alternative I. While fewer whales may be exposed to oil and gas activities under the deferral than under Alternative I, the extent and nature of the effects and the overall effect on the population is likely to be essentially the same as under Alternative I.

(2) The Spectacled Eider, the Steller's Eider, and the Arctic Peregrine Falcon:

Spectacled Eider: The buffer area defined by this alternative potentially may be used by spectacled eiders during summer and fall staging prior to migration. Because leasing would not take place within the area deferred by Alternative IV.a, the potential for adverse effects on eiders from discharges, noise and visual disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and construction associated with exploration and development or production, and any oil spills during the latter phases, may be reduced slightly compared to Alternative I. An estimate of these activities is provided in Table IV.A.1.1.

However, leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales, and aircraft and vessel traffic may cross the

area en route to these leased blocks. This traffic could disturb small numbers of eiders for a few minutes once or twice per day and cause them to avoid areas near vessel activities or aircraft corridors. In the area remaining to be offered for lease, the effect on spectacled eiders would be as described for Alternative I, with flocks avoiding areas within a few kilometers of three to five routinely used aircraft corridors and a few hundred meters of vessels, drilling units, and production platforms. Exposure of spectacled eiders to disturbing activities is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects that could be considered a "take" under the ESA.

Oil-spill risk to spectacled eiders would be reduced minimally as a result of reducing the resource range from 350 to 670 MMbbl for Alternative I to 280 to 550 MMbbl under this alternative. During development/production activities, the OSRA estimates a 39- to 62-percent chance of one or more spills ≥1,000 bbl occurring, as compared to a 46- to 70-percent chance under Alternative I (Table IV.A.2-1). The OSRA model estimates, over the production life of Alternative IV.a, a 2- to 14-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 through 9, where eiders may be present during summer or fall migration, within 30 days (Anderson et al., 1997; Table 16). This represents a I-percent reduction from Alternative I (Table 10). If spilled oil were to contact an eider foraging habitat area, effects would be as discussed under Alternative I (Sec. IV.B.4). Any substantial contact with eiders is assumed lethal, and the consumption of contaminated prey items may cause various sublethal pathological effects. Relatively low mortality is expected from an oil spill (<300 individuals); however, unless mortality is near the lower end of this range (e.g., 25), recovery from spill-related losses is not expected to occur if the current population status persists. A localized reduction in food resources and possible temporary displacement from some feeding areas also could result from a spill. Effects on the spectacled eider expected for Alternative IV.a would be similar to those expected under Alternative I, because essentially the same number of eiders are likely to be affected and the extent and nature of the effects are likely to be similar.

Under Alternative IV.a, support traffic to and operations on existing leases, and seismic or emergency activities, may result in short-term displacement of staging spectacled eider flocks from local foraging areas within the deferral adjacent to these leases lasting a few minutes to <1 day. If such displacement is routine when birds are present, declines in fitness could occur, but this is expected to impact only the small numbers potentially occurring in this area and cause only minor effects. Most potential sources of disturbance (transport, exploration rig operation, and construction and operation of platforms) would be eliminated from the area surrounding Cross Island by this deferral. Although the probability of spilled oil contacting areas offshore of Cross Island, where birds that have nested on the mainland may forage and stage prior to migration, remains substantial (up to 61%) under this alternative, the chance of nearshore or shoreline contact is reduced to <8 percent for most areas. More importantly, the probability of a spill occurring and contacting ice/sea segments or shoreline are reduced to <10 and <4 percent, respectively, and a spill is likely to be weathered and dispersed by the time the few eiders that may occur here are present. As a result, any spill-related losses of spectacled eiders is expected to be extremely low, as is the chance of such losses occurring under this alternative. The effects of any losses may be significant at the population level, but may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Conclusion: Effects on spectacled eiders under Alternative IV.a would be similar to the effects expected under Alternative I, because the level of activity is likely to be similar, essentially the same number of eiders are likely to be affected, and the extent and nature of the effects are likely to be similar.

Steller's Eider: The buffer area defined by this alternative is not expected to be used by Steller's eiders because their nearest nesting area is located south of Barrow and few sightings of this species have been made east of the Colville River since 1989. Because leasing would not take place within the area deferred by Alternative IV.a, the potential for adverse effects on any eiders that may occur there from discharges, noise and visual disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and construction associated with exploration and development or production, and any oil spills during the latter phases, may be reduced slightly compared to Alternative I.

Although leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales, and aircraft and vessel traffic may cross the area en route to these leased blocks, the lack of occurrence of Steller's eiders suggests that virtually no disturbance of this species would occur. In the area remaining to be offered for lease, the effect on Steller's eiders would be as described for Alternative I, with flocks avoiding areas within a few kilometers of three to five routinely used aircraft corridors and a few hundred meters of vessels, drilling units, and production platforms. Exposure of Steller's eiders to disturbing activities is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects that could be considered a "take" under the ESA.

The rarity of Steller's eiders in the vicinity of the ANWR suggests that this species' population is unlikely to be

adversely affected by factors associated with oil-development activities in this area.

Conclusion: Effects on Steller's eiders under Alternative IV.a would be similar to the effects expected under Alternative I, because the level of activity is likely to be similar, essentially the same number of eiders are likely to be affected, and the extent and nature of the effects are likely to be similar.

Arctic Peregrine Falcon: The buffer area defined by this alternative is not expected to be used by arctic peregrine falcons, because their typical nesting areas lie inland from the coast, any coastal foraging probably would not occur very far offshore, and coastal movements by subadults or postbreeding individuals are not expected to occur offshore. Although the probability of oil-spill occurrence and shoreline contact is minimally reduced from Alternative I under this alternative, virtually no peregrines would be expected to be oiled directly and few oiled indirectly by taking oiled prey because of infrequent occurrence along the coastal shoreline. Thus, effects on arctic peregrine falcons under Alternative IV.a would be similar to the effects expected under Alternative I: <5 percent of the population exposed to potentially adverse factors resulting only in sublethal effects.

The rarity of arctic peregrine falcons in the vicinity of coastal ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: Effects on arctic peregrine falcons under Alternative IV.a would be similar to the effects expected under Alternative I, because this species occurs infrequently in the deferred area.

b. Effects of Special Mitigating Measures:

(1) The Bowhead Whale: Special mitigating measures under Alternative IV.b would provide limited protection to bowhead whales within the area of Cross Island. The area around Cross Island would be available for leasing but with a special mitigating measure in place. Stipulation 6, Permanent Facility Siting in the Vicinity of Cross Island, prohibits permanent OCS production facility siting within a defined 10-mi radius around Cross Island, unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that the development will not preclude reasonable subsistence access to whales. This measure will help to ensure that interference with subsistence whaling activities are minimized or eliminated.

Conclusion: Special mitigation for Alternative IV.b will help to ensure that interference with subsistence-whaling activities are minimized or eliminated but is not expected to provide much additional protection to bowhead whales. The effects on bowhead whales are expected to be about the same as under Alternative I. The special mitigation likely would provide about the same amount of protection to bowhead whales that is provided by not leasing the area offshore Cross Island.

(2) The Spectacled Eider, the Steller's Eider, and the Arctic Peregrine Falcon: Special mitigation under Alternative IV.b would provide limited protection to spectacled and Steller's eiders and arctic peregrine falcon within the Cross Island buffer area. This area would be available for leasing but with a special mitigating measure in place. Stipulation 6, Permanent Facility Siting in the Vicinity of Cross Island, prohibits permanent OCS production facility siting within a defined 10-mi radius around Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that the development will not preclude reasonable subsistence access to whales. This measure likely would help to minimize disturbance effects on eiders but have little affect on peregrine falcons.

Conclusion: Special mitigation for Alternative IV.b may help to reduce disturbance of spectacled and Steller's eiders but is not expected to provide much additional protection for these species or the arctic peregrine falcon, and thus the effects on the eiders and peregrine falcon are expected to be about the same as under Alternative I. The special mitigation is expected to provide about the same amount of protection to the eiders and peregrine falcon as is provided by not leasing the area offshore Cross Island.

5. Effects on Marine and Coastal Birds:

a. Effects of the Deferral: The buffer area defined by this alternative may be used by several bird species, particularly common eiders and glaucous gulls nesting on the island and staging waterbirds during summer and fall staging prior to migration. Because leasing would not take place within the area deferred by Alternative IV.a, most adverse effects on these species from discharges, seismic activities, aircraft and vessel traffic, drilling activities, and construction associated with exploration and development or production, and any oil spills during the latter phases, are expected to be reduced, though not significantly, as compared to Alternative I. An estimate of the extent of these activities is provided in Table IV.A.1.1.

Aircraft and vessel traffic still may cross the area en route to blocks leased outside the deferral area where construction and drilling operations may occur. This support traffic could disturb small numbers of marine and coastal birds for a few minutes once or twice per day and cause them to avoid areas near vessel activities or aircraft corridors. As a result, small proportions of the regional

nesting populations of glaucous gull and common eider (e.g., 5% of Beaufort Sea common eiders, <250 individuals), as well as staging flocks of other water birds (e.g., oldsquaw) are expected to experience short-term displacement from foraging areas lasting a few minutes to < 1 day. If such displacement is routine when birds are present, declines in fitness could occur but this is expected to cause negligible population-level effects. The potential for seismic operations and emergency traffic associated with this proposed action would remain. In the area remaining to be offered for lease, the effect on marine and coastal species would be as described for Alternative I, with flocks avoiding areas within about 1 km of three to five routinely used aircraft corridors and a few hundred meters of vessels, drilling units, and production platforms.

Oil-spill risk to marine and coastal species would be reduced somewhat as a result of reducing resource range from 350 to 670 MMbbl for Alternative I to 280 to 550 MMbbl under Alternative IV.a. During development/ production activities, the OSRA estimates a 39- to 62-percent chance of one or more spills ≥1,000 bbl occurring compared to a 46- to 70-percent chance under Alternative I (Table IV.A.2-1). The OSRA model estimates a 2- to 9-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 and 8 within 30 days over the production life of Alternative IV.a, where these species may be present during summer or fall migration (Anderson et al., 1997; Table 16), slightly less than under Alternative I (3-12 percent, Table 10). The probability of spill occurrence and contact with Simpson Lagoon is reduced 1 percent and shoreline in this area 2 percent under this alternative.

If spilled oil were to contact a foraging-habitat area, effects would be as discussed under Alternative I (Sec. IV.B.4). Mortality from an oil spill still may range up to several thousand individuals. A localized reduction in food resources and possible temporary displacement from some feeding areas also could result from a spill. Effects on the marine and coastal species expected for this alternative would be similar to those expected under Alternative I, because essentially the same number of individuals are likely to be lost and the extent and nature of the effects are likely to be similar, but are less likely to occur. The effect of such losses are expected to be minor at the population level, and may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Under Alternative IV.a, support traffic to leases outside the deferral area, as well as seismic or emergency activities, may disturb nesting birds on Cross Island or result in short-term displacement of birds from local foraging areas within the deferral adjacent to these leases lasting a few minutes to <1 day. If such displacement is routine when birds are present, declines in fitness could occur; but this is expected to impact only small proportion of any affected population and cause only negligible population-level effects. Most potential sources of bird disturbance (transport, exploration-rig operation, and construction and operation of platforms) would be eliminated from the area surrounding Cross Island by this deferral. Although the probability of spilled oil contacting areas offshore of Cross Island, where birds that have nested on the island or mainland may forage and stage prior to migration, remains substantial (up to 61%) under this alternative, the chance of nearshore or shoreline contact is reduced to <8 percent for most areas. More importantly, the probability of a spill occurring and contacting ice/sea segments or shoreline, are reduced to <10 and <4 percent, respectively, and a spill may occur when few birds are present or be weathered and dispersed by the time they are. As a result, although any spill-related losses of marine and coastal birds still may include up to several thousand birds, the chance of such losses occurring is quite low under this alternative. The effects of any such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Conclusion: Effects on marine and coastal birds under Alternative IV.a would be similar to the effects expected under Alternative I (negligible population effects), because the level of activity outside the Cross Island buffer is likely to be similar, essentially the same number of individuals are likely to be affected, and the extent and nature of the effects are likely to be similar. In the Cross Island area, where the probability of both disturbance and oil spill effects occurring are likely to be somewhat reduced from that under Alternative I, overall effect is expected to be reduced, though not significantly, from Alternative I.

b. Effects of Special Mitigating Measures:

Special mitigation under Alternative IV.b would provide limited protection to marine and coastal species within the Cross Island buffer area. This area would be available for leasing but with a special mitigating measure in place. Stipulation 6, Permanent Facility Siting in the Vicinity of Cross Island, prohibits permanent OCS production facility siting within a defined 10-mi radius around Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that the development will not preclude reasonable subsistence access to whales. This measure also may help to minimize disturbance effects on waterbirds.

Conclusion: Special mitigation for Alternative IV.b may help to minimize disturbance of marine and coastal birds in a portion of the deferral area. The effects on marine and coastal species are expected to be about the same as under Alternative I. The special mitigating measure is expected to provide less protection to marine and coastal birds than would not leasing the area offshore Cross Island.

6. Pinnipeds, Polar Bears, and Belukha Whales:

a. Effects of the Deferral: Effects associated with Alternative IV.a, the Cross Island Deferral, essentially would be the same, at least qualitatively, as those analyzed for Alternative I (Sec. IV.B. 6). The magnitude of effects could vary, depending on the population status of affected marine-mammal species at the time when adverse effects could occur. For Alternative IV.a, noise and disturbance; habitat alterations from drill-platform installation, pipeline laying, and other construction; and oil spills could have some adverse effects on pinnipeds, polar bears, and belukha whales found in the sale area.

Under the development scenario for Alternative IV.a, the amount of helicopter and supply-boat support traffic would be reduced somewhat from that expected under the scenario for Alternative I (see Table IV.A.1-1). Helicopter trips (1 round trip/day to each of 2 drilling platforms vs. the same amount of traffic to each of 2 platforms under Alternative I) and supply-boat traffic could disturb some hauled out ringed, bearded, and spotted seals, causing them to panic and charge into the water, perhaps resulting in the injury or death of some seal pups. Aircraft disturbance of seals, walruses, and polar bears is likely to be short-term displacement (a few minutes to <a few days) of small numbers of these animals (<a few hundred) within 1 to 3 km of the helicopter. Vessel traffic associated with the two exploration-drilling units and two to four production units (vs 3-5 units under Alternative I) and seismic vessels operating during the open-water season temporarily could displace or interfere with marine mammal migration and change local distribution for a few hours to a few days. Such short-duration and local displacement (within 1-3 km of the traffic) is expected to have about the same level of short-term (<a few days) effect on the distribution of pinnipeds, polar bears, and belukha whales as described for Alternative I.

The installation of two to four (vs. 3-5 under Alternative I) production platforms and the laying of 48 to 80 mi (vs. 64-96.5 km under Alternative I) of offshore pipelines with about 1 to 5 km of benthic habitat altered are likely to have a short-term and local effect on these marine mammals.

There is a 39- to 62-percent chance of one or more oil spills ≥ 1,000 bbl occurring during exploration and development under Alternative IV (vs 46-70% chance under Alternative I). If an oil spill occurred, it would pose the greatest risk of contact to all marine mammals from the Camden Bay offshore area (I/SS 9) to ice-flaw-zone habitats located west to Cape Halkett (I/SS 6) (Fig. IV.B.6-1). Under Alternative IV.a, blocks offshore of Cross Island would not be leased, therefore somewhat reducing the risk of a spill occurring in this area (see Fig. II.C.1). However, blocks east and west to offshore of about Oliktok Point still would be leased under Alternative IV.a. If an oil spill occurred in this area, nonendangered marine mammals—pinnipeds, polar bears, and belukha whales—still would be about equally at risk from contact with the spill, and the effect is expected to be about the same. The combined effect of noise and disturbance, habitat alterations, and oil spills under the Alternative IV.a developmental scenario is expected to be about the same as under Alternative I.

Regarding the area around Cross Island, the removal or reduced effects to Cross Island on pinnipeds, polar bears, and belukha whales are as follows: There would be no oil spills (7,000 bbl), noise and disturbance (aircraft and vessel traffic, including seismic operations), or habitat alterations (installation of 1-2 exploration and production platforms and the laying of about 16.5 fewer kilometers offshore pipelines) occurring within the Cross Island area from this alternative. This would represent one to two fewer exploration and production platforms and about 16.5 fewer offshore pipeline kilometers compared to Alternative I. There is about an 8-percentage-point reduction in the chance of one or more oil spills ≥ 1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur in the Cross Island area, but the assumed 7,000-spill still is likely to contact the Cross Island area and have similar effects on pinnipeds, polar bears, and belukha whales, which would be exposed to some of these effects within and beyond the Cross Island area. Potential effects of the assumed 7,000-bbl oil spill, noise and disturbance from air and vessel traffic, seismic operations, and pipeline and platform installation near Cross Island are expected to be similar to the effects described under Alternative I (loss of small numbers of seals, polar bears, and belukha whales due to the spill, with recovery of populations expected within <1 generation [or 3-5 years]). These effects could be reduced slightly within the deferred area under Alternative IV.

Conclusion: The effect of Alternative IV.a on pinnipeds, polar bears and belukha whales (potential noise and disturbance, oil spill, and habitat alteration) is expected to be reduce slightly in the Cross Island area; however, potential noise and disturbance, oil-spill, and habitat effects beyond the Cross Island area are expected to be the same as under Alternative I. The overall effect is expected to be the same as under Alternative I.

b. Effects of Special Mitigating Measures: The special mitigating measure, proposed Stipulation 6, regarding prohibition of permanent oil-facility sittings within a 10 mi radius around Cross Island, is expected to reduce potential noise and disturbance and habitat effects on seals and polar bears in the Cross Island area from those that could occur under Alternative I. However, potential noise and disturbance, oil-spill, and habitat effects beyond

the Cross Island area are expected to be about the same as under Alternative I.

Conclusion: Stipulation 6 is expected to reduce local noise and disturbance and habitat effects on seals and polar bears near Cross Island as would the deferral of lease blocks near Cross Island under Alternative IV.b, but the overall effect is expected to be about the same as under the Alternative I.

7. Caribou:

a. Effects of the Deferral: Effects associated with Alternative IV.a, the Cross Island Deferral, would be the same, at least qualitatively, as those analyzed for Alternative I (Sec. IV B.7). However, the magnitude of effects could vary, depending on the population status of the CAH caribou herd when adverse effects could occur.

The primary source of disturbance to caribou is vehicle traffic (perhaps as much as several hundred vehicles/day) that could be associated with onshore transportation of oil from leases offshore of Prudhoe Bay. Disturbance of caribou along the pipelines and roads from Point McIntyre, Oliktok Point, and Point Thomson to the TAPS though existing facilities in the Prudhoe Bay and adjacent oilfields would be most intense during the construction period (perhaps 6 months), when motor-vehicle traffic is highest, but would subside after construction is complete. Caribou are likely to successfully cross the pipeline corridor within a short period of time (a few minutes to a few days) during breaks in the traffic flow, even during high-traffic periods, with little or no restriction in movement. However, a local reduction in cow-calf distribution within about 3 to 4 km (1.86-2.48 mi) along pipeline-road corridors may be expected, if the corridors cross main CAH calving habitats.

The field-development scenario for Alternative IV.a forecasts the construction of 32 to 161 km (the same as under Alternative I) of onshore pipelines, and potential adjacent roads are expected to be constructed (see Table IV.A.1-1). These pipeline miles and potential adjacent roads and vehicle traffic are expected to cause the same amount and duration of displacement of CAH caribou from habitats within 3 to 4 km (1.86-2.48 mi) of the pipeline-road corridors in the Prudhoe Bay area as under Alternative I. These pipelines are expected to connect to existing transportation facilities along the coast and not cross main calving areas of the CAH.

There is a 39- to 62-percent chance of one or more oil spills ≥1,000 bbl occurring during exploration and development under the development scenario for Alternative IV.a versus a 46- to 70-percent chance under Alternative I. Assuming one 7,000-bbl oil spill occurred under Alternative IV.a during the open-water season, caribou of the CAH that frequent coastal habitats from Cape Halkett (LS 28) to Flaxman Island (LS 37) possibly could be directly exposed to and contaminated by the spill along the beaches and in shallow waters during periods of insect-pest-escape activities (Fig. IV.B.7-1). However, even in a severe situation, a comparatively small number of animals (perhaps 100) is likely to be directly exposed to the oil spill and die as a result of toxic hydrocarbon inhalation and absorption. The effect of one or more oil spills (≥1,000 bbl) would represent the loss of small numbers of CAH caribou (perhaps a few hundred) or no more than a few thousand PCH caribou. These losses would be small for any of these caribou herds, with recovery expected within about 1 year. For the most part, the effect of onshore oil spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline; these spills would not be expected to significantly contaminate or alter caribou range within the pipeline corridors. This alternative would reduce somewhat potential the risk of oil-spill contact to CAH caribou coastal habitats from about Oliktok Point (LS 31) east to Flaxman Island (LS 37). However, the effects on the CAH are expected to be the same as under Alternative I.

Regarding the area around Cross Island, the removal of or reduced effects to Cross Island on caribou are as follows: There would be no oil spill (7,000 bbl) within the Cross Island area from this alternative. This would represent about an 8-percentage-point reduction in the chance of one or more oil spills ≥1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur near Cross Island, but the assumed 7,000-bbl spill still is expected to contact coastal habitats used by CAH caribou and have similar effects as described under Alternative I. Potential effects of the 7,000-bbl spill, noise and disturbance (from road and aircraft traffic along onshore pipelines), and habitat alteration (onshore pipelines-roads and other facilities) are not expected to be reduced from those under Alternative 1.

Conclusion: The effect of Alternative IV.a on caribou (local displacement of cow-calf groups within about 3-4 km [1.86-2.48 mi] along 32-161 km of onshore pipelines with roads, persisting for >1 generation, and the loss of a small number of caribou and relatively small area of habitat contamination from the assumed 7,000-bbl spill) is expected to be about the same for that under Alternative I. However, there would be about an 8-percentage-point reduction in the chance of one or more oil spills ≥1,000 bbl occurring within the proposed sale area.

b. Effects of Special Mitigating Measures: The special mitigating measure, Stipulation 6, regarding permanent oil-facility siting in the vicinity of Cross Island, is not expected to provide any specific protection of caribou from potential effects of oil and gas exploration and development activities along the coast adjacent to the proposed sale area.

Conclusion: Special mitigating measure, proposed Stipulation 6, is expected to have the same effect on caribou as Alternative I.

8. Economy of the North Slope Borough:

a. Effects of the Deferral: Increased revenues and employment are the most significant economic effects that would be generated by Alternative IV.a, the Cross Island area. The effect on NSB revenues and expenditures and on employment is about 20 percent less than for Alternative I. Increased property tax revenues and new employment would be created with the construction, operation, and servicing of facilities associated with OCS activities. This reduction in effects is because key elements of facilities associated with OCS activities for Alternative IV.a are reduced by 20 percent than in Alternative I. These facilities are described in Table IV.A.1-1 and summarized in Section IV.D.8

For Alternative IV.a, exploration, development, and production is projected to generate increases in property taxes above the levels without the sale starting in 1998 and average about 0.8 to 1.6 percent above the level without the sale each year through the production period. This is about 20 percent less than Alternative I.

Direct oil-industry employment in an enclave is anticipated to peak in the range of 1,120 to 1,280 jobs during the development phase, decline to a level in the range of 640 to 960 in 2011 to 2022, and then decline further to the range of 400 to 960 by 2027. Of these direct oil-industry jobs, 1 percent is anticipated to be held by resident NSB Natives. This is about 20 percent less than Alternative I.

Total resident employment is anticipated to increase in the range of 50 to 80 jobs in the peak of production and level off to 22 to 34 in the production phase after 2011. The peak increase during development is about 3.2- to 4.2-percent greater than resident employment without the development of Alternative IV resources and about 1.6- to 2.4-percent greater during the production phase. This is about 20 percent less than Alternative I.

