Chapter 1

Introduction

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OVERVIEW

The coastal plain of the Arctic National Wildlife Refuge, in the extreme northeast corner of Alaska (see Figure 1 -l), has become the focal point of a major debate among interest groups seeking either to promote or to block the leasing, exploration, and development of the area for its suspected massive oil resources. Because of the perceived oil and gas potential of the area, the 1.5 million acre coastal plain, or so-called "1002 area" named after Section 1002 of the Alaska Native Interest Lands Conservation Act (Public Law *96-487),* was left out of the Federal wilderness designation that protected 8 million acres in the Refuge. Instead, Congress asked the Department of the Interior (DOI) to study the area and to recommend an appropriate development course for it. Oil and gas development was forbidden without explicit congressional approval. DOI has now completed its study and has recommended to Congress that the entire 1002 area be opened to leasing and development. [1] This recommendation is fully supported by the oil industry and a variety of other pro-development interests (including the entire Alaskan congressional delegation), is vigorously opposed by a number of environmental groups and some Native groups, and is supported *with conditions* by the Alaskan State government and other interests. The variety of proposed Federal legislation dealing with the Refuge – summarized in Box 1 -A – reflects these different positions.

The **1002** area is the focus of a variety of seemingly conflicting values. On one side, there is unanimous agreement that the area represents a high value as a wildlife refuge–the 1002 coastal plain is, in most years, the primary calving ground and summer home for the nearly 200,000 caribou of the Porcupine herd, as well as the nesting habitat for millions of birds and the home of polar and grizzly bears, an expanding herd of musk oxen, and numerous other arctic species. Also, there is widespread agreement – supported even by the DOI report that recommended its development –that it has a high value as a wilderness area. Further, the area provides wildlife resources – particularly caribou – supporting the subsistence lifestyle of a number of native Inuit. On the other side, there is essentially unanimous agreement that the 1002 area has a high potential – by industry standards – for containing massive oil and gas deposits, although various interest groups differ on the value of these deposits to the Nation (see Box 1 -B).

It seems unlikely that all of these values can be supported simultaneously. For example, according to the DOI report, the successful exploration for and development of the 1002 area's potential oil resources would damage and possibly destroy the area's wilderness character. Although some interests have argued that the wilderness character can be restored over time, at our current state of knowledge this outcome should be viewed as extremely uncertain, and probably unlikely. Thus, the true "value" of the coastal plain as a wilderness area, though largely a subjective measure, is an important part of the development decision.

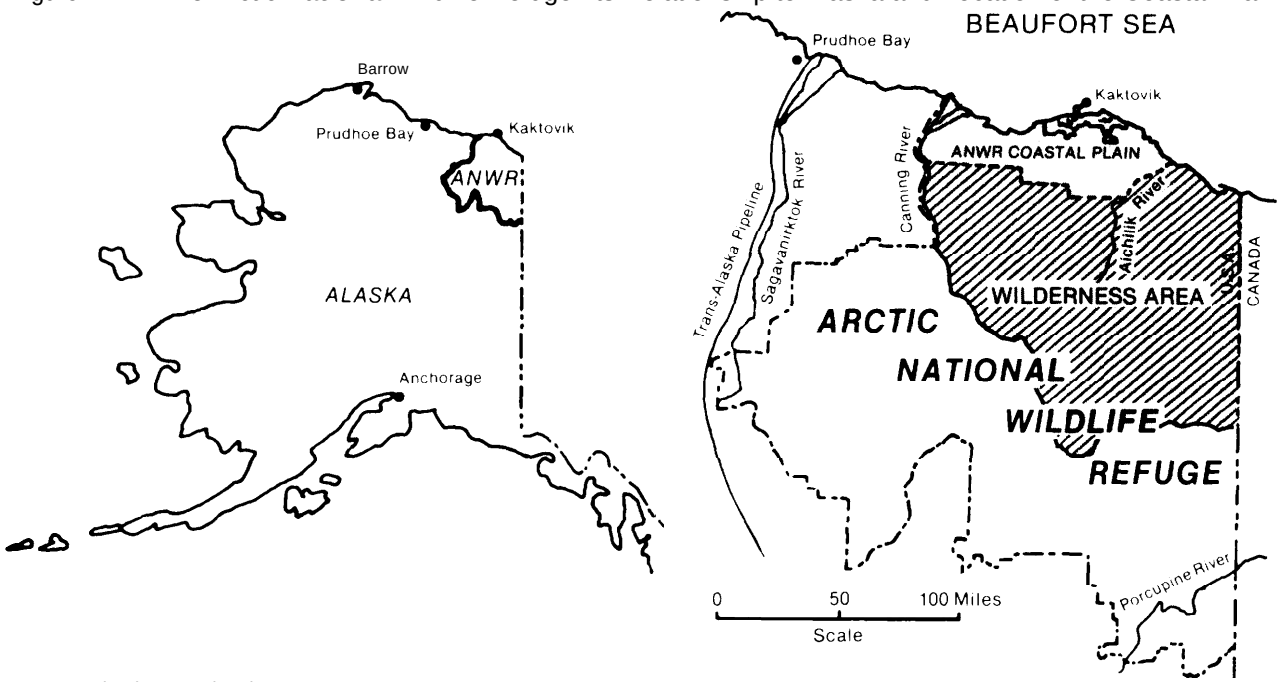
In addition, there is substantial disagreement about the potential conflict between large-scale oil development and the wildlife and other environmental and subsistence values of the area. Generally, the oil companies vigorously defend their environmental record in previous Alaskan North Slope development and assert that ANWR oil can be extracted with little damage to wildlife and other values. Environmental groups are taking the opposite view that previous develop-