The cleanup of an oil spill would generate jobs for up to 300 cleanup workers for 6 months in the first year, and would decline to zero by the fourth year following the spill. This is the same as for Alternative I.

Disruptions to the harvest of subsistence resources could affect the economic well-being of NSB residents primarily through the direct loss of subsistence resources. See Section IV.D.9 for conclusions on the effects on the subsistence-harvest patterns.

Regarding the Cross Island Deferral, the change in economic effects to the area deferred are zero. The economic effects (on property tax, direct oil-industry employment, and resident employment) are external to the area deferred.

Conclusion: Exploration, development, and production would generate increases under Alternative IV.a that are 20 percent less than those for Alternative I for property tax, direct oil-industry employment, and resident employment. Cleanup operations for an oil spill would generate employment the same as for Alternative I.

b. Effects of Special Mitigating Measures: There are no special mitigating measures in place for economics for Alternative IV.b.

Conclusion: There are no effects of special mitigating measures for economics for this alternative, and the full level of effects as analyzed for Alternative I would occur.

9. Subsistence Harvest Patterns:

a. Effects of the Deferral: Removing all lease blocks in a 10-mi radius offshore Cross Island (approximately 6% of the overall proposed Sale 170 area) would buffer Cross Island from conflicts between oil-industry activities and Nuiqsut subsistence whalers, and permanent OCS production-facility siting within this radius would be prohibited. An oil spill in the area offshore Cross Island would disrupt subsistence harvests slightly more than an oil spill that might originate in another part of the sale area. Under this alternative, the OSRA estimates a 39- to 62-percent chance of one or more spills ≥ 1,000 bbl occurring, a reduction in oil-spill risks from Alternative I (46-70%). In LS's 30 through 40, the OSRA model estimates a 1- to 5-percent chance of one or more spills ≥ 1,000 bbl occurring and contacting LS's 29 (Harrison Bay/Colville River Delta) through 40 (Camden Bay) within 180 days over the assumed production life of Beaufort Sea Sale 170. A minimal chance of oil-spill occurrence and contact is likely at Harrison Bay (LS's 28-30) and the Colville River Delta (LS's 31-32). Possible occurrence and contact to land segments nearshore of Beechy Point (LS 34, 2-5%), Cross Island (LS 35, 2-5%), and Flaxman Island (37, 3-5%) fall in the higher range of OSRA estimates and, in the event of a spill, conceivably are more likely to be impacted from oil-spill contact. Oil-spill contact in winter could affect polar bear hunting and sealing. Bird hunting, sealing, and whaling, and ocean fishing, could be affected by a spill during the open-water season.

The effects to fishes from this alternative would be similar to those in Alternative I, except that the magnitude of the effects likely would be decreased. The slightly decreased magnitudes of the effects would include disturbances resulting from discharges; noise and disturbances from seismic surveys; and noise and disturbances from aircraft, vessel, drilling, and construction activities. However, due

to previous Federal lease sales located near the Cross Island Area, it is likely that the removal of these blocks would not significantly decrease the aircraft and vessel traffic through or near the Cross Island Area. Disturbances from seismic surveys within previously leased areas could be transmitted into the Alternative IV area. However, the intensity of the seismic-survey disturbances would be reduced and is unlikely to significantly affect fishes. Under this alternative, seismic surveys are not precluded from being conducted in the Cross Island area. Should seismic surveys be conducted in the area, the effects to fishes would be the same as those discussed for Alternative I. Oil spill risks also would be reduced from those for Alternative I. The level of disturbance for Alternative IV would be slightly reduced from that of Alternative I. Effects on fish resources from Alternative IV likely would be similar to those expected under Alternative I (see Secs. IV.B.3 and IV.E.3).

Alternative IV.a pertains to an area used by bowhead whales for migration and possibly for occasional feeding during the late summer and fall. This alternative may slightly reduce the potential for adverse effects to bowhead whales as a result of discharges, noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and construction activities, and oil spills as a result of exploration and development and production activities compared to the scenario presented in Alternative I, because additional leasing would not take place within the area of this alternative. However, leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales, and aircraft and vessel traffic may cross the area en route to these leased blocks. This traffic could disturb low numbers of bowheads for a few minutes once or twice per day and cause bowheads to avoid areas near vessel activities. In addition, noise from seismic surveys or drilling operations within leased blocks could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels. Effects on bowheads expected from Alternative IV.a would be similar to the effects expected under Alternative I, because the level of exploration activities is likely to be similar to Alternative I, essentially the same number of bowheads are likely to be affected, and the extent and nature of the effects of the activities on bowhead whales are likely to be similar (see Secs. IV.B.4 and IV.E.4).

Disturbance of marine and coastal birds by air and vessel traffic occurring under this alternative is not expected to differ significantly from Alternative I (short-term displacement of birds lasting a few minutes to <1 day), because the level of development activity is similar under both alternatives. A moderate reduction in spill-contact probability in areas potentially used by marine and coastal species results from this alternative and, therefore, Alternative IV.a would result in some reduction to effects determined under Alternative I, primarily a reduction of the already relatively low mortality in the event of an oil spill. Under this alternative, only disturbance and oil-spill effects on marine and coastal birds and their habitats in the area near Cross Island potentially could be reduced; however, marine and coastal bird populations still are expected to sustain losses requiring up to one generation for recovery (see Secs. IV.B.5 and IV.E.5).

Effects associated with Alternative IV.a essentially would be the same on pinnipeds, polar bears, and belukha whales, at least qualitatively, as those analyzed for Alternative I. The magnitude of effects could vary, depending on the population status of affected marine-mammal species at the time when adverse effects occurred. For Alternative IV.a, noise and disturbance; habitat alterations from drill-platform installation, pipeline laying, and other construction; and oil spills could have some adverse effects on pinnipeds, polar bears, and belukha whales found in the sale area. Under the development scenario for Alternative IV.a, the amount of helicopter and supply-boat-support traffic would be reduced somewhat from that expected under the scenario for Alternative I. If an oil spill occurred, it would pose the greatest risk of contact to all marine mammals from the Camden Bay offshore area (I/SS 9) to ice-flaw-zone habitats located west to Cape Halkett (I/SS 6). Under Alternative IV.a, blocks offshore Cross Island would not be leased, somewhat reducing the risk of a spill occurring in this area. However, blocks east and west to offshore Oliktok Point still would be leased under Alternative IV.a. If an oil spill occurred in this area, pinnipeds, polar bears, and belukha whales still would be about equally at risk from contact with the spill, and the effect is expected to be about the same. The effect of Alternative IV.a is expected to somewhat reduce potential noise and disturbance, oil spill, and habitat effects on seals and polar bears in the Cross Island area; however, potential noise and disturbance, oil-spill, and habitat effects beyond the Cross Island area are expected to be about the same as under Alternative I (see Secs. IV.B.6 and IV.E.6).

Effects on caribou associated with Alternative IV.a would be the same, at least qualitatively, as those analyzed for Alternative I. However, the magnitude of effects could vary, depending on the population status of the CAH caribou herd, when adverse effects could occur. The primary source of disturbance to caribou is vehicle traffic that could be associated with onshore transportation of oil from leases offshore of Prudhoe Bay. Disturbance of caribou along the pipelines and roads from Point McIntyre, Oliktok Point, and Point Thomson to the TAPS though existing facilities in the Prudhoe Bay and adjacent oilfields would be most intense during the construction period (perhaps 6 months), when motor-vehicle traffic is highest, but would subside after construction is complete. A local reduction in cow-calf distribution within about 3 to 4 km (1.86-2.48 mi) along pipeline-road corridors may be

expected if the corridors cross main CAH calving habitats. The field-development scenario for Alternative IV forecasts the construction of 20 to 100 mi of onshore pipelines, and potential adjacent roads are expected to be constructed. These pipeline miles and potential adjacent roads and vehicle traffic are expected to cause the same amount and duration of displacement of CAH caribou from habitats within 3 to 4 km (1.86-2.48 mi) the pipeline-road corridors in the Prudhoe Bay area as under Alternative I. These pipelines are expected to be short (20-30 mi total length) and connect to existing transportation facilities along the coast and not cross main calving areas of the CAH. This alternative would reduce somewhat potential risk of oil-spill contact to CAH caribou coastal habitats from about Oliktok Point (LS 31) to east of Flaxman Island (LS 37). However, the effects on the CAH are expected to be the same as under Alternative I. The effect of Alternative IV.a on caribou is expected to be about the same for effects under Alternative I—local displacement of cow-calf groups within about 3 to 4 km (1.86-2.48 mi) along 20 to 100 mi of onshore pipelines with roads—with this local effect persisting for more than one generation and the loss of a small number of caribou with a relatively small area of habitat contamination (see Secs. IV.B.7 and IV.E.7).

Noise and disturbance to these subsistence resources would affect Nuiqsut's subsistence activities. While this deferral alternative would not substantially change biological effects to populations of subsistence species, it would eliminate blocks from a large portion of Nuiqsut's marine and coastal subsistence-harvest areas and, thus, may offer some mitigation from noise and traffic disturbance to the subsistence hunt for the hunters from this community. However, aircraft and vessel traffic and noise from seismic activity in previously leased areas within the deferred area would be expected to continue. Effects to bowhead and belukha whales, caribou, seals, polar bears, and fishes, from the slight reductions of noise and construction disturbance, oil-spill cleanup, and oil-spill risks under Alternative IV.a would remain essentially similar to the effects under Alternative I. Disturbance and oil-spill effects on marine and coastal birds and their habitats could be reduced.

Regarding the Cross Island Deferral, the reduction of effects to fishes would occur from fewer fishes being exposed to noise and disturbance from oil and gas activities under the deferral than under Alternative I. The reduction in the magnitude of the effects would result from fewer wells being drilled, less seismic activity being conducted, and less drilling muds and cuttings being discharged. A decrease in drilling discharges also would reduce alterations to fish habitat. However, fishes located in the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur on previously leased blocks inside and leases outside the deferred area. Fewer fishes would be exposed to the types of effects from oil and gas activities under the deferral than under Alternative I. The reduced effects on bowhead whales within the deferred area are likely to be fewer whales exposed to noise from oil and gas activities under the deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted with the area deferred. However, bowhead whales within the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur on previously leased blocks inside and leases outside the deferral area. These activities could disturb low numbers of bowheads and cause some bowheads to avoid areas near these activities. In addition, noise from seismic surveys or drilling operations within leased blocks outside of the deferral area could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels and would be unlikely to significantly displace feeding or migrating whales. The effect of noise on bowheads, with or without the deferral, would be as described for Alternative I: whales avoiding vessels, seismic surveys, drilling units, and production platforms at varying distances. Exposure of bowhead whales to noise-producing activities, whether inside or outside the deferral area, is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects. Additionally, any oil spill that may occur either from leases outside the deferral area or from existing leases within the deferral area has the potential to be present within the deferral area. Effects on bowheads expected from Alternative III would be similar to the effects expected under Alternative I. While fewer whales may be exposed to oil and gas activities under the deferral than under Alternative I, the extent and nature of the effects and the overall effect on the population is likely to be essentially the same as under Alternative I. Most potential sources of bird disturbance (transport, exploration rig operation, and construction and operation of platforms) would be eliminated from the area surrounding Cross Island by this deferral. Although the probability of spilled oil contacting areas offshore of Cross Island, where birds that have nested on the island or mainland may forage and stage prior to migration, remains substantial (up to 61%) under this alternative, the chance of nearshore or shoreline contact is reduced to <8 percent for most areas. More importantly, the probability of a spill occurring and contacting ice/sea segments or shoreline, are reduced to <10 and <4 percent, respectively, and a spill may occur when few birds are present or be weathered and dispersed by the time they are. As a result, although any spill-related losses of marine and coastal birds still may include up to several thousand birds, the chance of such losses occurring is quite low under this alternative. The effects of any such losses are expected to be minor at the population level, and may not be detectable above the natural fluctuations of the populations and

survey methods/data available. In the Cross Island area, where the probability of both disturbance and oil-spill effects occurring are likely to be somewhat reduced from that under Alternative I, overall effect is expected to be reduced, though not significantly, from Alternative I. Potential effects of the assumed 7,000-bbl oil spill, noise and disturbance from air and vessel traffic, seismic operations, and pipeline and platform installation near Cross Island on pinnipeds, polar bears, and belukha whales are expected to be reduced slightly in the Cross Island area; however, potential noise and disturbance, oil-spill, and habitat effects beyond the Cross Island area are expected to be the same as under Alternative I. The overall effects are expected to be the same as under Alternative I: loss of small numbers of seals, polar bears, and belukha whales due to the spill, with recovery of populations expected within less than one generation (or 3-5 years). Reduced effects to Cross Island on caribou would be no oil spill (7,000 bbl) within the Cross Island area from this alternative. This would represent about an 8-percent reduction in the chance of one or more oil spills ≥1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur near Cross Island, but the assumed 7,000-bbl spill still is expected to contact coastal habitats used by CAH caribou and have similar effects as described under Alternative I. Potential effects of the 7,000-bbl spill, noise and disturbance (from road and aircraft traffic along onshore pipelines), and habitat alteration (onshore pipelines-roads and other facilities) are not expected to be reduced from those under Alternative I: local displacement of cow-calf groups within about 3 to 4 km of onshore pipelines, with this local effect persisting for more than one generation and the loss of a small number of caribou (perhaps a few hundred) and a relatively small area of habitat contamination from the assumed 7,000-bbl spill.

Regarding the area offshore Cross Island, reduced effects to subsistence-harvest patterns in the community of Nuiqsut would come from reduced effects described above from noise and disturbance and oil spills on subsistence-fish, bowhead, bird, marine mammal, and caribou populations. The deferral would afford less disturbance to bowheads whales during the subsistence hunt and reduce the possibility of hunter-access conflicts. Decreased disturbance to subsistence species, habitats, harvests, and access from oil-spill-cleanup activity would be expected, as potentially spilled oil would contact shoreline areas after a longer period of weathering. Even with these effects reductions, effects would be essentially those expected for Alternative I with subsistence resources affected for up to an entire season (1 year), but with no resource becoming unavailable, undesirable for use, or experiencing overall population reductions.

Conclusion: Under Alternative IV.a, effects as a result of disturbance and oil spills on subsistence-harvest patterns in the community of Nuiqsut are expected to be slightly reduced from those expected from Alternative I. Effects would be expected to affect subsistence resources for up to an entire season (1 year), but no resource would become unavailable, undesirable for use (although an oil spill affecting any portion of the bowhead whale-migration route might taint resources or create the perception of tainting that would affect the subsistence hunt), or experience overall population reductions. Effects from the Cross Island Deferral Alternative on the subsistence-harvest patterns of Barrow and Kaktovik are expected to be the same as for Alternative I; for Nuiqsut, effects are expected to be slightly reduced from those expected for Alternative I.

b. Effects of Special Mitigating Measures:

Stipulations 1 and 5 described under Alternative I afford protection to fish resources in the Sale 170 area. Alternative IV.b, has Stipulation 6 as a special mitigating measure. This measure would provide limited protection to bowhead whales within the area of Cross Island. The area around the island would be available for leasing, but Stipulation 6 would prohibit permanent OCS production facility siting within a defined 10-mi radius around Cross Island, unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that the development will not preclude reasonable subsistence access to whales. This measure will help to ensure that interference with subsistence-whaling activities is minimized or eliminated. Special mitigation is not expected to provide any specific protection for caribou from potential effects of oil and gas exploration and development activities along the coast adjacent to the proposed sale area, but it would reduce potential noise and disturbance and habitat effects on seals and polar bears in the Cross Island area from those effects expected to occur under Alternative I. However, potential noise and disturbance, oil spill, and habitat effects to marine mammals beyond the Cross Island area are expected to be about the same as under Alternative I. This special mitigating measure does not prevent the construction of undersea pipelines in the Cross Island Area.

Conclusion: Special mitigating measure Stipulation 6, Permanent Facility Siting in the Vicinity of Cross Island, is expected to reduce noise and habitat disturbance to seals, polar bears, and bowhead whales near Cross Island and oil industry conflicts with Nuiqsut subsistence-whaling practices. This special mitigating measure likely would provide the same degree of protection to bowhead whales and the subsistence-bowhead whale harvest that is provided by not leasing the area offshore Cross Island. Consequently, similar reductions on subsistence-harvest patterns are expected from either special mitigation or deferral.

10. Sociocultural Systems:

a. Effects of the Deferral: Alternative IV.a, the Cross Island Deferral Alternative, would reduce slightly the onshore industrial activities and population and employment projections for this sale, because the resource estimate for this alternative is lower, reduced from 350 to 670 MMbbl to 280 to 550 MMbbl; basic exploration, development and production, and transportation assumptions would be reduced accordingly from those expected for Alternative I. Under this alternative, the OSRA estimates a 39- to 62-percent chance of one or more spills ≥1,000 bbl occurring, a reduction in oil-spill risks from Alternative I (46-70%). In LS's 30 through 40, the OSRA model estimates a 1- to 5-percent chance of one or more spills ≥1,000 bbl occurring and contacting LS's 29 (Harrison Bay/Colville River Delta) through 40 (Camden Bay) within 180 days over the assumed production life of Beaufort Sea Sale 170. A minimal chance of oil-spill occurrence and contact is likely at Harrison Bay (LS's 28-30) and the Colville River Delta (LS's 31-32). Possible occurrence and contact to land segments nearshore of Beechy Point (LS 34, 2-5%), Cross Island (LS 35, 2-5%), and Flaxman Island (37, 3-5%) fall in the higher range of OSRA estimates and, in the event of a spill, conceivably are more likely to be impacted from oil-spill contact. Effects on subsistence resources from disturbance and oil spills would be slightly reduced under this alternative but would remain essentially the same for subsistence-harvest patterns as those for Alternative I (see Sec. IV.E.9, Subsistence-Harvest Patterns). Oil-industry and resident employment and property taxes are expected to be reduced 20 percent from Alternative I, but local employment changes to the community of Nuiqsut would be slight (see Sec. IV.E.8, Economy of the North Slope Borough).

Regarding the Cross Island Deferral, effects on sociocultural systems from changes in population and employment, effects on subsistence-harvest patterns, and effects from possible oil spills and oil-spill cleanup in the community of Nuiqsut are expected to be slightly reduced but are expected to produce the same levels of effect as Alternative I. Potential disturbance effects could disrupt sociocultural systems for an entire season (1 year) and create disruption to institutions and sociocultural systems, but these disruptions are not expected to displace ongoing sociocultural institutions; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources.

Conclusion: Under Alternative IV.a, effects on sociocultural systems could result from industrial activities, changes in population and employment, effects on subsistence-harvest patterns, and effects from possible oil spills and oil-spill cleanup. The effects from the Cross Island Deferral Alternative on the sociocultural systems in the community of Nuiqsut are expected to be reduced from those expected for Alternative I due to decreases in oil-spill risks and construction and oil-spill-cleanup disturbance. Effects to sociocultural systems in the communities of Barrow and Kaktovik would be the same as for Alternative I.

b. Effects of Special Mitigating Measures: Stipulation 6, Permanent Facility Siting in the Vicinity of Cross Island, would provide limited protection to bowhead whales within the area of Cross Island. The area around the island would be available for leasing, but Stipulation 6 would prohibit permanent OCS production-facility siting within a defined 10-mi radius around Cross Island unless the lessee demonstrates to the satisfaction of the Regional Director, in consultation with the NSB and the AEWC, that the development will not preclude reasonable subsistence access to whales. This measure will help to ensure that interference with subsistence whaling activities is minimized or eliminated.

Conclusion: This special mitigating measure is expected to reduce potential noise and disturbance to bowhead whales and reduce or eliminated oil-industry conflicts with the subsistence bowhead whale harvest. This special mitigating measure is expected to have a similar reduction in adverse effects on the subsistence-bowhead whale harvest as the deferral of blocks under Alternative IV.a. Consequent reductions to disruptions to the sociocultural systems in Nuiqsut are expected from either special mitigation or deferral.

11. Archaeological Resources:

a. Effects of the Deferral: Under the Cross Island Deferral Alternative (Alternative IV.a), the effects to archaeological resources would be similar to those under the Alternative I analysis in Section 4.B.11. The expected effect on archaeological resources should be low because of the requirement for review of geophysical data prior to any lease activities. Although oil-spill effects on onshore archaeological resources are uncertain, data from the EVOS indicate that few onshore archaeological resources (<3%) are likely to be significantly affected by an oil spill.

Therefore, the removal of exploration and development off of Cross Island is not expected to reduce the overall effect on archaeological resources as described under Alternative I.

Conclusion: The effects from the Cross Island Deferral Alternative (Alternative IV.a) would be the same as for Alternative I.

b. Effects of Special Mitigating Measures: Stipulation 6 does not apply to archaeological resources for this alternative.

Conclusion: Special mitigating measures would have no effect in this alternative. There would be no differences in levels of effects whether or not the blocks were deferred.

12. Air Quality:

a. Effects of the Deferral: Activities that may affect air quality include drilling discharges, seismic surveys, construction, and those associated with an accidental oil spill. The effects of these activities and the agents associated with them already have been discussed for Alternative I. This analysis considers differences in the amount of change in air quality effects for Alternative IV.a as compared to those of Alternative I. It then estimates the resulting effect of these differences on air quality.

Alternative IV.a involves fewer drilling discharges, seismic surveys, and construction-related activities than Alternative I. However, there is not enough difference in their number or magnitude to alter the expected effect of these activities on air quality. Therefore, Alternative IV.a is expected to have essentially the same effect on air quality as Alternative I.

Regarding the area around Cross Island, the removal or reduced effects to the area around Cross Island on air quality are as follows: There would be no exploration or development to directly produce emissions for the area around Cross Island. The potential to affect air quality would not occur in the area around Cross Island.

Conclusion: Alternative IV.a is expected to have essentially the same effect on air quality as Alternative I.

b. Effects of Special Mitigating Measures: There are no special mitigating measures that apply to air quality for this alternative.

Conclusion: Special mitigating measures would have no effect on air quality. There would be no differences in levels of effects whether or not the blocks around Cross Island were deferred.

13. Land Use Plans and Coastal Management Programs:

a. Effects of the Deferral: The potential for conflict with NSB CMP policies could occur in two main areas: conflicts could occur with the policy related to access to subsistence resources, Policy 2.4.3(d) (NSBMC 19.70.050.D), which requires that development not preclude reasonable subsistence-user access to a subsistence resource and 2) conflicts could occur with the policies that relate to adverse effects to subsistence resources, Policy 2.4.3(a) (NSBMC 19.70.050.A) states that "development shall not deplete subsistence resources below the subsistence needs of local residents of the Borough." Policy 2.4.5.1(a) (NSBMC 19.70.050.J.1) relates to "development that will likely result in significantly decreased productivity of subsistence resources or their ecosystems." (Section IV.B.13 provides a description of these policies). Temporary access problems with the subsistence seal harvest and the subsistence caribou harvest may occur as a result of onshore pipeline construction. Access could also be restricted in the event of an oil spill and the related cleanup activity. Temporary reductions in subsistence resources could occur as a result of disturbance and noise related to seismic activities, drilling and support activities, and pipeline construction activities.

Under Alternative IV.a, the OSRA estimates a 39- 62-percent probability of one or more spills ≥1,000 bbl occurring (compared to a 46-70% chance for Alternative I). The OSRA model indicates a minimal chance of one or more spills occurring and contacting the Colville delta area. Temporary reductions in subsistence resources and changes in subsistence resource-distribution patterns could occur in the unlikely event of an oil spill and the related cleanup activities. The chance of an oil spill occurring and contacting the land segments near Beechey Point, Cross Island, and Flaxman Island are slightly higher and impacts from an oil spill contact are more likely than the Colville delta area. Much of Nuiqsut's marine and coastal harvest area is encompassed by the area surrounding Cross Island. However, an oil spill in the area offshore Cross Island would disrupt subsistence harvests only slightly more than an oil spill that might originate in another part of the sale area. Deferral of this area may offer some mitigation from noise and traffic disturbance to the subsistence hunt for the hunters from Nuiqsut, although noise and disturbance in previously leased areas within the deferred area would be expected to continue. Effects as a result of noise and traffic disturbance and oil spills from Cross Island Alternative IV.a on the subsistence-harvest patterns in the community of Nuiqsut are expected to be only slightly reduced from those for Alternative I.

The potential for conflict with the cited policies might be reduced for the community of Nuiqsut, however; the potential for conflict would not be eliminated. The effects on the subsistence-harvest patterns of Kaktovik and Barrow are expected to be the same as those for Alternative I (see Sec.IV.E.9.a, Subsistence-Harvest Patterns), and there would be no corresponding reduction in the potential for conflict with NSB CMP policies as they relate to those communities.

Regarding Cross Island Alternative IV.a, the potential for conflict within the 10-mi radius around Cross Island would be reduced. Effects on subsistence resources as they occur in that area would be somewhat reduced, as would the potential for conflict with subsistence harvest activities occurring in the 10-mi radius around Cross Island. This

reduction in the potential for conflict is a result of the reduction of noise and traffic disturbance to the subsistence resources and the subsistence hunt. However, aircraft and vessel traffic and noise from seismic activity in previously leased areas within the Alternative IV.a area would be expected to continue.

Conclusion: For Alternative IV.a, the potential for conflict with land use plans and coastal management programs would be the same as for Alternative I. Conflicts could still occur in two main areas: 1) conflicts could occur with specific NSB CMP policy related to the potential for user conflicts between development activities and access to subsistence resources, Policy 2.4.3(d) (NSBMC 19.70.050.D); and 2) conflicts are possible with the NSB CMP policies related to adverse effects on subsistence resources, Policy 2.4.3(a) (NSBMC 19.70.050.A) and Policy 2.4.5.1(a) (NSBMC 19.70.050.J.1). The potential for conflict related to subsistence activities for the communities of Barrow and Kaktovik would remain the same as for Alternative I. A slight reduction in the potential for conflicts could occur, but not be eliminated, as a result of small reductions in effects on the subsistence-harvest patterns in the community of Nuiqsut. However, the overall potential for conflict would remain the same as for Alternative I.

b. Effects of Special Mitigating Measures:

Special mitigating measure, Stipulation6, would provide limited protection to bowhead whales, a subsistence resource, within the area of Cross Island. This measure would help ensure that interference with subsistence whaling activities is minimized or eliminated. This mitigation also has the potential to reduce effects related to noise and disturbance and habitat effects on seals and polar bears in the area around Cross Island from those expected to occur for Alternative I.

Conclusion: Stipulation 6 could reduce the potential for conflict with the NSB CMP policies related to adverse effects on subsistence resources and reasonable subsistence-user access to subsistence resources as they relate to subsistence activities in the community of Nuiqsut. The potential for conflict related to subsistence activities in the communities of Barrow and Kaktovik are expected to be the same as that for Alternative I. Although the potential for conflict might be reduced for the community of Nuiqsut, it is not eliminated. The overall potential for conflict would remain the same as for Alternative I. This conclusion is the same as that for the Cross Island Alternative IV.a.

F. ALTERNATIVE V - AREA OFFSHORE THE ARCTIC NATIONAL WILDLIFE REFUGE (ANWR):

The Area Offshore the ANWR being considered under Alternative V is a "special area" consisting of 122 blocks offshore the ANWR. Alternative V includes all of the Kaktovik deferral (Alternative III) analyzed in the DEIS plus additional areas to the west and north to 146° W. longitude (Fig. II.E.1). (The Kaktovik Deferral, Alternative III, would offer 278 blocks or 519,419 ha). Alternative V is examined in this EIS as two options: option V.a analyzes a deferral of an area designed to protect areas offshore the ANWR, and option V.b analyzes the application of special mitigation to protect the area offshore the refuge in lieu of deferral.

Alternative V.a(deferral) would result in the offering of 241 whole and partial blocks or 437,866 ha (1.08 million acres), approximately 64 percent of the area of Alternative I. Alternative V.a analyzes the effects of the potential deferral of an area offshore the ANWR extending from the Federal/State OCS boundary out to the seaward limit of the sale area, from the eastern limit of the sale area (extending to 12 mi west of the community of Kaktovik) westward to a point approximately 146° W. longitude. The area that would be deferred under Alternative V.a includes 122 blocks covering 250,164 ha (618,167 acres).

Alternative V.b analyzes the effects of special mitigation developed to protect the area offshore the ANWR in lieu of deferral. Three new special stipulations were developed for Alternative V.b and apply to specific blocks located in the eastern Beaufort Sea offshore the ANWR. These potential new stipulations were developed to provide for protection of wildlife and habitats (both land and marine), subsistence, recreation, and other concerns identified during the public hearing process on the DEIS. Stipulation 7, Planning for Activities Offshore the ANWR, emphasizes existing restrictions or prohibitions on activities within and adjacent to the Refuge. It requires that exploration and development and production plans must contain a description of proposed equipment staging areas, infrastructure, and other related activities, and that lessees demonstrate the ability to stage and mobilize equipment, including oil-spill-response equipment, from locations other than the ANWR. Special Stipulation 8, OCS Pipelines Offshore the Arctic National Wildlife Refuge, emphasizes that production from an OCS facility offshore the ANWR will not be allowed until a subsea pipeline has been constructed in offshore areas of the Beaufort Sea or areas with similar arctic conditions. This stipulation requires that any proposal to construct a pipeline must address the methods for construction, maintenance, monitoring, and repair of the pipeline under limiting seasonal conditions and restricted access from the ANWR. Special Stipulation 9, Protection of Polar Bears from Proposed Development Offshore the ANWR, addresses the need for information on effects to polar bears to be included in Development and Production Plan (DPP) environmental assessment. This stipulation requires lessees to provide information on measures to be taken to minimize effects to polar bears as part of their DPP; and that lessees may be required to conduct project-specific surveys related to polar bears.

The resource estimates forecast for the Alternative V area range from 210 MMbbl at the $18-per-barrel level to 450 MMbbl at the $30-per-barrel level. This resource level is about 60 to 67 percent of the forecasted resources of Alternative I. For Alternative V.a, there would be a general, across-the-board 40-percent decline in associated infrastructure (wells, platforms and pipeline miles). However, no pipeline landfalls would be eliminated. Resource development timeframes are the same as those of Alternative I. Table IV.A.1-1 and Table A-4 in Appendix A show the essential developmental timeframes for platforms and well numbers and other infrastructure requirements relevant for Alternative V.a.

More than 40 individuals raised the issue of protecting the ANWR largely in response to a Sierra Club letter on this subject. More than 50 individuals responded on behalf of the Teetl'it Gwich'in Council to protect the Porcupine Caribou Herd. The FWS raised concerns regarding compliance with the Refuge Conservation Plan, which prohibits activities within the refuge without the permission of the FWS and regarding the effects of oil spills on the Refuge. At the Alaska OCS Advisory Committee (AOAC) meeting in August, the FWS also requested that this area be deferred until more information is available on the effects of OCS operations off the ANWR. This deferral alternative was requested by the AOAC, the City of Kaktovik, the NSB, the Arctic Slope Native Association, and environmental groups.

The area that would be deferred under Alternative V.a includes blocks used for subsistence activities by the residents of the community of Kaktovik and provides protection for the areas offshore the ANWR. Alternative V.a also would ensure that no exploration and development drilling would occur in the deferred blocks, which may encompass a whale-feeding area; the potential for oil spills or use conflicts originating from the unoffered portion of the planning area would be reduced accordingly. The addition and analysis of this deferral in this document was supported by the FWS; the NSB; the Gwich'in Tribal Council of Canada; various environmental groups; and the AOAC.

In the following analyses of impacts on environmental and socioeconomic resources, the effects of area deferral (Alternative IV.a) are considered first followed by an analysis of effects of applying the special mitigation identified above for option V.b in lieu of deferral.

1. Water Quality:

a. Effects of the Deferral: The agents associated with petroleum exploitation that are most likely to affect water quality are the permitted discharges from exploration drilling units and production platforms, turbidity from construction activities, and hydrocarbons from oil spills. For Alternative V.a, there is a 32- to 40-percent reduction in the estimated oil production, and this decrease results in some reductions in the estimated level of activities (Table IV.A.1-1). For the permitted discharges, the basic unit area in the receiving waters that would be affected by the discharges from well drilling or production activities is the same as those defined for Alternative I in Section IV.B.1.a; also estimated in this section is the amount of time the waters would be affected. With the reduced resource estimate, there potentially is a 33- to 50-percent reduction in the number of areas where permitted discharges might occur; 6 to 10 exploration/delineation wells and 2 to 3 production platforms (Table IV.A.1-1).

Water quality within an area of about 0.03 km^2 (100-m radius) around each exploratory drilling unit or production platform temporarily would be degraded during active discharge of drilling muds and cuttings. The toxicity of the drilling muds generally is low, and the concentrations of the bulk constituents become nontoxic as the dilutions reached shortly after discharge. For Alternative V.a as compared to Alternative I, there is an estimated (1) 28- to 50-percent reduction in the number of exploration/ delineation wells drilled and weight of muds (3,780-6,300 short tons) and cuttings (4,920-8,200 short tons) discharged and (2) a 40-percent reduction in the number of production/ service wells drilled (52-67 wells) and weight of muds (7,800-45,560 short tons) and cuttings (61,360-79,060 short tons) discharged (Table IV.A.1-1).

If produced waters are discharged into the Beaufort Sea, the water quality in an area of several square kilometers would be degraded. The toxicity of produced waters mainly is caused by hydrocarbons that include nonvolatile hydrocarbons (EPA oil and grease) and aromatic hydrocarbons. Oil and grease concentrations in formation waters discharged into the Arctic marine environment would be limited to a 29 mg/1 (29 ppm) monthly average by the current Arctic NPDES General Permit. Assuming the water-to-oil ratio is between 0.35 and 0.62, the production of formation waters over the 20 years of production is estimated to range from about 74 to 279 MMbbl. The quantity of produced waters discharged over the life of the fields would be reduced by about 33 to 40 percent compared to similar activities associated with Alternative I; and this also decreases the amount of toxic substances, oil and grease, and aromatic hydrocarbons that might be discharged into the Beaufort Sea.

The turbidity associated with each type of offshore-construction activity would be increased in an area of about 4 km^2 at any one time. The decrease in the number of exploration/delineation wells (38-50%) and length (32-64 km) of offshore pipeline (33-50%) indicates a potential reduction in the number of areas that might be temporarily affected by an increase in the concentration of suspended particulate matter in the water column.

Small spills (<1,000 bbl) associated with exploration and production activities would result in local, chronic contamination of the waters with the margins of the fields. The instances of small spills (52-110) would be reduced by about 33 to 39 percent, and the volume of oil spilled (575-1,176 bbl) would be reduced by about 33 to 38 percent compared to Alternative I (Table IV.A.2-3).

The effects of a ≥1,000-bbl spill would be the same as described for Alternative I (Sec. IV.B.1.c). A spill of 7,000 bbl could, for about a month, temporarily contaminate water in an estimated area of <400 km^2, with hydrocarbons above the chronic criterion of 0.015 ppm. There is a 31- to 55-percent chance of a spill ≥1,000 bbl occurring, and this is slightly less than the chance estimated for Alternative I (Table IV.A.2-1). Concentrations above the 1.5-ppm-acute criterion may occur in an area <75 km^2 during the first several days of a spill. Regional, long-term degradation of water quality to levels above State and Federal criteria because of hydrocarbon contamination is very unlikely.

For the deferral alternative, petroleum exploration and development and production would not occur in the deferred (not available for oil and gas leasing) area. Thus, there would be no direct discharges of any permitted substances into the waters of the area. The number of exploration and delineation wells that might have been drilled in the deferred area is estimated to be six. The amount of muds and cuttings associated with these wells is estimated to be about 3,780 to 3805 and 4,920 short tons, respectively—about a 17- to 25-percent reduction from Alternative I.

It is estimated one or two production facilities could have been installed in the deferred area. The number of production and service wells associated with these facilities is estimated to range from 35 to 44. Drilling these wells would have used 5,250 to 29,920 short tons of drilling muds and produced 41,300 to 51,920 short tons of cuttings—about 40 percent of both the muds and cuttings associated with Alternative I. Produced waters from the one or two production facilities would range from 48 to 136 MMbbl—about 33 to 40 percent of the amount associated with Alternative I. The decrease in produced waters also represents a reduction in the amount of toxic substances, oil and grease, and aromatic hydrocarbons that might be discharged into the waters off the ANWR.

Reducing the number of exploration and delineation well sites, production facility sites, and length of offshore pipeline reduces the number of areas that might be temporarily affected by an increase in the concentration of suspended particulate matter in the waters column by 33 to 50 percent compared to Alternative I.

It is unlikely there would be any oil spills in the deferred area. Petroleum exploitation in the deferred area could have resulted in an estimated 33 to 54 spills ≥ 1 and <1,000 bbl for a total of 315 to 729 bbl for the life of the field(s). The number of spills and the amount of oil spilled represents about 33 to 39 and 33 to 38 percent, respectively, of the number of spills and the amount spilled that are estimated for Alternative I.

However, substances that enter the water column as a result of activities in other areas that could be open to oil and gas leasing could be transported into the waters of the deferred area—depending on the time of year and the direction of the winds and currents. Some areas that have been leased for oil and gas development lie adjacent to or inside the deferred area. The concentration of the substances entering the waters of the deferred area would depend upon the amount discharged or spilled, the distance the source is from the deferred area, and the amount of mixing and dispersion—which are functions of the waves and currents.

Conclusion: In comparison to Alternative I, the reductions in the permitted discharge quantities and areas affected by increased turbidity from offshore construction activities might range from about 33 to 50 percent and 33 to 50 percent, respectively.

b. Effects of Special Mitigating Measures: Special Stipulation 8 could decrease the risk of a spill from a pipeline. This stipulation does not allow for the installation and operation of a pipeline from an OCS facility offshore the ANWR, until there has been experience with the construction and operation of a subsea pipeline in other offshore areas of the Beaufort Sea or other areas with similar conditions. Stipulation 8 further provides that any proposal to construct a pipeline offshore the ANWR must address the methods for construction, maintenance, monitoring, and repair of the pipeline under the limiting seasonal conditions and restricted access to and from the ANWR. While these requirements might help reduce the risk of spills from a pipeline, information that could be used to estimate such a reduction is not available. Thus, the types and estimated levels of planned and unplanned activities remain the same as assumed for the analysis for Alternative I. The other special mitigating measures that have been proposed to reduce the risk of offshore development to the ANWR are not expected to modify the effects of Alternative V.b on water quality.

Conclusion: The special mitigating measure on OCS pipelines offshore the ANWR (Stipulation 8) might help reduce the risk of a subsea pipeline oil spill. However, the overall effect of the special mitigating measures on water quality are expected to be about the same as under Alternative I.

2. Lower Trophic-Level Organisms:

a. Effects of the Deferral: Activities that may affect lower trophic-level organisms include drilling discharges, seismic surveys, construction, and those associated with an accidental oil spill. The effects of these activities and the agents associated with them already have been discussed for Alternative I. This analysis considers differences in the amount of exposure lower trophic-level organisms would have to these activities/agents for Alternative Va. as compared to those of Alternative I. It then estimates the resulting effect of these differences on lower trophic-level organisms.

Alternative V.a eliminates about 36 percent of the Alternative I sale area and the effects of drilling discharges, seismic surveys, and construction-related activities from that area. However, because (1) the estimated effects of Alternative I already are so low (lethal and sublethal effects on <1 percent of the benthic organisms in the sale area), and (2) the number and magnitude of these activities for Alternative V.a would be similar to those of Alternative 1, Alternative V.a is expected to result in an immeasurably small reduction in adverse effects on lower trophic-level organisms within the sale area. Concerning the potential effect of an accidental oil spill, Alternative V.a deletes about 36 percent of the eastern portion of the Alternative I sale area. This would eliminate any OCS activity in the deferral area and would eliminate it as an area where a platform or pipeline oil spill could originate. This also would eliminate all of the beneficial effects of platform placement within the deferral area, which would have been used by marine organisms that require a hard substrate for attachment. Due to the normal westward pattern of wind and water currents in this area, any platform or pipeline oil spill occurring to the west of the deferral area is not likely to contact it; but, if the wind and water currents shifted eastward, the deferral area probably would be contacted. Hence, Alternative V.a may offer little advantage over Alternative I for an oil spill occurring to the west of the deferral area. However, if it is assumed that wind and water currents are moving westward following an oil spill, Alternative V.a is likely to reduce the probability of oil contacting the deferral area by eliminating platforms and pipelines from that area. This would reduce the adverse effects on lower trophic-level organisms estimated for Alternative I (lethal and sublethal effects on <1 percent of the plankton and invertebrate larva and <5 percent of the epontic community [assuming a winter spill] in the sale area). However, because the estimated effects of

Alternative I are so low, Alternative V.a is not expected to measurably benefit lower trophic-level organisms within the sale area. Alternative V.a, therefore, is expected to have essentially the same effect on lower trophic-level organisms as Alternative I.

Regarding the area offshore the ANWR, the effects on lower trophic-level organisms are as follows: It eliminates or reduces the estimated adverse effects of drilling discharges, seismic surveys, and construction-related activities on lower trophic-level organisms within the ANWR deferral area estimated for Alternative 1 (i.e., lethal and sublethal effects on <1 percent of the benthic organisms). If wind and water currents are moving westward following an oil spill, Alternative V.a is likely to reduce the probability of oil contacting the ANWR deferral area by eliminating platforms and pipelines from that area. This would reduce or eliminate the adverse effects of oil on lower trophic-level organisms within the ANWR deferral area estimated for Alternative 1 (i.e., lethal and sublethal effects on <1 percent of the plankton and invertebrate larva and <5 percent of the epontic community). However, if wind and water currents are moving eastward following an oil spill, the ANWR deferral area probably also would be contacted, and Alternative V.a would not reduce or eliminate adverse effects in the deferral area. Alternative V.a also would eliminate all of the beneficial effects of platform placement within the ANWR deferral area, which otherwise would have been colonized by lower trophic-level organisms requiring a hard substrate for attachment.

Conclusion: Alternative V.a is expected to have essentially the same effect on lower trophic-level organisms within the sale area as Alternative I.

b. Effects of Special Mitigation Measures: In addition to the standard stipulations and ITL's, three additional stipulations (7, 8, and 9) and three additional ITL's (15, 22, and 23) are being considered for Alternative V.b. These stipulations and ITL's primarily concern the protection of the ANWR deferral area, the ANWR, and the vertebrate resources therein. While they theoretically could have some small benefit on lower trophic-level organisms within the deferral area, they are not expected to benefit lower trophic-level organisms in the greater sale area. Hence, the implementation of these additional stipulations and ITL's is not expected to produce measurable benefits for lower trophic-level organisms within the sale area, or alter the expected effect of Alternative V.b on lower trophic-level organisms.

Conclusion: The special mitigation measures for Alternative V.b are not expected to measurably benefit lower trophic-level organisms in the sale area.

3. Fishes:

a. Effects of the Deferral: Under Alternative V.a, the types of effects to fishes would be similar to those in Alternative I, except that the magnitude of the effects likely would be decreased.

The decreased magnitudes in effects would include the disturbances as a result of discharges; noise and disturbances from seismic surveys; and noise and disturbances from aircraft, vessel, drilling, and construction activities. For Alternative V.a, the number of exploration wells would decrease to three to five from the six to eight for Alternative I. Shallow-hazard surveys would cover only 69 to 115 km^2 for Alternative V.a, whereas these surveys for Alternative I would cover 138 to 184 km^2. Drilling discharges for Alternative V.a would be reduced 40- to 50-percent from Alternative I. Support activities (helicopter flights and supply-boat trips) would be reduced by approximately 35 to 50 percent from Alternative I. However, aircraft and vessel traffic to and from nearby, previous Federal lease sales may disturb some fishes in the Alternative V area. Disturbances from seismic surveys within previously leased areas could be transmitted into the Alternative V area. However, the intensity of the seismic-survey disturbance would be reduced and unlikely to significantly affect fishes.

Oil-spill risks to fishes would be reduced as compared to Alternative I (Table IV.A.2-1). The range of resources would be reduced from 350 to 670 MMbbl in Alternative I to 210 to 450 MMbbl in this alternative. The OSRA model estimates a 31- to 55-percent probability for the occurrence of one or more oil spills ≥1,000 bbl over the assumed production life of Alternative I. The OSRA model for combined probabilities estimates a 2- to 10-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 through 9 and Simpson Lagoon (only from July through September), depending on whether or not fishes are located in these areas, within 30 days over the production life of Alternative I. Except for I/SS 8, which has a probability of contact of 5 to 10 percent, the aforementioned segments have probabilities of contact ≤6 percent. This is a reduction for I/SS 8 of 1 to 2 percent and I/SS 9 of 5 to 9 percent from the combined probabilities for Alternative I. If spilled oil contacted fish habitat, the results would be the same as discussed in Section IV.B.3. As with oil spills under the other alternatives, except the no-sale alternative, fishes could experience any of the following as a result of an oil spill: skin contact, respiratory distress from gill fouling, localized reduction in food resources, consumption of contaminated prey, displacement from migratory routes, and temporary displacement from local habitat. In winter, fishes in critical and scarce overwintering nearshore habitats likely would suffer the most lethal effects due to their dependency on these habitats and their inability to avoid the spill by

moving out of the spill area. These affected fish populations could take many generations to recover, depending on the recruitment into the population. Otherwise, fishes likely would suffer nonlethal effects from an oil spill.

Regarding the area offshore the ANWR, the reduction of effects to fishes are as follows. Fewer fishes would be exposed to noise and disturbance from oil and gas activities under this deferral than under Alternative I. The reduction in the magnitude of the effects would result from fewer wells being drilled, less seismic activity being conducted, and less drilling muds and cuttings being discharged. A decrease in drilling discharges also would reduce alterations to fish habitat. However, fishes located in the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur inside and/or outside the deferred area. This could result from lease activities from previous Federal lease sales being granted adjacent to and within this alternative's area. Fewer fishes would be exposed to the types of effects from oil and gas activities under the deferral than under Alternative I.

Conclusion: The types of effects on fish resources from Alternative V.a likely would be similar to those expected under Alternative I and its resource-development scenario. The level of disturbance (magnitude of the effects) for Alternative V.a would be reduced from those of Alternative I.

b. Effects of Special Mitigating Measures: In addition to Stipulations 1 and 5 described under Alternative 1 that afford protection to fish resources in the Sale 170 area, special mitigating measures for the area offshore of the ANWR, specifically Stipulations 7 and 8, provide limited, immeasurable additional protection for fish resources in the nearshore and offshore waters of the ANWR. Stipulation 7 ensures that exploration, development, and production plans contain a description of the all their activities, and that the staging and mobilization of equipment can be accomplished from locations other than the ANWR. Stipulation 8 states that no production from an OCS offshore facility will be permitted, until an undersea pipeline has been constructed in the Beaufort Sea or similar area. It also states that proposals for any pipeline construction must address all its involved activities under the limiting seasonal conditions and restricted access from the ANWR. However, this stipulation pertains only to pipeline leakage and not the construction activities such as the deposition of excess trench dirt on the surface of the ice. Stipulation 8 would not ensure that the new Beaufort Sea undersea pipelines would be somewhat proven as a safe technology prior to the pipelines being constructed offshore of the ANWR, because the monitoring is for leakage not the environmental effects caused by the undersea pipeline construction.