1, N,K. Clough, R.C. Patton, and A..C. Christiansen (eds.), Arctic National Wildlife Refuge, Alaska, Coastal Plain Resource Assessment-Report and Recommendation to the Congress of the United States and Final Legislative Environmental Impact Statement, (Washington, DC: U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management U.S. Department of the Interior, 1987).

ment has caused substantial damage and that any future oil development in ANWR also will substantially damage wildlife and other environmental values.

These conflicting viewpoints have been the subject of a number of congressional hearings as well as studies by a number of groups. The issues raised during the hearings are summarized in Box 1-C.

Figure 1.1 .—The Arctic **National** Wildlife Refuge: Its Relationship to Alaska and Location of the Coastal Plain



SOURCE Arctic Slope Regional Corp ,"The Arctic National Wildlife Refuge Its People, Wildlife Resources, and 011 and Gas Potential," revised May 1987,

Photo credit: American Petroleum Institute

The site of Chevron's KIC well, which is the only onshore exploratory well to probe ANWR's oil potential. The well was drilled from a temporary insulated pad, and the site is now being rehabilitated. The success of this rehabilitation effort will clarify arguments over the long-term impacts of exploratory drilling in ANWR.

BOX 1-A
ARCTIC NATIONAL WILDLIFE REFUGE BILLS

More than a dozen bills have been introduced in the IOOth Congress that address issues related to the Arctic National Wildlife Refuge. Two pro-leasing bills, S 2214 and HR 3928, have emerged as the leading bills around **which debate is currently centered.**

S 2214, which Incorporates some of the provisions of a pro-leasing bill introduced by Senators **Murkowski and Stevens of Alaska, was reported by the Senate Energy and Natural Resources Committee on February** 25, 1988. **The bill provides for a phased-in leasing program** governed by existing State Federal environmental law, **and subject** to **further environmental regulations to be developed by** the **Interior Department. S** 2214 would permit Interior to exciude from leasing areas of particular environmental sensitivity. Interior **would be required to determine whether an activity may result in "significant adverse effect" and** to modify, suspend, or terminate the activity to prevent that adverse effect. Royalties would be divided equally **between the State and Federal Government.** The bill also calls for an energy policy study to be conducted **while leasing and development proceed.**

HR 3601 was approved by the House Merchant Marine and Fisheries Committee on May 3, 1988. **The bill is generaily similar to S** 2214 in providing for a phased-in leasing program. However, unlike **S** 2214, it establishes **a 260,000-acre protective management zone in the "we calving area" of the** Porcupine caribou herd and does hot require an energy study. The **bill will also be considered by** the House Interior Committee, which is headed by Congressman Morris Udall, Chairman Udall favors a wilderness designation for the ANWR coastal plain and has introduced legislation (HR 39) to accomplish that **purpose. A similar bill (S** 1804) **has been introduced in the Senate,**

Four committees, House Merchant Marine and Fisheries, House Interior and Insular Affairs, Senate Energy and Natural Resources, and Senate Environment and Public Works have **held** more than 25 hearings since the debate on ANWR's future began in 1987.

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1. **Environmental and Energy Study Conference, "Merchant Marine to Mark Up New Arctic Refuge Leasing Bill," Special Report, Apr. 13, 1988. p. 2.**

2. Environmental and Energy Study Conference, "Interior Sets ANWR Hearings," Weekly Bulletin, May 16, 1988. pp. B10811.

BOX I-B

WHAT DID THE DEPARTMENT OF THE INIERIOR CONCLUDE ABOUT THE MAGNITUDE OF ANWR OIL RESOURCES?