Additionally, ITL's 22 and 23 would ensure that the FWS be made aware of offshore leasing activities. The ITL 22 informs the lessee that the FWS manages the ANWR, and that no activities can be conducted within the ANWR without its permission. The ITL 23 advises lessees that MMS will consult with FWS about any pipelines constructed offshore of the ANWR, so that necessary measures to protect the ANWR can be formulated. These ITL's also should provide an added immeasurable means of protecting fish resources by ensuring that the FWS knows of leasing activities in the offshore ANWR area.

Conclusion: These special mitigating measures may provide limited, immeasurable additional protection to fish resources offshore of the ANWR, by ensuring that offshore activity plans contain a description of their activities and that the necessary equipment will not need to encroach upon the ANWR. The ITL's will ensure that the FWS is given notice of leasing activities offshore of the ANWR. The special mitigating measures are expected to have about the same reduction of adverse effects to fish resources as the deferral of lease tracts under Alternative Va.

4. Endangered and Threatened Species:

a. Effects of the Deferral:

(1) The Bowhead Whale: Alternative V.a would remove approximately 36 percent of the unleased blocks from the proposed sale area, deferring an offshore area in Camden Bay west of Barter Island from petroleum exploration and development/production (Fig. II.C-1). The resource estimate and development scenario for Alternative V.a would provide a potential reduction in oil-spill effects on endangered and threatened species and their habitats west of Barter Island.

This alternative pertains to an area used by bowhead whales for migration and possibly for occasional feeding during the late summer and fall. This alternative may reduce the potential for adverse effects to bowhead whales as a result of discharges, noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and construction activities, and oil spills as a result of exploration and development and production activities compared to the scenario presented in Alternative I, because additional leasing would not take place within the deferral area. An estimate of these activities is provided in Table IV.A.1.1.

Noise from drilling and seismic activities has the most potential to affect bowhead behavior. It is estimated that the number of exploration wells drilled would be reduced from six to eight wells under Alternative I to three to five wells as a result of the deferral and the number of delineation wells would be reduced from six to eight wells to three to five wells. The area included in shallow-hazards

site surveys would be reduced from an estimated 138 to 184 km^2 under Alternative I to an estimated 69 to 115 km^2 as a result of the deferral. Bowhead whales exposed to noise from exploration and development and production activities may experience temporary, nonlethal effects. Some bowheads may avoid areas near the activities. It is likely that fewer whales would be exposed to noise from these activities under the deferral than under Alternative I. However, with or without the deferral, the overall migration is not likely to be affected and the overall effect on the population is likely to be essentially the same as under Alternative I.

Oil-spill risks to bowhead whales would be reduced compared to Alternative I. The range of resources would be reduced to 210 to 450 MMbbl as compared to 350 to 670 MMbbl for Alternative I. During development/ production activities, the OSRA estimates a 31- to 55-percent chance of one or more spills ≥1,000 bbl occurring compared to a 46- to 70-percent chance under Alternative I (Table IV.A.2-1). For combined probabilities, the OSRA model estimates a 3- to 10-percent chance of one or more spills ≥1,000 bbl occurring and contacting I/SS's 7 through 9, where bowheads may be present during the fall migration within 30 days over the production life of Alternative I. The probability of contact in I/SS 8, the area of highest probability of contact, is estimated at 5 to 10 percent. This is a reduction in oil-spill risk for this alternative compared to Alternative I, where the probability of contact in I/SS's 8 and 9 is estimated at 6 to 12 percent and 8 to 15 percent, respectively. If spilled oil were to contact a whale-habitat area, resulting effects would be as discussed under Alternative I (Sec. IV.B.4). Some bowhead whales could experience one or more of the following: skin contact with oil, baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of contaminated prey items, and perhaps temporary displacement from some feeding areas. Some individuals might be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals so affected is expected to be small. Overall, exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, with the population recovering to prespill population levels within 1 to 3 years. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects. Effects on bowheads expected for this alternative would be similar to the effects expected under Alternative I.

Regarding the ANWR deferral, the effects on bowhead whales within the deferred area are as follows. It is likely that fewer whales would be exposed to noise from these activities under this deferral than under Alternative I, because fewer wells would be drilled and less seismic activity would be conducted with the area deferred. However, bowhead whales within the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur both inside and outside the deferral area. It should be noted that these activities may occur in the deferral area without additional leasing, because leases have been granted adjacent to and within the area of this alternative as a result of previous Federal lease sales. Drilling operations and seismic surveys may be conducted on these leases, and aircraft and vessel traffic may cross the area en route to these leased blocks. These activities could disturb low numbers of bowheads and cause some bowheads to avoid areas near the activities. In addition, noise from seismic surveys or drilling operations within leased blocks outside of the deferral area could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels and would be unlikely to significantly displace feeding or migrating whales. The effect of noise on bowheads, with or without the deferral, would be as described for Alternative I, with whales avoiding vessels, seismic surveys, drilling units, and production platforms at varying distances. It is likely that fewer whales would be exposed to noise from these activities under the deferral than under Alternative I. Exposure of bowhead whales to noise-producing activities, whether inside or outside the deferral area, is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects.

Likewise, any oil spill that may occur either on leases outside the deferral area or on leases within the deferral area has the potential to be present within the deferral area.

Conclusion: Effects on bowheads expected from Alternative V.a would be similar to the effects expected under Alternative I. While fewer whales may be exposed to oil and gas activities under the deferral than under Alternative I, the extent and nature of the effects and the overall effect on the population is likely to be essentially the same as under Alternative I.

(2) The Spectacled Eider, the Steller's Eider, and the Arctic Peregrine Falcon:

Spectacled Eider: Spectacled eiders are uncommon east of the Sagavanirktok River and rare east of the Canning River, where the probability of spilled oil that originates in the Alternative V area offshore of the ANWR (launch boxes L5, L6, L7 or L8, or pipeline segment P4, Fig. IV.A.2-1) contacting habitats potentially used by eiders (I/SS's 8-10 and LS's 35-38, Fig. IV.A.2-2, -3) is higher than most areas farther east or west. Although deferral of this area reduces the probability of one or more spills ≥1,000 bbl occurring (46-70% in Alternative I vs 31-55% with deferral), removal of potential spill sites provides only a minor reduction in the probability of spill occurrence and contact within 30 days (most areas ≤5%, Anderson et al., 1997, Tables 10, 11, 14, 15) in areas potentially used by this species. Effects (primarily disturbance) of routine

exploration and development activities also are likely to be reduced to a minor extent with this deferral. As a result, Alternative V.a would result in no significant reduction of the effects determined under Alternative I (Sec. IV.B.4), which included no significant effects from routine activities and relatively low mortality if an oil spill occurred (<300 individuals). However, unless mortality is near the lower end of this range (e.g., <25), recovery from spill-related losses is not expected to occur if numbers on the breeding grounds continue to decline and the relatively low reproductive rate persists.

The rarity of spectacled eiders in the vicinity of the ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: Alternative V.a would produce no significant reduction of routine activity or oil-spill effects on spectacled eiders from those expected under Alternative I. Effects are expected to be minimal, affecting <2 percent of the population; however, recovery from even minimal mortality is unlikely to occur while the current uncertain population status persists.

Steller's Eider: The only substantial occurrence of Steller's eiders in Alaska during the nesting season is in the Barrow area (they are uncommon east of Point Barrow, rare east of the Colville River). Because there would be almost no reduction in the low probability (0-4%; Anderson et al., 1997, Table 10, 11, 14, 15) of one or more spills occurring and contacting areas potentially used by this species (I/SS's 4-6, LS 20-29, Elson Lagoon, C2; Figs. IV.A.2-2, -3, -6), Alternative V.a would result in no significant reduction of effects determined under Alternative I (Sec. IV.B.4). These include no significant effects from routine activities and relatively low mortality from an oil spill (<100 individuals); however, unless mortality is near the lower end of this range (e.g., <25), recovery from spill-related losses is not expected to occur if numbers on the breeding ground continue to decline and the relatively low reproductive rate persists.

The rarity of Steller's eiders in the vicinity of the ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: Alternative V.a would provide no significant reduction of routine activity or oil-spill effects on Steller's eiders from that expected under Alternative I. Effects are expected to be minimal, affecting <2 percent of the population; however, recovery from even minimal mortality is unlikely to occur while the current uncertain population status persists.

Arctic Peregrine Falcon: Because arctic peregrines primarily nest inland 32 km (20 mi) or more from the coast, Alternative V.a would result in no demonstrable reduction of effects determined under Alternative I (Sec. IV.B.4). These include disturbance (rarely) by distant support aircraft, construction of onshore gathering pipelines, gravel mining, and potential contact with oil either directly or through contact with oiled prey. Neither disturbance nor oiling of peregrines is considered a likely result of Alternative I (<5 percent of the population exposed to potentially adverse factors), because activities involving these adverse factors generally are far removed from primary areas of falcon activity. Exposure of peregrines to oiled prey, likely to be infrequent in any case, is not expected to decrease significantly under this alternative, because the decreased number of projected spills does not result in significantly decreased shoreline contact by oil. No mortality is expected to result from this alternative.

The rarity of arctic peregrine falcons in the vicinity of coastal ANWR suggests that this species' population is unlikely to be adversely affected by factors associated with oil-development activities in this area.

Conclusion: Routine and spill-related effects of Alternative V.a on the arctic peregrine falcon are expected to be minimal. Because exposure of falcons to adverse factors is expected to be insignificant under both Alternative I and this alternative, reduction of adverse effects is expected to be insignificant.

b. Effects of Special Mitigating Measures:

(1) The Bowhead Whale: Special mitigating measures under Alternative Vb. would provide limited protection to bowhead whales offshore of the ANWR. The area offshore of the ANWR would be available for leasing but with special mitigating measures in place. Stipulation 7, Planning for Activities Offshore the Arctic National Wildlife Refuge, requires lessees to demonstrate the ability to stage and mobilize equipment, including oil-spill-response equipment, from locations other than the ANWR. This measure will help to ensure that equipment and personnel are prepared to respond to an oil spill in the area offshore the ANWR, should one occur. However, this measure and other special mitigating measures are not expected to provide much additional protection to bowhead whales.

Conclusion: Special mitigating measures for Alternative V.b are not expected to provide much additional protection to bowhead whales. The effects on bowhead whales are expected to be about the same as under Alternative I. The special mitigating measures would be likely to provide about the same amount of protection to bowhead whales that is provided by not leasing the area offshore the ANWR.

(2) **The Spectacled Eider, the Steller's Eider, and the Arctic Peregrine Falcon:** Under Alternative V.b, the area offshore of the ANWR would be available for leasing but with special mitigating measures in place that may provide limited additional protection from disturbance factors and oil spills for these species over that provided by measures in Alternative I. Permission of the FWS would be required for activities in the Refuge, which are governed by the ANWR Comprehensive Conservation Plan (ITL 22). Lessees must demonstrate the ability to stage and mobilize equipment, including oil-spill-response equipment, from alternate locations (Stipulation 7). Production will not be allowed until subsea pipeline safety is demonstrated (Stipulation 8), and MMS will consult with the FWS regarding any pipelines offshore the ANWR (ITL 23). These measures may help ensure that equipment and personnel are prepared to respond to an oil spill offshore of the ANWR, and that the probability of a pipeline spill has been minimized.

Conclusion: Special mitigating measures under Alternative V.b are expected to provide limited additional protection for these species over that provided by Alternative I and, thus, the effects on these species are expected to be about the same. The special mitigating measures likely would provide about the same degree of protection for these species as is provided by deferral of the area offshore the ANWR.

5. Marine and Coastal Birds:

a. **Effects of the Deferral:** Alternative V.a would delete an area offshore of the ANWR, reducing the number of exploration wells drilled from six to eight to three to five, the number of production platforms from three to five to two to three, and activities associated with each. These reductions would reduce disturbance and potential oil-spill effects in marine and coastal bird habitats in this area.

As a result of this level of activity reduction, local disturbance of marine and coastal birds by support traffic and operations would be reduced substantially in this area from that expected under Alternative I (effects under Alternative I include short-term displacement of birds from the vicinity of vessels or routinely used air and vessel corridors to platforms, lasting a few minutes to <1 day; and/or long-term displacement from the vicinity of platforms or onshore facilities). The potential for seismic operations and emergency traffic in the deferred area would remain. Because disturbance is not expected to have population-level effects under Alternative I, this reduction would be considered minor.

Deferral of leasing offshore the ANWR under Alternative V.a reduces the combined probabilities (expressed as a percent chance) of one or more ≥1,000-bbl spills occurring and contacting important habitats for marine and coastal birds within 30 days of spill occurrence to Jago Lagoon (Fig. IV.A.2-6) from 1 to 2 percent under Alternative I to 0 to 1 percent under Alternative V.a, and to Gwydyr Bay from 2 to 4 percent under Alternative I to 1 to 2 percent under Alternative V.a. The chance of spill occurrence and contact with offshore marine bird habitats from Mackenzie Bay (Canada) west to Prudhoe Bay (represented by I/SS's 8-13, Fig. IV.A.2-2) also is reduced under Alternative V.a, particularly in the area offshore the western ANWR (I/SS 9). However, the chance of spill occurrence and contact with other offshore habitats west of Prudhoe Bay (represented by I/SS's 4-7) is the same under Alternatives I and V.a. The chance of spill occurrence and contact with coastal-shoreline habitats in the western ANWR (represented by LS's 38-41, Fig. IV.A.2-3) is slightly reduced under Alternative V.a (1% at several segments) as compared to Alternative I; elsewhere there is no change (Anderson et al., 1997; Tables 10, 11, 14, 15).

Areas where the probability of contact by spilled oil originating in the deferred eastern sale area is greatest (from launch boxes L7 and L8, pipeline segment P4, Fig. IV.A.2-1) include Camden Bay and Barter Island (LS 38-41; I/SS 9-10, ERA C5, Figs. IV.A.2-2, -3, -6). Under this alternative, reduction in spill-contact probability for the ice/sea segments ranges from 0 to 26 percent; for land segments, 0 to 9 percent; and for the environmental resource area, 2 to 9 percent (Anderson et al., 1997; Tables 4, 8). Greatest reduction occurs in the Camden Bay area, although contact probability remains as high as 44 percent from launch box L5. Potential contact in most of these areas is reduced <6 percent. Thus, the ANWR deferral would reduce the probability of occurrence of the relatively low spill-related mortality determined under Alternative I (Sec. IV.B.5). Probability of contact with marine and coastal birds in offshore habitats west of Camden Bay and nearshore habitats west of Gwydyr Bay would not be reduced under Alternative V.a, but offshore and west of Harrison Bay and nearshore west of Simpson Lagoon the probabilities are quite low (≤6 %).

Any spill-related losses of marine and coastal birds still may include up to several thousand birds, but the chance of occurrence of such losses is reduced from Alternative I by this alternative, and a spill may occur when few birds are present. There still remains a substantial probability of spill contact with areas offshore of the western portion of the ANWR (44%). The effect of such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Elimination of the potential for platform or pipeline oil-spill occurrence and habitat alteration in the deferred area offshore of the ANWR, as well as most potential sources of disturbance during exploration or development and production would reduce effects on marine and coastal

birds that seasonally occupy the ANWR, including short-term displacement of <1 day or avoidance of routinely used air and vessel corridors potentially causing some level of reduced fitness of individuals displaced from traditional marine foraging areas to a negligible level. Seismic operations and emergency traffic, which are not expected to cause significant disturbance, would remain as potentially disturbing activities. Although the probability of spilled oil contacting areas offshore of the western portion of the ANWR, where birds that have nested on the Refuge may forage and stage prior to migration, remains substantial (44%) under this alternative, the chance of nearshore or shoreline contact is <6 percent. More importantly, the probability of a spill occurring and contacting ice/sea segments offshore of the refuge, or Jago Lagoon and the western ANWR shoreline, are reduced to <7 and <3 percent, respectively, and a spill may be weathered and dispersed by the time birds are contacted, or occur when few birds are present. As a result, although any spill-related losses of marine and coastal birds still may include up to several thousand birds, the chance of such losses occurring is quite low under this alternative. The effects of any such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the populations and survey methods/data available.

Conclusion: Under Alternative V.a, disturbance of marine and coastal birds the deferral area ia expected to be negligible; in the remainder of the proposed sale area it would remain the same as that discussed under Alternative I. Because the chance of spill occurrence and contact with habitats from Gwydyr Bay eastward, particularly offshore of the western portion of the ANWR, is reduced from Alternative I, risk of oil-spill effects on birds and their habitats also is reduced to a relatively low level. Risk of oil-spill contact remains substantial offshore of the ANWR, so birds from nesting areas in the ANWR that enter this area when oil is present are expected to sustain spill-generated losses equivalent to those discussed for Alternative I (up to several thousand individuals). The effects of any such losses are expected to be minor at the population level and may not be detectable above the natural fluctuations of the population and survey methods/data available.

b. Effects of Special Mitigating Measures: Under this option, the area offshore of the ANWR would be available for leasing, but with special mitigating measures in place that may provide additional protection from disturbance factors and oil spills for marine and coastal birds over that provided by measures in Alternative I. Permission of the FWS would be required for activities in the ANWR, which are governed by the ANWR Comprehensive Conservation Plan (ITL 22). Lessees must demonstrate the ability to stage and mobilize equipment, including oil-spill-response equipment, from alternate locations (Stipulation 7). Production will not be allowed until subsea pipeline safety is demonstrated (Stipulation 8), and the MMS will consult with the FWS regarding any pipelines offshore the ANWR (ITL 23). These measures may help ensure that equipment and personnel are prepared to respond to an oil spill offshore of the ANWR, and that the probability of a pipeline spill has been minimized.

Conclusion: Special mitigating measures under Alternative V.b are expected to provide about the same protection for marine and coastal birds as provided in Alternative I and, thus, the effects on these species are expected to be about the same. The special mitigating measures likely would provide about the same degree of protection to these species as is provided by deferral of the area offshore the ANWR.

6. Pinnipeds, Polar Bears, and Belukha Whales:

a. Effects of the Deferral: Effects associated with Alternative V.a essentially would be the same, at least qualitatively, as those analyzed for Alternative I (Sec. IV.B. 6). The magnitude of effects could vary, depending on the population status of affected marine-mammal species at the time when adverse effects could occur. For Alternative V.a, noise and disturbance; habitat alterations from drill-platform installation, pipeline laying, and other construction; and oil spills could have some adverse effects on pinnipeds, polar bears, and belukha whales found in the sale area.

Under the development scenario for Alternative V.a, the amount of helicopter and supply-boat-support traffic would be reduced somewhat from that expected under the scenario for Alternative I (see Table IV.A.1-1). Helicopter trips (1 round trip/day to each of 2-3 drilling platforms vs the same amount of traffic to each of 3-4 platforms under Alternative I) and supply-boat traffic could disturb some hauled out ringed, bearded, and spotted seals, causing them to panic and charge into the water, perhaps resulting in the injury or death of some seal pups. Aircraft disturbance of seals, walruses, and polar bears is likely to be short-term displacement (a few minutes to less than a few days) of small numbers of these animals (less than a few hundred) within 1 to 3 km of the helicopter. Vessel traffic associated with the two exploration-drilling units and two to three production units and seismic vessels operating during the open-water season temporarily could displace or interfere with marine mammal migration and change local distribution for a few hours to a few days. Such short-duration and local displacement (within 1-3 km of the traffic) is expected to have about the same level of short-term (less than a few days) effect on the distribution of pinnipeds, polar bears, and belukha whales as described for Alternative I. Past and ongoing oil and gas exploration activities offshore of the ANWR and industrial activities

west of the ANWR have not been found to be affecting rates of recruitment or survival of the Beaufort Sea stock of polar bears in Alaska (USDOI, FWS, 1995). Denning polar bears were reported to tolerate exceptional levels of seismic activity and ice-road traffic, the latter only 400 m from an occupied den (Amstrup, 1993). Therefore, air and vessel traffic and seismic operations associated with oil and gas exploration and development within the deferred area are not expected to significantly affect polar bears or their habitat on or along the coast of the ANWR.

The installation of two to three (vs 3-5 under Alternative I) production platforms and the laying of 32 to 64 km (vs 64-96.5 km under Alternative I) of offshore pipelines with an estimated 1 to 5 km of benthic habitat altered are expected to have a short-term and very local effect (within a few kilometers or less of the platforms and pipelaying operations) on seals, polar bears, and belukha whales and not affect marine mammal populations.

There is a 31- to 55-percent chance of one or more oil spills ≥ 1,000 bbl occurring during exploration and development under Alternative V.a (vs 46-70% chance under Alternative I). Assuming a 7,000-bbl oil spill occurred, it would pose the greatest risk of contact to all marine mammals from the Camden Bay offshore area (I/SS 9) to ice-flaw-zone habitats located west to Cape Halkett (I/SS 6) (Fig. IV.B.6-1). Under Alternative V.a, blocks offshore of Camden Bay would not be leased, therefore greatly reducing the risk of the 7,000-bbl spill occurring in this area (see Fig. II.C.1). However, blocks immediately west in Camden Bay and west to offshore of about Oliktok Point still may be leased under Alternative V.a If an oil spill occurred in this area, nonendangered marine mammals—pinnipeds, polar bears, and belukha whales—still would be about equally at risk from contact with the spill, and the effect is expected to be about the same. In a severe situation where a concentration of perhaps 20 or 40 bears (such as at a whale carcass on the coast of the ANWR-Barter Island, Cross Island, or Barrow) out of a population of 1,300 to 2,500 were contaminated by the 7,000-bbl oil spill and all the bears died, this one-time loss is expected to be replaced by the Beaufort Sea population of polar bears within less than one generation (no more than 3-5 years for recovery). Assuming an annual recruitment rate from the current growth rate of 2.4 percent would allow a potential biological removal rate or a yield of 48 bears per year and assuming equal sex ratio of removed bears and a subsistence harvest of 20 to 30 bears/year (USDOI, FWS, 1995). Assuming a Beaufort Sea polar bear population of 2,000 and a sex ratio of 2:1 male to female, the sustainable yearly harvest would be about 76 bears, which is considerably more than recent annual subsistence harvest of about 30 bears from this population under the North Slope Borough/Inuvailuit Game Committee Management Agreement on Polar Bears (Nageak, Brower, and Schliebe, 1991). Thus, the additional loss of 20 to 40 bears from the assumed 7,000-bbl spill over and above the subsistence harvest is expected to be replace within less than one generation (3-5 years with an assumed polar bear generation time of at least 7-8 years), even if the sustainable yield is exceeded for 1 year).

Although the deferral of oil and gas activities offshore of the ANWR would protect coastal and offshore habitats of the ANWR from potential oil spills, polar bears that den on the Refuge or den on pack ice offshore of the Refuge are at equal risk of contacting and being killed by potential oil spills occurring west of the ANWR, when these bears leave the ANWR and follow ice-movements-habitats to the west and move to feeding areas, such as whale carcasses west along the coast at Cross Island or Barrow (USDOI, FWS, 1995, Habitat Conservation Strategy for Polar Bears in Alaska, Fig. 8). The combined effect of noise and disturbance, habitat alterations, and oil spills under the Alternative V.a developmental scenario is expected to be about the same as under Alternative I.

Regarding the area offshore of the ANWR, the removal of or reduced effects to the ANWR on pinnipeds, polar bears, and belukha whales are as follows: There would be no oil spills (7,000 bbl), noise and disturbance (aircraft and vessel traffic including seismic operations), or habitat alterations (installation of 1-2 exploration and production platforms and the laying of 32 km of pipelines) within the area from this alternative . This would represent one to two fewer exploration and production platforms and 32 fewer offshore pipeline kilometers compared to Alternative I. There is about a 15-percentage-point reduction in the chance of one or more oil spills ≥ 1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur in the area offshore of the ANWR. The potential loss of small numbers of seals and belukha whales is not expected to occur offshore of the ANWR, and the loss of an estimated 20 to 40 polar bears on or near the coast of the ANWR would not occur. However, such losses still are expected to occur to the polar bear population (that includes some of the bears that occur on the ANWR), if the 7,000-bbl spill contacts other polar bear concentrations at whale carcass sites such as at Cross Island, Barrow, or other locations where whales die and end up on the shore. The effect of the 7,000-bbl spill on seals and belukha whales west of the area offshore of the ANWR is expected to be the same. Potential noise and disturbance from aircraft and vessel traffic, including seismic operations, and habitat alteration from platform and pipeline installation, would not occur in the area offshore of the ANWR, but these effects were expected to be short term and not affect pinniped, polar bear, and belukha whale populations. Therefore, the removal of exploration and development offshore of the ANWR is not expected to reduce the overall effect on pinniped, polar bear, and belukha whale populations as described under Alternative I.

Conclusion: The effect of Alternative V.a (noise and disturbance, oil spill, and habitat alteration) is expected to be reduced or avoided on pinnipeds, polar bears, and belukha whales offshore of and on the ANWR, but the overall effect on pinniped, polar bear, and belukha whale populations is expected to be about the same as under Alternative I (such as the loss of perhaps 20-40 polar bears and the loss of small numbers of seals and whales).

b. Effects of Special Mitigating Measures: Special mitigating measures under Alternative V.b would provide for protection of pinnipeds, polar bears, and belukha whales in the marine environment along the coast of the ANWR and provide protection to coastal habitats of polar bears on the Refuge. Stipulation 8 on transportation of hydrocarbons addresses the need of industry to design, construct, maintain, and repair pipelines that would meet the special environmental conditions of the Arctic. This measure is expected to reduce the risk of oil-spill effects on marine mammals such as polar bears frequenting marine and coastal habitats adjacent to the ANWR.

Stipulations 7, 8, and 9 and ITL's 18, 22, and 23 address the concerns about potential onshore facilities that may be associated with leasing offshore of the ANWR. Staging of equipment, infrastructure, and other activities would not be allowed in the Refuge in accordance with the ANWR Comprehensive Conservation Plan (ITL's 22 and 23). No activities including pipeline landfalls would be allowed without permission of the FWS (Stipulation 7 and ITL 22), and MMS would be required to consult with FWS on proposed pipelines to be located offshore of the ANWR and monitoring and inspection of these pipelines (ITL 18). These measures are expected to reduce any potential noise and disturbance and habitat effects on polar bears that den on the Refuge as well as reduce potential effects on other marine mammals occurring along the coast of the ANWR.

Stipulation 9 requires the lessees to provide information on polar bear distribution, denning, habitats, and potential effects of industrial activities and describe measures to be taken to minimize effects, including the Letter of Authority (LOA) required under the MMPA. The lessees may be required to conduct project-specific surveys related to polar bears. Stipulation 9 is expected to provide project-specific information on polar bears within or adjacent to the lease area that would help to formulate project-specific measures that would be expected to reduce effects on polar bears and their habitats on the ANWR and adjacent offshore areas.

Conclusion: These special mitigating measures are expected to reduce potential noise and disturbance, oil spills, and habitat effects on marine mammals, particularly on polar bears occurring on or adjacent to the ANWR. However, the overall effects on pinnipeds, polar bears, and belukha whales are expected to be the same as under Alternative I. These special mitigating measures are expected to have a similar reduction in adverse effects on polar bears, pinnipeds, and belukha whales as the deferral of lease tracts under Alternative V.

7. Caribou:

a. Effects of the Deferral: Effects associated with Alternative V.a, the area offshore of the ANWR, would be the same, at least qualitatively, as those analyzed for Alternative I (Sec. IV.B.7). However, the magnitude of effects could vary, depending on the population status of the affected caribou herds (CAH and PCH) when adverse effects could occur. The present population status of the CAH indicates a 22-percent overall decline in the population between 1992 (23,000 animals) and 1995 (18,000 animals), with all of the decline occurring in that portion of the herd exposed to extensive oil development, and a 41-percent decline in CAH caribou ranging in the Prudhoe Bay area and west of the TAPS (USDOI, FWS, 1997). The decline in abundance and productivity deficiencies of CAH cows (higher rate of reproductive pauses for cows ranging on the oilfields) appears to be directly linked to reduced body condition of females during the fall rather than to weather conditions, range quantity or quality, or different predation rates (USDOI, FWS, 1997).

The primary source of disturbance to caribou is vehicle traffic (perhaps as much as several hundred vehicles/day) that could be associated with onshore transportation of oil from offshore leases west of Camden Bay (Fig. II.A.2). Disturbance of caribou along the pipelines and roads from Point McIntyre, Oliktok Point, and Point Thomson to the TAPS though existing facilities in the Prudhoe Bay and adjacent oilfields would be most intense during the construction period (perhaps 6 months) when motor-vehicle traffic is highest, but would subside after construction is complete. Caribou are likely to successfully cross the pipeline corridor within a short period of time (a few minutes to a few days) during breaks in the traffic flow, even during high-traffic periods, with little or no restriction in movement. However, a local reduction in cow-calf distribution within about 3 to 4 km (1.86-2.48 mi) along pipeline-road corridors may be expected if the corridors cross main CAH calving habitats.

The field-development scenario for Alternative V.a forecasts the construction of 32 to 113 km (vs 32-161 km under Alternative I) of onshore pipelines, and potential adjacent roads are expected to be constructed (Table IV.A.1-1). This reduction in pipeline miles and reduction in potential adjacent roads and vehicle traffic is expected to reduce the amount and duration of displacement of CAH caribou from habitats within 3 to 4 km (1.86-2.48 mi) the pipeline-road corridors east of the Prudhoe Bay oil field and near the ANWR boundary. These pipelines are expected to be short (20-30 mi total length) and connect to

existing transportation facilities along the coast and not cross calving areas of the PCH.

There is a 31- to 55-percent chance of one or more oil spills ≥1,000 bbl occurring during exploration and development under the development scenario for Alternative Va. versus a 46- to 70-percent chance under the scenario for Alternative I. Assuming one 7,000-bbl oil spill occurred under Alternative Va. during the open-water season, caribou of the CAH that frequent coastal habitats from Cape Halkett (LS 28) to Flaxman Island (LS 37) possibly could be directly exposed to and contaminated by the spill along the beaches and in shallow waters during periods of insect-pest-escape activities (Fig. IV.B.7-1). However, even in a severe situation, a comparatively small number of CAH animals (perhaps a few hundred or more) is likely to be directly exposed to the oil spill and die as a result of toxic hydrocarbon inhalation and absorption. The effect of one 7,000-bbl spill would represent the loss of small numbers (perhaps a few hundred or more) of CAH caribou. This loss probably would be small for the CAH population (18,000 animals), with this loss replaced within less than one generation (about 1 year). However, if the 7,000-bbl spill occurred offshore of the ANWR and contacted coastal habitats during insect-relief periods 1,500 to 3,000 PCH caribou or 1 to 2 percent of the population (152,000 animals) could be directly exposed to the spill. For the most part, the effect of onshore oil spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline; these spills would not be expected to significantly contaminate or alter caribou range within the pipeline corridors. This alternative would avoid most potential oil-spill, noise and disturbance, and possible habitat effects on the PCH. However, the effects on the CAH are expected to be the same as under Alternative I.

Regarding the area offshore of the ANWR, the removal or reduced effects to the ANWR on caribou are as follows: There would be no oil spills (7,000 bbl) within the area from this alternative. There is about a 15-percentage-point reduction in the chance of one or more oil spills ≥1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur in the area offshore of the ANWR. The potential loss of a an estimated few hundred or more caribou would not occur along the coast of the ANWR. Potential effects of an oil spill on PCH caribou could be greatly reduced within the deferred area under Alternative V.

Conclusion: The effect of Alternative V.a on CAH caribou is expected to be about the same from that under Alternative I (local displacement of cow-calf groups within about 3-4 km [1.86-2.48 mi] along 20-30 mi vs 20-100 mi of onshore pipelines with roads), with this local effect persisting for more than one generation and the loss of a few hundred CAH caribou to a few thousand PCH caribou and relatively small area of habitat contamination assuming one oil spill of 7,000 bbl. This alternative is expected to significantly reduce adverse effects on the PCH and on ANWR habitats.

b. Effects of Special Mitigating Measures: Special mitigating measures under Alternative I would provide for protection of caribou along the coast of the ANWR and provide protection to coastal habitats of caribou on the refuge. Stipulation 8 on transportation of hydrocarbons addresses the need of industry to design, construct, maintain, and repair pipelines that would meet the special environmental conditions of the Arctic. This measure is expected to reduce the risk of oil spills from pipelines that may transport oil from leases offshore of the ANWR. This measure is expected to reduce the risk of oil-spill effects on PCH caribou frequenting marine and coastal habitats along the coast of the ANWR.

Stipulations 7 and 8 and ITL's 18, 22, and 23 address the concerns about potential onshore facilities that may be associated with leasing offshore of the ANWR. Staging of equipment, infrastructure, and other activities would not be allowed in the Refuge, in accordance with the ANWR Comprehensive Conservation Plan (ITL's 22 and 23). No activities including pipeline landfalls would be allowed on the ANWR, and the MMS would be required to consult with the FWS on proposed pipelines to be located offshore of the ANWR as well as monitoring and inspection of these pipelines (ITL 18). These measures are expected to reduce any potential noise and disturbance and habitat effects on PCH caribou on the Refuge.

Conclusion: These special mitigating measures are expected to reduce potential noise and disturbance, and oil-spill, and habitat effects on caribou, particularly on PCH caribou occurring on the ANWR. The effect on CAH caribou is expected to be reduced somewhat from that effect under Alternative I. These special mitigating measures are expected to have a similar reduction in adverse effects on PCH caribou as the deferral of lease tracts under Alternative V.b.

8. Economy of the North Slope Borough:

a. Effects of the Deferral: Increased revenues and employment are the most significant economic effects that would be generated by Alternative V.a. The effect on NSB revenues and expenditures and on employment would be about 40 percent less than for Alternative I. Increased property tax revenues and new employment would be created with the construction, operation, and servicing of facilities associated with OCS activities. This reduction in effects is because key elements of facilities associated with OCS activities for Alternative V.a are reduced by 40 percent from Alternative I. These facilities are described in Table IV.A.1-1 and summarized in Section IV.D.8.

For Alternative V.a, exploration, development, and production is projected to generate increases in property taxes above the levels without the sale starting in the year 1998 and average about 0.6 to 1.2 percent above the level without the sale each year through the production period—40 percent less than Alternative I.

Direct oil-industry employment in an enclave is anticipated to peak in the range of 840 to 1,080 jobs during the development phase, decline to a level in the range of 480 to 720 in 2011 to 2022, and then decline further to the range of 300 to 720 by 2027. One percent of these direct oil-industry jobs is anticipated to be held by resident NSB Natives. This is about 40 percent less than Alternative I.

Total resident employment is anticipated to increase in the range of 38 to 60 jobs in the peak of production and level off to 16 to 25 in the production phase after 2011. The peak increase during development is about 2.4- to 3.6-percent greater than resident employment without the development of Alternative V.a resources and about 1.2- to 1.8- percent greater during the production phase. This is about 40 percent less than Alternative I.

The cleanup operation of an oil spill would generate jobs for up to 300 workers for 6 months in the first year, which would decline to zero by the fourth year following the spill. This is the same as for Alternative I.

Disruptions to the harvest of subsistence resources could affect the economic well-being of NSB residents primarily through the direct loss of subsistence resources. See Section IV.D.10 for conclusions on the effects on the subsistence-harvest patterns.

Regarding the ANWR deferral, the change in economic effects to the area deferred is zero. The economic effects (on property tax, direct oil-industry employment, and resident employment) are external to the area deferred.

Conclusion: Exploration, development, and production under Alternative V.a would generate increases that are 40 percent less than those for Alternative I for property tax, direct oil-industry employment, and resident employment. Cleanup operation for an oil spill would generate employment the same as for Alternative I.

b. Effects of Special Mitigating Measures: There are no special mitigating measures for economics applicable to this alternative.

Conclusion: There are no effects of special mitigating measures for economics for this alternative.

9. Subsistence Harvest Patterns:

a. Effects of the Deferral: An oil spill in the midst of the area offshore the ANWR would disrupt subsistence harvests slightly more than an oil spill that might originate in another part of the sale area. Under this alternative, the OSRA estimates a 31- to 55-percent chance of one or more spills ≥ 1,000 bbl occurring, a reduction in oil-spill risks from Alternative I (46-70%). Land Segments 36 through 45 include the area offshore the ANWR, much of which is used by Kaktovik (and somewhat by Nuiqsut) subsistence hunters to harvest marine mammals. The OSRA model estimates a 1- to 4-percent chance of one or more spills ≥ 1,000 bbl occurring and contacting LS's 36 (Sag Delta/ Bullen Point/Mikkelsen Bay) through 41 (Barter Island) within 180 days over the assumed production life of Beaufort Sea Sale 170. Combined probabilities do not indicate a >5 percent-chance of occurrence and contact in any of these land segments. This means a minimal chance of oil-spill occurrence and contact to land segments from the Sag Delta area all the way to Barter Island and a <0.5-percent chance of occurrence and contact to land segments from Barter Island to Demarcation Bay. Oil-spill contact in winter could affect polar bear hunting and sealing. Bird hunting, sealing, and whaling, as well as the ocean netting of fish, could be affected by a spill during the open-water season.

Removing all lease blocks offshore of the ANWR removes all the blocks from west of Kaktovik to offshore of the Canning River from leasing. The effects to fishes from this alternative would be similar to those in Alternative I, except that the magnitude of the effects likely would be decreased. The decreased magnitudes in effects would include disturbances as a result of discharges; noise and disturbances from seismic surveys; and noise and disturbances from aircraft, vessel, drilling, and construction activities. However, aircraft and vessel traffic to and from nearby active leases may disturb some fishes in the Alternative V area. Disturbances from seismic surveys within these previously leased areas also could be transmitted into the Alternative V area. However, the intensity of the seismic-survey disturbance would be reduced and is unlikely to significantly affect fishes. Oil-spill risks to fishes under this alternative would experience minor reductions as compared to those for Alternative I. Overall effects on fish resources from Alternative V.a likely would be similar to those expected under Alternative I (see Secs. IV.B.3 and IV.F.3).

This alternative defers an area used by bowhead whales for migration and possibly for occasional feeding during the late summer and fall. The resource estimate and development scenario for Alternative V.a would provide a potential reduction in oil-spill effects on endangered and threatened species and their habitats west of Barter Island. However, previous Federal lease sales have granted leases

adjacent to and within the area of this alternative, and aircraft and vessel traffic may cross the area en route to these leased blocks. This traffic could disturb low numbers of bowheads for a few minutes once or twice per day and cause bowheads to avoid areas near vessel activities. In addition, noise from seismic surveys or drilling operations within leased blocks could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels. Oil-spill risks to bowhead whales would be reduced compared to Alternative I. Effects on bowheads expected from Alternative V.a would be similar to the effects expected under Alternative I, because the level of exploration activities is likely to be similar—essentially the same number of bowheads are likely to be affected, and the extent and nature of the effects of activities on bowhead whales are likely to be similar (see Secs. IV.B.4 and IV.F.4). Stipulation 5, Conflict Avoidance Agreement, will be in effect for this alternative.

Disturbance of marine and coastal birds by air and vessel traffic occurring under this alternative is not expected to differ significantly from Alternative I (short-term displacement of birds lasting a few minutes to <1 day), because the level of development activity is similar under both alternatives. Assuming that offshore pipelines would be built to support oil development and production in the eastern part of the proposed sale area, this alternative would not reduce onshore habitat and disturbance effects on marine and coastal birds from those effects described for Alternative I. A moderate reduction in spill-contact probability in areas potentially used by marine and coastal species results from this alternative and, therefore, the ANWR deferral would result in some reduction of the effects determined under Alternative I, primarily a reduction of the already relatively low mortality in the event of an oil spill. Under this alternative, only disturbance and oil-spill effects on marine and coastal birds and their habitats in the area offshore the ANWR potentially could be reduced; however, marine and coastal bird populations still are expected to sustain losses requiring up to one generation for recovery (see Secs. IV.B.5 and IV.F.5).

Effects from noise and disturbance; habitat alterations from drill-platform installation, pipeline laying, and other construction; and oil spills could have some adverse effects on pinnipeds, polar bears, and belukha whales found in the sale area. Effects from this alternative are expected to have about the same level of short-term (less than a few days) effect on the distribution of pinnipeds, polar bears, and belukha whales as described for Alternative I. If an oil spill occurred, it would pose the greatest risk of contact to all marine mammals from the Camden Bay offshore area (I/SS 9) to ice-flaw-zone habitats located west to Cape Halkett (I/SS 6). Under Alternative V.a, lease blocks offshore of Camden Bay would not be leased, therefore greatly reducing the risk of a spill occurring in this area, but blocks immediately west in Camden Bay and west to offshore of Oliktok Point still would be leased under this alternative and, if an oil spill occurred in this area, nonendangered marine mammals would still be about equally at risk from contact with the spill, and the effect is expected to be about the same as Alternative I. Alternative V.a is expected to somewhat reduce noise and disturbance, oil spills, and habitat effects on pinnipeds, polar bears, and belukha whales adjacent to the ANWR, but the overall effect is expected to be about the same as Alternative I (see Secs. IV.B.6 and IV.F.6).

The field-development scenario for Alternative V.a forecasts the construction of 20 to 30 mi of onshore pipelines and potential adjacent roads. This reduction in pipeline miles and reduction in potential adjacent roads and vehicle traffic is expected to reduce the amount and duration of displacement of CAH caribou from habitats within 3 to 4 km (1.86-2.48 mi) of pipeline-road corridors east of the Prudhoe Bay oilfield and near the ANWR boundary. These pipelines are expected to be short (20-30 mi total length), connect to existing transportation facilities along the coast, and not cross calving areas of the PCH. The effect of one or more oil spills ≥ 1,000 bbl would represent the loss of perhaps 100 caribou. This loss probably would be small for any of these caribou herds, with losses replaced within less than one generation (about 1 year). For the most part, the effect of onshore oil spills would be very local and would contaminate tundra in the immediate vicinity of the pipeline, with spills not expected to significantly contaminate or alter caribou range within the pipeline corridors. This alternative would prevent most potential oil spills, noise and disturbance, and possible habitat effects on the PCH, and the overall effects of Alternative V.a on PCH caribou are expected to be reduced somewhat from those expected for Alternative I (see Secs. IV.B.7 and IV.F.7).

Noise and disturbance to these subsistence resources would affect Kaktovik's subsistence activities. While this alternative would not substantially change biological effects to populations of subsistence species, it would eliminate blocks of a large portion of Kaktovik and Nuiqsut's marine and coastal subsistence-harvest areas and, thus, may offer some mitigation from noise and traffic disturbance to the subsistence hunt for the hunters of these two communities. However, aircraft and vessel traffic and noise from seismic activity in previously leased areas within the deferred area would be expected to continue. Effects to bowhead and belukha whales, seals, polar bears, and fishes, from the slight reductions of noise and construction disturbance, oil-spill cleanup, and oil-spill risks under Alternative V..would remain essentially similar to the effects under Alternative I. Disturbance and oil-spill effects on caribou are expected to be reduced, and effects

to marine and coastal birds and their habitats could be reduced as well.

Regarding the area offshore the ANWR, the reduction of effects to fishes would be fewer fishes exposed to noise and disturbance from oil and gas activities under the ANWR deferral than under Alternative I. The reduction in the magnitude of the effects would result from fewer wells being drilled, less seismic activity being conducted, and less drilling muds and cuttings being discharged. A decrease in drilling discharges also would reduce alterations to fish habitat. However, fishes located in the deferred area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur on previously leased blocks inside and leases outside the deferred area. This could result from lease activities from previous sales. The level of disturbance for Alternative V.a would be reduced from that of Alternative I. The reduced effects on bowhead whales within the deferred area would be fewer whales exposed to noise from oil and gas activities, because fewer wells would be drilled and less seismic activity would be conducted with the area deferred. However, bowhead whales within the ANWR deferral area may be affected by noise and disturbance from seismic activities, aircraft and vessel traffic, drilling activities, and oil spills that may occur on previously leased blocks inside and leases outside the deferred area. These activities could disturb low numbers of bowheads and cause some whales to avoid areas near oil and gas activities. In addition, noise from seismic surveys or drilling operations within leased blocks outside of the deferral area could be transmitted into the area of this alternative, although the sound intensity within the area would be at reduced levels and would be unlikely to significantly displace feeding or migrating whales. The effect of noise on bowheads, with or without the deferral, would be as described for Alternative I, with whales avoiding vessels, seismic surveys, drilling units, and production platforms at varying distances. It is likely that fewer whales would be exposed to noise from these activities under the ANWR deferral than under Alternative I. Exposure of bowhead whales to noise-producing activities, whether inside or outside the deferral area, is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects. Additionally, any oil spill that might occur either on leases outside the deferral area or on leases within the deferral area has the potential to be present within the deferral area. Effects on bowheads expected from Alternative V.a would be similar to the effects expected under Alternative I. While fewer whales may be exposed to oil and gas activities under the deferral than under Alternative I, the extent and nature of the effects and the overall effect on the population is likely to be essentially the same as under Alternative I.

Under Alternative V.a, air-support traffic to existing leases from previous sales may disturb birds occupying nearshore lagoons as well as offshore areas in the western portion of the deferral area. This activity, together with vessel traffic, primarily would cause short-term displacement of <1 day, and possible avoidance of routinely used air and vessel corridors. Elsewhere in the deferral area, disturbance effects, such as reduced fitness of individuals displaced from traditional marine foraging areas experienced by bird populations seasonally occupying the ANWR, are likely to be negligible. This is because the deferral of leasing offshore the ANWR would eliminate from the vicinity of the refuge nearly all potential sources of disturbance associated with exploration or development and production activities, including transport, exploration-rig operation, and construction and operation of platforms. Seismic operations and emergency traffic, although not expected to cause significant disturbance, would remain as potentially disturbing activities. Although the probability of spilled oil contacting areas offshore of the western portion of the ANWR, where birds that have nested on the refuge may forage and stage prior to migration, remains substantial (44%) under this alternative, the chance of nearshore or shoreline contact is <6 percent. More importantly, the probability of a spill occurring and contacting ice/sea segments offshore of the refuge, or Jago Lagoon and the western ANWR shoreline, are reduced to <7 and <3 percent, respectively, and a spill may be weathered and dispersed by the time birds are contacted or occur when few birds are present. Under Alternative V.a, activities associated with existing leases in the western portion of the deferral area and in the remainder of the proposed sale area, are expected to cause minor disturbance of marine and coastal birds similar to that discussed under Alternative I. In the remainder of the deferral area, nearly all sources of disturbance would be eliminated and, thus, disturbance is expected to be negligible. The chance of spill occurrence and contact with habitats from Gwydyr Bay eastward, particularly in the area offshore the western portion of the ANWR, is reduced from Alternative I to a relatively low level, thereby reducing risk of oil-spill effects on birds and their habitats. However, risk of spilled-oil contact remains substantial in the ice/sea segments offshore of the ANWR, and birds from nesting areas in the ANWR that enter this area when oil is present are expected to sustain spill-generated losses equivalent to those discussed for Alternative I (up to several thousand individuals). The effects of any such losses are expected to be minor at the population level, and may not be detectable above the natural fluctuations of the population and survey methods/data available.