The Department of the Interiors conclusions about the magnitude of oil resources in the ANWR coastal plain have been the source of confusion since the DOI ANWR Legislative Environmental Impact Statement was **released. The actual** conclusion was:

1. There is a 19 percent chance that oil is present in the coastal plain under conditions that would allow commercial recovery (Le., large quantity in one place, good quality oil, permeable reservoir rock).
2. If oil is present in commercially recoverable form, its estimated mean volume is 3.23 billion barrels of recoverable oil.

in terms of the decision to allow or block leasing of the coastal plain, the DOI assessment means that:

1. There is an 81 percent chance that no commercially recoverable oil will be discovered, In that case, the total impact of leasing will be restricted **to** the impacts of the exploratory program, No permanent facilities will be built –no pipelines, no production facilities, and no permanent crew quarters.
2. There is a 19 percent chance that commercially recoverable oil will be found. In that case, the expected value of the magnitude of the oil likely to be recovered is 3.23 billion barrels. The value of this oil must be weighed against the effects, negative *and* positive, of building and operating the pipelines, production facilities, and other extensive infrastructure involved in producing this volume of oil in an Arctic environment.

A number of misinterpretations of the DOI conclusions have been communicated to Congress and to the media by both proponents and opponents of ANWR 011 development. The following two examples appear to represent the extremes:

- *'The Arctic Refuge coastal plain...is estimated to contain more than* 9 *billion barrels of recoverable oil, an amount approximately equal to Prudhoe Bay. "* Secretary Hodel in the cover letter accompanying the DOI ANWR assessment, April 21, 1987. According to the DOI **assess-**ment, the chance of recovering this amount **or greater is about 1 percent... it** represents the 5 percent probability mark for economically recoverable oil, and the latter occurs with only a 19 percent probability.
- *"There is about a* 7 *percent chance of finding* 3.2 *billion recoverable barrels, a* 200 *day supply (of U.S. oil consumption requirements). "* John Woodwell, Group for Good Government, "Oilscam, " January 28, 1988. **This value is** arrived at by misinterpreting the probability distribution for resource magnitudes in the DOI report. The author notes that the 3.2 billion barrel resource is situated at the 34th percentile on the probability curve, and interprets this to mean that there is a 34 percent chance of obtaining 3.2 billion barrels of oil. Thus, he multiplies .34 by .19, the conditional probability of finding any recoverable oil, to obtain "the probability of finding 3.2 billion barrels, However, the proper interpretation is that there is a 7 percent chance of finding *at least* 3.2 billion barrels; this probability includes the potential of finding 8 billion,9 billion, or even more barrels of recoverable oil. In OTA's view, the most useful interpretation still is that there is a 19 percent chance of recovering oil **at ANWR, and** if oil is recovered, the mean volume is 3.2 billion recoverable barreis.

Also, a number of leasing opponents have presented the leasing decision as a choice between 600 million barrels of oil –the "risked **mean" volume of oil, obtained by multiplying** 3.2 billion barrels by the 19 percent probability of finding **any recoverable oil in ANWR -and the environmental costs of** full development, e.g., hundreds **of miles of roads and** pipelines, thousands of acres of gravel pads, etc. This is an unfair comparison, because full development will occur only if recoverable amounts of 011 are found, and the expected volume of this oil is the full 3.2 billion barrels. As noted above, If no commercial oil is found, the impacts will be far less.

"Risked mean" volumes *are* useful when assessing the likely oil resources of an area that includes a *number of* unexplored regions. For example, in assessing the total oil resources remaining in all unexplored regions of the United States, the best estimate of the total resource is the sum **of the risked mean** oil volumes. However, for these estimates, the risked mean estimates for the individual regions have little meaning.

Box 1-C

ISSUES AFFECTING THE MM/F? DEVELOPMENT DECISION

1. To what extent would development of ANWR oil resources improve U.S. national security and offer significant economic benefits? Are the likely levels of ANWR oil production, if cotnmercial quantities are found, of real significance to U.S. liquid fuels supply? Are predictions of expected decfines in North Slope and U.S. oil production levels correct? Is it likelythat world oil markets will be under the tight control of the Middle Eastern OPEC countries at the time when ANWR oil could be flowing into the TAPS pipeline?

2. Are there alternatives to developing ANWR 011 that likely would prove more effective at lower cost (including environmental cost)? Could improving the efficiency of the automobile fleet save significantly more oil than ANWR could supply? Would pursuit of alternative liquid fuels such as methanol be preferable to investing in marginal U.S. oil resources? What are the risks of foregoing the development of any one alternative, assuming others are pursued?