The reduced effects to the ANWR on pinnipeds, polar bears, and belukha whales would be no oil spills (7,000 bbl), noise and disturbance (aircraft and vessel traffic including seismic operations), or habitat alterations (installation of 1-2 exploration and production platforms

and the laying of 32 km of pipelines) within the deferred area. The 7,000-bbl spill would not occur in the area offshore of the ANWR, the potential loss of small numbers of seals and belukha whales is not expected to occur offshore of the ANWR, and the loss of an estimated 20 to 40 polar bears on or near the coast of the ANWR would not occur. However, such losses are still expected to occur to the polar bear population (which includes some of the bears that occur on the ANWR), if the 7,000-bbl spill contacts other polar bear concentrations at whale-carcass sites such as at Cross Island, Barrow, or other locations where whales die and end up on the shore. The effect of the 7,000-bbl spill on seals and belukha whales west of the area offshore of the ANWR is expected to be similar. Potential noise and disturbance from aircraft and vessel traffic, including seismic operations and habitat alteration from platform and pipeline installation, would not occur in the area offshore of the ANWR. Effects are expected to be short term and not affect pinniped, polar bear, and belukha whale populations, and the removal of exploration and development offshore of the ANWR is not expected to reduce overall effects on pinniped, polar bear and belukha whale populations from those described under Alternative I. The effects of Alternative V.a from noise and disturbance, oil spill, and habitat alteration on pinnipeds, polar bears, and belukha whales are expected to be reduced or avoided offshore of and on the ANWR, but overall effects on pinniped, polar bear, and belukha whale populations are expected to be similar to Alternative I, such as the loss of perhaps 20 to 40 polar bears and the loss of small numbers of seals and whales. The reduced effects to caribou from the ANWR deferral would be no oil spills (7,000 bbl) within the area of the alternative. There is about a 15-percent reduction in the chance of one or more oil spills ≥ 1,000 bbl occurring within the proposed sale area. The 7,000-bbl spill would not occur in the area offshore of the ANWR, and the potential loss of a an estimated few hundred or more caribou would not occur along the coast of the ANWR. Potential effects of an oil spill on PCH caribou could be greatly reduced within the deferred area under Alternative V. The effects of Alternative V.a on CAH caribou are expected to be about the same as those for Alternative I: local displacement of cow-calf groups within about 3 to 4 km (1.86-2.48 mi) of onshore pipelines, with this local effect persisting for more than one generation, and the loss of a few hundred CAH caribou to a few thousand PCH caribou and a relatively small area of habitat contamination from a single assumed oil spill of 7,000 bbl. This alternative is expected to significantly reduce adverse effects on the PCH and on the ANWR habitats.

Regarding the area offshore of the ANWR, reduced effects to subsistence-harvest patterns in the community of Kaktovik would come from reduced effects described above from noise and disturbance and oil spills on subsistence fish, bowhead whale, bird, marine mammal, and particularly on PCH caribou populations. The deferral would reduce the possibility of hunter-access conflicts during the bowhead whale hunt and to the subsistence-caribou hunt that is quite intensive in the ANWR 1002 coastal areas. Decreased disturbance to subsistence species, habitats, harvests, and access from oil-spill-cleanup activity would be expected as potentially spilled oil would contact shoreline areas after a longer period of weathering. With these effects reductions, effects on subsistence-harvest patterns would be reduced from those of Alternative I with subsistence resources being periodically affected but subsistence harvests experiencing no apparent effects.

Conclusion: Under Alternative V.a, effects as a result of disturbance and oil spills on subsistence-harvest patterns in the community of Kaktovik are expected to be slightly reduced from those expected from Alternative I. With these effects reductions, effects on subsistence-harvest patterns would be reduced from those of Alternative I, with subsistence resources being periodically affected but subsistence harvests experiencing no apparent effects. An oil spill affecting any portion of the bowhead whale-migration route might taint resources or create the perception of tainting that would affect the subsistence hunt. Effects from the ANWR deferral on the subsistence-harvest patterns of Barrow and Nuiqsut are expected to be the same as for Alternative I.

b. Effects of Special Mitigating Measures:

Special mitigating measures under Alternative V.b would provide for protection of fish (Stipulations 7 and 8 and ITL's 22 and 23); pinnipeds, polar bears, and belukha whales (Stipulations 7, 8, and 9 and ITL's 18, 22, and 23) in the marine environment; birds (Stipulations 7 and 8 and ITL's 18, 22, and 23); and caribou (Stipulations 7, 8, and 9 and ITL's 18, 22, and 23) along the coast of the ANWR and provide protection to coastal habitats for many of these species. Special mitigating measures for Alternative V.b are not expected to provide much additional protection to bowhead whales.

Stipulations 7 and 8 and ITL's 18, 22, and 23 address the concerns about potential onshore facilities that may be associated with leasing offshore of the ANWR. Staging of equipment, infrastructure, and other activities would not be allowed in the Refuge in accordance with the ANWR Comprehensive Conservation Plan (Stipulation 8 and ITL 23). No activities including pipeline landfalls would be allowed without permission of the the FWS (Stipulation 7 and ITL 22), and the MMS would be required to consult with the FWS on proposed pipelines to be located offshore of the ANWR as well as monitoring and inspection of these pipelines (ITL 18). These measures are expected to reduce any potential noise and disturbance and habitat effects on PCH caribou on the Refuge. Stipulation 9 requires lessees to provide information on polar bear distribution, denning,

habitats, and potential effects of industrial activities and describe measures to be taken to minimize effects, including the LOA required under the MMPA. Lessees may be required to conduct project-specific surveys related to polar bears. Stipulation 9 is expected to provide project-specific information on polar bears within or adjacent to the lease area that would help to formulate project-specific measures that would be expected to reduce effects on polar bears and their habitats on the ANWR and adjacent offshore areas.

In addition to special mitigation measures, Stipulation 3 on transportation of hydrocarbons addresses the need of industry to design, construct, maintain, and repair pipelines that would meet the special environmental conditions of the Arctic. This measure is expected to reduce the risk of oil spills from pipelines that may transport oil from leases offshore of theANWR. This measure is expected to reduce the risk of oil-spill effects on caribou of the PCH frequenting marine and coastal habitats along the coast of the ANWR and reduce the risk of oil-spill effects on marine mammals such as polar bear frequenting marine and coastal habitats adjacent to the ANWR.

Conclusion: These special mitigating measures are expected to reduce potential noise and disturbance, oil spills, and habitat effects on fish, marine mammals, and caribou, particularly effects on PCH caribou and marine mammals, primarily on polar bears occurring on or adjacent to the ANWR. These special mitigating measures are expected to have a similar reduction in adverse effects on these species as the deferral of lease tracts under Alternative V.b. The special mitigating measures likely would likely provide the same degree of protection to marine and coastal birds and bowhead whales that is provided by not leasing the area offshore the ANWR. Consequently, similar reductions on subsistence-harvest patterns are expected from either special mitigation or deferral.

10. Sociocultural Systems:

a. Effects of the Deferral: Alternative V.a would reduce slightly the onshore industrial activities and population and employment projections for this sale, because the resource estimate for this alternative is lower, reduced from 350 to 670 MMbbl to 210 to 450 MMbbl; basic exploration, development and production, and transportation assumptions would be reduced accordingly from those expected for Alternative I. Under this alternative, the OSRA estimates a 31- to 55-percent chance of one or more spills ≥1,000 bbl occurring, a clear reduction in oil-spill risk from Alternative I (46-70%). Land Segments 36 through 45 include the area offshore the ANWR, much of which is used by Kaktovik (and somewhat by Nuiqsut) subsistence hunters to harvest marine mammals. The OSRA model estimates a 1- to 4-percent chance of one or more spills ≥1,000 bbl occurring and contacting LS's 36 (Sag Delta/Bullen Point/Mikkelsen Bay) through 41 (Barter Island) within 180 days over the assumed production life of Beaufort Sea Sale 170. Combined probabilities do not indicate a >5-percent chance of occurrence and contact in any of these land segments. This means a minimal chance of oil-spill occurrence and contact to land segments from the Sag Delta area all the way to Barter Island and a <0.5-percent chance of occurrence and contact to land segments from Barter Island to Demarcation Bay. Effects on subsistence resources from disturbance and oil spills would be slightly reduced under this alternative but would remain essentially the same for subsistence-harvest patterns as those for Alternative I (see Sec. IV.F.9, Subsistence-Harvest Patterns). Oil-industry and resident employment and property taxes are expected to be reduced 40 percent from Alternative I, but local employment changes to the communities of Kaktovik and Nuiqsut would be slight (see Sec. IV.F.8, Economy of the North Slope Borough).

Regarding the ANWR deferral, effects on sociocultural systems from changes in population and employment, effects on subsistence-harvest patterns, and effects from possible oil spills and oil-spill cleanup in the community of Kaktovik are expected to be slightly reduced. Reductions in expected oil-spill effects on PCH caribou populations and possible hunter-access conflicts during the bowhead whale hunt and the subsistence-caribou hunt that is quite intensive in ANWR 1002 coastal areas would reduce effects to subsistence harvests. With these effects reductions, effects on sociocultural systems would be reduced from those of Alternative I, with disruptions to sociocultural systems expected to occur for a period <1 year. These disruptions are not expected to displace ongoing sociocultural institutions; community activities; and traditional practices for harvesting, sharing, and processing subsistence resources.

Conclusion: Under Alternative V.a, effects on sociocultural systems could result from industrial activities, changes in population and employment, effects on subsistence-harvest patterns, and effects from possible oil spills and oil-spill cleanup. The effects from Alternative V.a on the sociocultural systems in the communities of Kaktovik are expected to be reduced from those expected for Alternative I due to decreases in oil-spill risks and access conflicts to subsistence harvests and potential reduction in disturbance from oil-spill-cleanup. Effects to sociocultural systems in the communities of Barrow and Nuiqsut would be the same as for Alternative I.

b. Effects of Special Mitigating Measures: Special mitigating measures under Alternative V.b (Stipulations 7 and 8 and ITL's 18, 22, and 23; see Sec. IV.F.9, Subsistence-Harvest Patterns) would provide protection to coastal habitats for subsistence fish, marine

mammal, and caribou populations along the coast of the ANWR. These special mitigating measures are expected to reduce potential noise and disturbance, oil spills, and habitat effects on fish, marine mammals, and caribou (particularly effects on PCH caribou) and marine mammals (primarily on polar bears) occurring on or adjacent to the ANWR. These special mitigating measures are expected to have a similar reduction in adverse effects on these species as the deferral of lease tracts under Alternative V.a.

Conclusion: The special mitigating measures likely would provide the same degree of protection to marine and coastal birds, bowhead whales, caribou, fishes and marine mammals that would be provided by not leasing the area offshore the ANWR. Special mitigation is expected to have no mitigating effect on effects to sociocultural systems in Nuiqsut and Kaktovik.

11. Archaeological Resources:

a. Effects of the Deferral: Under Alternative V.a, the effects to archaeological resources would be similar to those under the Alternative I analysis in Section IV.B.11. The expected effect on archaeological resources should be low because of the requirement for review of geophysical data prior to any lease activities. Although oil-spill effects on onshore archaeological resources are uncertain, data from the EVOS indicate that few onshore archaeological resources (<3%) are likely to be significantly affected by an oil spill.

Therefore, the removal of exploration and development offshore of the ANWR is not expected to reduce the overall effect on archaeological resources as described under Alternative I.

Conclusion: The effects from Alternative V.a would be the same as for Alternative I.

b. Effects of Special Mitigating Measures: There are no special mitigating measures that apply to archaeological resources for this alternative.

Conclusion: Special mitigating measures would have no effect in this alternative. There would be no differences in levels of effects whether or not the blocks off of the ANWR were deferred.

12. Air Quality:

a. Effects of the Deferral: Activities that may affect air quality include drilling discharges, seismic surveys, construction, and those associated with an accidental oil spill. The effects of these activities and the agents associated with them already have been discussed for Alternative I. This analysis considers differences in the amount of change in air quality effects for Alternative V.a as compared to those of Alternative I. It then estimates the resulting effect of these differences on air quality.

Alternative V.a involves fewer drilling discharges, seismic surveys, and construction-related activities than Alternative I. This would be expected to lessen the effect of the activities on the air Therefore, Alternative V is expected to have less of an effect on air quality than does Alternative I.

Regarding the area offshore of the ANWR, the removal or reduced effects to the ANWR on air quality are as follows: There would be no exploration or development to directly produce emissions offshore the ANWR. The potential to effect air quality would not occur along the coast of the ANWR.

Conclusion: Alternative V.a is expected to have less of an effect on air quality than Alternative I.

b. Effects of Special Mitigating Measures: There are no special mitigating measures that apply to air quality for this alternative.

Conclusion: Special mitigating measures would have no effect on air quality. There would be no differences in levels of effects whether or not the blocks off of the ANWR were deferred.

13. Land Use Plans and Coastal Management Programs:

a. Effects of the Deferral The potential for conflict with NSB CMP policies could occur in two main areas: conflicts could occur with the policy related to access to subsistence resources, Policy 2.4.3(d) (NSBMC 19.70.050.D), which requires that development not preclude reasonable subsistence-user access to a subsistence resource and 2) conflicts could occur with the policies that relate to adverse effects to subsistence resources, Policy 2.4.3(a) (NSBMC 19.70.050.A) states that "development shall not deplete subsistence resources below the subsistence needs of local residents of the Borough." Policy 2.4.5.1(a) (NSBMC 19.70.050.J.1) relates to "development that will likely result in significantly decreased productivity of subsistence resources or their ecosystems." (Sec. IV.B.13 provides a description of these policies). Temporary access problems with the subsistence seal harvest and the subsistence caribou harvest may occur as a result of onshore pipeline construction. Access could also be restricted in the event of an oil spill and the related cleanup activity. Temporary reductions in subsistence resources could occur as a result of disturbance and noise related to seismic activities, drilling and support activities, and pipeline construction activities.

Under Alternative V.a, the OSRA estimates a 31- 55-percent probability of one or more spills ≥1,000 bbl occurring (compared to a 46-70% chance for Alternative I). The OSRA model indicates a minimal chance of oil-spill occurrence and contact to land segments from the Sag Delta west to Barter Island. Much of this area is used by Kaktovik (and somewhat by Nuiqsut) for subsistence harvest of marine mammals. However, an oil spill in the midst of the ANWR offshore area would disrupt the subsistence harvest only slightly more than a spill that might originate in another part of the sale area. Temporary reductions in subsistence resources and changes in subsistence resource-distribution patterns could occur in the unlikely event of an oil spill and the related cleanup activities. Effects from the ANWR Alternative V.a on the subsistence-harvest patterns in the communities of Kaktovik and Nuiqsut are expected to be only slightly reduced from those for Alternative I; effects on Barrow's subsistence-harvest patterns are expected to be the same as those for Alternative I (see Sec.IV.F.9, Subsistence Harvest Patterns). This reduction in effects could occur as a result of slight reductions in the amount of noise and disturbance and in the slightly reduced likelihood of spilled oil contacting subsistence resources and habitats.

Regarding the area offshore the ANWR, Section IV.F.9, Subsistence Harvest Patterns, concludes that reduced effects to subsistence-harvest patterns for the community of Kaktovik would result from reduced effects from noise and disturbance and potential oil spills. Decreased disturbance to subsistence species, habitats, harvests, and access from oil-spill related cleanup activity would be expected. Subsistence resources would be periodically affected but subsistence harvests would experience no apparent effects.

Conclusion: For Alternative V.a, the potential for conflict with land use plans and coastal management programs would be the same as that for Alternative I. Conflicts could occur in two main areas: (1) conflicts could occur with specific NSB CMP policy related to the potential for user conflicts between development activities and access to subsistence resources, Policy 2.4.3(d) (NSBMC 19.70.050.D); and (2) conflicts are possible with the NSB CMP policies related to adverse effects on subsistence resources, Policy 2.4.3(a) (NSBMC 19.70.050.A) and Policy 2.4.5.1(a) (NSBMC 19.70.050.J1). A slight reduction in the potential for conflicts could occur as a result of small reductions in effects on the subsistence-harvest patterns in the communities of Kaktovik and Nuiqsut. However, the overall potential for conflict would remain the same as for Alternative I.

Development on the coastal plain of the ANWR has not been authorized by Congress. None of the pipeline routes are assumed to traverse the refuge; no conflict with ANWR policy is inherent in the scenario for Alternative I, and remains the same for Alternative V.a.

b. Effects of Special Mitigating Measures:

Special mitigating measures under Alternative V.b (Stipulations 7, 8, and 9; and ITL's 22 and 23) provide additional protection for the subsistence resources of fish, pinnipeds, polar bears, and belukha whales in the marine environment and birds and caribou along the coast of the ANWR. Stipulation 8 on OCS pipelines could decrease the risk of an oil spill from a subsea pipeline, thereby reducing the overall oil-spill risk. The analysis of the effects of these mitigating measures in Section IV.F.9.b concludes that the same slight reductions on subsistence-harvest patterns (as a result of slight reductions in disturbance and in the likelihood of oil spills) are expected from either this special mitigation or the deferral. A correspondingly small reduction could be expected in the potential for conflict with the NSB CMP policy related to adverse effects on subsistence resources and the policy related to user conflicts in the communities of Kaktovik and Nuiqsut. This slight reduction in the potential for conflicts with these two policies is, for the most part, attributed to the special mitigating measure on OCS pipelines offshore the ANWR (Stipulation 8) which might help reduce the risk of a subsea pipeline oil spill and the resulting cleanup activities.

Conclusion: These special mitigating measures could reduce the potential for conflict with the NSB CMP policies related to adverse effects on subsistence resources and reasonable subsistence-user access to subsistence resources as they relate to the communities of Nuiqsut and Kaktovik. However, the overall potential for conflict would remain the same as for Alternative I. This conclusion is the same as that for Alternative V.a.

G. EFFECTS OF THE CUMULATIVE CASE:

The analysis for the cumulative case is based on the potential effects associated with (1) exploitation of known or estimated resources from onshore and offshore State and/or Federal leases, (2) major potential and ongoing resource-development projects, (3) major potential and ongoing construction projects, and (4) other facilities whose activities may affect the proposed sale area. This section focuses on those oil and gas projects that can be hypothesized to have some reasonable chance of occurrence during the life of Alternative I. The discussion in this section is not assumed to be definitive. Each of the analysts contributing to this EIS also may focus on other issues that they feel to be particularly germane to their resource topics.

In analyzing the cumulative case for Sale 170, the authors consider potential effects on (1) the physical and biological resources, sociocultural systems, and various programs from activities associated with petroleum exploration, development and production, and transportation in the Beaufort Sea Planning Area and the major projects discussed in Section IV.A.5 and (2) migratory species from activities over their range, including the transportation of oil from Valdez, Alaska, to the U.S. West Coast and from industrial and other activities along the Alaska coast and along the Pacific Coast of Canada and the United States. Migratory species include those species or species groups that migrate to and from Alaska and migratory as well as other species in other areas that might be affected by the transportation of Sale 170 oil—especially oil spilled along pipeline and tanker-transportation routes.

Tanker transport of oil potentially could affect migratory as well as other species in the event of an oil spill. As noted in Section IV.A, any economically recoverable oil that might be discovered in the Sale 170 area would be transported through offshore pipelines to various landfalls along the Beaufort Sea coast (see Sec. IV.A.1) and then transported overland via TAPS to Valdez for transshipment to the U.S. West Coast. Should all of this oil be shipped out of State, it would, using the resource estimate of Alternative I, generate approximately 10 to 19 tanker loadings in 2005 (field startup), 45 to 74 in 2011 to 2012 (field maximum), and 18-40 in 2017 (late maturity/decline).

Oil exploitation associated with Sale 170 would increase the level of activities affecting environments and resources. The level of activities associated with potential exploitation of Sale 170 oil has been estimated in Sections II.A and IV.A, and the proportion contributed by these activities to the overall level of activities associated with the present and proposed projects is further discussed in Section IV.A.5. The amount of oil that might be produced as a result of Sale 170 (Alternative I) is estimated to range from 350 MMbbl to 670 MMbbl. The analyses of the potential effects of Sale 170 was based on this assumed resource range.

1. Water Quality: The agents associated with petroleum exploitation that are most likely to affect water quality are the permitted discharges from exploration-drilling units and production platforms, turbidity from construction activities, and hydrocarbons from oil spills. For the permitted discharges, the basic unit area in the receiving waters that would be affected by the discharges from well drilling or production activities is the same as those defined for Alternative I in Section IV.B.1.a; also estimated in this section is the amount of time the waters would be affected. In the context of this analysis, "regional" effects are those encompassing at least 1,000 km^2 (292 nmi^2), and "local" effects are those encompassing smaller areas, most frequently a few or less square kilometers (km^2 = 0.29 nmi^2).

a. Effects of Permitted Discharges: Discharges of muds and cuttings resulting from continued exploration and additional development would be several times greater than those for proposed Sale 170. Residual, elevated concentrations of USEPA priority metals (arsenic, chromium, lead, and zinc) have been found to persist within sediments below mixing zones for at least 2 to 4 years after exploration at shallow- (<5-m) water sites in low-energy State Beaufort waters (Snyder-Conn et al., 1990). Additional muds and cuttings would be discharged in State waters from leases in past or proposed State sales. However, discharges from both State and Federal leases during both exploration and development are regulated by USEPA and are no longer allowed to occur in <5-m water depth. Discharges of muds and cuttings would continue for at most only a few years as production wells are drilled. Cumulative effects of muds and cuttings discharges are expected only within mixing zones, i.e., within about 0.03 km^2 (7 acres) of each platform.

If formation waters were discharged, the degradation of water quality would be local but would persist over the life of each field. The number of areas where permitted discharges may occur and the quantities of material discharged may be up to several times greater than estimated for Alternative I and its resource-development scenario (Sec. IV.B.1.a).

b. Effects of Disturbances:

(1) Dredging and Pipelaying: The only dredging activity that is expected to significantly affect water quality in the planning area is pipeline trenching for Federal leases. Pipelines from development in State waters would be short and in waters that already are naturally turbid over much of the summer. Only a few square kilometers (1 km^2 = 0.29 nmi^2) of water on any single day would have increased turbidity above chronic criteria as a

result of dredging, and the turbidity at any location would rapidly disappear when the dredge moves or stops excavation.

(2) Offshore Structures: Offshore structures associated with petroleum exploitation would include (1) platforms to support exploratory drilling operations or development and production facilities and (2) shore-access structures—docks and/or causeways.

Manmade gravel islands could be used in waters shallower than about 12 m (40 ft) to support exploratory drilling operations or production platforms (Appendix A). In waters deeper than about 12 m, bottom-founded mobile offshore drilling units may be used to depths of about 25 m (80 ft) for exploratory drilling, and bottom-founded structures may be used to depths of about 38 m (125 ft) to support development and production activities.

Material for constructing the manmade gravel islands probably would be mined at permitted onshore sites and hauled to the island location by truck over ice roads in the winter or by barge in the summer; most of the manmade gravel islands in the Beaufort Sea have been constructed in the winter. Dumping of the gravel would create a plume of suspended material with characteristics generally similar to that described for suspended sediments in Section IV.B.1.b.

Manmade gravel islands used for exploration and/or development and production eventually would be abandoned, and abandonment would include removal of the material used around the island perimeter to prevent erosion. With the removal of the shoreline protection material, erosion of abandoned gravel islands can result in local but persistent turbidity plumes as the sediments of the islands are reworked by waves and currents for a few to several years.

For some bottom-founded structures, preparatory dredging may be necessary before a structure can be placed on the seafloor. Other bottom-founded structures may have to sit on a gravel berm; construction of the berm would be similar to construction of a gravel island and most likely would occur in the summer. The turbidity from these activities would be similar to the material suspension associated with pipeline trenching or gravel island construction previously noted.

Four shore-access structures currently exist in the Beaufort Sea—on the east and west sides of Prudhoe Bay, at Oliktok Point, and at the Endicott Development. Long shore-access structures such as causeways can redirect the flow of watermasses and lengthen the period of ice cover within about a 5-km (3-nmi) distance (Hale et al., 1989). These effects may reduce turbidity by increasing the potential for sedimentation of the suspended particles. The construction of additional long causeways, such as Endicott, is not anticipated for the reasons noted in Section IV.B.1.b(2). One short 800-m (0.4-nmi) additional causeway has been proposed near Bullen Point for barge and service access for development and production of the Badami prospect in State waters.

The Alaska Dept. of Environmental Conservation has listed the area near the Endicott Causeway—the longest causeway—on its 303(d) list of impaired water bodies because of temperature and salinity exceedances. The redirection of water flow also changes local temperature and salinity regimes, and these changes can exceed those allowed by State and Federal chronic standards and criteria. Relevant State standards (to protect marine wildlife and human consumption of raw seafood; State of Alaska, DEC, 1995) for marine-water temperatures are no more than a 1-°C (1.8-°F) increase in the weekly average water temperature, with maximum rate of change not to exceed 0.5 °C (0.9 °F) per hour. Normal daily temperature cycles are not to be altered in amplitude or frequency. The parallel State standard for dissolved inorganic substances (salinity) is a maximum allowable variation above natural salinity of 1 to 4 parts per thousand ($^{o}/_{oo}$), depending on ambient salinity.

Federal marine criteria for water temperature are similar to the State standards, with the additional caveat that summer thermal maxima should not be artificially exceeded (USEPA, 1986). There is no Federal marine criterion for salinity. The rationale for State salinity standards was derived from the analysis of the National Technical Advisory Committee to the Secretary of the Interior (1968).

The above standards and criteria for temperature and salinity are designed to protect against chronic or secondary effects rather than against direct toxicity. Much greater temperature or salinity increases than permitted in these standards and criteria would be required to cause direct mortality.

The effect of these causeways on the water quality of the Beaufort Sea is limited to about a 5-km (3-nmi) distance offshore of each causeway, but the total area affected—including both current and projected causeways—could be >1,000 km^2 (290 nmi^2). The chronic State marine standards (for growth and propagation and for harvesting for consumption of aquatic life) could be exceeded for water temperature, salinity, and turbidity in the vicinity of most of the causeways for the life of the fields. This cumulative effect of all shore-access structures would be due almost entirely to existing causeways and is large enough to be considered a regional effect on water quality.

c. Oil Spills: The number of offshore small spills (spills ≥1 and <1,000 bbl) is estimated to range from 287 to

571; the amount of oil in these spills is estimated to be between 3,295 and 6,420 bbl (Table IV.A.2-3). The number of spills and amount of oil spilled is about 3.4 and 3.4 to 3.7 times greater, respectively, than the estimated number of spill and amount spilled for Alternative I (Table IV.A.2-3). Over the range, the number of spills and the amount spilled from Federal and State offshore areas are about equal.

For spills ≥ 1,000 bbl, there is an estimated 87- to 98-percent chance of two to four platform/pipeline spills occurring in the Beaufort Sea; both the Federal and State offshore areas are estimated to contribute one to two spills each (Table IV.A.2-2). The average size of these platform/pipeline spills is estimated to be 7,000 bbl (Sec. IV.A.2.a(1)). The number of spills ≥ 1,000 bbl associated with the tanker transport of Alaska North Slope crude oil is estimated to range from three to seven; the chance of these spills occurring ranges from 97 to >99.9 percent (Table IV.A.2-2). The average size of the tanker spills is estimated to be 30,000 bbl (Sec. IV.A.2.a(1)). The Federal offshore contribution to the tanker spills is estimated to range from zero to one and the State contribution, from both offshore and onshore production sources, is estimated to range from three to six. Estimates of Federal offshore and State offshore and onshore oil resources and reserves are shown in Table IV.A.5-1; the Federal offshore estimates make up about 10 percent of the total resources and reserves.

The characteristics of a 7,000-bbl platform/pipeline oil spill in the summer and during meltout are shown in Table IV.A.3-1a. Based on these characteristics, the estimated concentration of oil dispersed in the water column for a summer spill after (1) 3 days is estimated to be 1.745 ppm (assuming a 2-m dispersal depth), (2) 10 days is estimated to be 0.33 ppm (assuming a 5-m dispersal depth), and (3) 30 days is estimated to be 0.07 ppm (assuming a 10-m dispersal depth). If the spill occurred in the spring during melting, the environmental conditions affecting the characteristics of a spill would be different than those of summer (Table IV.A.3-1a). The estimated concentration of oil dispersed in the water column for a meltout spill after (1) 3 days is estimated to be 5.65 ppm (assuming a 2-m dispersal depth), (2) 10 days is estimated to be 0.88 ppm (assuming a 5-m dispersal depth), and (3) 30 days is estimated to be 0.13 ppm (assuming a 10-m dispersal depth).

The characteristics of a 30,000-bbl tanker oil spill are shown in Table IV.A.3-1b. Based on these characteristics, the estimated concentration of oil dispersed in the water column for a spill after (1) 3 days is estimated to be 0.49 ppm (assuming a 5-m dispersal depth), (2) 10 days is estimated to be 0.13 ppm (assuming a 10-m dispersal depth), and (3) 30 days is estimated to be 0.03 ppm (assuming a 20-m dispersal depth).

The high concentrations of oil associated with estimated dispersal in the water column may represent an upper range of dispersed oil concentrations reached during the first several days following a large spill. These concentrations are greater than the 0.015 ppm that was assumed to be the total hydrocarbon chronic criterion. Hydrocarbon concentrations in the platform/pipeline spills ≥ 1,000 bbl during the first 3 days are estimated to be greater than the 1.5 ppm that was assumed to be the acute criterion. The concentrations of oil that are estimated to be dispersed in the water column after 30 days for the platform/pipeline spills and 10 days for the tanker spills are within the range of concentrations reported for the larger *Argo Merchant* and *Amoco Cadiz* spills noted in Section IV.A.c. The concentration of dispersed oil in the water 30 days after the spills is >0.015 ppm and indicates a relatively long period of time, perhaps about a month or more, before dilution of the dispersed oil reduces the concentrations below 0.015 ppm.

Regional, long-term degradation of water quality to levels above State and Federal criteria because of hydrocarbon contamination is not likely in the Beaufort Sea. The number of exploration and production small spills (<1,000 bbl) anticipated over the production life of the fields could result in local, chronic hydrocarbon contamination of water within the margins of the oil fields. A spill of 7,000 bbl temporarily could contaminate the water with hydrocarbon concentrations above the chronic criterion of 0.015 ppm in an estimated area of <400 km^2 for about a month. Concentrations above the 1.5-ppm-acute criterion may occur in an area <75 km^2 during the first several days of a spill.

Along the tanker routes, regional degradation of water quality to levels above State and Federal criteria because of hydrocarbon contamination for periods of more than a month may occur. A 30,000-bbl spill temporarily could contaminate the water with hydrocarbon concentrations above the chronic criterion of 0.015 ppm in an estimated area of 2,400 km^2 for more than a month. Generally, concentrations above the 1.5-ppm-acute criterion are not expected after the first several days following a spill.

Cumulative Effects on the ANWR: Impacts to the lagoons and bays in the ANWR from petroleum industry activities in the Beaufort Sea would be indirect. No facilities would be located within the ANWR; any exploration and/or production facilities would be located seaward of the lagoons and bays. Areas that could be opened for oil and gas leasing are located 3 nmi (3.45 statute miles) offshore. Offshore oil and gas projects in the Beaufort Sea are listed in Section IV.A.5 (Major Projects Considered in the cumulative Case). With the facilities located offshore, probably at distances >3 nm, any discharges, permitted or accidental, from offshore facilities that might reach the ANWR coast would have to be transported in the water

column from the source to the mainland or barrier islands shorelines, lagoons, or bays and would be diluted by mixing and dispersal in the water column. Mixing and lateral movement of the water column is caused by winds blowing across the surface and the coastal winds in and adjacent to the ANWR generally are a constant feature.

In the winter with the ice cover, closed or restricted entrances to the lagoons and bays, and grounded offshore sea ice, it is assumed any substances entering the water column from an offshore oil and gas facility would not enter any of the lagoons or bays along the ANWR coast.

Effects of Permitted Discharges: Present-day industry practices are to return any substances that are not part of the "export stream"; i.e., cuttings from drilling, produced waters, and expendable substances used in facility operations; to subsurface formations and not discharge them into the surface environment.

However, if there are discharges of permitted substances, the discharge streams must comply with USEPA standards, which would limit the amounts entering the marine environment. In addition, mixing and dispersal in the water column further would dilute the concentrations of any substance discharged. During periods when the winds are from the east, >50 percent of the time, the coastal waters move to the west and offshore. Under these conditions, the chance of any substances discharged into the western part of the Sale 170 area reach ANWR lagoons and bays is greatly reduced as the waters are transported away from ANWR. If the substances are discharged in the eastern part of the sale area during the time easterly winds are blowing there is some risk the substances may be transported into the ANWR coastal environment as the water masses flow past ANWR in a westerly direction. However, there may be an offshore component to the movement of the water and the water tends move parallel to the bathymetric contours which generally parallel the coastline; these phenomena would help to reduce the chance to discharged substances reaching the ANWR coast.

When the winds are from a westerly direction the ANWR coast is more likely to be contacted by waters containing discharged substances than if the winds were from an easterly direction. Water masses moving to the east under the influence of westerly winds tend also to move onshore. If the substances are discharged in the western part of the sale area during the time westerly winds are blowing there is some risk the substances may be transported into the ANWR coastal environment as the water masses flow past ANWR in an easterly direction.

Waters containing any of the discharged substances which might reach the ANWR coastal area would contain only a fraction the substances discharged and their effect(s) on the lagoons and bays would be influenced by the state of the tides, freshwater discharge, and winds. Ebbing tides and discharge from freshwater rivers and streams could prevent water masses containing discharged substances from entering lagoons and bays; during flood tides marine waters would enter the lagoons. For the open-type lagoons marine waters would enter at one end of the lagoon, depending on wind direction, mix with the lagoon water, and pass out the other end; open lagoons are characterized as having multiple openings between the barrier islands that are open to alongshore transport as well as cross-shelf exchange through the multiple large openings between the barrier islands. Under sustained winds and in the absence of any fresh water discharge, the waters inside the lagoon will resemble the waters outside the lagoon. If there some freshwater discharge entering the lagoon, mixing of the marine water with the lagoon water will help to further dilute any discharged substances that might enter the lagoon.

The exchange of nearshore marine waters with lagoon waters occurs primarily via tidal currents through the barrier islands for the pulsing-type lagoons; for these types of lagoons exchange with the nearshore waters primarily occurs via tidal currents through a single major entrance. During the tidal cycle the nearshore water enters the lagoon on the flood tide and mixes with the lagoon water which would further dilute the concentration of any substance entering the lagoons or bays. During the ebb tide, the mixed nearshore/lagoon water flows out and there is some water exchange during each tidal cycle—flushing efficiency.

Discharged substances in the waters reaching areas adjacent to the limited-exchange-type lagoons may or may not enter the lagoons; the flow of alongshore currents through several large entrances to the lagoon is limited. Water exchange between the nearshore and lagoon environment may or may not be affected by tidal action and flow of alongshore currents through the openings in the barrier islands and through the lagoon is limited.

Water depths in the bays and lagoons are relatively shallow and mixing during the open water period should prevent any long term accumulations in the deeper parts of any discharged substances that might enter the waters behind the barrier islands, especially the open- and pulsing-type lagoons where there are exchanges with the nearshore marine waters. In some instances discharged substances in the lagoons, especially the limited-exchange type may remain over the winter. However, the waters containing these substances could be flushed out in late spring/early summer when the relatively large volume of freshwater discharge enters and mixes with the lagoon water prior to flowing out into the Beaufort Sea; the flushing might also occur when there are heavy rains in the headwaters of the

streams or rivers. All three lagoon types—open, pulsing, and limited exchange—occur off the ANWR area.

Also, there would could be some exchanges between the nearshore marine waters and the lagoons and bays during storm surges. During these periods water levels may rise as much as 3 to 10 feet and flood parts of the barrier islands. This overflow could carry any entrained discharged substances into the lagoons or mix with and flush out any discharged substances in waters trapped in the lagoons.

Effects of Oil Spills: Waters into which oil has been spilled will respond to the meteorologic and oceanographic phenomena in basically the same manner as will the waters containing discharged substances. The effects of winds, tides, and storm surges on movement of marine offshore and nearshore waters containing discharged substances and the interaction of these waters with the waters in ANWR lagoons and bays is described in the preceding section. The effects of crude oil compounds dissolved in the water column on waters in lagoons and bays will be the same as the discharged substances that dissolve in the water some of which are also hydrocarbons.

The crude oil from a spill that remains in suspension, either at the surface or dispersed in the water column, will adhere to any of the inorganic material or organic matter that it comes in contact with along the beaches. Waters containing suspended crude oil hydrocarbons which might reach the ANWR coastal area would contain only a fraction of the oil spilled. This oil would adhere to the mainland shorelines and to the beaches on seaward side of the barrier islands. The extent to which shorelines and beaches would be oiled would depend on the persistence of the winds that force the waters onshore, wave height, and, probably to a lesser extent, tides--the tidal range is only about one foot. The beaches inside the lagoons and bays would also be covered with oil if the contaminated waters enter the lagoons. The extent beaches inside the lagoons and bays are covered with oil depend on the same factors as noted for beaches outside the lagoons. The beaches in the open- and pulsing-types lagoons are probably more at risk of being covered with oil than are beaches in the limited-exchange-type lagoon. However, once the contaminated water has passed and uncontaminated water appears the crude oil that entered the limited-exchange-type lagoon is likely to remain in this type of lagoon longer than in the open- or pulsing-type lagoons where there is more opportunity for the uncontaminated to flow through.

Crude oil trapped inside a lagoon or bay during freezeup will be incorporated into the forming ice. However when the ice melts in the spring the water column inside the lagoon or bay will again be contaminated with crude oil.

The entrances to the lagoons and bays vary in width from about 100 to 3,500 yd across. If booms can be placed across entrances that are in the path of waters containing crude oil, water and oil may be prevented from entering the isolated lagoon or bay or the amount entering may be reduced. Also beaches may be isolated by booms which would prevent from reaching the beaches or reduce the amount of oil that could contact them.

Conclusion: For the cumulative case, contaminants from permitted discharges over the life of the fields and offshore construction activities for several years could exceed sublethal levels over a few square kilometers; the permitted discharge quantities and areas affected by increased turbidity from offshore construction activities might be up to several times greater than estimated for Alternative I. Hydrocarbons from (1) small spills (<1,000 bbl) could result in local, chronic hydrocarbon contamination of water within the margins of the oil fields; (2) a platform/pipeline oil spill ≥ 1,000 bbl could exceed the 1.5-ppm-acute criterion during the first several days of a spill, and the 0.015-ppm-chronic criterion for about a month in an area of about 400 km^2; and (3) a tanker spill ≥ 1,000 bbl could exceed the 0.015-ppm-chronic criterion for more than a month in an area of about 2,400 km^2. Regional water quality in the Beaufort Sea would not be affected but could be degraded for more than a month along the tanker routes in the event of a ≥ 1,000-bbl spill.

2. Lower Trophic-Level Organisms: The cumulative case considers other actions in addition to those of Alternative I. These include former Federal and State oil and gas lease sales, resource-development projects, and oil-field-related construction projects. The activities associated with these actions that may affect lower trophic-level organisms include drilling discharges, seismic surveys, construction, and those pertaining to an accidental oil spill. The effects of these activities and the agents associated with them already have been discussed for Alternative 1. This analysis considers differences in the amount of exposure lower trophic-level organisms would have to these activities/agents for the cumulative case as compared to that of Alternative I. It then estimates the resulting effect of these differences on lower trophic-level organisms.

The cumulative case involves more drilling discharges, seismic surveys, and construction-related activities than Alternative I. However, there is not enough difference in their expected number or magnitude to alter the expected effect of these additional activities on lower trophic-level organisms. Concerning the potential effect of an accidental oil spill, the cumulative case involves 5 to 11 oil spills ≥ 1,000 bbl (Table IV.A.2-2), depending on the resource estimate involved. Production at the lower resource estimate involves up to five oil spills. These would consist of one pipeline/platform spill from Alternative I, one pipeline or platform spill from State offshore activities, and three oil-tanker spills from State onshore activities.

Production at the higher resource estimate involves up to 11 oil spills. These would consist of one pipeline or platform spill from Alternative I, one pipeline or platform spill from former Federal lease sales, two pipeline/platform spills from State offshore activities, one oil-tanker spill from Alternative I, one oil-tanker spill from State offshore activities, and five oil-tanker spills from State onshore activities. All tanker spills occur somewhere along the tanker route between California and the Gulf of Alaska.

The overall number of oil spills estimated for the cumulative case in the Beaufort Sea area is four. One of these spills is contributed by Alternative I (a pipeline or platform spill). The other three oil spills are due to State-related activities. If these three State-related oil spills were about the same size as the Alternative I oil spill (estimated at 7,000 bbl), then their expected effect on lower trophic-level organisms would be correspondingly greater. Hence, oil spills in the cumulative case in the Beaufort Sea area are expected to have about four times the adverse effect of Alternative I on lower trophic-level organisms. Each of the four oil spills are estimated to have lethal and sublethal effects on <1 percent of the phytoplankton and zooplankton in the sale area. Recovery is expected within 2 days for phytoplankton and within a week for zooplankton (2 weeks in embayment areas). Each spill also is estimated to have lethal and sublethal effects on <5 percent of the epontic community (assuming a winter spill), and <1 percent of the marine invertebrate larva nearest the surface. Recovery is expected within a month (within a year where water circulation is significantly reduced).

Cumulative Effects on the ANWR: Oil and gas projects that occur from Badami onshore east to the ANWR boundary and offshore projects in State of Alaska and Federal OCS waters include the following onshore projects: Badami, Point Thompson, Sourdough, and Yukon Gold oil prospects and Flaxman Island, and the following offshore projects located in Camden Bay to the west: Warthog, Stinson, Kuvlum, and Hammerhead. A hypothetical 7,000-bbl oil spill is assumed to occur and contact the Canning River delta on the boundary of the ANWR in association with cumulative development of these offshore projects. The expected effect of this oil spill on lower trophic-level organisms offshore of the ANWR would be the same as for spills discussed above, namely, lethal and sublethal effects on <1 percent of the phytoplankton and zooplankton in the affected area. Recovery is expected within 2 days for phytoplankton and within a week for zooplankton (2 weeks in embayment areas). The oil spill also is estimated to have lethal and sublethal effects on <5 percent of the epontic community (assuming a winter spill), and <1 percent of the marine invertebrate larva nearest the surface. Recovery is expected within a month (within a year where water circulation is significantly reduced).

Conclusion: Effects on lower trophic-level organisms due to drilling discharges, seismic surveys, and construction-related activities in the cumulative case are expected to be similar to those of Alternative I. Based on the assumptions discussed in the analysis, cumulative-case oil spills are expected to have about four times the adverse effect of Alternative I on lower trophic-level organisms within the sale area.

3. Fishes: Fishes could be cumulatively affected by several activities occurring in the Arctic Region. Cumulative effects involve the analysis of additive effects from past, present, and reasonably foreseeable future actions, regardless of the source of the action. For Sale 170, this would encompass previous Federal and State offshore oil and gas lease sales, ongoing production, and possible future leases in the area. Other activities to be considered are possible future Canadian Beaufort Sea oil and gas activities and subsistence harvesting activities.

Six Federal lease sales have been conducted in the Beaufort Sea. The most recent sale was Sale 144 in September 1996. A total of 660 leases totaling 1.14 million hectares have been sold. Twenty-eight wells have been drilled on Federal lands. Presently, 76 active leases are located on Federal submerged lands in the Beaufort Sea. Two potentially producible prospects from previous Federal lease sales are the Kuvlum and Hammerhead Units. The Northstar Unit contains some Federal tracts, but most of the submerged tracts are in State waters.

Previous State lease sales consist of 934,038 hectares of offshore leases and 609,643 hectares of leases composed of both onshore and offshore components. In the next 5 years, four State oil and gas lease sales are scheduled in the Beaufort Sea.

Additionally, the Alpine prospect in the Colville River Delta is likely to be developed. Seismic surveys currently are being conducted in the area. The NPR-A recently has been mentioned as a possible oil source. The NPR-A is located on land just west of the Colville River and its delta. The Liberty (previously known as Tern Island) prospect also has development potential that is currently being explored.

Canadian Beaufort Sea exploration and development/ production industry interest seems to occur around the Mackenzie River Delta. The Mackenzie River is the only known spawning area for Arctic cisco and an extremely critical and important overwintering habitat for many Beaufort Sea fishes.

Fishes in the arctic region could be cumulatively affected by drilling, seismic operations, oil spills, and construction from Federal and State and Canadian offshore and onshore oil and gas activities in the Beaufort Sea. Fishery resource

subsistence-harvest activities also are a factor in the cumulative analysis. The effects of oil and gas exploration, development, and production activities also are discussed in Alternative I, Section IV.B.3.

a. **Effects of Discharges:** Under the cumulative case, additional drilling and discharges, including the discharge of muds and cuttings, likely would occur in the Beaufort Sea area, including nearshore areas, from proposed State and Federal lease sales. Fishes would be displaced from the local habitat during the installation of the drilling equipment and when discharges occurred. Discharges in shallow, ice-covered waters are presently restricted. Therefore, the likelihood that fishes would be exposed to discharges during their critical overwintering habitat or for relatively long periods of time in areas of little circulation is reduced. Cumulative effects to fishes from drilling and discharges likely would be local and temporary.

b. **Effects of Disturbances:** Noise effects may result from exploration, development, and production activities occurring on previously sold or proposed State and Federal offshore leases. The effects of noise on fishes can be found in Section IV.B.3. These effects would be amplified as activities in the area increased. Seismic surveys also would be conducted in shallow, nearshore areas and within river deltas during the winter. Noise effects on fishes could include local avoidance of seismic surveys, aircraft and vessel traffic, drilling and construction activities, and production operations. However, the fishes' ability to avoid noise and disturbances would be significantly curtailed if the noises occurred in nearshore brackish and freshwater areas during the winter season, when fish were restricted in their critical overwintering habitat. A significant increase in the disturbance levels could cause a variation in some fishes' migration patterns. This alteration could adversely affect the fishes' recruitment and survival. However, no scientific evidence currently is available to indicate if industrial noise and disturbance in an area for a number of years would adversely affect fishes in those areas.

(1) **Seismic Surveys:** Seismic-survey activities could increase under the cumulative case. Marine fishes are likely to incur minimal effects from seismic surveys due to their ability to move and avoid the impact area. Many nearshore areas previously have been surveyed due to past lease sales and exploration activities for new oil and gas prospects. However, fishes in critical and scarce nearshore overwintering habitat, especially in river delta areas, could be particularly vulnerable to seismic activities due to their dependency on these areas and their inability to move from these areas during the winter season.

(2) **Construction:** Future offshore developments should attempt to use existing onshore pipelines when possible. Available facilities include Oliktok Point, Point McIntyre/West Dock, and Endicott/ Duck Island.

For the cumulative case, it is likely that oil transport to onshore facilities would be accomplished by undersea pipelines, such as those currently being developed for British Petroleum's Northstar site. The pipelines will be installed by digging trenches in the sea floor. This construction will create additional sedimentation. Fish and epibenthic invertebrates annually recolonize shallow habitat that is seasonally disturbed. The cumulative effects on fishes from the installation of pipelines in the undersea trenches should be localized and temporary, except if it occurs during the time of fish migration. At that time, the construction could disrupt the fishes' migration pattern. However, it is likely that cumulative adverse effects to fishes could result from the excess dirt from the trenching activities being temporarily stored on the ice surface. This dirt could be 1 ft deep on the ice surface and have an insulation effect on the underlying ice, causing a significant lag in the area's natural processes and/or interfere with the important summer, nearshore coastal band of water. This would adversely affect fish migration and/or feeding in the area. The specific adverse effects to fishes from the undersea pipeline process are yet to be determined. It is likely that other production units would use the same pipeline technology as that proposed for the Northstar Unit. This would merit a re-evaluation of both unit and cumulative effects to fishes.