3. What might be the benefits of delaying the leasing of ANWR, with or without first determining the extent of its oil resources? Is it likely that an accurate determination of its resources could be made without promising that any commercial quantities of oil would be allowed to be developed immediately after discovery? Are ANWR's potential oil resources worth more to the United States in the ground than they are under timely development?

4. Is the ANWR coastal ptain truly a unique and irreplaceable wilderness? To what extent are its wilderness values duplicated elsewhere in Alaska? In other words, is developing the coastal plain truly the same league as developing the Grand Canyon, Yellowstone, or the other "jewels" in our National Parks and Wilderness systems?

5. Could ANWR oil resources be developed without significant damage to the coastal plain's wildlife and other natural resources?

- How have Prudhoe Bay and other North Slope development damaged the natural environment? What are the long-term effects of the hundreds of small oil spills that have occurred? What long-term changes to drainage patterns have occurred because of the extensive road network? What solid and liquid waste problems exist, and what has been their effect? Does the growth of the Central Arctic caribou herd reflect Its long-term health, or is the appropriate interpretation less optimistic? What have been the effects of increased air emissions on the North Slope?
- Does current Arctic oilfieid technology and practices offer significant environmental improvements over those used earlier on the North Slope? Would probiems that existed at the &idY Prudhoe Bay developments be significantly less of a problem at ANWR because of these changes?
- What differences exist between ANWR and the North Slope/Prudhoe Bay area, and how will these affect the environmental impacts that might accompany development at ANWR?

6. Could ANWR oil resources be developed without foreclosing the eventual return of the coastal plain to a wilderness state? How likely is it that drilling sites can be rehabilitated, roads dismantled, and other physical effects of development successfully removed? Would development be likely to be temporary, or would the building of the needed infrastructure lead to more permanent development and exploitation of other ANWR resources? Would oil development be followed by natural gas development, extending the timeframe of petroleum development well past 20 or 30 years?

THE OTA STUDY

At the request of the Senate Committee on Energy and Natural Resources and the House Committee on Merchant Marine and Fisheries, the Office of Technology Assessment has undertaken a study of technologies for Arctic oil production and their effect on future oil production in Alaska and, particularly, in the 1002 area. The OTA study focuses on a subset of the issues relevant to Congress' decision on the fate of the area (the full set of issues are listed in Box 1-C), and does not provide guidance on a number of issues critical to the decision. OTA hopes that Congress, in making its decision, will draw on this study in conjunction with an extensive hearing record, several analyses by the Congressional Research Service, the Department of the Interior's Legislative Environmental Impact Statement (LEIS) and its supporting documents, and numerous reports and presentations from Alaskan State government, industry groups, Alaskan Native associations, environmental organizations, and other interest groups and technical organizations.

In addition, a forthcoming OTA study (Technological Risks and Opportunities for Future U.S. Energy Supply and Demand, scheduled for Fall, 1989) will examine topics associated with ANWR's role in future U.S. liquid fuels supply and demand--including future domestic oil production; alternative liquid fuels; the potential for reducing oil requirements by increasing energy efficiency; and the security implications of growing oil imports.

In Chapter 2, this report examines the state-of-the-art of Arctic oilfield technology and attempts to project the nature of technology that might be used in the future to explore, develop, and produce oil in the 1002 area. As part of this evaluation, the report attempts to show how such technology may resemble or differ from the technology used to develop the Prudhoe Bay oilfield, which is the oldest, largest, and most intensively studied of the North Slope oilfields. During extensive congressional testimony on ANWR, advocates and opponents of oil development have argued strenuously about the likelihood that ANWR development would raise many of the same environmental concerns associated with Prudhoe Bay development, and about the importance and accuracy of such concerns. Because the nature of the technology is an important determinant of environmental impacts, this portion of the report should help Congress understand how the impacts of possible future development at ANWR might resemble or differ from the impacts of existing development at Prudhoe. However, the report does not comment on the accuracy of the various claims made about the absolute magnitude of environmental impacts at Prudhoe Bay.

In Chapter 3, the report examines the available estimates of total Alaskan North Slope oil resources and reserves and the projections of future oil production, and evaluates the potential for shifts in future production rates with technology development and changing economic conditions. This evaluation includes an examination of enhanced recovery technologies that might be used to boost North Slope production in the future. The purpose of this portion of the report is to place any future oil production from the 1002 area into a better overall Alaskan and U.S. oil perspective. The report tries here to determine whether or not ANWR oil production represents the only feasible means of maintaining a high throughput through the Trans Alaska Pipeline System to the Lower 48 States for the year *2000* **and beyond.** Although projections of North Slope production made available to OTA portray sharply declining production in the 1990s, some Members of Congress are skeptical of these projections.