It is unlikely that any long docks or causeways will be constructed in the future. However, according to the MMS scenario short jettylike structures may be constructed in conjunction with the shore approach of offshore pipelines. These structures would likely be about 90 meters in length. Effects on fishes would depend upon the jetty-like structure's siting and the hydrology associated with the site. Site-specific effects on fishes of jettylike structures would be more appropriately addressed in a development and production EIS. Current industry thinking tends toward using undersea pipelines. This technology is currently untested but being planned. Past construction of long, solid-filled causeways in the nearshore Beaufort Sea has affected some fishes. At the present time, two long causeways, West Dock and Endicott, exist in the Prudhoe Bay-Sag River area. These causeways extend several kilometers seaward from the shore. The two existing causeways and their effects on nearshore-water characteristics are summarized by Segar (1990), Norton (1989), and Colonell and Gallaway (1990).

Alteration of the nearshore physical oceanographic regime, specifically by the West Dock Causeway, together with meteorological conditions are considered the primary factors affecting the distribution and migration of some

fishes, particular the migratory form of least and Arctic ciscoes (Fechhelm et al., 1994).

If development of the Kuvlum and Hammerhead units proceeds, production platforms would be installed and pipelines would be constructed. Fishes could be disturbed in the area of these activities. Fishes may ignore noise if it continues over a long period of time. However, they are sensitive to changes between 5 to 1,000 Hz (Bell, 1990).

If the Canadian Beaufort Sea were to have oil and gas exploration, development, and production activities in the future, fishes could be significantly affected. Arctic cisco spawn exclusively in the Mackenzie River area and migrate from there to the U.S. Beaufort Sea. Broad whitefish and least cisco populations also are found in the Mackenzie River area. Disruption of these fishes' life cycles by oil and gas activities could have substantial adverse effects to their survival and future recruitment and to their availability for Alaskan Native subsistence harvesting.

The Alpine Unit and NPR-A are located at and adjacent to the Colville River Delta. Alpine is likely to be developed, and the potential exists for the possibility of exploration and development of the NPR-A. Although these are basically land-based units, their activities could definitely affect fishes throughout the year. The Colville River Delta is the most important critical overwintering areas for fishes. It is part of several major migration routes and a part of an important feeding area in the summer season. Activities in the delta area likely would significantly affect fishes that previously have been subjected to the effects of past and ongoing activities in the Beaufort Sea. Consequently, cumulative adverse effects to fishes could be profoundly amplified.

c. Effects of Oil Spills: The OSRA model estimated two to four oil spills ≥1,000 bbl from pipelines or platforms from Federal and State lease activity for the cumulative case, with an estimated 87- to 98-percent chance of one or more such spills occurring within the Beaufort Sea over the production life of Alternative I. However, Sale 170 would contribute only one offshore spill for either the low or high range of the resource range. As discussed previously in Section IV.B.3, the effects of an oil spill on fishes could vary, depending on when it occurred and at what areas were affected. Adverse effects from a spill could include skin contact, respiratory distress from gill fouling, localized reduction in food resources, consumption of contaminated prey, displacement from migratory routes, and temporary displacement from local habitat. Juveniles, larvae, and eggs are more likely to be adversely affected than adult fishes. Nearshore habitats, especially those in the delta areas, are of critical and great importance as overwintering habitat for several anadromous and amphidromous fishes during the winter season. In the summer season, a nearshore band forms along the Beaufort Sea coastline when coastal river freshwater combines with shallow marine water and decreases marine salinity and elevates water temperatures. This band provides a major feeding area for fishes during the summer season. Disruption as a result of an oil spill could have significant adverse effects to several fish species using these habitats during these seasons.

Oil spills from onshore pipelines (see Table IV.A.2-4) are likely to have a significant effect on fishes in their overwintering, rearing, and spawning habitats. Spills also could affect fishes during their migration periods. A high effect on fishes likely would result if the Sagavanirktok or Colville rivers and/or their delta areas were contaminated.

A non-OCS oil and gas activity that could affect fishes is the annual subsistence harvest by Alaskan Natives. Harvesting activities and oil and gas exploration, development, and production activities could have a synergistic adverse effect on the harvested species. This would be in spite of the fact the current subsistence harvesting does not appear to have any adverse effects under the present level of oil and gas activities in the Beaufort Sea. A more complete discussion of cumulative effects on subsistence fishes can be found in Section IV.E.9.

Cumulative Effects on the ANWR: Cumulative effects to fishes in ANWR waters and waters offshore of the ANWR include the following. Lethal effects to fishes in the ANWR area from oil and gas activities most likely would occur in the nearshore habitat rather than in the marine habitat. Fishes are likely to avoid noise and disturbances, if possible. Seismic surveys have the potential to possibly cause lethal effects to fishes. Drilling discharges and pipeline installation (construction), except for the on-ice, temporary storage of excess trench material, likely would cause local and temporary adverse effects to fishes. The possibility exists that fishes could be adversely affected from the placement, on the ice surface, of excess material from undersea trenching activities.

The cumulative effects of Beaufort Sea oil and gas activities on the ANWR and fishes includes a 7,000-bbl oil spill. Should a 7,000-bbl pipeline oil spill occur under the development/production scenario, both fishes and fish habitat could suffer effects from contact. The numbers and species of fishes affected would depend on the season, lifestage (adult, juvenile, larval, egg), and the time of contact. Egg, larval, and juvenile lifestages are more likely to be affected due to the increased sensitivity to pollutants and less mobility to avoid a spill. Fishes in the ANWR area could experience one or more of the following effects from an oil spill: skin contact, respiratory distress from gill fouling, localized reduction in food sources, consumption of contaminated prey, displacement from migratory routes, and temporary displacement from local habitat. Some

fishes may die as a result of a spill, depending on the location and season. Recovery of the affected species would require the minimum time period of their life span or a greater time period, depending on the recruitment level from the surviving year-classes. During the summer season, fishes feeding and/or migrating in the nearshore, warmer, less saline water band that forms as a result of river runoff, which is a relatively small area in the ANWR area, could be significantly affected by an oil spill. An oil spill could prevent fishes from feeding in this productive band area and consequently affect their ability to accumulate food reserves for overwintering and their continued survival. Marine fishes likely would sustain minimal damage from a spill in either the winter or summer season, because they are relatively widely dispersed and able to avoid the spill by moving.

Summary: Under the cumulative case, fish behavior, such as avoidance, should be qualitatively similar to that discussed for Alternative I. Seismic surveys, aircraft and vessel traffic, and drilling and construction activities likely would increase. Fishes likely would avoid these activities, if possible. However, their avoidance ability would be greatly curtailed if these activities occurred in or affected critical nearshore brackish water and freshwater habitat during the winter season, when fishes are severely restricted to this scarce overwintering habitat due to their dependency on the habitat and their inability to move from this habitat. This also would be the case for fishes attempting to avoid seismic surveys. Undersea pipeline installation likely would have only localized and temporary effects on fishes, unless it is done after breakup when it could disrupt nearshore fish migrations. However, temporary storage on the ice surface of excess dirt resulting from the undersea pipeline construction could alter the area's natural processes and/or interfere with the summer, nearshore coastal water band. This could adversely affect fish migration and/or feeding in the area and cumulatively could result in an additive adverse effects to the fishes. Effects from the construction of short, jettylike structures are possible, but would depend on the siting of the structure and the hydrology of the surrounding area. Long docks and causeways are not likely to be constructed in the future. Of the two present causeways, West Dock may affect the migrations of least and Arctic ciscoes, depending on meteorological conditions. Oil and gas activities in the Canadian Beaufort Sea could impact Mackenzie River fishes that migrate to the U.S. Beaufort Sea. Land-based oil and gas activities in the Beaufort Sea area significantly could impact fishes in their scarce and critical brackish water and freshwater overwintering habitat. Whether the adverse effects to fishes were nonlethal or lethal would depend upon the timing, location, duration, the type, etc. of oil and gas activities involved.

More oil spills are assumed to occur under the cumulative case than under Alternative I. Therefore, the probability is greater that fishes may be contacted by spilled oil, and oil-spill effects are likely to be greater. Fishes are likely to incur significant impacts if an oil spill contacts and/or affects critical and scarce nearshore overwintering habitat, especially in river-delta areas, during the winter season. During the summer season when a warmer, less saline nearshore band forms, fishes also could be significantly affected, because they concentrate in this band area to feed on the abundance of invertebrates found here. An oil spill contacting this band could affect fishes directly and indirectly by killing food that is essential to fish for the accumulation of overwintering food reserves. Oil spills from onshore pipelines significantly could affect fishes in their overwintering, rearing, and spawning habitats. These effects could be nonlethal or lethal, depending on the circumstances.

Conclusion: Lethal effects to fishes most likely would occur in nearshore and overwintering habitats rather than in the marine habitat. Fishes are likely to avoid noise and disturbances, if possible. Seismic surveys have the potential to possibly cause lethal effects to fishes. Drilling discharges and pipeline installation, except for the temporary storage of excess dirt, likely would cause local and temporary effects to fishes. The possibility exists that fishes could be adversely affected from the placement on the ice surface of excess dirt from undersea trenching activities. Oil spills from Sale 170 would comprise approximately 25 percent of all the spills in the Beaufort Sea area. Generally, oil spills likely would have the most lethal effects on fishes. The effect of Sale 170 to the fishery resources under the cumulative case could be nonlethal or lethal, depending on the circumstances involved. Overall, the contribution of Alternative I to the cumulative effects is expected to be of short duration and mostly with nonlethal effects, except in the case of an oil spill in the nearshore and overwintering fish habitats, where the cumulative effects could be significant.

4. Endangered and Threatened Species: The potential for cumulative effects to endangered and threatened species takes into consideration previous Federal and State offshore lease sales and some State or private activities that may occur in the future. State or private actions reasonably certain to occur within or near the proposed sale area would include State of Alaska oil and gas lease sales, possibly some Canadian Beaufort Sea oil and gas activities in the future, and subsistence-harvest activities.

A total of six Federal lease sales have been conducted in Beaufort Sea waters, the most recent being Sale 144 in September 1996. In addition to Sale 170, another Beaufort Sea sale, Sale 176, is planned for 2002. A total of 660 leases have been sold totaling 1.14 million ha, and 28 wells have been drilled on Federal leases. Currently, there are 80 active leases on Federal submerged lands in the Beaufort

Sea. There are two potentially producible prospects from previous Federal lease sales, the Kuvlum and Hammerhead units, which are both within the normal fall-migration route of the bowhead whale. The Northstar unit contains some Federal tracts, although the majority of submerged tracts comprising this unit lie under State waters; and development and production activities should have relatively little effect on bowhead whales. Two Federal lease sales have been conducted in the Chukchi Sea, although exploration activities resulted in no producible wells. A Chukchi Sea/Hope Basin Sale is included in the 1997-2002 5-Year Program. It is highly speculative whether the sale will be held and, if held, may result in exploration-only activities. Currently, there are no plans for future oil and gas exploration activities in the Bering Sea.

As a result of previous State lease sales, there are approximately 934,038 ha of offshore leases in addition to 609,643 ha of leases that have both onshore and offshore components. Over the next 5 years, four additional State oil and gas lease sales are scheduled in State waters of the Beaufort Sea. Sale 86 in the central Beaufort Sea was held in November 1997. Beginning in 1999 through 2001, the State will offer all State-owned lands located between Pt. Barrow and the Canadian border annually. If these sales occur, additional noise and disturbance effects could occur from exploratory activities similar to those described below for previous State lease sales.

The OSRA estimates a total of two to four spills ≥ 1,000 bbl from pipelines or platforms from Federal and State lease activity for the cumulative case, with an estimated 87- to 98-percent chance of one or more such spills occurring within the Beaufort Sea over the production life of the Alternative I. The OSRA estimates a 64- to 88-percent chance that activities on Federal offshore leases will contribute one to two spills in the Beaufort Sea for the cumulative case. In this analysis, it is estimated that Sale 170 will contribute one pipeline/platform spill at the low end of the resource range and one pipeline/platform spill resulting from activities on leases from Sale 144 and from other previous Federal sales at the high end of the resource range. For spills from State sales, it is estimated that one pipeline/platform spill will occur at the low end of the resource range, and two pipeline/platform spills will occur at the high end of the resource range.

The main area of industry interest in the Canadian Beaufort Sea has centered around the Mackenzie River Delta and offshore of the Tuktoyaktuk Peninsula, although there has been little industry interest there in recent years.

Analysis of the oil-spill risk on species along transportation routes south of the proposed sale area (Fig. IV.A.5-2), particularly the southern sea otter and the marbled murrelet, is summarized for the Alternative I in Section IV.B.4 and also can be found in the Cook Inlet Planning Area Oil and Gas Lease Sale 149 FEIS (USDOI, MMS, Alaska OCS Region, 1996b), which is incorporated here by reference. Analysis of the potential effects of an oil spill on species along transportation routes (Fig. IV.A.5-3) to ports in the Far East can be found in the Beaufort Sea Sale 144 FEIS (USDOI, MMS, 1996a), which also is incorporated here by reference. It is anticipated that most of the oil produced as a result of Sale 170 will be shipped to southern ports rather than to Far East ports.

a. Effects on the Bowhead Whale: The following analysis of potential effects was extracted from pertinent sections of the Sale 144 FEIS (USDOI, MMS, 1996a). The effects of noise and spilled oil on bowhead whales also are discussed in Section IV.B.4.

Some effects on bowhead whales may occur from previous and proposed State and Federal offshore lease sales. Generally, bowhead whales remain far enough offshore to be found mainly in Federal waters; however, in some areas (e.g., the Beaufort Sea southeast and north of Kaktovik and near Point Barrow), the whales may occur in State waters. Exploration and development and production activities occurring on leases from previous or proposed State or Federal offshore lease sales may result in noise effects on whales, as described in the Sale 144 FEIS. It is expected that there would be few effects on bowhead whales during their fall migration through the Beaufort and Chukchi Seas to overwintering areas in the Bering Sea as a result of previous and proposed offshore lease sales. Noise effects on bowheads under the cumulative case could include local avoidance of seismic surveys; aircraft and vessels; exploratory drilling; construction activities, including dredging; and production operations that occur at varying distances from the whales. It is unlikely that there would be any major changes in the overall fall bowhead migration route resulting from noise associated with previous or future State or Federal lease sales. Should an oil spill occur, effects on whales primarily would be temporary and nonlethal, as discussed for the Alternative I, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency, and skin and/or sensory-organ damage. A low number of individuals could be killed as a result of prolonged contact with freshly spilled oil, particularly if spills were to occur within ice-lead system.

Should development of the Kuvlum and Hammerhead units or other offshore prospects proceed, production platforms would be installed and pipelines would be constructed. Some minor disturbance to bowhead whales on their fall migration might occur in the vicinity of these activities. Support traffic (helicopters and vessels) likely would travel from Deadhorse. Bowheads may dive if helicopters passed low overhead, and they would seek to avoid close approach

by vessels. Behavioral studies have suggested that bowhead whales habituate to noise from distant ongoing drilling, dredging, or seismic operations, but there still is some apparent localized avoidance. There is insufficient evidence to indicate whether or not industrial activity in an area for a number of years would adversely affect bowhead use of that area, and there has been no documented evidence that noise from OCS operations would serve as a barrier to migration.

On their summer-feeding grounds in the Canadian Beaufort Sea, bowhead whales may be subject to some disturbance from activities associated with offshore oil and gas exploration and development and production at some time in the future. There has been little industry interest in the Canadian Beaufort Sea in recent years, and there currently are no plans for future oil and gas exploration activities. Should interest in the area be renewed, possible disturbance to bowhead whales from helicopters, vessels, seismic surveys, drilling, dredging, and construction activities would be as previously described. Oil-spill effects on the bowhead whales also would be as previously described.

A non-OCS activity that affects bowhead whales is the annual subsistence harvest by Alaskan Natives. Bowheads are taken in the northern Bering Sea and in the Chukchi Sea on their spring migration and in the Beaufort Sea on their fall migration. A quota of 266 strikes or 204 bowheads landed has been authorized by the IWC for 1995 through 1998. Whales likely would try to avoid being closely approached by motorized hunting boats; however, once the whales migrate out of the Beaufort Sea, there probably would be few whales interacting with hunters during the fall season and none during the winter. As the bowheads migrate northward through the northern Bering, Chukchi, and Alaskan Beaufort Seas during the spring, they are subject to being taken by subsistence whalers.

Cumulative Effects on the ANWR: The potential for cumulative effects to endangered and threatened species takes into consideration activities that may occur as a result of previous State onshore lease sales and Federal and State offshore lease sales. The focus of this section is on potential harm to the coastal lands of the ANWR. If a 7,000-bbl oil spill were to occur and directly impact the Canning River delta, it is unlikely that endangered bowhead whales will be affected beyond what was discussed in Alternative I and the cumulative effects section. Based on years of aerial surveys in the Beaufort Sea it appears that Camden Bay is shoreward of the main fall migration route and that relatively small numbers of whales would be likely to be present in the trajectory of such an oil spill. Spills that may occur offshore of the ANWR and affect bowhead whales are discussed in Alternative I.

Summary: Under the cumulative case, bowhead whale behavior, such as avoidance, is expected to be qualitatively similar to that discussed under the Alternative I. There could be an increase in seismic surveys, aircraft and vessel traffic, drilling, and construction activity, although bowhead whales generally would not encounter activities in State waters. Bowheads may exhibit avoidance behavior at varying distances if approached by vessels or seismic-survey activity but are not affected much by any overflights, unless aircraft altitudes are below 300 m (328 yd). Whales also likely would try to avoid being closely approached by motorized hunting boats. Bowheads have been sighted near drillships, although some bowheads probably change their migration speed and swimming direction to avoid close approach to them. Whales appear to exhibit less avoidance behavior with stationary sources of relatively constant noise than with moving sound sources. Bowheads do not seem to travel more than a few kilometers in response to a single disturbance incident; and behavioral changes are temporary, lasting from minutes (in the case of vessels and aircraft) up to 30 to 60 minutes (in the case of seismic activity). Overall, exposure of bowhead whales to noise-producing activities from oil and gas exploration and development and production operations is not expected to result in lethal effects, but some individuals could experience temporary, nonlethal effects.

Because more oil spills are assumed to occur under the cumulative case than over the life of the Alternative I, the probability is greater that whales may be contacted by spilled oil, and oil-spill effects are likely to be greater. However, the probability of oil actually contacting whales would be considerably less than the probability of contact with bowhead habitat. Some individuals may be killed or injured as a result of prolonged exposure to freshly spilled oil; however, the number of individuals so affected is expected to be small. Overall, prolonged exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, with the population recovering within 1 to 3 years. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects.

Although prolonged exposure of bowhead whales to spilled oil may result in lethal effects to a few individuals, the overall contribution of the Alternative I to the cumulative effects is expected to be of short duration and to result in primarily temporary, nonlethal effects.

Conclusion: Bowheads may exhibit avoidance behavior to vessels and activities related to seismic surveys, drilling, and construction during exploration and development and production. Some bowhead whales could be exposed to spilled oil, resulting in temporary, nonlethal effects, although prolonged exposure to freshly spilled oil could result in lethal effects to a few individuals, with the population recovering to prespill population levels within 1 to 3 years. Overall, bowhead whales exposed to noise-

producing activities and oil spills associated with the Alternative I and other future and existing projects within the Arctic Region—combined with other activities within the range of the migrating bowhead whale—most likely would experience temporary, nonlethal effects. The overall contribution of the Alternative I to the cumulative effects is expected to be of short duration and to result in primarily temporary, nonlethal effects.

b. Effects on the Spectacled Eider: In addition to Sale 170, other projects or activities that could contribute to cumulative effects on spectacled eiders include development on Federal and State oil and gas leases from past sales in the Beaufort Sea area, current and developing State oil production, subsistence harvests, commercial fishing, marine shipping, and recreational activities. These projects could result in disturbance of nest sites and areas occupied during broodrearing, molting, staging, and migration, as well as habitat degradation and oil or other toxic pollution effects. Disease, predation, fluctuations in prey availability, and severe weather, and unknown factors that have caused the spectacled eider population in Alaska to decline 90 percent in the past several decades, presumably would contribute to the cumulative effect or affect the intensity with which other factors operate. For example, Native elders feel that fox numbers on the Arctic Slope have increased in recent decades due to reduced trapping (Suydam, 1996, pers. comm.), and numbers in the oilfields probably have increased due to availability of human-generated food; such increases are likely to increase predation pressure on eiders.

(1) Potential Effects of Discharges, Disturbance, Habitat Alteration, and Other Factors: As in the development scenario for Alternative I, discharges and potentially disturbing routine activities associated with existing, current, and foreseeable State and/or Federal oil and gas developments are not expected to occur frequently near substantial numbers of dispersed nesting or staging/migrating spectacled eiders; hence, routine disturbance under cumulative assumptions is expected to be approximately equivalent to that under Alternative I (no significant adverse effects from drilling discharges or potentially disturbing routine activities during exploration and development/production). On the Arctic Slope, an estimated 15 percent of available eider nesting habitat has been developed as oil-production fields, although <5 percent of the tundra wetlands within the developed area has been destroyed (58 *FR* 27478). Future State onshore development could result in increased eider disturbance and habitat degradation, but the extent of such development will depend on economic factors. Subsistence harvest is estimated to remove at least 500 spectacled eiders from the Alaskan population annually (58 *FR* 27477). The level of potential eider mortality from all additional cumulative routine activities is likely to be substantially greater than that associated with Alternative I, and thus the population is expected to experience substantially greater overall effects under cumulative assumptions. The net result is likely to be lower survival and/or productivity than expected under Alternative I, from which the population is not likely to recover while the current decline persists. Effects of the other factors (e.g., fishing-net entanglement, bioaccumulation of toxins in the food chain, predators) on the spectacled eider population currently are unknown.

(2) Potential Effects of Oil Spills: Substantially greater spectacled eider mortality (<600 individuals) is expected from additional oil spills (2-4) likely to occur under cumulative assumptions, approximately twice that associated with Alternative I; however, unless mortality is near the lower end of this range, recovery from cumulative spill-related losses is not expected to occur while the population numbers decline on the breeding grounds and the relatively low reproductive rate persists.

Conclusion: Effect of routine lethal and nonlethal cumulative factors on the arctic slope spectacled eider population is likely to be substantially greater than that associated with Alternative I. Likewise, substantially greater (2 times) spectacled eider mortality (<600 individuals) is expected to result from additional oil spills likely to occur under cumulative assumptions than is expected with Alternative I. Recovery from substantial overall cumulative effect is not expected to occur while the uncertain population status of recent decades persists. The contribution of activities associated with proposed Sale 170 to the cumulative effect on the spectacled eider population is expected to represent perhaps 25 percent.

c. Effects on the Steller's Eider: In addition to proposed Sale 170, other projects or activities that could contribute to cumulative effects on Steller's eiders include development on Federal and State oil and gas leases from past sales in the Beaufort Sea area, current and developing State oil production, subsistence harvests, commercial fishing, marine shipping, and recreational activities. These projects could result in disturbance of nest sites and areas occupied during brood rearing, molting, staging, and migration, as well as habitat degradation and oil or other toxic pollution effects. Disease, predation, fluctuations in prey availability, and severe weather, as well as these or unknown factors that have caused the Steller's eider population in Alaska to decline >50 percent in the past several decades, presumably would contribute to the cumulative effect or affect the intensity with which other factors operate. For example, Native elders feel that fox numbers on the Arctic Slope have increased in recent decades due to reduced trapping (Suydam, 1996, pers. comm.), and numbers in the oilfields probably have increased due to availability of human-generated food;